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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

MEMORANDUM

FEB - 8 2006

TO: Genevieve Salmonson, Director
Office of Environmental Quality Control

FROM: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

SUBJECT: After-The-Fact (ATF) Conservation District Use Application (CDUA) KA-3272 for Kauai Coffee Company

The Department has reviewed the After-The-Fact (ATF) Conservation District Use Application (CDUA) KA-3272 for Kauai Coffee Company, and Final Environmental Assessment (FEA) to restore, and utilize State-owned land adjacent to Alexander Dam Irrigation Ditch for operations and maintenance work, Koloa District, Island of Kauai, Subject Parcels TMK's: (4) 2-4-008:001, 002, and 016 & 2-4-009:001 and 003. The Draft Environmental Assessment (DEA) for CDUA KA-3272 was published in OEQC's December 8, 2005 Environmental Notice for the project.

The FEA is being submitted to OEQC. We have determined that this project will not have significant environmental effects, and have therefore issued a FONSI. Please publish this notice in OEQC's upcoming February 23, 2006 Environmental Notice.

We have enclosed four copies of the FEA and CDUA KA-3272 for the project. The OEQC Bulletin Publication Form is attached. Comments on the draft EA were sought from relevant agencies and the public, and were included in the FEA.

Please contact Dawn Hegger of our Office of Conservation and Coastal Lands staff at 587-0380 if you have any questions on this matter.

Enclosures

c: Rodney Funakoshi
Wilson Okamoto Corporation

RECEIVED
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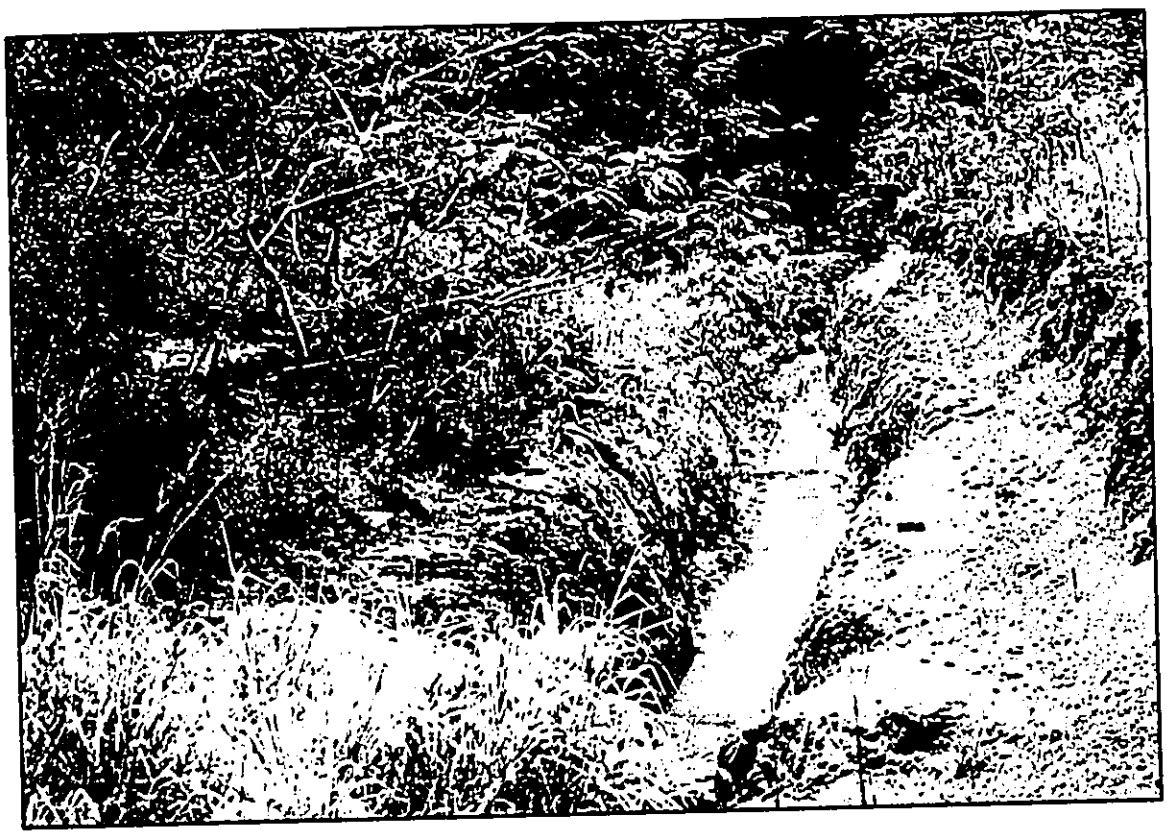
OFC. OF ENVIRONMENTAL QUALITY CONTROL

2006-02-23 KA FEA ALEXANDER DAM IRRIGATION DITCH RESTORATION

ALEXANDER DAM
IRRIGATION DITCH RESTORATION

FINAL ENVIRONMENTAL ASSESSMENT



Applicant:
Kauai Coffee Company

Prepared By:
Wilson Okamoto Corporation
Engineers and Planners
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

February 2006

ALEXANDER DAM

IRRIGATION DITCH RESTORATION

FINAL ENVIRONMENTAL ASSESSMENT

Applicant

Kauai Coffee Company

Prepared By

Wilson Okamoto Corporation
Engineers and Planners
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

February 2006

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Appendix B An Archaeological Inventory Survey to Support the Restoration of Alexander Dam Irrigation Ditch Project, Wahiawa Ahupua'a, Koloa-Poipu District, Kauai, prepared by Cultural Surveys Hawaii, Inc.

Appendix C Cultural Impact Assessment for the Restoration of the Alexander Dam Irrigation Ditch Project, Wahiawa Ahupua'a, Kona District, Island of Kaua'i, Prepared by Cultural Surveys Hawaii, Inc.

Appendix D Compliance with NRCS soil and water conservation practice standards, prepared by Kauai Coffee Company.

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PROJECT SUMMARY

Applicant:	Kauai Coffee Company
Accepting Authority:	State of Hawaii, Department of Land and Natural Resources
Determination:	Anticipate Finding of No Significant Impact
Tax Map Keys:	Portion of TMKs (4) 2-4-008: 001, 002, 016; 2-4-009: 001 and 003
Land Area:	Approximately 3 acres for the irrigation ditch restoration. Approximately 15 acres for future operations and maintenance activities related to the water system.
Landowners:	State of Hawaii, Department of Land and Natural Resources McBryde Sugar Company, Ltd.
Existing Use:	The Alexander Dam water system is an agricultural irrigation system constructed in the 1930's that supplies water to about 1,200 acres of agricultural fields. En route to the fields, water from the irrigation system passes through Kauai Coffee Company's Kalaheo hydroelectric plant and is used to generate electricity.
State Land Use Designation:	Conservation District, Resource subzone
Project Description:	This Environmental Assessment is being prepared in conjunction with an after-the-fact Conservation District Use Application (CDUA) for emergency repairs to the Alexander Dam water system. In June 2001, the main outlet tunnel from Alexander Dam collapsed resulting in 1) the inability to release water from Alexander Reservoir, except through the emergency spillway; 2) the inability to provide irrigation water to 1,200 acres of coffee fields; and 3) the inability to generate needed electricity from Kauai Coffee Company's Kalaheo hydroelectric facility. In order to re-establish flow from Alexander Reservoir, an irrigation ditch that was last used in the 1970's was restored. Restoration of the irrigation ditch involved clearing vegetation and deepening and widening the ditch. An existing unimproved access road adjacent to the ditch was also restored and three concrete culverts were constructed where the ditch passes under the road.

After-the-fact calculations estimate that a total of about three acres were cleared and 33,000 cubic yards of soil were excavated.

At the time the work was performed, KCOF believed that the work could be covered under a CDUA exemption for the repair of an existing irrigation facility. The Board of Land and Natural Resources (BLNR), however, determined that KCOF engaged in five separate land uses without a permit including: 1) unauthorized grubbing and grading; 2) unauthorized excavation of 33,000 cubic yards of soil; 3) unauthorized construction of an access road; 4) unauthorized tree removal; and, 5) unauthorized bypass ditch construction on State-owned lands. This EA assesses the impact of the ditch restoration work completed by KCOF in 2001 (including all of the land uses that were determined by the BLNR to require a permit), as well as future operations and maintenance activities related to the Alexander Dam, forebay, irrigation ditch, and appurtenant facilities, and the planned revegetation of certain portions of the project area.

Pre-Assessment Consultation:	U.S. Army Corps of Engineers U.S. Fish and Wildlife Service State Department of Health (DOH) State DOH, Environmental Management Division State Office of Planning State Historic Preservation Division Office of Hawaiian Affairs County of Kauai Planning Department
Draft EA Consultation:	U.S. Army Corps of Engineers U.S. Natural Resources Conservation Service State Department of Agriculture State Department of Health Office of Environmental Quality Control Office of Hawaiian Affairs Office of Planning State Historic Preservation Division County of Kauai Planning Department County of Kauai Department of Public Works County of Kauai Department of Water

1 INTRODUCTION

Kauai Coffee Company (KCOF) is preparing an after-the-fact Conservation District Use Application (CDUA) for improvements associated with emergency repairs to the Alexander Dam water system. The improvements, which were constructed in July 2001, are located on State and privately owned lands in the State Land Use Conservation District Resource subzone in the Lihue-Koloa Forest Reserve on the island of Kauai. Pursuant to Hawaii Revised Statutes, Chapter 343, and Hawaii Administrative Rules, Title 13, Chapter 5, this Environmental Assessment (EA) was prepared due to the use of State lands and the project's location within the State Conservation District.

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2 SETTING AND PROJECT DESCRIPTION

2.1 Project Location and Setting

The Alexander Dam water system is located in the Koloa district of the island of Kauai above the town of Kalaheo (see Figure 1, Location Map). The irrigation ditch that was restored is within the Lihue-Koloa Forest Reserve and extends from an elevation of approximately 1,400 feet to 1,600 feet. Lands surrounding the restored irrigation ditch can be characterized as a mature forest comprised predominately of introduced species. The irrigation ditch passes through tax map key parcels (4) 2-4-008:002; and 2-4-009: 001 and 003 (see Figures 2 and 3). The Alexander Dam and forebay are located on tax map key parcels 2-4-008:016 and 2-4-008:001, respectively (see Figure 2).

The Alexander Dam Water System was constructed in about 1930 to provide water to the sugarcane fields of the former McBryde Sugar Company. Today, the Alexander Dam water system provides water to irrigate approximately 1,200 acres of coffee fields owned by Kauai Coffee Company (KCOF).

2.2 Project Description

2.2.1 Background

The Alexander Dam water system had consisted of an 810-million gallon storage reservoir (Alexander Reservoir), a transmission tunnel to a forebay, a transmission pipeline to a power generating plant (the penstock), and finally a ditch system that delivers irrigation water for coffee crop irrigation (see Figure 4, Alexander Dam Water System and Figure 5, Kauai Coffee Company Irrigation System). This water system is the sole source of water for approximately 1,200 acres of coffee fields, or one-third of KCOF's plantation. Water flowing through the irrigation system also generates hydropower to operate KCOF's coffee processing facility. In June 2001, the main outlet tunnel from Alexander Dam collapsed resulting in: 1) the inability to release water from the Alexander Reservoir, except through the emergency spillway; 2) the inability to provide irrigation water to 1,200 acres of coffee; and 3) the inability to generate needed electricity. Efforts were made to clear the tunnel, however, it was discovered that the tunnel had collapsed in several areas and the high likelihood of further collapse made repair infeasible, as any attempt would pose a severe safety threat to workers.

In the course of investigating alternatives, an unused McBryde Sugar Company irrigation ditch was discovered in the area. The ditch, last used in the 1970's, had become partially filled in and overgrown with vegetation, but was repairable. Faced with emergency conditions, KCOF personnel proceeded with the only timely solution they could identify, which was the restoration and rerouting of the McBryde Sugar Company ditch.

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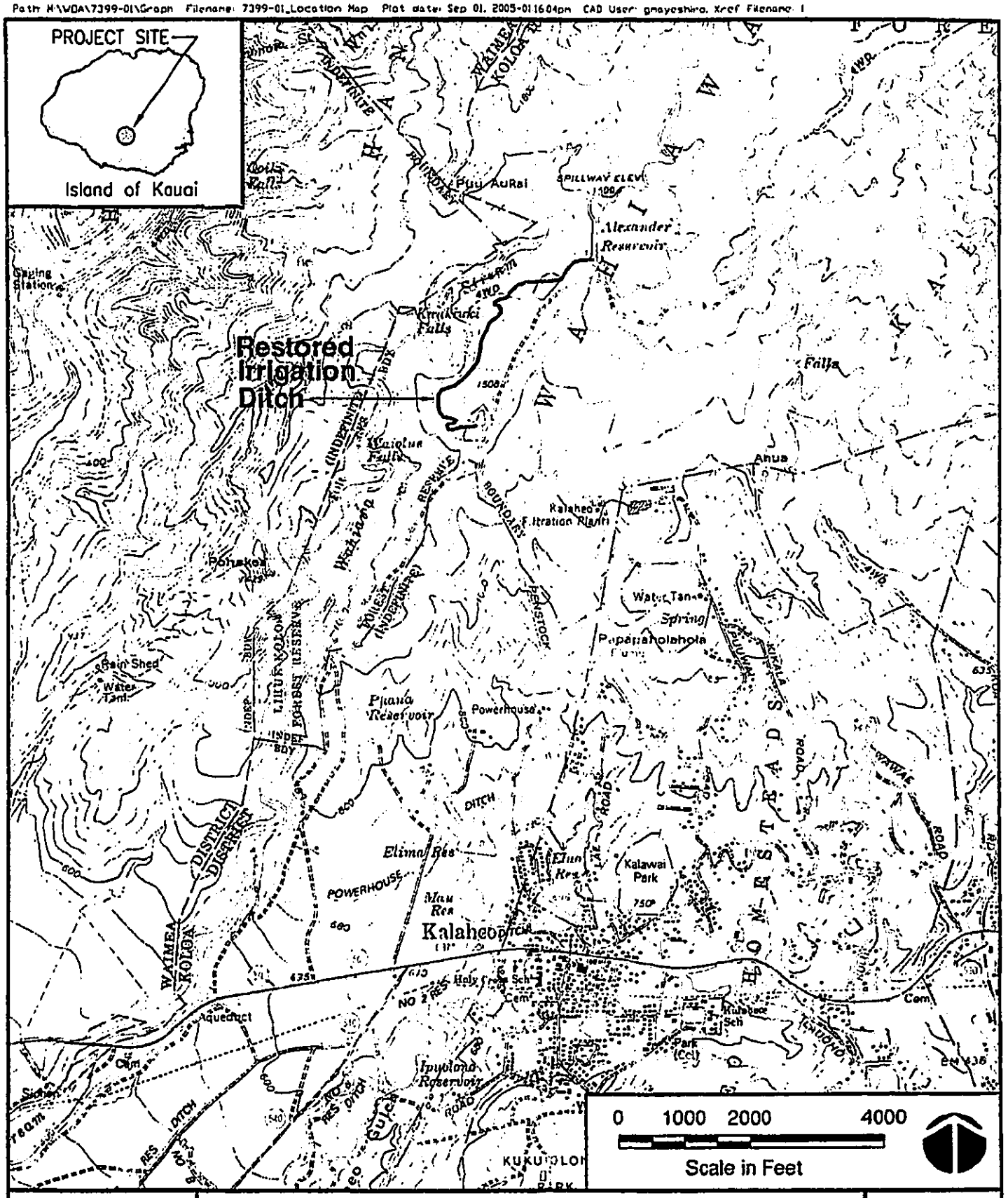

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

ALEXANDER DAM IRRIGATION DITCH RESTORATION

LOCATION MAP

FIGURE 1

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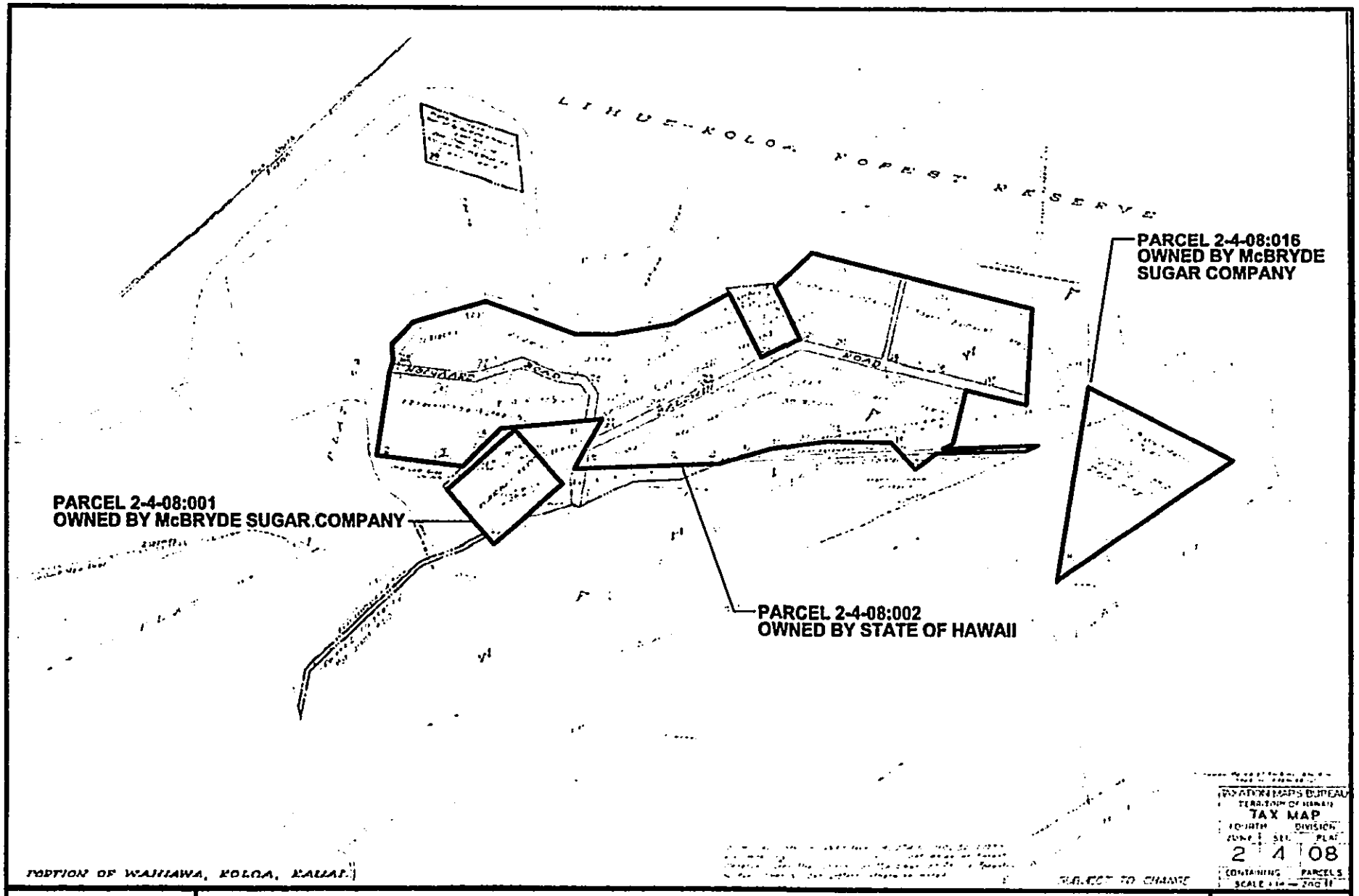

PORTION OF WAIHAWA, KOLOA, KAUAI

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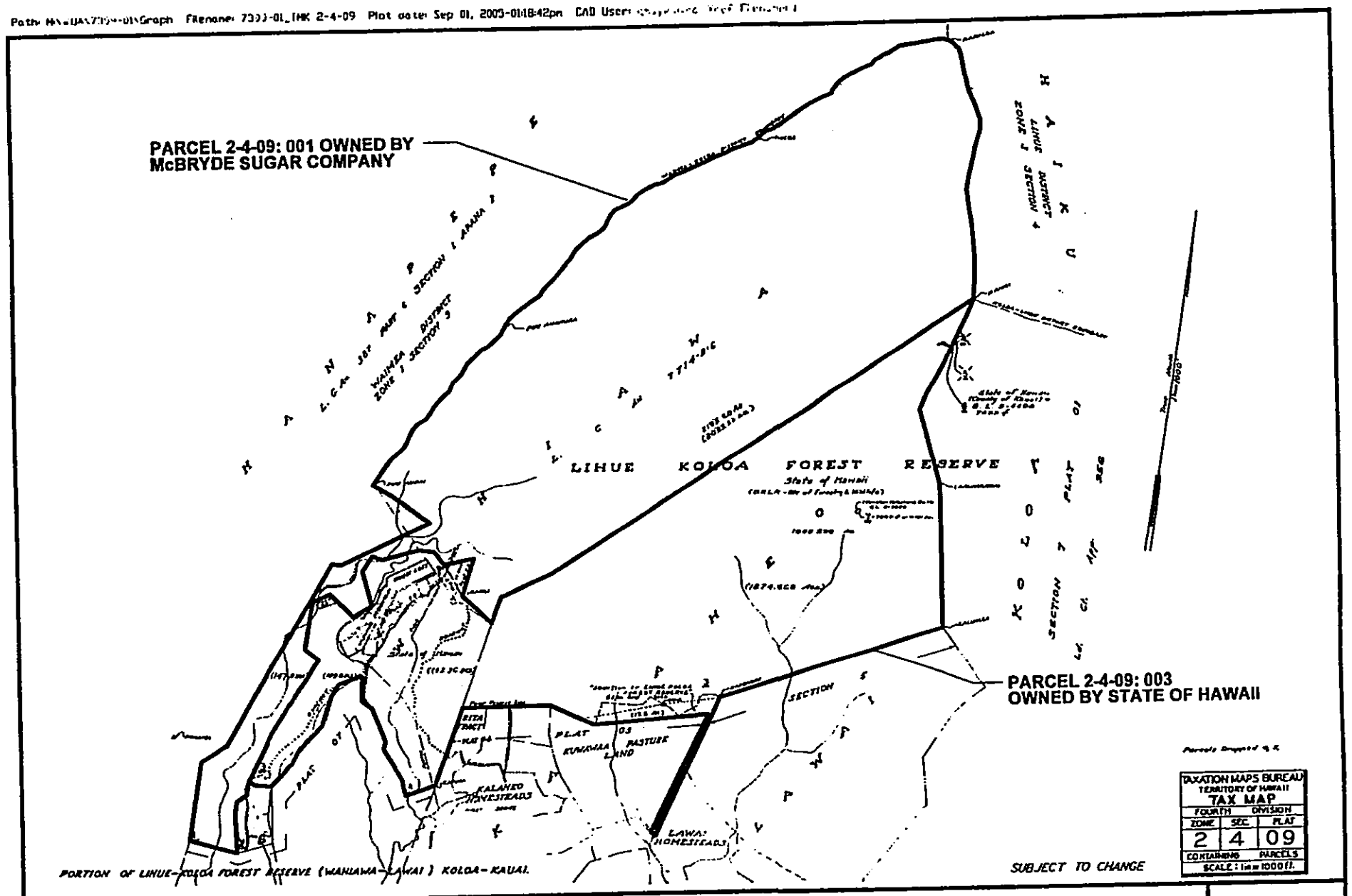
ALEXANDER DAM IRRIGATION DITCH RESTORATION

TAX MAP KEY 2-4-08

FIGURE
2



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ALEXANDER DAM IRRIGATION DITCH RESTORATION

TAX MAP KEY 2-4-09

FIGURE 3

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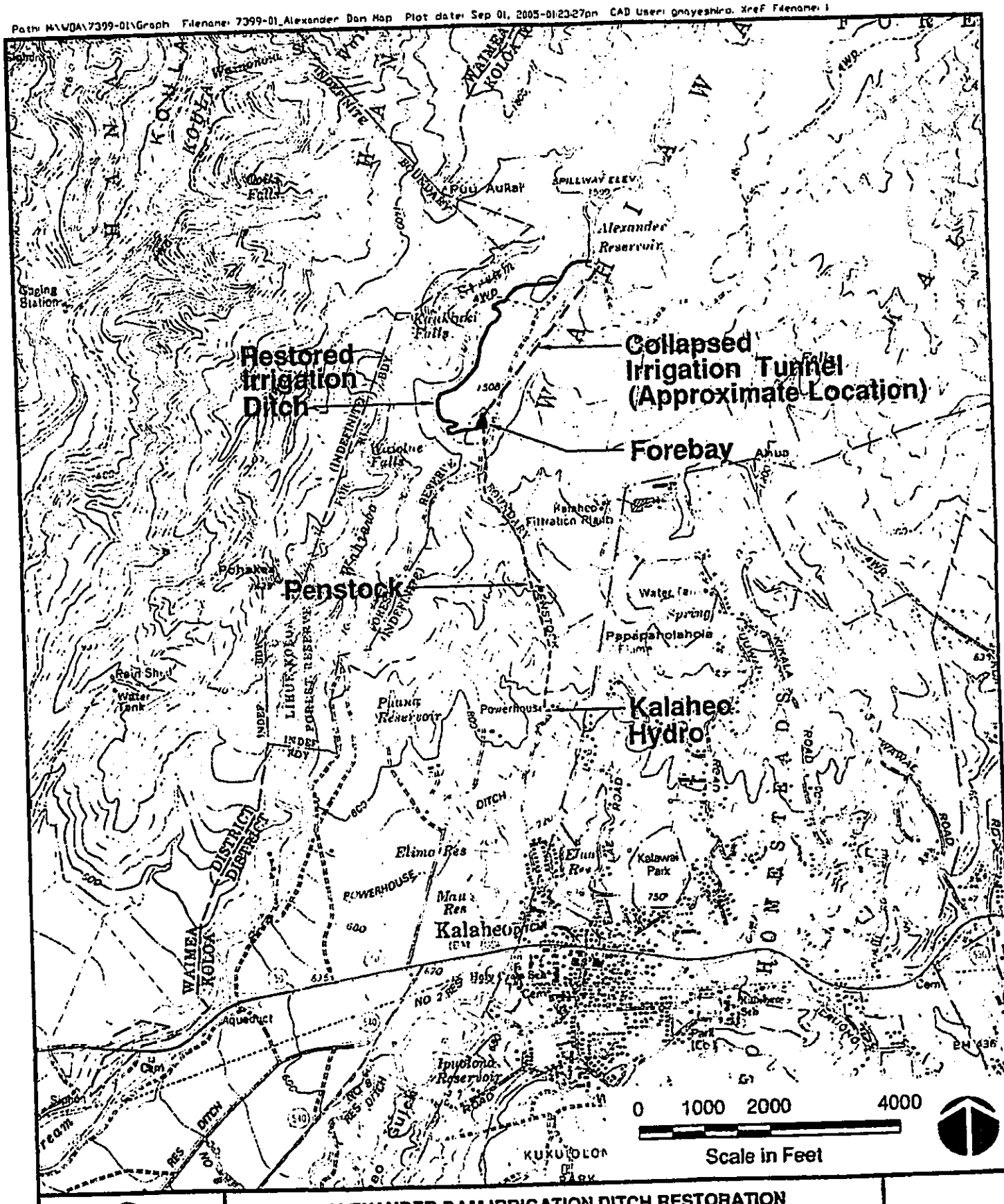

WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS	ALEXANDER DAM IRRIGATION DITCH RESTORATION ALEXANDER DAM WATER SYSTEM MAP	FIGURE 4

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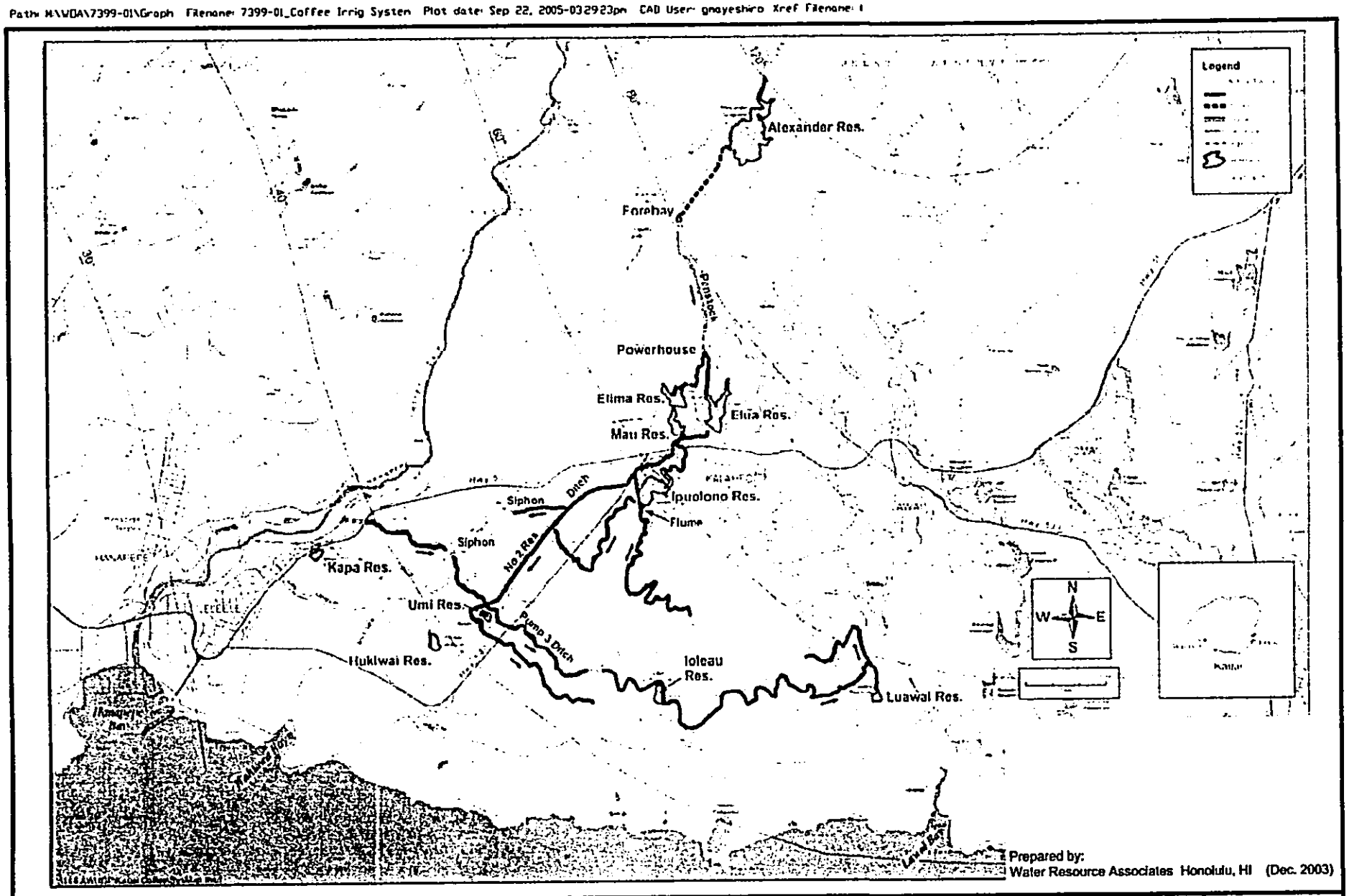

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ALEXANDER DAM IRRIGATION DITCH RESTORATION

KAUAI COFFEE IRRIGATION SYSTEM

FIGURE 5

At the time the work was performed, KCOF believed that the work could be covered under a CDUA exemption for the repair of an existing irrigation facility. KCOF also believed that the existing Soil and Water Conservation Plan (SWCP) for the coffee plantation adequately covered grading associated with maintenance of the farm's roads and irrigation infrastructure. In February 2003, however, the Office of Conservation and Coastal Lands began an investigation regarding unauthorized land use activities associated with the project. At its March 11, 2005 meeting, the Board of Land and Natural Resources (BLNR) determined that KCOF had engaged in five separate land uses without a permit including: 1) unauthorized grubbing and grading; 2) unauthorized excavation of 33,000 cubic yards of soil; 3) unauthorized construction of an access road; 4) unauthorized tree removal; and, 5) unauthorized bypass ditch construction on State-owned lands. As required by the BLNR, an after-the-fact CDUA is being prepared for these land use activities. In addition, KCOF is incorporating into the CDUA ongoing activities necessary to operate and maintain the Alexander Dam water system (including the dam, irrigation ditch, forebay, penstock, and appurtenant facilities), and the planned revegetation of portions of the project site.

2.2.2 Description of Ditch Restoration

Restoration of the McBryde Sugar Company irrigation ditch consisted of grading and grubbing along the path of the original ditch and the adjacent existing access road to remove accumulated undergrowth blocking the ditch and/or access road. The path of the restored ditch follows the path of the original ditch, except for the sections shown in Figure 6. Based on portions of the irrigation ditch that were not restored, it appears that the unrestored ditch was about 3-meters in depth and 3.5 to 4.0 meters in width at the top and about 1.0 to 1.5 meters in width at its bottom. The ditch was deepened and widened to provide sufficient capacity to handle the maximum anticipated flows and to increase system reliability in the event of landslides or fallen trees. Backcuts into the slope above the ditch were made where necessary to improve the stability of the slope and the edge of the existing access road was backfilled to provide for adequate roadway width and to utilize excavated material. In areas where the ditch was realigned, the excavated material was also used to backfill the original ditch. Three concrete culverts were also constructed where the ditch passes under the access road (see Figure 6).

The total area affected by the ditch restoration work has been conservatively estimated at about three acres based on an average clearing width of 30 to 40 feet to accommodate the ditch and access road along the 0.75-mile length of the ditch. After-the-fact engineering calculations estimated that about 33,000 cubic yards of soil were excavated, the majority of which was embanked along the west (downslope) side of the ditch to support and/or widen the access road. Photos of the restored ditch are provided in Photos 1 to 6 and a key map to the photos is provided in Figure 7.

Regular maintenance and repair work will be required to maintain the ditch and other portions of the water system in proper operating condition. These activities, listed in Table 1, will be covered by the CDUA although some of them are normally exempt from permitting. Also included in the CDUA will be revegetation by KCOF of limited areas of the project where natural revegetation has not yet occurred.

2.3 Project Schedule and Funding

Investigation of the collapsed tunnel and restoration of the irrigation ditch began in July 2001 and required about two months to complete. Funding for the ditch restoration effort was provided by KCOF. No public funds were used for the project.

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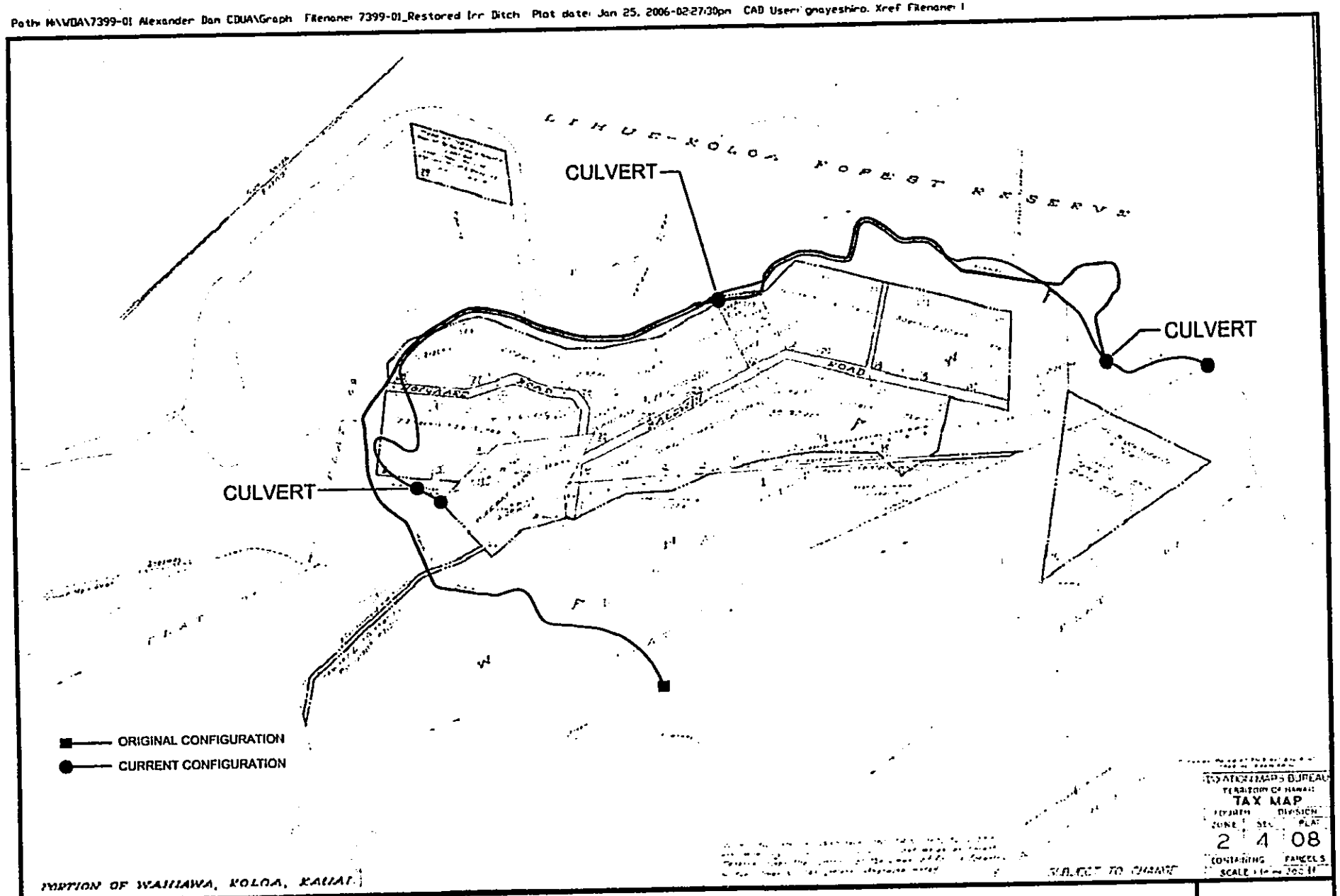

WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS	**ALEXANDER DAM IRRIGATION DITCH RESTORATION** RESTORED IRRIGATION DITCH	FIGURE 6

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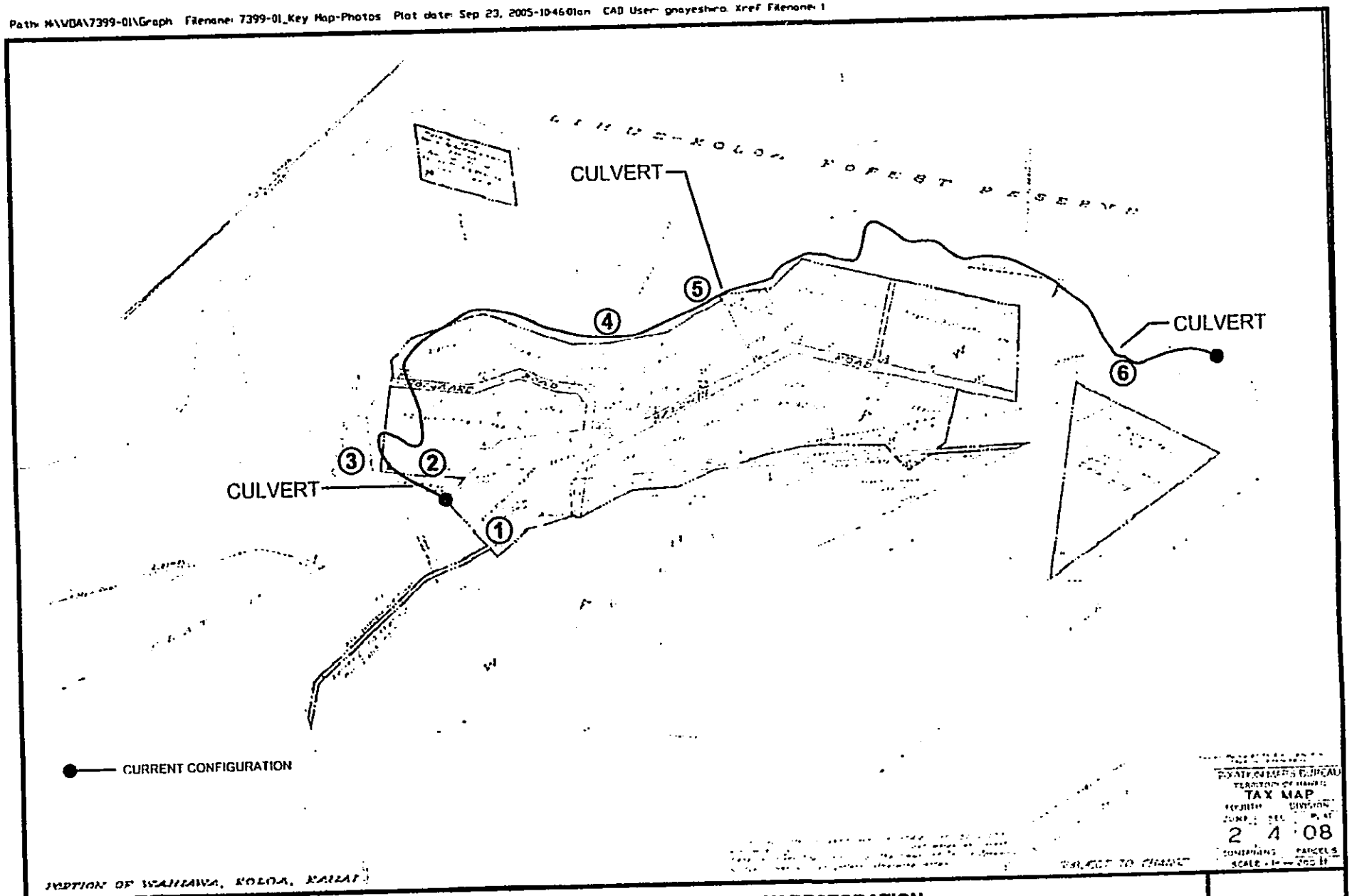

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ALEXANDER DAM IRRIGATION DITCH RESTORATION

KEY MAP TO PHOTOS

FIGURE 7

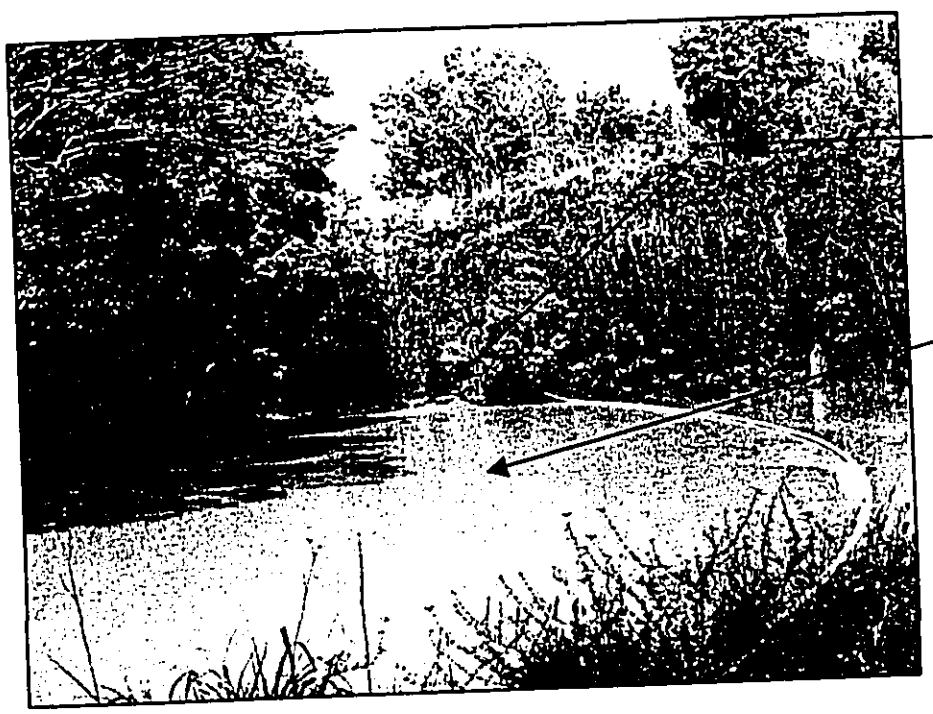

Photo 1: Restored irrigation ditch discharging into forebay.

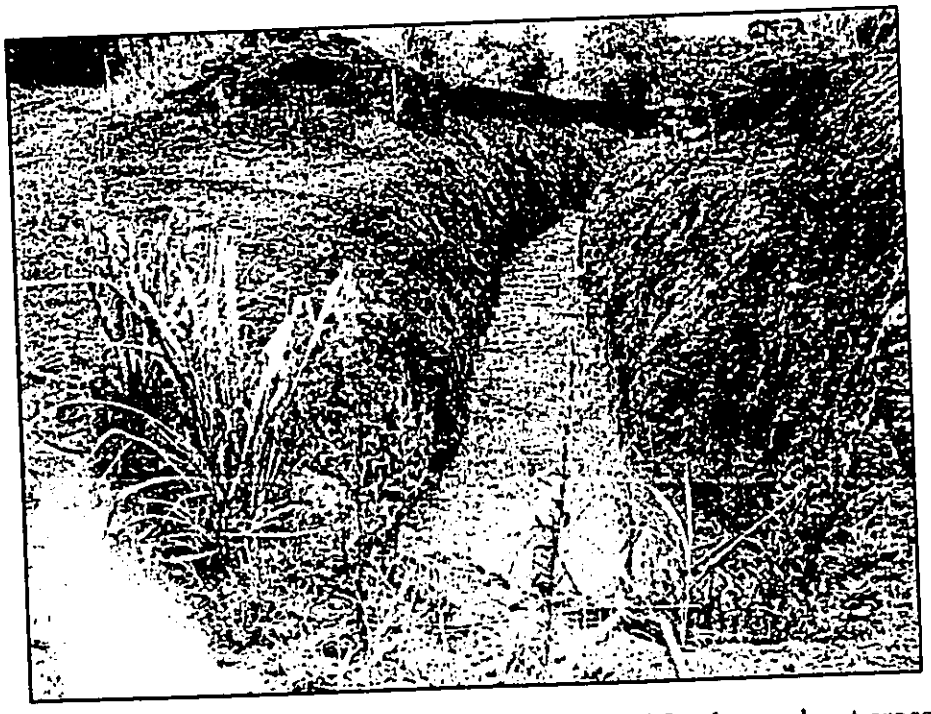

Photo 2: Restored irrigation ditch upstream of forebay culvert crossing.

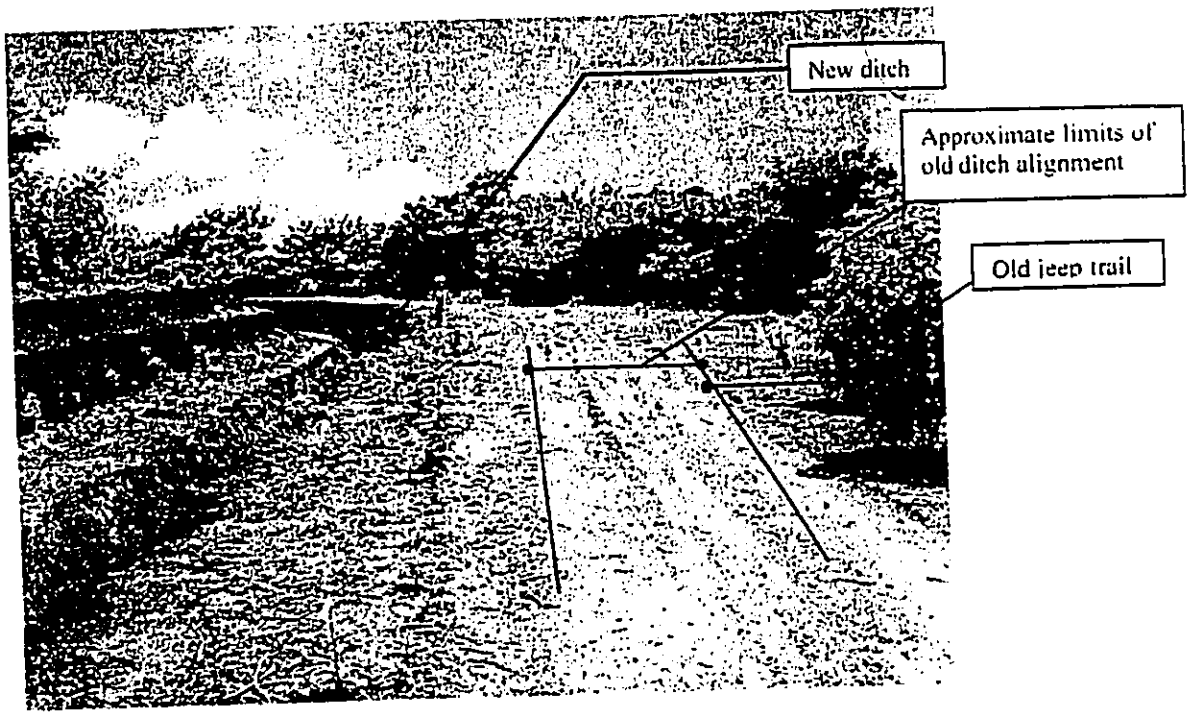

Photo 3: Realigned irrigation ditch.

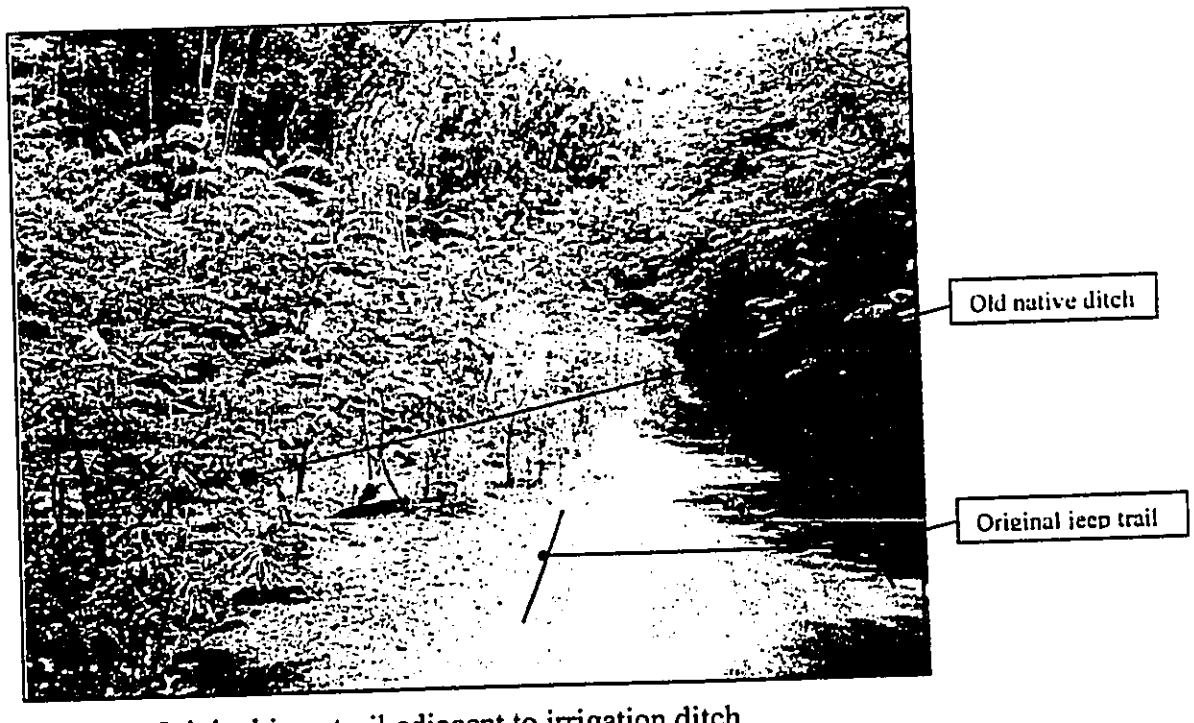

Photo 4: Original jeep trail adjacent to irrigation ditch.

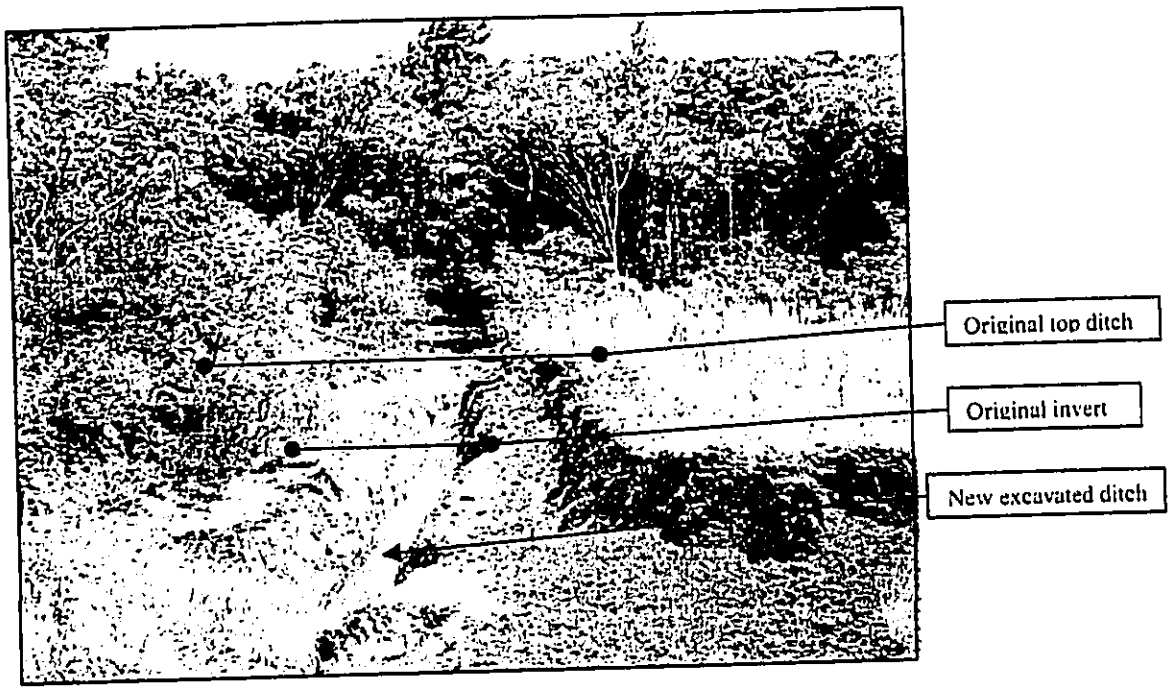

Photo 5: Restored irrigation ditch.

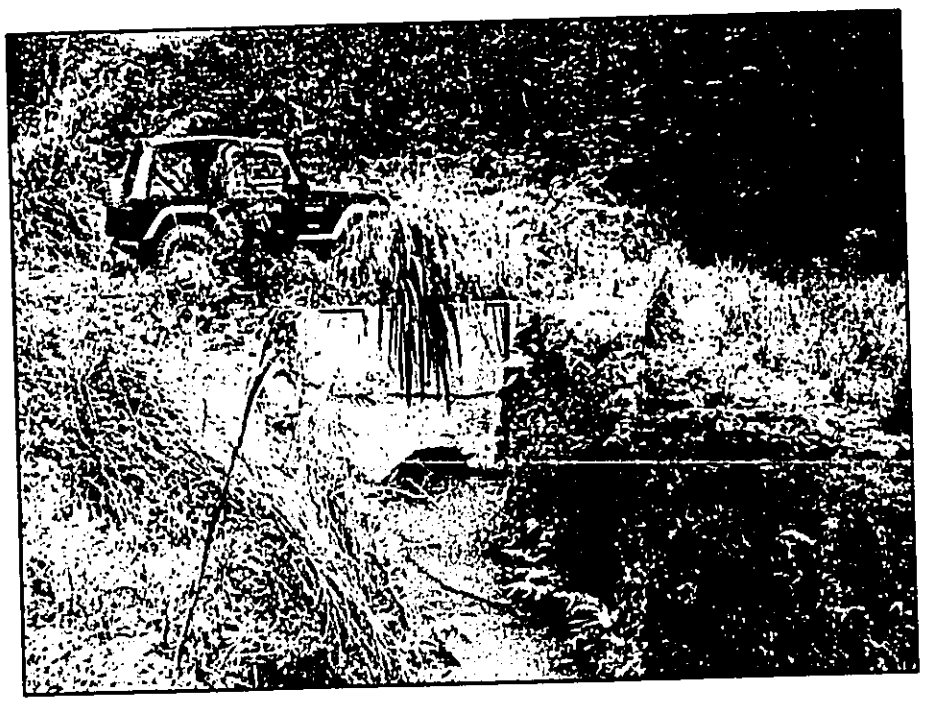

Photo 6: New concrete culvert.

TABLE 1
Alexander Dam Water System
Operation, Maintenance and Repair Activities

1. Maintenance and repair of existing roads in accordance with an approved Soil and Water Conservation Plan (as applicable).
   - A. Roadside weed control activities, including application of Round-Up.
   - B. Removal of vegetation, as necessary, to maintain passable roads.
   - C. Maintenance grading and clearing of existing roadways.
   - D. Clearing landslides, as necessary, to maintain passable roads.

2. Maintenance and repair of the existing ditch in accordance with an approved Soil and Water Conservation Plan (as applicable).
   - A. Ditch-side weed control, including application of Rodeo.
   - B. Removal of fallen trees, landslides, vegetation, and other debris from the ditch, as necessary, to maintain flow.

3. Maintenance and repair of existing power lines.
   - A. Replacement of fallen or damaged lines or poles.
   - B. Removal of trees growing underneath power lines to prevent damage to the power lines.

4. Maintenance and repair of the existing penstock to the Kalaheo hydroelectric plant and buried 10-inch PVC irrigation lines.
   - A. Welding, patching, and other repairs and maintenance to address leaks in the lines.
   - B. Repair or replacement of penstock piping supports.
   - C. Replacement of segments of the line that are not practicable to repair due to deterioration.
   - D. Removal of trees growing under or adjacent to the penstock or water lines in order to prevent damage to the lines.

5. Maintenance and repair of the forebay in accordance with an approved Soil and Water Conservation Plan (as applicable).
   - A. Weed control in the vicinity of the forebay.
   - B. Periodic cleaning of the forebay to remove accumulated sediment and maintain the forebay's capacity.
   - C. On-site stockpiling of excavated soil from the forebay for use in road repair and maintenance work.

TABLE 1 (continued)
Alexander Dam Water System
Operation, Maintenance and Repair Activities

6. General maintenance of Alexander Dam, in accordance with an approved Soil and Water Conservation Plan (as applicable), as required to maintain dam safety.

   A. Removal of trees from the reservoir banks, as necessary, to prevent structural damage to the dam and restoration of damaged embankments following tree removal per dam safety requirements.

   B. Weed control activities, including spraying Round-Up and/or Rodeo to enable visual inspection per dam safety requirements.

   C. Clearing of the spillway, including removal of trees and other vegetation as necessary to ensure that flow over the spillway is not impaired.

   D. Tunnel maintenance, including clearing of cave-ins, where necessary.

   E. Repair, replacement and maintenance of staff gages necessary for reservoir depth level indication.

   F. Other general maintenance and repairs necessary to comply with dam safety requirements under Hawaii Administrative Rules, Title 13, Chapter 190.

7. General maintenance and landscaping of the surrounding areas, in accordance with an approved Soil and Water Conservation Plan (as applicable), to prevent erosion.

   A. Revegetation by KCOF of limited areas of the project where natural revegetation has not occurred.

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3 DESCRIPTION OF THE EXISTING ENVIRONMENT, PROJECT IMPACTS, AND MITIGATION MEASURES

3.1 Climate

The climate of Hawaii is relatively moderate throughout most of the State, although some differences in certain meteorological parameters may occur from one region to another. Most of these differences are caused by the islands' mountainous topography. The climate in the area is characterized as semi-tropical with two seasons. The summer period from May through September is generally warm and dry, with predominantly northeast trades. In contrast, the winter season from October through April is associated with lower temperatures and greater rainfall. The trade winds are less prevalent during this period.

Long-term data collected at Lihue Airport, located approximately 10 miles east of the project site, indicates that the northeast wind direction prevails throughout the year with a mean annual wind speed of 20 km/hr (12.3 mph). Winds from the south are infrequent, occurring only a few days during the year and mostly in winter in association with Kona storms.

Average temperature ranges from about 66 degrees Fahrenheit (°F) in the coolest month to about 83°F in the warmest month. Median annual rainfall is around 43.3 inches (Rainfall Atlas, 1986).

3.2 Geology, Topography and Soils

The Island of Kauai is geologically one of the oldest and structurally complex islands in the State of Hawaii, consisting principally of a large volcano, the Kauai shield, which became active approximately four million years ago. The island's land mass was formed by two major volcanic series identified as the Waimea Canyon Volcanic Series and the Koloa Volcanic Series.

The Koloa Volcanic Series occurred during the Pleistocene Epoch, covering the older Waimea Canyon Volcanic Series with lava. In general, the project site is located on the Koloa Volcanic Series, which is mostly dense to moderately dense, and includes lava flows of nepheline basalt, melilite-nepheline basalt, olivine basalt, picrite-basalt, and basanite.

To the near west of the project site exists a portion of the Napali formation. The Napali formation comprises the thin flows of basalt and are typically thin-bedded tholeiitic aa and pahoehoe flows, with scarce ash deposits that erupted in rapid succession from narrow fissures. (Stearns, Geology of Hawaii, 1966).

The project site is located at an elevation of 1,400 feet at its lower end to 1,600 feet at its upper boundary, covering a distance of about three-quarters of a mile.

According to the 1972 Soil Survey, the predominant soil type in the project area is Pooku silty clay, 8 to 15 percent slopes (PmC). The Pooku Series is comprised of well-drained soils distributed on uplands and develops in material that has weathered from basic igneous rock. Pooku soils vary from level to very steep. The runoff rate is slow to medium, and the erosion hazard considered slight to moderate. The soil is also considered poor as a topsoil media as it possesses low fertility. Typically these soils are suitable for pasture, sugarcane, woodland, water supply and wildlife habitat.

In addition, rough broken land (rRR) is present along the eastern boundary of the project area. This soil type is characterized by very steep land with numerous intermittent drainages and typically is found in gulches and steep mountainsides. Runoff is rapid, and geologic erosion is active.

Impact and Mitigation Measures

The project has had no impact on regional geology and a minimal impact on soils at the project site. During restoration of the irrigation ditch, about 33,000 cubic yards of soil were excavated. The excavated soils were primarily used as embankment to widen and stabilize the ditch's access road or to fill portions of the original irrigation ditch where the ditch was rerouted.

The work that was undertaken is generally consistent with the practices set forth in the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) *Conservation Practice Standard for Irrigation Canal or Lateral* and *Conservation Practice Standard for Access Road,* which are intended to reduce soil erosion associated with construction, operation, and maintenance of farm roads and irrigation ditches. A discussion of the project's consistency with the NRCS standards is provided in Appendix D. An updated conservation plan covering KCOF's farm roads and ditches has been approved by the West Kauai Soil and Water Conservation District.

Based on field observations conducted in September 2004, soils that were disturbed by the project appear stable and the majority of the project site has revegetated except for two areas, one in the vicinity of the forebay and the second where the ditch was realigned to avoid a stand of koa trees. Despite the fact that the two areas did not revegetate, no evidence of major erosion was visible. KCOF will be performing soil nutrient analysis tests to determine appropriate soil amendment methods and vegetation that may be best suited for the two areas, and will include revegetation of these areas in the CDUA.

3.3 Hydrology

The major streams on the island of Kauai originate in the rainy uplands and are relatively large and uniform in flow. The major streams, and most minor ones, are sustained in

large measure by groundwater drainage. Stream water is often diverted into ditches and tunnel systems for irrigation purposes. Surface water resources in the vicinity of the project site include Alexander Reservoir to the west and Wahiawa Stream to the east. Wahiawa Stream is a Class 2, intermittent stream where it passes below the project area. Alexander Reservoir is an 810-million gallon reservoir fed by Wahiawa Stream that was constructed in the 1930's to provide water for sugarcane irrigation.

The nearest marine waters to the project site are about 4.3 miles to the south. The marine waters are classified as Class A waters by the State Department of Health. The objective of the Class A classification is to protect water quality for recreational purposes, including swimming, bathing, and other water contact sports and aesthetic enjoyment.

The project site overlies the Koloa aquifer system of the Lihue aquifer sector. Perched and basal groundwater resources are found in this aquifer system.

Impact and Mitigation Measures

The project has had no impact on surface or ground water resources. The quantity of water flowing through the restored irrigation ditch is the same that had been flowing through the irrigation tunnel before its collapse. During a field observation in September 2004, it was noted that water flowing in the restored ditch was relatively clear and there was no evidence of erosion or sediment transport. Water in the forebay was also clear and did not exhibit evidence of sedimentation.

It is unlikely that runoff from the project site has affected Wahiawa Stream or coastal waters. The work that was undertaken is generally consistent with the practices set forth in the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) *Conservation Practice Standard for Irrigation Canal or Lateral* and *Conservation Practice Standard for Access Road,* which are intended to reduce soil erosion associated with construction, operation, and maintenance of farm roads and irrigation ditches. The closest point from the irrigation ditch to Wahiawa Stream is about 0.5 miles and the underbrush between the ditch and Wahiawa Stream is extremely dense. The nearest coastal waters are over 4 miles distant.

3.4 Flora and Fauna

A Biological Survey Report was prepared in April 2005 to characterize the vegetation and to determine the presence of any rare or endangered flora or fauna species at the project site. The report is summarized below and attached as Appendix A.

Between 1910 and 1960 the Hawaii Department of Land and Natural Resources (DLNR) planted thousands of trees on the Island of Kauai in various reforestation projects. Above Kalaheo town, many of those trees have become established and have reproduced to become a significant part of the flora of the study site. The vegetation is a mix of alien species and no specific type can be distinguished. At about 1600 feet elevation, the

canopy is dominated by tall siris trees (*Albizia lebbeck* (L.) Benth). The stream banks are sparsely covered with gold and silver fern (*Pitygrogramma chrysophylla* (Sw.) Link) and neke (*Cyclosorus interruptus* H. Ito.). At the 1500 feet elevation, young native Koa trees (*Meterosideros polymorpha* Gaud) form a major part of the vegetative cover. At about 1400 feet elevation, the scant ground cover is a mix of weedy species such as sensitive plant (*Mimosa pudica* L.).

The large number of seedlings and saplings indicate vegetation quickly regenerates. Since the vegetation of the project site is almost entirely alien species, there is little to no food for endemic fauna. The presence of seed producing grasses offers food for a variety of introduced bird species, rats, and mice. The most unusual bird sighting was a small flock of Least terns. Other species include the Red Junglefowl (*Gallus gallus*) and White Rumped-Shama (*Copsychus molabaricus).* At 1600 feet elevation, evidence of pig activity in the form of digging was clearly evident although no pigs were seen.

There are no known threatened or endangered floral or faunal species in the project area.

Impact and Mitigation Measures

Vegetation was cleared from the ditch and access road during restoration work. Trees that were cleared were primarily alien species including albizia and guava trees and at least twelve pine trees. Considerable effort was made to avoid damaging koa trees, including altering the ditch alignment in two locations to avoid stands of koa.

Based on field observations conducted in September 2004, the majority of the project site has revegetated except for two areas, one in the vicinity of the forebay and the second where the ditch was realigned to avoid a stand of koa trees. KCOF will be performing soil nutrient analysis tests to determine appropriate soil amendment methods and vegetation that may be best suited for the two areas, and will include revegetation of these areas in the CDUA. As recommended by the Biological Survey Report, koa trees in the vicinity of the project site will be protected.

3.5 Air Quality

As required by the Clean Air Act, National Ambient Air Quality Standards (AAQS) were established by the U.S. Environmental Protection Agency (USEPA) for seven major air pollutants: carbon monoxide (CO), nitrogen oxides (NO_x), ozone (O_3), particulate matter smaller than 10 microns (PM_{10}), $PM_{2.5}$ (particulate matter smaller than 2.5 microns), sulfur oxides (SO_x), and lead. Current standards for ozone and $PM_{2.5}$ were established in September 1997. The State of Hawaii has also established its own standards for these pollutants.

Currently, there is one DOH air-monitoring site in downtown Lihue at the Health District Office that is only equipped to measure PM_{10}. Generally PM_{10} levels are well below the State and Federal ambient air quality standards. In 2000, air quality measurements of

total particulate matter ranged from a minimum of 8 micrograms per cubic meter (mg/m_3) to a high of 39 mg/m_3. The 2000 annual mean for all hours was 18 mg/m_3.

Air quality in the project area is considered to be good due to sparse development and absence of point-source pollutant generators in the vicinity of the project site.

Impact and Mitigation Measures

During construction, dust from exposed soil and emissions from construction vehicles may have impaired air quality in the immediate vicinity of the project site. Any impacts that occurred, however, were short-term and have not had a long-term adverse impact.

3.6 Historic and Archaeological

An Archaeological Inventory Survey for the project was conducted by Cultural Surveys Hawaii in May 2005 (see Appendix B). According to the survey, a McBryde Sugar Company map dated to 1900 shows a "Native Ditch" that roughly corresponds to the course of the restored irrigation ditch. It does not appear that the term "Native Ditch" refers to a pre-contact traditional 'auwai, although the possibility does exist that the ditch was originally a traditional 'auwai that had been adapted and deepened by McBryde Sugar Company. Other historic features in the vicinity of the project site include Alexander Dam and the forebay. A more detailed description of each of these features is provided below.

Irrigation Ditch. The irrigation ditch is labeled as "Native Ditch" on historic maps but is known to have been constructed between 1900 and 1905. The ditch was designed to carry water from Alexander Reservoir to sugar cane fields on Kauai's southern coastal plain. It appears that the ditch was originally about 6,600 feet long and extended from Alexander Reservoir to about 700 feet below the existing forebay. An intact portion of the ditch that was undisturbed by the restoration work is approximately 3.0 meters in depth and 3.5 to 4.0 meters in width, and varies in bottom width from 1.0 to 1.5 meters. A photo of the undisturbed section of ditch is provided in Photo 7.

Alexander Dam and Alexander Reservoir. Alexander Dam and Alexander Reservoir were constructed in 1931 (see photo 8). The dam, which is189 feet in length and 119 feet in height, is the highest dam in Hawaii and one of the highest hydraulic fill dams in the western U.S. The maximum storage capacity of Alexander Reservoir is 2,540 acre-feet and normal storage is about 1,070 acre-feet. The dam has a concrete spillway that slopes to the west at a 20-25 degree angle. In profile, the dam has a shouldered appearance (see Photo 9).

Photo 7: Undisturbed portion of "Native Ditch".

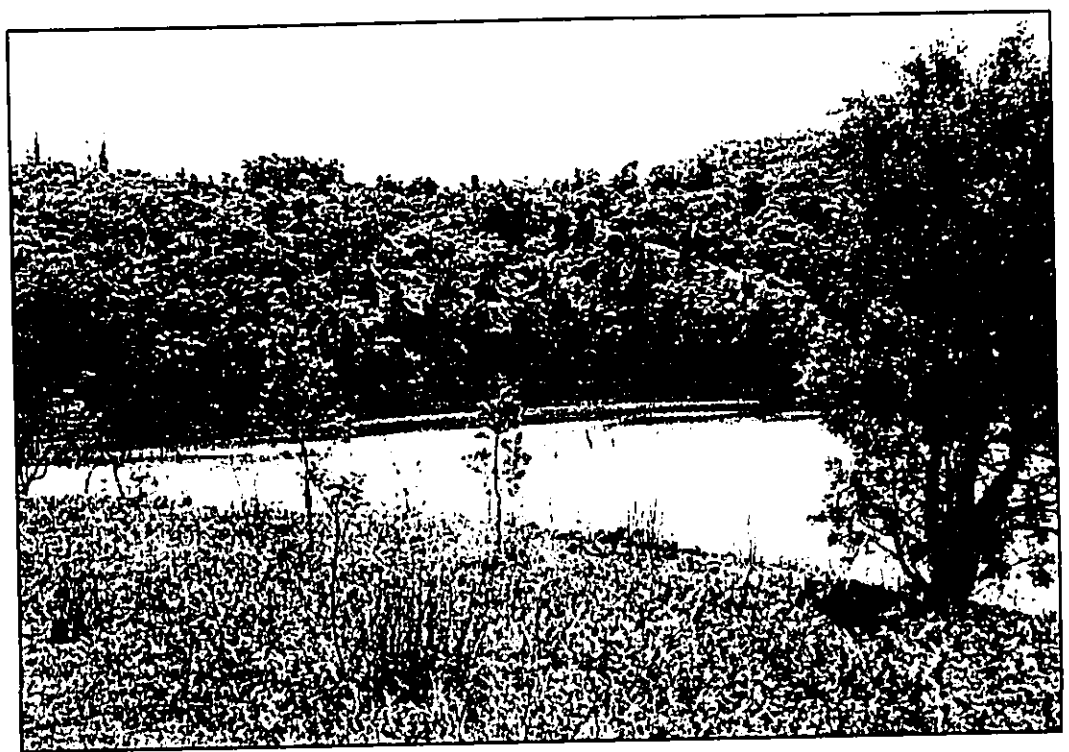

Photo 8: Alexander Reservoir

Photo 9: Alexander Dam

The face of the dam is very well faced with quarried basalt material that was apparently split by drilling and shaped by hammers before placement. Small fragments and percussion flakes were used as chinking between larger pieces of stone to create a dense fabric of rockwork on the dam face. At the far southern edge of the reservoir, a large retaining wall was constructed of large basalt boulders, possibly to provide support for the access road and function as a water-impounding feature.

Forebay. The forebay is an excavated earth water impoundment facility about 1.65 acres in area situated downslope from Alexander Dam. The forebay was constructed at about the same time as Alexander Dam and Alexander Reservoir. Water from Alexander reservoir flows through the restored irrigation ditch to the forebay. From the forebay, water flows through a metal pipe (the penstock) to the Kalaheo hydroelectric station and then to KCOF coffee fields.

According to the Rules Governing Procedures for Historic Preservation Review, in order to be considered historically significant a site must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the criteria listed below:

Criterion A: Association with events that have made an important contribution to the broad patterns of our history.
Criterion B: Association with the lives of persons important in our past.
Criterion C: Distinctive characteristics of a type, period, or method of construction, represent the work of a master, or possess high artistic value.
Criterion D: Have yielded, or is likely to yield, information important for research on prehistory or history.
Criterion E: Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

The uppermost remnant portion of the Native Ditch and a section outside the current project corridor are considered significant under Criterion D for the potential additional information that could be recorded.

Alexander Dam is considered significant under Criteria A, B, C, and D. The dam is considered significant under criterion A because of its association with the development of irrigation systems related to McBryde Sugar Company. The dam is also considered significant because of its failure and collapse during construction in 1931 claiming six lives. The dam's collapse is listed along with a number of other dam collapses in the

United States as having a significant influence upon engineering science and soil mechanics. Alexander Dam is considered significant under Criterion B due to its association with Duncan McBryde of McBryde Sugar Company. The dam is also believed to represent a unique piece of engineering and architecture because it is the highest hydraulic fill dam in Hawaii and the western United States. The dam is significant under Criterion D because of the potential for additional information that can be retrieved from the feature.

The forebay is considered significant under Criterion D for its potential to reveal additional information related to the Plantation era on Kauai and in Hawaii.

Impact and Mitigation Measures:

According to the archaeological inventory survey, the realignment, deepening, and restoration of water flow through the "Native Ditch" and the associated access road appear to have had little effect upon its historic properties. The continued use of the "Native Ditch" into the mid-1970s suggests that earlier historical integrity had already been somewhat compromised by prolonged use and probable periodic maintenance. Until that time the ditch represented a functioning part of the irrigation/water supply infrastructure much as Alexander Dam and the forebay feature continue to represent.

To preserve the remaining historical value of the Native Ditch, the archaeological inventory survey recommends that the intact portions of the Native Ditch be preserved through avoidance. If future work is undertaken that will impact the intact portions of the ditch, it is recommended that additional archaeological documentation be conducted prior to ground disturbance.

The survey determined that the project had no impact on Alexander Dam and a minimal impact on the forebay. Since Alexander Dam and the forebay will continue to be significant facilities associated with KCOF's irrigation and hydroelectric infrastructure, contingencies must be made for their continued maintenance. Maintenance of the dam and forebay is not expected to have a significant impact on either feature.

Finally, the archaeological inventory survey recommended that KCOF consider preparing a historic preservation plan to manage the historic features of the Alexander Dam water system and other cultural resources that may be a part of the overall irrigation infrastructure originally constructed by McBryde Sugar Company. An SHPD approved preservation plan would allow KCOF to more effectively monitor and manage irrigation facilities and assist in mitigating future negative impacts to historic properties.

3.7 Cultural Resources

A Cultural Impact Assessment was prepared by Cultural Surveys Hawaii in August 2005 to assess impacts to traditional cultural practices that may have occurred as a result of the project. The assessment is attached as Appendix C. According to the Cultural Impact

Assessment, in traditional Hawaiian times the lower stream lands in the ahupua'a of Wahiawa were primarily a focus of habitation and agriculture. Based on Land Commission Awards, it appears that at the time of the Māhele in the mid-19th century, there was a relatively dense pattern of wetland taro cultivation adjacent to Wahiawa stream. The Land Commission Award claimant's house lot was also typically located within the same land parcel as the lo'i.

By the early 20th century, sugarcane cultivation and development of plantation infrastructure was the dominant land use activity in the Wahiawa ahupua'a. The construction of Alexander Dam from 1927 to 1931 is representative of the major landscape transformation brought by development of commercial sugar interests. These transformations, and the sense that areas like Alexander reservoir were private property, restricted access to the project area to sugar company employees for most of the 20th century.

Impact and Mitigation Measures

None of the community contacts queried as part of the Cultural Impact Assessment identified any cultural sites in the project area, or recalled any past or present traditional cultural practices at the project area. Consequently, the assessment determined that the restoration of the irrigation ditch has had a minimal impact upon native Hawaiian cultural resources, beliefs and practices. The assessment recommends, however, that since cultural artifacts and layers may be present at the project site, personnel involved with ongoing maintenance of the irrigation ditch be informed of the possibility of inadvertent cultural finds, and be aware of the appropriate notification measures that should be followed.

3.8 Viewplanes and Aesthetic Resources

The lush vegetation of the Lihue-Koloa forest reserve provides a scenic backdrop for view from Kaumualii Highway and coastal areas. There are no public viewplanes at the project site as it is inaccessible to the general public.

Impact and Mitigation Measures

Restoration of the irrigation ditch has had no impact on viewplanes or aesthetic resources. Due to its remote location and the dense vegetation in the vicinity if the irrigation ditch, it is not visible from Kaumualii Highway or coastal areas.

3.9 Population and Employment

Kalaheo Town is about 1.75 miles south of the project site. According to the 2000 U.S. Census Bureau, Kalaheo had a population of 3,913, or approximately 7 percent of the island population. In 2000, the average age of residents in Kalaheo was 40 years. There were 1,509 housing units, in which 68.1% of the housing units were owner occupied and the median household income was $57,813.

In 2004, the job count for the County of Kauai was about 28,800. The Leisure and Hospitality sector accounted for nearly 30% of jobs, followed by the Trade, Transportation and Utilities sector (21%), Government (15%), and Professional and Business Services (11%). Agriculture accounted for about 2.5% of all jobs in Kauai County in 2004.

Impact and Mitigation Measures:
Restoration of the irrigation ditch has had no impact on population. The project has had a beneficial impact on employment and the local economy by allowing the 1,200 acres of land irrigated by the Alexander Dam water system to continue to be cultivated.

3.10 Transportation System

Access to the project site is provided by an unimproved road off of Kaumualii Highway. Access along the restored irrigation ditch is provided by an unimproved access road that was restored concurrently with the irrigation ditch. Although the restored road's grade was not formally engineered and has not been measured, field observations indicate the grade is less than ten percent throughout the project with the exception of the section below the ditch crossing at the discharge to the forebay. For the most part, the road is located on the down slope side of the restored ditch and runoff from above the road is directed into the ditch rather than passing over and potentially eroding the roadway. Soil stabilization was achieved through limited plantings along the banks and natural revegetation throughout much of the project. A natural buffer of dense underbrush exists between the access road and the nearest surface water resource, Wahiawa Stream.

Impact and Mitigation Measures
Restoration of the irrigation ditch has had no impact on Kaumualii Highway or the unimproved road leading to the project site.

3.11 Utilities

An overhead power line runs parallel to the unimproved road leading from Kaumualii Highway to Alexander Reservoir. As it flows to the KCOF irrigation system, water from the Alexander Dam water system is used to generate hydropower to operate KCOF's coffee processing facility. The project site is not served by a potable water system, sewer system, or storm drain system.

Impact and Mitigation Measures
The project has had no adverse effect on utility systems in the vicinity of the project site. Restoration of the irrigation ditch has had a beneficial impact on KCOF's electrical system by maintaining a source of water to operate its hydroelectric plant.

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4 RELATIONSHIP TO LAND USE PLANS AND POLICIES

4.1 Clean Water Act, Section 404

Under Section 404 of the Clean Water Act, authorization from the U.S. Army Corps of Engineers is required for certain activities that may result in a discharge of dredged or fill material into waters of the United States. The Alexander Dam Water System, including the forebay and upstream ditches, are considered waters of the United States because they are hydraulically connected to other waters of the United States. Work that may result in a discharge of dredged or fill material into these waters, therefore, is potentially subject to regulation under the Section 404 permit program.

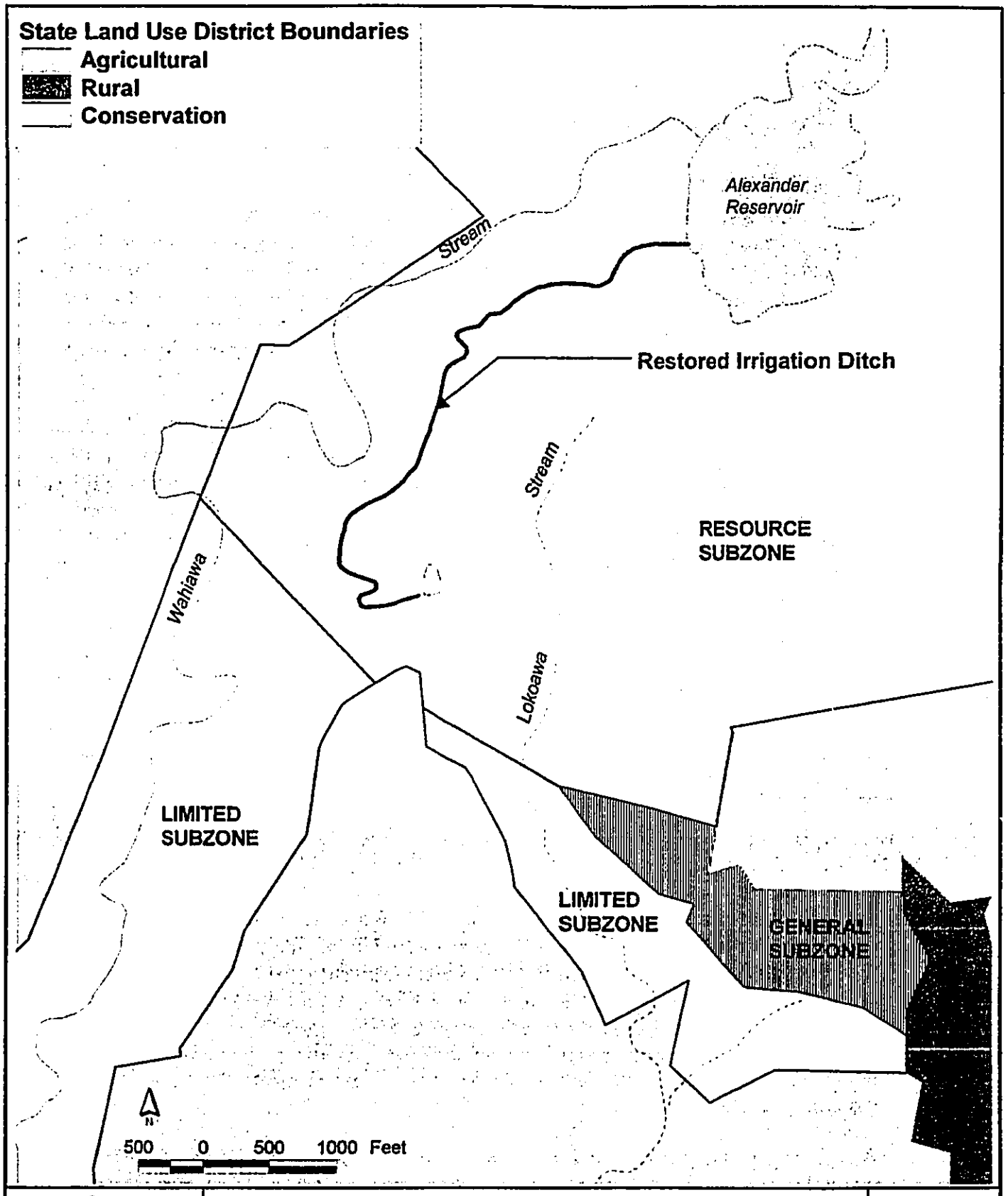
However, 33 CFR Section 323.4 and 40 CFR Section 232.3 provide that discharges from certain farming activities, including discharges from construction or maintenance of farm or forest roads, and from construction or maintenance of irrigation ditches and facilities appurtenant and functionally related to irrigation ditches do not require permits. Accordingly, a Section 404 permit was not required for restoration of the irrigation ditch and access road. The Army Corps of Engineers is a consulted party for the *Environmental Assessment*.

4.2 State Land Use Districts

The State Land Use Law, Chapter 205, Hawaii Revised Statutes (HRS), is intended to preserve, protect, and encourage the development of lands in the State for uses that are best suited to the public health and welfare of Hawaii's people. The State Land Use Commission classifies all lands in the State into four land use districts: Urban, Agricultural, Conservation, and Rural.

The project site is within the State Land Use "Conservation" District, "Resource" subzone (see Figure 8). As stated in HRS §205-2 the Conservation district includes areas necessary for "protecting watersheds and water sources; preserving scenic and historic areas; providing park lands, wilderness and beach reserves; conserving indigenous or endemic plants, fish, and wildlife, including those which are threatened or endangered; preventing floods and soil erosion; forestry; open space areas whose existing openness, natural condition or present state of use, if retained, would enhance the present or potential value of abutting or surrounding communities, or would maintain or enhance the conservation of natural or scenic resources; areas of value for recreational purposes; other related activities; and other permitted uses not detrimental to a multiple use conservation concept."

As stated in Hawaii Administrative Rules §13-5-13, the objective of the Conservation District Resource subzone is "to develop, with proper management, areas to ensure sustained use of the natural resources of those areas."



WILSON OKAMOTO CORPORATION ENGINEERS - PLANNERS	ALEXANDER DAM IRRIGATION DITCH RESTORATION STATE LAND USE DISTRICT BOUNDARIES	FIGURE 8

The activities that were undertaken for the project including restoration of the irrigation ditch, grubbing and grading, clearing of non-native trees, and restoration of the access road are permissible uses in the Conservation District Resource Subzone, subject to procuring a Conservation District Use Permit (CDUP). This Environmental Assessment is being prepared in conjunction with an after-the-fact Conservation District Use Application for the activities that were undertaken. The CDUP will also cover the repair and maintenance activities listed in Table 1, and revegetation efforts by KCOF.

Restoration of the irrigation ditch did not significantly affect natural resources in the vicinity of the project including water resources, flora and fauna, air quality, or landforms. Maintenance of the irrigation ditch is also not expected to significantly affect natural resources.

4.3 Coastal Zone Management Program

The National Coastal Zone Management Program was created through passage of the Coastal Zone Management Act of 1972. Hawaii's Coastal Zone Management Program, adopted as Chapter 205A, HRS, provides a basis for protecting, restoring and responsibly developing coastal communities and resources. A discussion of the project's consistency with the objectives and policies of the Coastal Zone Management Program is provided below.

(1) *Recreational Resources*

Objective:
Provide coastal recreational opportunities accessible to the public.

Policies

(A) *Improve coordination and funding of coastal recreational planning and management; and*

(B) *Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:*

(i) *Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;*

(ii) *Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the state for recreation when replacement is not feasible or desirable;*

(iii) *Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*

(iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

(v) Ensuring public recreational use of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;

(vi) Adopting water quality standards and regulating point and non-point sources of pollution to protect, and where feasible, restore the recreational value of coastal waters.

(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and

(viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, county planning commissions; and crediting such dedication against the requirements of Section 46-6, HRS.

The project has had no impact on coastal recreational opportunities.

(2) *Historic Resources*

Objective:

Protect, preserve and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies:

(A) Identify and analyze significant archaeological resources;

(B) Maximize information retention through preservation of remains and artifacts or salvage operations; and

(C) Support state goals for protection, restoration, interpretation, and display of historic resources.

An archaeological inventory survey has been prepared for the project. As summarized in section 3.6, the inventory survey identified the "Native Ditch", Alexander Dam and Reservoir, and the forebay as significant historic features. As recommended by the inventory survey, intact portions of the "Native Ditch" will be preserved through avoidance. If future work is undertaken that will impact the intact portions of the ditch, additional archaeological documentation will be conducted prior to ground disturbance.

(3) *Scenic and Open Space Resources*

Objective:
Protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:
(A) *Identify valued scenic resources in the coastal zone management area;*
(B) *Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;*
(C) *Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and*
(D) *Encourage those developments which are not coastal dependent to locate in inland areas.*

The project has had no impact on scenic or open space resources. Due to the dense vegetation in the vicinity of the project site, the restored irrigation ditch and access road are not visible from public vantage points.

(4) *Coastal Ecosystems*

Objective:
Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:
(A) *Improve the technical basis for natural resource management;*
(B) *Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;*
(C) *Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and*
(D) *Promote water quantity and quality planning and management practices which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses which violate state water quality standards.*

No adverse impact to coastal ecosystems is known to have occurred during restoration of the irrigation ditch and access road and no long-term impacts are expected. The work generally adhered to NRCS conservation practices intended to reduce soil erosion associated with construction, operation, and maintenance of farm roads and irrigation ditches, and so is consistent with management measures for agriculture specified in

Hawaii's Coastal Nonpoint Pollution Control Program. In addition, it is unlikely that runoff from the project site has affected Wahiawa Stream or coastal waters since the underbrush between the project site and Wahiawa Stream is extremely dense and coastal waters are over 4 miles distant.

(5) *Economic Uses*

Objective:
Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:
(A) *Concentrate coastal dependent development in appropriate areas;*
(B) *Ensure that coastal dependent developments such as harbors and ports, and coastal related development such as visitor facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and*
(C) *Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:*
(i) *Use of presently designated locations is not feasible;*
(ii) *Adverse environmental effects are minimized; and*
(iii) *The development is important to the State's economy.*

Restoration of the irrigation ditch was necessary to supply water to 1,200 acres of coffee fields. Loss of the coffee crop would have had a significant financial impact on KCOF. The project has not created adverse social, visual or environmental impacts.

(6) *Coastal hazards*

Objectives:
Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence and pollution.

Policies
(A) *Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;*
(B) *Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint pollution hazards;*

(C) Ensure that developments comply with requirements of the Federal Flood Insurance Program;
(D) Prevent coastal flooding from inland projects; and
(E) Develop a coastal point and nonpoint source pollution control program.

The project has had a beneficial effect by preventing Alexander Reservoir from overflowing. Prior to restoration of the irrigation ditch, the water level in Alexander Reservoir had reached 96 feet, 3-feet below the overflow level. The restored irrigation ditch is generally consistent with the practices set forth in the USDA's Natural Resources Conservation Service "Conservation Practice Standard for Irrigation Canal or Lateral", which sets forth practices to minimize soil erosion.

(7) Managing Development

Objective:
Improve the development review process, communication and public participation in the management of coastal resource and hazards.

Policies:
(A) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;
(B) Facilitate timely processing of applications for development permits and resolve overlapping of conflicting permit requirements; and
(C) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life-cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

Government agencies, organizations and the general public are being notified of the project, and being given an opportunity to comment on the project, through the environmental review and the Conservation District Use Permit process. Short and long-term impacts have been assessed in this Environmental Assessment.

(8) Public Participation

Objective:
Stimulate public awareness, education, and participation in coastal management.

Policies:
(A) Maintain a public advisory body to identify coastal management problems and to provide policy advice and assistance to the coastal zone management program;

(B) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal-related issues, developments, and government activities; and

(C) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

Government agencies, organizations and the general public are being notified of the project, and being given an opportunity to comment on the project, through the environmental review and the Conservation District Use Permit process.

(9) Beach Protection

Objective:
Protect beaches for public use and recreation.

Policies:

(A) Locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion;

(B) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and

(C) Minimize the construction of public erosion-protection structures seaward of the shoreline.

The proposed project does not involve the construction of improvements in the shoreline setback or erosion-protection structures. The project has not adversely affected coastal recreational opportunities available to the public.

(10) Marine Resources

Objective:
Implement the State's ocean resources management plan.

Policies:

(A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

(B) Assure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

(C) Coordinate the management of marine and coastal resources and activities management to improve effectiveness and efficiency;

(D) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;

(E) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and

(F) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

The project has had no adverse impact on marine resources. The work generally adhered to NRCS conservation practices intended to reduce soil erosion associated with construction, operation, and maintenance of farm roads and irrigation ditches, and it is unlikely that runoff from the project site has affected Wahiawa Stream or coastal waters since the underbrush between the project site and Wahiawa Stream is extremely dense and coastal waters are over 4 miles distant.

4.4 County of Kauai General Plan

The County of Kauai General Plan provides broad policy statements to guide land use regulations, new developments and facilities, and planning for County and State facilities and services. Relevant sections of the General Plan are as follows:

4.3.3 Irrigation Systems

Though agricultural lands have been preserved to a great extent, the irrigation systems serving them have decayed. Many reservoirs and ditches are poorly maintained, and some – primarily on the north and east sides of the island – have been taken out of use or abandoned. Some systems have been interrupted by land subdivisions, so that the reservoir may be owned by one entity while the ditches are divided among multiple owners.

On the North Shore, some Kilauea Plantation systems no longer function due to ownership or operational problems. On the east side, former systems are falling into disrepair in areas such as Kapa'a and Kealia where Lihue Plantation has abandoned cultivation and is selling off lands. In contrast, on the south and west sides of the island, large sugar, seed corn, and coffee plantations continue to use and maintain their irrigation systems. Without irrigation, the potential for intensive agriculture is severely diminished, if not lost. The State Department of Agriculture, Agriculture Development Corporation, recognizes the threat and is undertaking an assessment of the condition of major irrigation systems on all islands.

In many areas, irrigation reservoirs and ditches also serve to retain and channel stormwater away from settled areas. If these systems are disrupted or allowed to fall into disrepair, it could increase the risk of flooding on surrounding lands.

4.3.7 Policy

(c) The County and State shall take measures to maintain viable irrigation systems – both government- and privately-owned – and to support the supply of irrigation water to farmers at reasonable prices. Measures should include tax relief and other incentives.

The Koloa-Poipu-Kalaheo Planning District Heritage Resources Map identifies lands in the vicinity of the project site as "Important Land Form".

The Alexander Dam water system supplies water to about 1,200 acres of KCOF's coffee fields and also generates power for its processing facility. The emergency repairs that were undertaken were necessary to provide irrigation water to 1,200 acres of coffee fields and also to prevent overflow of Alexander Dam, which could have posed a public health risk. Restoration of the irrigation ditch did not significantly alter the landform in the vicinity of the project site.

4.5 Koloa-Poipu-Kalaheo Development Plan

The Koloa-Poipu-Kalaheo Development Plan provides more detailed criteria and standards to implement the objectives of the County of Kauai General Plan. The project is within the Development Plan's Kalaheo/Lawai/Omao subarea. According to the Development Plan, the Kalaheo/Lawai/Omao complex "functions as a residential base for primary employment which is both inside and outside the planning area. Agriculture, tourism, public service and military activities constitute the bulk of the primary employment. It is recommended that these communities remain residential in character by not seeking to establish primary employment bases within their urban areas."

Restoration of the irrigation ditch will have no effect on the long-term development of the Koloa-Poipu-Kalaheo region. With the exception of the restored irrigation ditch, which transports the same quantity of water that the collapsed tunnel had transported, the Alexander Dam water system is unchanged.

5 ALTERNATIVES TO THE PROPOSED ACTION

5.1 No Action Alternative

Under the No Action Alternative, restoration of the irrigation ditch would not have been undertaken. This could have resulted in the loss of up to 1,200 acres of coffee trees and the inability for KCOF to generate power from its Kalaheo hydroelectric plant. In addition, the risk of overflow from Alexander Reservoir would have increased, as the reservoir water level was already at 96 feet (three feet below overflow level) before the irrigation ditch was restored. In the long-term, a new source of water would need to have been developed, which could have reduced the supply of water for other agricultural operations.

5.2 Repair of the Collapsed Irrigation Tunnel

Repair of the collapsed irrigation tunnel was initially considered. After the tunnel collapsed, portions of the tunnel were excavated in an attempt to clear the blockage and enable KCOF personnel along with personnel from East Maui Irrigation Company, Ltd. (EMI) to inspect the tunnel. The EMI personnel, who have extensive experience with similar water systems, advised that further collapse of the tunnel was very possible and could pose a safety threat to workers if repairs were attempted. Since KCOF did not wish to endanger its workers, it was determined that this was not a feasible alternative.

5.3 Alternative Ditch Alignments

Constructing a new irrigation ditch or following the path of the "Native Ditch", were possible alternatives. Constructing a new irrigation ditch, however, would have increased the risk for adverse environmental effects since a greater amount of clearing, grubbing and grading would have been required. Following the former path of the "Native Ditch" would also have increased adverse environmental effects since the reason that the ditch was realigned in two areas was to avoid stands of koa that otherwise may have been destroyed. The third area where the ditch was realigned, at its northern starting point, created a more direct route that reduced the length of the irrigation ditch by about 300 feet, thereby reducing the amount of grubbing and grading required.

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6 REQUIRED PERMITS AND APPROVALS

The following permits will be procured for the project:

State of Hawaii
- After-the-fact Conservation District Use Permit

County of Kauai
- After-the-fact exemption from the county's Sediment and Erosion Control Ordinance under the exclusion for agricultural operations

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7 ANTICIPATED DETERMINATION

Restoration of the irrigation ditch did not generate a significant impact based on the criteria set forth in Section 11-200-12, Hawaii Administrative Rules. Likewise, maintenance and operation of the irrigation ditch, forebay, dam, and appurtenant facilities, and planned revegetation efforts, are not anticipated to cause a significant impact. KCOF, therefore, anticipates that a Finding of No Significant Impact (FONSI) will be issued for the project. The proposed project's relationship to each of the significance criteria is discussed below.

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.*

Restoration of the irrigation ditch did not involve an irrevocable commitment to loss or destruction of a natural or cultural resource. Although the "Native Ditch" has been identified as a historic feature, the archaeological inventory survey determined that earlier historical integrity had already been somewhat compromised by prolonged use and probable periodic maintenance. As recommended by the archaeological inventory survey, the remaining historical value of the intact portions of the Native Ditch will be preserved through avoidance. If future work is undertaken that will impact the intact portions of the ditch, additional archaeological documentation will be conducted prior to ground disturbance.

The survey determined that the project had no impact on Alexander Dam and a minimal impact on the forebay. Maintenance of the dam and forebay is not expected to have a significant impact on either feature.

The cultural impact assessment prepared for the project determined that restoration of the irrigation ditch has had a minimal impact on native Hawaiian cultural resources, beliefs and practices.

2. *Curtails the range of beneficial uses of the environment.*

Restoration of the irrigation ditch has not curtailed the range of beneficial uses of the environment. The irrigation ditch and access road were existing features that had been in active use until the 1970's. Restoration of the irrigation ditch allowed water to continue to be supplied through the Alexander Dam water system, which allowed 1,200 acres of coffee fields to continue to be cultivated.

3. *Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions or executive orders;*

The project is consistent with the environmental policy and guidelines set forth in Chapter 344, HRS. The project has had no adverse environmental effect and has allowed 1,200 acres of coffee fields to continue to be cultivated, which is consistent with guideline (5)(B) "Promote and foster the agricultural industry of the State; and preserve and conserve productive agricultural lands".

4. Substantially affects the economic or social welfare of the community or state.

Restoration of the irrigation ditch had a beneficial impact by preventing the loss of 1,200 acres of coffee fields, which had been exhibiting stress after the irrigation tunnel collapsed. Loss of the coffee fields would have had a significant adverse financial impact to KCOF.

5. Substantially affects public health.

The project has had no adverse effect on public health. The project had a beneficial impact by preventing the overflow of Alexander Reservoir, which had reached a water level of 96 feet (three feet below the overflow level). Overflow of the reservoir could have created a public health hazard.

6. Involves substantial secondary impacts, such as population changes or effects on public facilities.

The project does not involve secondary impacts such as population changes or effects on public facilities. The restored irrigation ditch transports the same quantity of water from Alexander Reservoir to the forebay that the irrigation tunnel had transported. The remainder of the Alexander Dam water system operates as it had prior to the irrigation tunnel collapse.

7. Involves a substantial degradation of environmental quality.

The project has not involved a substantial degradation of environmental quality. Based on field observations, the project has had no impact on surface water resources and vegetation at the majority of the project site has been reestablished. KCOF will perform remedial work in the areas where vegetation has not reestablished.

8. Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.

The project was an emergency action to repair the existing Alexander Dam water system. The project has not had a cumulative environmental effect and it does not involve a commitment for larger actions.

9. Substantially affects a rare, threatened or endangered species, or its habitat.

Flora and faunal studies conducted for the project did not identify any rare, threatened or endangered species in the vicinity of the project site.

10. Detrimentally affects air or water quality or ambient noise levels.

The project has had no long-term adverse effect on air or water quality or ambient noise levels. Based on field observations, water flowing through the irrigation ditch is clear and the ditch is not eroding. The work generally adhered to NRCS conservation practices intended to reduce soil erosion associated with construction, operation, and maintenance of farm roads and irrigation ditches, and it is unlikely that runoff from the irrigation ditch's access road has affected surface water resources since the nearest stream is about 0.5 miles away and there is thick underbrush between the access road and the stream.

11. Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, freshwater, or coastal waters.

The project is not located in an environmentally sensitive area.

12. Substantially affects scenic vistas and viewplanes identified in county or state plans or studies.

The project has not substantially affected scenic vistas or viewplanes. Due to its remote location and because lands surrounding the irrigation ditch are heavily vegetated, the restored irrigation ditch and access road are not visible from public vantage points.

13. Requires substantial energy consumption.

The restored irrigation ditch flows by gravity and does not consume energy.

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8 CONSULTATION

8.1 Pre-Assessment Consultation

Pre-assessment comments were solicited from the following agencies. Agencies from which comments were received are indicated by a "✓".

Federal Government

✓ U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service

State Government

Department of Health
Department of Land and Natural (DLNR)
✓ DLNR, State Historic Preservation Division
Office of Hawaiian Affairs
Office of Planning

County Government

County of Kauai Planning Department

8.2 Draft Environmental Assessment Consultation

The Draft EA has been distributed to the following agencies. Agencies from which comments were received are indicated by a "✓".

Federal Government

✓ U.S. Army Corps of Engineers
U.S. Natural Resources Conservation Service

State Government

Department of Agriculture
Department of Health
✓ Office of Environmental Quality Control
✓ Office of Hawaiian Affairs
Office of Planning
✓ State Historic Preservation Division
✓ DLNR, Engineering Division
✓ DLNR, Division of Forestry and Wildlife

County of Kauai Government

✓ Planning Department
Department of Public Works
Department of Water

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9 REFERENCES

County of Kauai. Kauai General Plan. November 2001.

County of Kauai. Koloa-Poipu-Kalaheo Development Plan. 1978. Prepared by Muroda & Associates, Inc. and Edaw Inc.

Giambelluca, Thomas W, Michael A. Nullet and Thomas A. Schroeder. Rainfall Atlas of Hawai'i. Prepared for the State of Hawaii, Department of Land and Natural Resources, Division of Water and Land Development. June 1986.

State of Hawaii, Department of Business, Economic Development, and Tourism. State of Hawaii Data Book.

Stearns, Harold T. Geology of the State of Hawaii. 1985.

PRE-ASSESSMENT CONSULTATION COMMENTS

DM

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 223
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF: CEPOH-EC-T

June 15, 2005

Civil Works Technical Branch

Mr. Dean Minakami
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Minakami:

Thank you for the opportunity to review and comment on the Pre-Consultation Process for the Alexander Dam Water System Project, Kalaheo, Kauai. The following comments are provided in accordance with Corps of Engineers authorities to provide flood hazard information and to issue Department of the Army (DA) permits.

a. It appears that the irrigation system, including Alexander Dam, may be subject to Corps jurisdiction under Section 404 of the Clean Water Act (CWA). Additional information would be necessary as part of the draft EA to determine if the activities addressed through the Conservation District Use Application review would be subject to regulation under the CWA. For further information, please contact Ms. Connie Ramsey of our Regulatory Branch at (808) 438-2039.

b. According to the attached Flood Insurance Rate Map for Kauai (panel number 1500020180C), the project site is located in Zone X (unshaded - areas outside of the 500-year floodplain).

Should you have any questions, please call Ms. Jessie Dobinchick of my staff at 438-8876.

Sincerely,

James Pennaz

James Pennaz, P.E.
Chief, Civil Works
Technical Branch

Encls

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

KAUAI COUNTY,
HAWAII

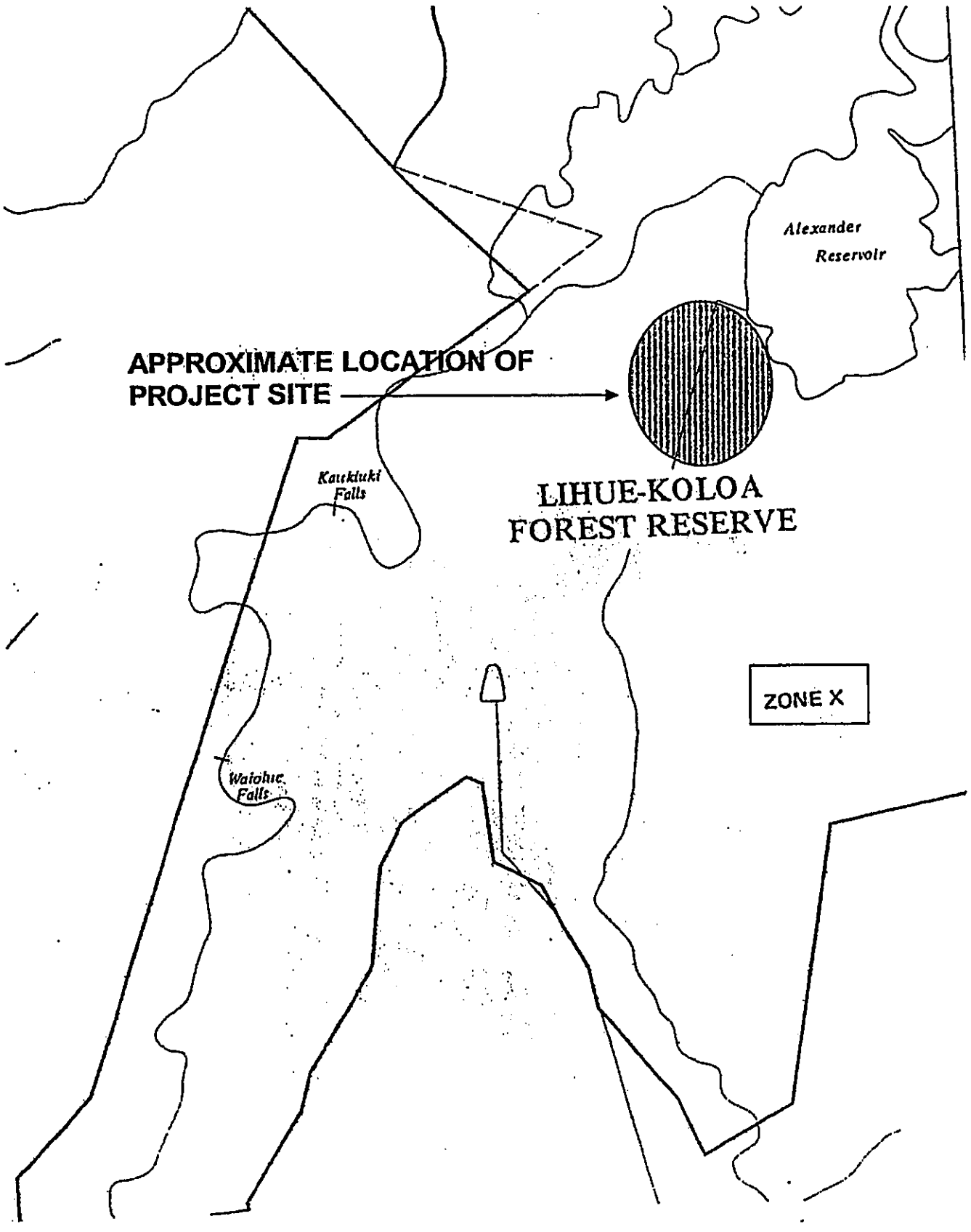
PANEL 180 OF 225
(SEE MAP INDEX FOR PANELS NOT PRINTED)

PANEL LOCATION

COMMUNITY-PANEL NUMBER
150002 0180 C

MAP REVISED:
MARCH 4, 1987

Federal Emergency Management Agency


APPROXIMATE LOCATION OF
PROJECT SITE
Alexander
Reservoir
Kaeleluki
Falls
LIHUE-KOLOA
FOREST RESERVE
ZONE X
Waiohue
Falls

WILSON
OKAMOTO
CORPORATION

ENGINEERS
PLANNERS

1907 S. BERETANIA ST.
SUITE 400
HONOLULU, HI 96826
PH. (808)946-2277
FAX: (808)946-2253

October 6, 2005

Mr. James Pennaz, P.E., Chief
Civil Works Technical Branch
U.S. Army Engineer District, Honolulu
Building 223
Fort Shafter, Hawaii 96858-5440

Dear Mr. Pennaz:

Subject: Pre-Assessment Consultation
Alexander Dam Irrigation Ditch Restoration
Lihue-Koloa Forest Reserve, Kauai
Tax Map Keys (4) 2-4-008: 002 and 2-4-009: 001 and 003

Thank you for your letter of June 15, 2005 providing comments on the subject project. We acknowledge that the project site is in flood hazard Zone X – areas outside of the 500-year floodplain.

With regard to Clean Water Act Section 404 permit requirements, we acknowledge that the Alexander Dam water system may be under Corps jurisdiction because it is hydraulically connected to other waters of the United States. However, it appears that the irrigation ditch restoration is exempt from Section 404 permit requirements under 33 CFR 323.4 and 40 CFR 232.3. These sections provide that discharges from certain farming activities, including discharges from construction or maintenance of farm or forest roads, and from construction or maintenance of irrigation ditches and facilities appurtenant and functionally related to irrigation ditches, do not require a Section 404 permit. Additional information regarding the irrigation ditch restoration will be provided in the Draft Environmental Assessment.

We appreciate your participation in the environmental review process.

Very truly yours.

Rodney Funakoshi, AICP
Project Manager

LINDA LINGLE
GOVERNOR OF HAWAII

RECEIVED
JUL 25 2005
WILSON OKAMOTO CORPORATION

DM

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
DEPUTY DIRECTOR - LAND

DEAN NAKANO
ACTING DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING, ROOM 555
601 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707

July 21, 2005

Mr. Dean Minakami, AICP, Planner
Wilson Okamoto Corp.
1907 S. Beretania Street, Suite 400
Honolulu, Hawaii 96826

LOG NO: 2005.1334
DOC NO: 0506NM38

Dear Mr. Minakami:

SUBJECT: Chapter 6E-42 Historic Preservation Review Pre-Assessment on EA For After-the-Fact CDUA for Improvements Associated With Emergency Repairs to Alexander Dam Water System

Thank you for your letter of May 31, 2005, requesting our review and comments regarding any impact the emergency repairs to the Alexander Dam Water System may have had on historic properties. Cultural Surveys Hawaii has recently requested historic site numbers for the Alexander Dam Water System which indicates this system may be historic. Once we review the survey report on this area we can provide a more appropriate comment to you on this after-the-fact EA and CDUA.

If you have any questions, please call Nancy McMahon 742-7033.

Aloha,

MELANIE CHINEN, Administrator
State Historic Preservation Division

NM:jen

October 6, 2005

WILSON
OKAMOTO
CORPORATION

ENGINEERS
PLANNERS

1907 S. BERETANIA ST.
SUITE 400
HONOLULU, HI 96826
PH. (808)946-2277
FAX: (808)946-2253

Ms. Melanie Chinen, Administrator
State Historic Preservation Division
601 Kamokila Boulevard
Kakuhihewa Building Room 555
Kapolei, Hawaii 96707

Dear Ms. Chinen:

Subject: Pre-Assessment Consultation
Alexander Dam Irrigation Ditch Restoration
Lihue-Koloa Forest Reserve, Kauai
Tax Map Keys (4) 2-4-008: 002 and 2-4-009: 001 and 003

Thank you for your letter of July 21, 2005 commenting on the subject project. We acknowledge that Cultural Surveys Hawaii has recently requested historic site numbers for the Alexander Dam water system and that more appropriate comments will be provided after the survey report is reviewed.

We appreciate your participation in the environmental review process.

Very truly yours.

Rodney Funakoshi, AICP
Project Manager

COMMENTS TO DRAFT EA

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 223
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF: CEPOH-EC-T

December 23, 2005

Civil Works Technical Branch

Mr. Rodney Funakoshi
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Mr. Funakoshi:

Thank you for the opportunity to review and comment on the Draft Environmental Assessment for the Alexander Dam Irrigation Ditch Restoration Project, Koloa, Kauai. We do not have any additional comments to offer beyond those originally provided in our letter dated June 15, 2005.

Should you require additional information, please contact Ms. Jessie Dobinchick of my staff at (808) 438-8876.

Sincerely,

James Pennaz

James Pennaz, P.E.
Chief, Civil Works
Technical Branch

LINDA LINGLE
GOVERNOR OF HAWAII

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186
E-mail: oeqc@health.state.hi.us

December 14, 2005

Sam Lemmo
Dept. of Land and Natural Resources
Office of Conservation & Coastal Lands
P.O. Box 621
Honolulu, Hawaii 96809

Attention: Dawn Hegger

Dear Mr. Lemmo:

Subject: Draft Environmental Assessment (EA), **Alexander Dam Irrigation Ditch, Kauai**

Two-sided pages: HRS 342G-44 requires double-sided copying in all state and county agencies, offices and facilities. This EA is printed single-sided, although the appendices are printed duplex. In order to reduce bulk and save on paper please print the final EA also in duplex.

If you have any questions, call Nancy Heinrich at 586-4185.

Sincerely,

GENEVIEVE SALMONSON
Director

c: Dean Minakami, Wilson Okamoto

7399-01
February 16, 2006

WILSON
OKAMOTO
CORPORATION

ENGINEERS
PLANNERS

1907 S. BERETANIA ST.
SUITE 400
HONOLULU, HI 96826
PH. (808)946-2277
FAX: (808)946-2253

Clyde W. Namuo, Administrator
Office of Hawaiian Affairs
State of Hawaii
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Namuo:

Subject: Draft Environmental Assessment (DEA) for the Alexander Dam Irrigation Ditch Restoration, Koloa, Kauai, TMK (4) 2-4-008:001, 002, and 16 & 2-4-009:001 and 003.

Thank you for your letter of December 8, 2005 on the subject DEA. We acknowledge and assure you that should iwi or Native Hawaiian cultural or traditional deposits be found during ground disturbance, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

We appreciate your interest and participation in the DEA process.

Sincerely,

Rodney Funakoshi, AICP
Project Manager

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD05/2144

December 8, 2005

Samuel Lemmo
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, HI 96809

RE: Draft Environmental Assessment for the Alexander Dam Irrigation Ditch Restoration, Koloa, Kaua'i, TMK (4) 2-4-008: 001, 002 and 16 & 2-4-009: 001 and 003.

Dear Mr. Lemmo,

The Office of Hawaiian Affairs (OHA) is in receipt of your November 25, 2005 request for comment on the above listed proposed project, TMK (4) 2-4-008: 001, 002 and 16 & 2-4-009: 001 and 003. OHA offers the following comments:

Our office has no comment Draft Environmental Assessment. Thank you for your continued correspondence.

OHA further requests your assurances that if the project goes forward, should iwi or Native Hawaiian cultural or traditional deposits be found during ground disturbance, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

Thank you for the opportunity to comment. If you have further questions or concerns, please contact Jesse Yorck at (808) 594-0239 or jessey@oha.org.

'O wau iho nō,

Clyde W. Nāmu'o
Administrator

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

HAWAI'I HISTORIC PRESERVATION DIVISION REVIEW

Log #: 2005.2533
Doc #: 0512NM22.doc

Applicant/Agency: Samuel J. Lemmo, Administrator/Office of Conservation and Coastal Lands
FOR: Kauai Coffee

Address: DLNR, POB 621,
Honolulu, HI 96809

SUBJECT: Chapter 6E-42 Historic Preservation Review – ATF CDUA KA-3272
Kauai Coffee for improvements and repairs to Alexander Dam

Ahupua`a: Wahiawa
District, Island: Koloa, Kauai
TMK: (4) 2-4-008; 001, 002, 016 and 2-4-009: 001 and 003

1. We believe there are no historic properties present, because:
__a) intensive cultivation has altered the land
__b) residential development/urbanization has altered the land
__ c) previous grubbing/grading has altered the land
___d) an acceptable archaeological assessment or inventory survey found no historic properties
___ e) other:

2. This project has already gone through the historic preservation review process, and mitigation has been completed ✓.

✓ Thus, we believe that "no historic properties will be affected" by this undertaking

Staff: Nancy McMahon Date: 12/19/05

Title: Archaeologist for Kaua'i

PHONE (8

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

REF.: OCCL:DH
Kauai.43

COMMENTS

( ) We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone ___.

(X) **Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone D. The National Flood Insurance Program does not have any regulations for developments within Zone D.**

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

( ) Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

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

( ) Mr. Robert Sumimoto at (808) 523-4254 or Mr. Mario Siu Li at (808) 523-4247 of the City and County of Honolulu, Department of Planning and Permitting.

( ) Mr. Kelly Gomes at (808) 961-8327 (Hilo) or Mr. Kiran Emler at (808) 327-3530 (Kona) of the County of Hawaii, Department of Public Works.

( ) Mr. Francis Cerizo at (808) 270-7771 of the County of Maui, Department of Planning.

( ) Mr. Mario Antonio at (808) 241-6620 of the County of Kauai, Department of Public Works.

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

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments: _____

( ) Other: _____

Should you have any questions, please call Mr. Andrew Monden of the Planning Branch at 587-0229.

Signed: _____
ERIC T. HIRANO, CHIEF ENGINEER

Date: 12/19/05

LINDA LINGLE
GOVERNOR OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
DEPUTY DIRECTOR - LAND

DEAN NAKANO
ACTING DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF FORESTRY AND WILDLIFE
KAUAI DISTRICT
3060 EIWA STREET, ROOM 306
LIHUE, KAUAI, HAWAII 96766

November 4, 2005

MEMORANDUM

TO: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

FROM: Alvin M. Kyono, Kauai District Manager

SUBJECT: Request for Authorization from the Department to Process a Conservation Use Application by Kauai Coffee Company Located on State-owned Lands, File No., KA-3272

We have no objections to this request, by Kauai Coffee Company. The project will not have any effect on any of Kauai DOFAW plans for the area.

cc: DOFAW Administrator

2951

BRYAN J. BAPTISTE
MAYOR

GARY K. HEU
ADMINISTRATIVE ASSISTANT

IAN K. COSTA
DIRECTOR OF PLANNING

MYLES S. HIRONAKA
DEPUTY DIRECTOR OF PLANNING

COUNTY OF KAUA'I
PLANNING DEPARTMENT
4444 RICE STREET
KAPULE BUILDING, SUITE A473
LIHU'E, KAUA'I, HAWAI'I 96766-1326
TELEPHONE: (808) 241-6677 FAX: (808) 241-6699

December 27, 2005

Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, Hawaii 96809

2005 DEC 30 A 8:21

Subject: Conservation District Use Application (CDUA) KA-3272
And Draft Environmental Assessment
Alexander Dam Irrigation Ditch Restoration
Kauai Coffee Company, Applicant
TMK: (4) 2-4-008: 001, 002, 016; 2-4-009: 001 and 003
Kalaheo, Kauai

We have reviewed the subject Application and Draft Environmental Assessment and have determined that the project as described in the documents is not situated within the Special Management Area of the County of Kauai.

Thank you for consulting us on this matter.

Ian K. Costa,
Director of Planning

cc: Rodney Funakoshi

APPENDIX A

Biological Survey Report for the Alexander Ditch Dam Restoration Project Site

Prepared by Botanical Consultants

CORRECTION

THE PRECEDING DOCUMENT(S) HAS
BEEN REPHOTOGRAPHED TO ASSURE
LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

APPENDIX A

Biological Survey Report for the Alexander Ditch Dam Restoration Project Site

Prepared by Botanical Consultants

BIOLOGICAL SURVEY REPORT FOR THE ALEXANDER DITCH

DAM RESTORATION PROJECT SITE

FOR
WILSON OKAMOTO AND ASSOCIATES
1907 SOUTH BERETANIA STREET, SUITE 400
HONOLULU, HAWAII 96826
April 2005

BY
EVANGELINE J. FUNK, PH.D.
BOTANICAL CONSULTANTS
HONOLULU, HAWAII 96815

TABLE OF CONTENTS

INTRODUCTION

The Alexander Dam Ditch Restoration Project site is approximately one mile long and extends from about 1400 feet elevation to a little over 1600 feet elevation. It consists of an irrigation ditch and an access road. The ditch is approximately twenty-five feet across and the access road consists of a single tract plus ten foot wide shoulders. Flora and fauna surveys on this site were carried out in April 2005. The results of those surveys will be presented below.

BOTANICAL SURVEY REPORT

A two person field team collected data on the vegetation of the access road by way of the walk through method. Data on the ditch vegetation were collected by way of frequent forays across the road shoulder to the ditch rim

RESULTS

Between 1910 and 1960 the Hawaii Department of Land and Natural Resources (DLNR) planted thousands of trees on the Island of Kauai in various reforestation projects. Above Kalaheo town they planted *Eucalyptus citriodora* Hook. *E. robusta* Sm., *Grevillea robusta* A. Gunn. Ex R. Br., *Hibiscus elatus* Sw., *Juniperus bermudiana* L., *Syncarpia glomulifera* Sm., and *Toona ciliate* M. Roem (Skolman 1980). Many of these trees have become established and are reproducing. Seedlings and saplings of the above mentioned taxa make up a significant part of the flora of the study site.

At about 1600 feet elevation where the survey began the canopy is dominated by very tall siris trees (*Albizia lebbeck* (L.) Benth) fifty to sixty feet in height. The shrub layer consists of young siris saplings, red guava (*Psidium cattleianum* Sabine), African tulip saplings (*Spathodea campanulata* P. Beauv.), and sourbush (*Pluchea symphytifolia*

(Mill.) Gillis), The ground layer is a mat of mixed grasses and ferns. Both gold and silver fern (*Pitygrogramma chrysophylla* (Sw.) Link) and neke *(Cyclosorus interruptus* H. Ito.) appear often among the Hilo grass (*Paspalum conjugatum* Bergius), Guinea grass (*Panicum maximum* Jacq.), Lyon's grass (*Themeda villosa* (Poir) A. Camus) and Maile hohono (*Ageratum conyzoides* L.) and other low growing herbs. In this area the stream banks are sparsely covered with the same ferns, grasses and seedlings.

Moving westward or makai from the dam the area becomes more mesic and other species enter the mix. Cuba bast (*Hibiscus elatus* Sw.), lemon-scented gum (*Eucalyptus citriodora* Hook), and blue gum (*Eucalyptus globulus* LaBill) seedlings and saplings along with yellow guava trees (*Psidium guajava* L.), ironwood trees (*Casuarina equisetifolia* L.) and Guinea grass (*Panicum maximum* Jacq.).

At about 1500 feet elevation young native Koa trees (*Metrosideros polymorpha* Gaud) form a major part of the vegetative cover. Along the walls of the ditch gold fern, Ahu'awa haole (*Cyperus alternifolius* L), guinea grass and young Koa make up the scant vegetative cover.

The access road crosses a long line of planted Norfolk Island pine trees (*Araucaria heterphylla* Franco). In this area large numbers of Norfolk Island pine tree seedlings and saplings can be found along both the access road, the ditch and among the planted trees.

At about 1400 feet the canopy is a mix of Siris, Eucalyptus, red guava, and ironwood trees. The scant ground cover is a mix of many weedy species such as sensitive plant (*Mimosa pudica* L.), Guinea grass, hairy horseweed (*Conyza bonariensis* (L.) Cronq.) and broom sedge (*Andropogon bicomis* L.).

CONCLUSIONS

The vegetation of this site is such a mix of alien species that no vegetation type can be distinguished. The large number of seedlings and saplings indicate that if the vegetation was disturbed it would quickly regenerate.

It is recommended that every effort be made to save and protect the young Koa trees found along the access road and the ditch.

ENDANGERED SPECIES

No candidate, proposed, or listed threatened or endangered species as set forth in The Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) are known from this site and none were found during this survey.

SPECIES LIST OF THE PLANTS FOUND ON THE ALEXANDER DAM DITCH RESTORATION SITE

The plant families in the following species list have been alphabetically arranged within four groups, Ferns and Allies, Gymnosperms, Monocotyledons, and Dicotyledons. The genera and species are arranged alphabetically within families. The taxonomy and nomenclature follow that of Wagner, Herbst, and Sohmer (1990). For each taxon the following information is provided:

1. An asterisk before the plant name indicates a plant introduced to the Hawaiian Islands since Cook or by the aborigines.
2. The scientific name of the plant.
3. The Hawaiian name or the most widely used common name of the plant.
4. Abundance ratings are for this site only and they have the following meanings:
   Uncommon = a plant that was found less than five times.
   Occasional = a plant that was found between five and ten times.
   Common = a plant considered an important part of the vegetation.
   Locally abundant = plants found in large numbers over a limited area. For example the plants found in grassy patches.

This species list is the result of an extensive survey of this site during, cool spring weather (April 2005) and it reflects the vegetative composition of the flora during a single growing season. Minor changes in the vegetation will occur due to introductions and losses and a slightly different species list would result from a survey conducted during a different growing season.

Scientific Name	Common Name	Abundance
FERNS AND ALLIES		
DICKSONIACEAE – Dicksonia Family		
Microlepia setosa (Sm.) Alton.	Palapalai	Locally abundant
GLEICHENIACEAE- Vine Fern Family		
Dicranopteris linearis Underw.	False staghorn fern	Locally abundant
POLYPODIACEAE – Common Fern Family		
**Cyclosorus interruptus* H. Ito		Locally abundant
**Pitygrogramma chrysophylla* (Sw.) Link	Gold fern	Common
GYMNOSPERMS		
ARAUCARIACEEAE – Araucaria Family		
**Araucaria heterphylla* Franco	Norfolk Island pine	Common
MONOCOTYLEDONS		
AGAVACEAE – Agave Family		
Cordyline fruticosa (L.) A. Chev.	Ti	Occasional
CYPERACEAE – Sedge Family		
**Cyperus alternifolius* L.	'Ahu awa haole	Occasional
**Cyperus rotundus* L.	Nut grass	Occasional
ORCHIDACEAE – Orchid Family		
**Spathoglottis plicata* Blume	Philippine orchid	Occasional
POACEAE - Grass Family		
**Andropogon bicomis* L.	Broomsedge	Common
**Digitaria ciliaris* (Retz.) Koeler	Henry's crabgrass	Common
**Panicum maximum* Jacq.	Guinea grass	Common
**Paspalum conjugatum* Bergius	Hilo grass	Abundant
**Rhynchelytrum repens* (Willd.) Hubb.	Natal redtop	Uncommon
**Stenotaphrum secundatum* Kuntze	St. Augustine grass	Locally abundant

Scientific Name	Common Name	Abundance
POACEAE - Grass Family con't		
**Sporobolus diander* (Retz.) P. Beauv.	Indian dropseed	Occasional
**Themeda villosa* (Poir.) A.Camus	Lyon's grass	Common
DICOTYLEDONES		
ASCLEPIADACEAE – Milkweed Family		
**Asclepias physocarpa* Schlechter	Balloon flower	Uncommon
ASTERACEAE – Sunflower Family		
**Ageratum conyzoides* L.	Maile hohono	Common
**Conyza bonariensis* (L.)	Hairy horseweed	Common
**Elephantopus mollis* Kunth		Uncommon
**Emilia coccinea* (Sims) G. Don	Flora's paintbrush	Common
**Emilia fosbergii* Nicolson	Pualele	Occasional
**Erechtites hieracifolia* (L.) Raf. Ex DC		Occasional
**Pluchea symphytifolia* (Mill.) Gillis	Sourbush	Common
BIGNONIACEAE – Bignonia Family		
**Spathodea campanulata* P. Beauv.	African tulip tree	Occasional
CASUARINACEAE – She-oak Family		
**Casuarina equisetifolia* L.	Ironwood	Common
FABACEAE – Bean Family		
Acacia koa A. Gray	Koa	Common
**Albizia lebbeck.* L.	Siris tree	Common
**Desmodium incanum* DC	Spanish clover	Occasional
**Glycine wightii* Verdec.		Occasional
**Indigofera suffruticosa* Mill.	Iniko	Uncommon
**Leucaena leucocephala* (Lam.) de Wit	Koa haole	Common
**Mimosa pudica* L.	Sensitive plant	Common
LYTHRACEAE – Loosestrife – Family		
**Cuphea carthagenensis* (Jacq.) Macbr.	Tarweed	Common

Scientific Name	Common Name	Abundance
MALVACEAE – Mallow Family		
**Hibiscus elatus* Sw.	Cuba bast	Common
MELASTOMATACEAE – Melastoma Family		
**Heterocentron subtriplinervium* A. Braun&C. Bouche	Pearl flower	Uncommon
MELIACEAE – Mahogany Family		
**Toona ciliata* M. Roem	Australian red cedar	Common
MYRTACEAE – Myrtle Family		
**Eucalyptus citriodora* Hook	Lemon scented gum	Common
**Eucalyptus globulus* LaBill		Common
**Eucalyptus sideroxylon* A. Cunn.		Common
**Melaleuca quinquenervia* S. T. Blacke	Paper bark	Uncommon
Metrosideros Polymorpha Gaud	Lehua	Occasional
**Psidium cattleianum* Sabine	Strawberry guava	Occasional
**Psidium guajava* L.	Yellow guava	Occasional
POLYGALACEAE – Milkwort Family		
**Polygala paniculata* L.		Common
PROTEACEAE – Protea Family		
**Grevillea robusta* A. Cunn. Ex R.Br.	Silk oak	Uncommon
ROSACEAE – Rose Family		
**Rubus rosifolius* Sm.	Thimble berry	Common
RUBIACEAE – Coffee Family		
**Hedyotis biflora* Lam. (L.) Lam.		Uncommon
**Spermacoce assurgens* Ruiz & Pav.	Buttonweed	Uncommon
SCROPHULARIACEAE – Figwort Family		
**Castilleja arvensis* Cham. & Schlechtend.	Indian paint brush	Occasional

Scientific Name	Common Name	Abundance
VERBENACEAE – Verbena Family		
**Lantana camara* L.		Uncommon
**Stachytarpheta urticifolia* (Salisb.L.) Sims	Vervain	Common

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FAUNA SURVEY REPORT

INTRODUCTION

The vegetation of the Alexander Dam Ditch Restoration Project site is made up almost entirely of alien species. Therefore it offers little or no food for endemic fauna. The presence of large numbers of seed producing grasses does offer food for a variety of introduced bird species and for rats and mice which are presumed to be present on all sites where food and water are available. Hence, rats and mice are assumed to be present on this study site. At 1600 feet elevation where the water tunnel from Alexander Dam empties into Alexander Ditch evidence of pig activity in the form of digging was clearly evident although no pigs were seen.

METHODS

Data on the fauna of this site were collected by a two person team. Four twenty minute early morning listening stops were carried out in addition to frequent stops for observations from a parked car. Results of these observations are presented here.

RESULTS

A variety of bird species use the long narrow Alexander Dam Ditch Restoration Project site. In the tall siris trees at 1600 foot elevation a small flock of migratory Least terns (*Sterna antillarum*) were clearly seen. The black head and tail markings plus the slim white under bellies and the loud chattering of these birds make them very arresting. They flit around the high canopy while uttering loud scratchy cries. Five birds were clearly seen, however there may have been others.

Red Junglefowl *(Gallus gallus)*

In the vicinity of the Alexander Dam tunnel several Red Junglefowl were seen and many more were heard in the surrounding forest. Both male and female birds were foraging for insects in the leaf litter.

White Rumped-Shama (Copsychus molabaricus)

The beautiful clear voice of the White Rumped Shama was heard along the entry road and along the access road. Flitting birds were seen along both roads. The bird's flashing white rump and rusty orange breast was make it easy to spot in the low under brush.

Northern Cardinal (*Cardinalis cardinalis*)

Bright red male Northern Cardinals and the brown nondescript females were seen and heard along the access road at about the 1500 foot elevation and near the end on the site at 1400 feet elevation. They were also seen along the entry road to the study site.

Myna (Acidotheres tristis)

The white wing and tail patches that flash when Mynas are in flight make them easy to spot. Mynas were present along the lower part of the access road and along the entry road.

Zebra Doves (*Zenaida marcoura*)

The cooing of Zebra doves was heard more often at lower, drier parts of the study site. Birds were seen both on the ground and in flight. Doves were also seen on the power lines leading to the project site.

House Sparrows (*Passer domesticus*)

House Sparrows were seen and heard near the lower, drier part of the study site, House sparrows are commensals and are more often seen near houses. Because of the available water and the abundance of grass seed on the study site probably accounts for their presence on this isolated site.

ENDANGERED SPECIES

No candidate, proposed, or listed threatened or endangered species as set forth in The Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) are known from this site and none were found during this survey.

CONCLUSIONS

The most unusual bird sighting was the little flock of Least terns. They are migratory birds and are seldom seen in the Hawaiian Islands, but they are known to occasionally visit these islands. It was somewhat unexpected to see Red Junglefowl and House sparrows so far from human habitation. The abundance of food probably accounts for their presence.

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APPENDIX B

An Archaeological Inventory Survey to Support the Restoration of Alexander Dam Irrigation Ditch Project

Prepared by Cultural Surveys Hawaii, Inc.

An Archaeological Inventory Survey to Support the Restoration of Alexander Dam Irrigation Ditch Project, Wahiawa Ahupua'a, Kōloa-Poipu District, Kaua'i TMK (4) 2-4-8: por 002 and 2-4-09: por 001 and por 003

Prepared for
Wilson Okamoto Corporation

Prepared by
John E. Dockall, Ph.D,
Robert Hill, B.A.,
Tanya L. Lee-Greig, M.A.
and
Hallett H. Hammatt, Ph.D.

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An Archaeological Inventory Survey to Support the Restoration of Alexander Dam Irrigation Ditch Project, Wahiawa Ahupua'a, Kōloa-Poipu District, Kaua'i TMK (4) 2-4-8: por 002 and 2-4-09: por 001 and por 003

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Management Summary

Report Reference	An Archaeological Inventory Survey to Support the Restoration of Alexander Dam Irrigation Ditch Project, Wahiawa Ahupua'a, Kōloa-Poipu District , Kaua'i. Prepared for Wilson Okamoto Corporation. Cultural Surveys Hawai'i, Inc. Wailuku, Maui. By John E. Dockall, Ph.D, Tanya L. Lee-Greig, M.A., and Hallett H. Hammatt, Ph.D.
Project Number	CSH Job Code: WAHI 4
Location	Kaua'i, Kōloa-Poipu District, Wahiawa Ahupua'a, TMK (4) 2-4-8: por 002 and 2-4-09: por 001 and por 003, USGS 1:24,000 map Hanapēpē Quad
Date Submitted	September 2005
Permit Number	Hawai'i State Historic Preservation Division (SHPD) permit No. 0404.
Agencies	SHPD
Land Jurisdiction	A portion of the project area is owned and operated by the Kaua'i Coffee company, Inc. (KCOF) and a portion of the project area is owned by the state and under the jurisdiction of the Department of Agriculture and Forestry (in accord with Executive Order No. 1083).
Survey Acreage	3 acres

Development Project Description	At the request of Kaua'i Coffee Company and Wilson Okamoto Corporation, two archaeologists from Cultural Surveys Hawai'i, Inc., conducted an archaeological inventory survey of a narrow corridor of land along a refurbished irrigation ditch situated between Alexander Dam and a forebay structure. The requested inventory survey was to comply with requirements for application for an "after the fact" application for a Conservation District Use Permit (CDUP). In July of 2001, personnel from Kaua'i Coffee Company (KCOF) accomplished emergency repairs to a key portion of the water system in Kalāheo after the main outlet tunnel from Alexander Reservoir had collapsed. These repairs were conducted to prevent overtopping of water behind Alexander Dam and to reestablish irrigation water and hydroelectric power to KCOF coffee growing and processing activities. The 2001 collapse of the main outlet tunnel from Alexander Dam resulted in a loss of the abilities to release water from Alexander Reservoir except through the spillway and the to provide irrigation water to 1200 acres of KCOF plantation, but also the loss of the ability to generate necessary electricity. Alexander Dam provides the only water source for the KCOF plantation and provides hydropower to operate the KCOF factory.
Historic Preservation Regulatory Context	This study was conducted to fulfill permitting and regulatory requirements associated with HAR 13-276 and 13-284. In addition, the project is required to fulfill permitting and regulatory requirements associated with an application for a Conservation District Use Permit for land that is under the jurisdiction of the State Department of Agriculture and Forestry. Additionally, a permit would also have been required according to the Kaua'i County Grading Ordinance No. 808 and the State Conservation District Rules, Title 13, Chapter 5. Since portions of the project were conducted on state-owned land beyond the boundaries of any existing easements or other access agreements that are applicable to the Native Ditch it may be necessary to address requirements for access and use in accord with HAR 11-200 regarding use of state land.
Field Effort	Field effort was conducted by John E. Dockall, Ph.D., and Robert Hill, B.A., under the overall supervision of Hallett H. Hammatt, Ph.D., and required 1 person-day to complete. The inventory survey was conducted on April 22, 2005.

Sites Identified	There were three historic properties identified during the inventory survey. 50-30-09-3917 is a remnant of an irrigation canal known locally as the Native Ditch, however, the history of the feature indicates its construction in about 1900. This feature served to transport water from the Wahiawa Stream watershed. 50-30-09-3918 is identified as Alexander Dam that consists of a concrete spillway and a hydraulic filled dam with a rock-armored front. 50-30-09-3919 represents the forebay feature that receives water from outlet tunnels below the reservoir. The forebay then feeds water into a riveted pressurized penstock feature that transmits water to KCOF coffee fields and a hydroelectric station at Kalāheo .
Site Significance Evaluations	50-30-09-3917 is significant under Criterion D. 50-30-09-3918 is significant under Criteria A, B, C, and D. 50-30-09-3919 is significant under Criterion D.
Area of Potential Effect (APE)	The area of potential effect (APE) includes the corridor for the realigned and refurbished irrigation ditch and the associated access road. Also included in the APE are the fore bay and Alexander Dam.
Determination of Effect	The realignment, deepening, and restoration of water flow through the "Native Ditch" and the associated access road appear to have had little effect upon historic properties. The continued use of the "Native Ditch" into the mid-1970s suggests that earlier historical integrity had already been somewhat compromised by prolonged use and probable periodic maintenance. Until that time the ditch represented a functioning part of the irrigation/water supply infrastructure much as Alexander Dam and the forebay feature continue to represent. The only apparent modification of the forebay has been the cutting of a new inflow for the terminus of the realigned "Native Ditch".

Recommendations	Native Ditch portion closest to the tunnels below Alexander Dam should be preserved. Alexander Dam, even though a historic property continues to function as an integral part of the irrigation and hydroelectric system of the Kaua'i Coffee Company and Kalāheo. A&B should be allowed to continue to maintain the feature as they have in the past. The forebay feature also represents a historic property that continues to function as an integral part of the irrigation and water supply system for the Kaua'i Coffee Company and Kalāheo . A&B should continue to maintain this feature as they have in the past. At their convenience it might be to their benefit for KCOF personnel to consider the development of a Historic Preservation Management Plan that incorporates such features as historic ditches, flumes, dams, reservoirs, penstocks and other facilities related to the irrigation infrastructure.

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Section 1 Introduction

1.1 Project Background

At the request of Kaua'i Coffee Company and Wilson Okamoto Corporation, two archaeologists from Cultural Surveys Hawai'i, Inc., conducted an archaeological inventory survey of a narrow corridor of land along a refurbished irrigation ditch situated between Alexander Dam and a forebay structure (Figure 1 and Figure 2). The requested inventory survey was to comply with requirements for an "after the fact" application for a Conservation District Use Permit (CDUP). In July of 2001, personnel from Kaua'i Coffee Company (KCOF) accomplished emergency repairs to a key portion of the water system in Kalāheo after the main outlet tunnel from Alexander Reservoir had collapsed. These repairs were conducted to prevent overtopping of water behind Alexander Dam and to reestablish irrigation water and hydroelectric power to KCOF coffee growing and processing activities.

The 2001 collapse of the main outlet tunnel from Alexander Dam resulted in a loss of the abilities to release water from Alexander Reservoir except through the spillway, and to provide irrigation water to 1200 acres of KCOF plantation, but also the loss of the ability to generate necessary electricity. Alexander Dam provides the only water source for the KCOF plantation and provides hydropower to operate the KCOF factory.

Examination of the main outlet tunnel revealed collapse in several areas and the hazard of attempting to clear it. Project documentation indicates that opportunities to restore irrigation flow to heat-stressed coffee trees and to reduce rising waters behind Alexander Dam were limited.

The option chosen was to refurbish and reactivate a former McBryde Sugar Company irrigation ditch that had last been used by McBryde Sugar Company, Ltd., in the mid-1970s. Since its last use, the ditch had become partially silted in and overgrown with vegetation but was deemed suitable for clearance and reuse. The decision to restore, refurbish, and reroute the old ditch was made under the belief that the work fell under an existing water facility exemption and that no permit was needed.

Restoration activities focused on rehabilitating approximately three-quarters of a mile of the old ditch and an adjacent access road. The work involved the clearance of about three total acres of land along the former ditch course and roadway and represented the excavation of approximately 33,000 cubic yards of sediment. Restoration of the ditch along its entire original alignment was not feasible and would have required the excavation of an additional mile of ditch. This would have bypassed the forebay and diverted water into Puana Reservoir. Water diverted into Puana Reservoir could not be distributed to the hydroelectric plant at Kalāheo or to KCOF irrigation facilities.

Work associated with the restoration and realignment of the ditch was completed within 28 days and succeeded in restoring flow to the KCOF plantation fields, the hydroelectric plant at Kalāheo, and avoided overtopping of Alexander Dam.

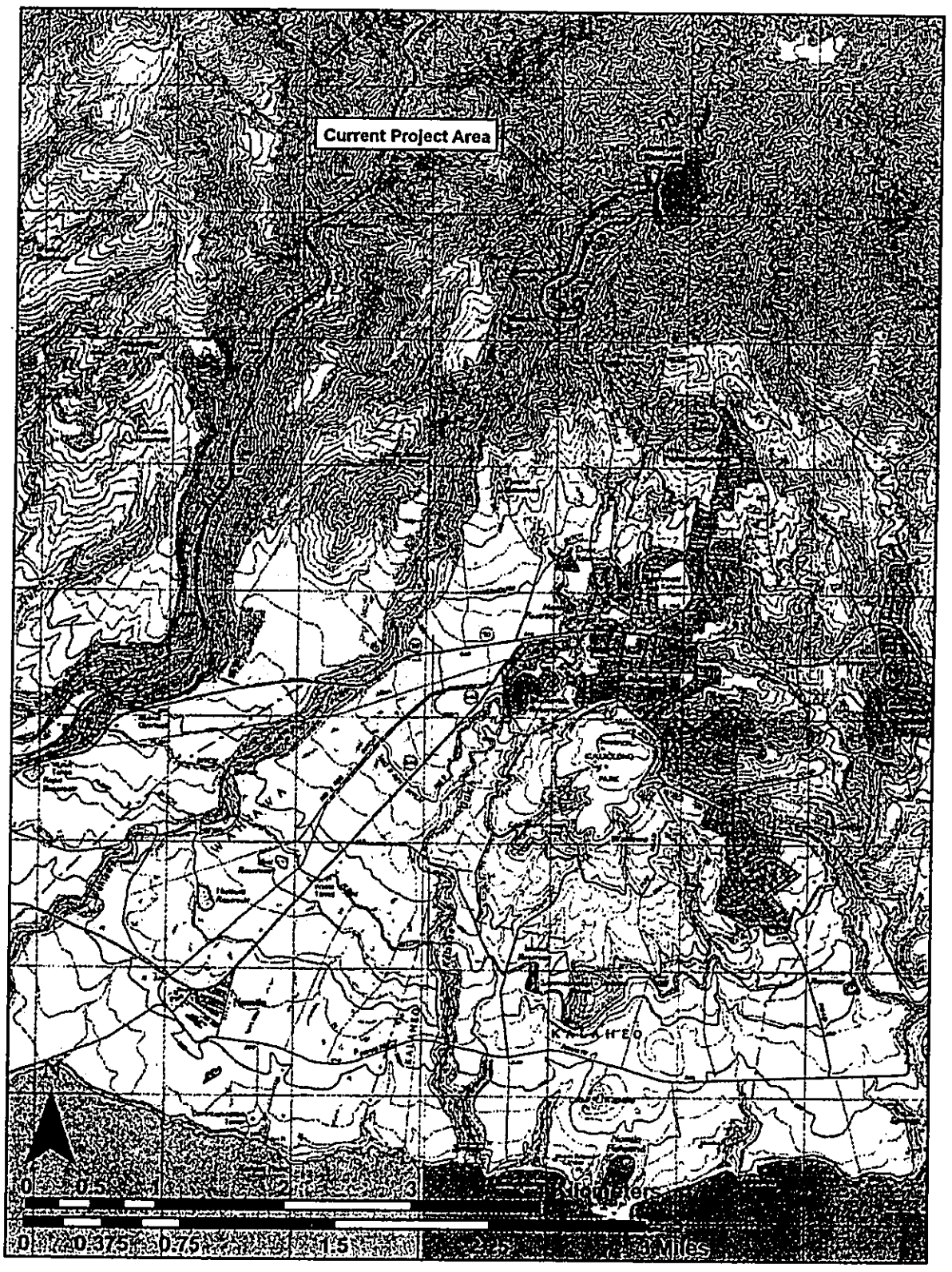

Figure 1. Portion of U.S. Geological Survey Kōloa Quadrangle showing location of general project area in relation to Alexander Reservoir and Kalāheo Town

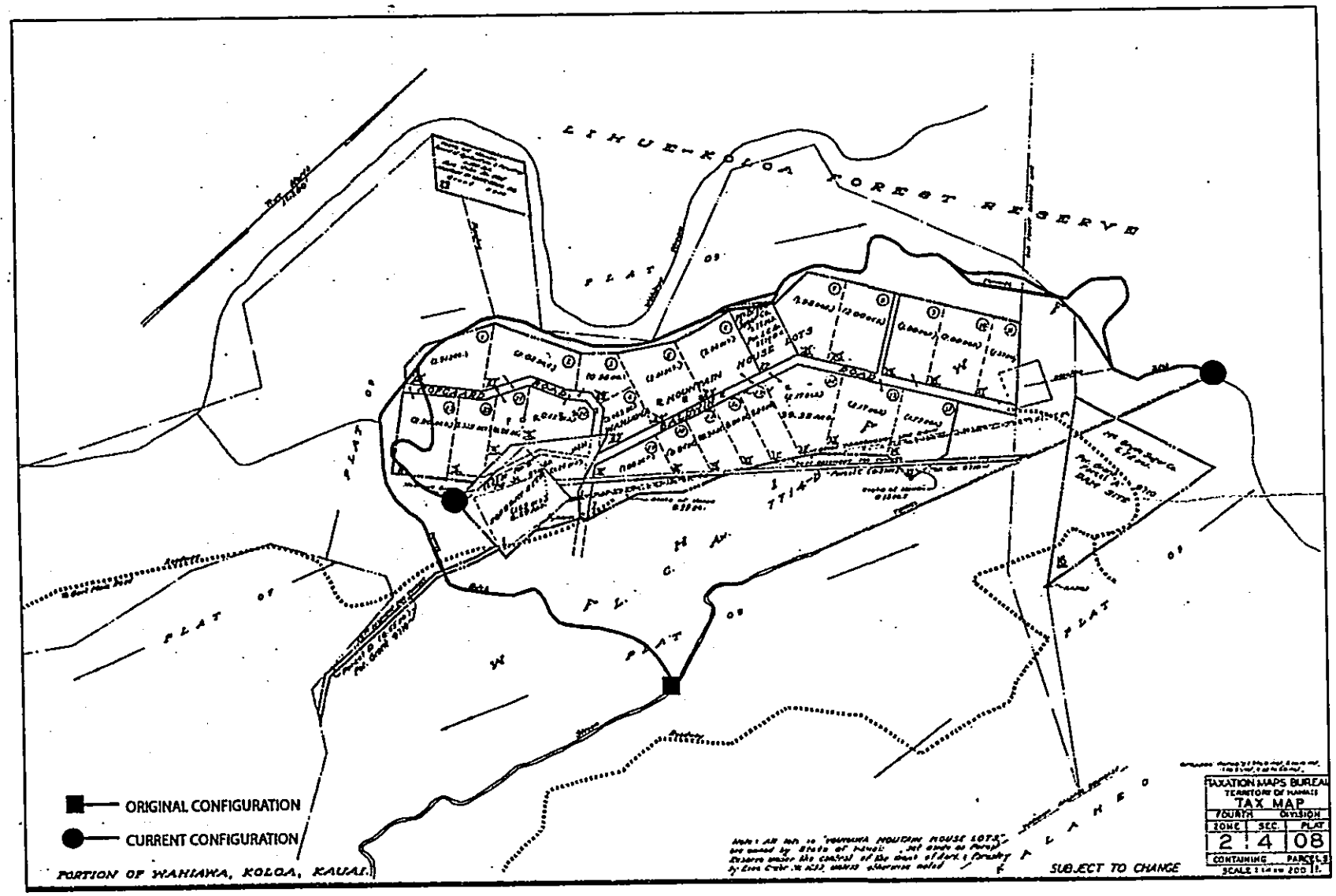

Figure 2. TMKs: (4) 2-4-08:por. 002 and 2-4-09: por 001 and por 003 showing location of original Native Ditch (blue) course and realigned portions of ditch (red) (also note locations of Alexander Dam and fore bay structures)

1.2 Scope of Work

The following scope of work for this inventory survey was designed to satisfy the State and County requirements for an archaeological inventory survey.

1. A complete ground survey of the entire project area for the purpose of site inventory. All sites would be located, described, and mapped with the evaluation of function, interrelationships and significance. Documentation will include photographs and scale drawings of selected sites and complexes. All sites will be assigned State site numbers.
2. Limited subsurface testing, if appropriate, to determine if subsurface deposits are located in the project area, and, if so, evaluate their significance. If appropriate samples from these excavations are found they will be analyzed for chronological information.
3. Research on historic and archaeological background, including search of historic maps, written records, and Land Commission Award documents. This research will focus on the specific area with general background on the *ahupua'a* and district and will emphasize settlement patterns and the development of plantation infrastructure.
4. Preparation of a survey report that will include the following.
   a. A topographic map, if available, of the survey area showing all archaeological sites and site areas.
   b. Description of all archaeological sites with selected photographs, scale drawings, and discussions of function.
   c. Historical and archaeological background sections summarizing pre-contact and historic land use as they relate to the archaeological features.
   d. A summary of site categories and their significance in an archaeological and historic context.
   e. Recommendations based on all information generated that will specify what steps should be taken to mitigate the impact of development on archaeological resources—such as data recovery (excavation) and preservation of specific areas. These recommendations will be developed in consultation with the client and the appropriate State agencies.

The Scope of Work also includes full coordination with the State Historic Preservation Division (SHPD) and Kaua'i County relating to archaeological matters. This coordination takes place after consent of the owner or representatives.

1.3 Environmental Setting

1.3.1 Natural Environment

The realignment corridor for the Native Ditch is situated within a portion of the Lihue-Kōloa Forest Reserve. Vegetation in the area consists of molasses grass (*Melinis minutiflora*) ground

cover in some areas, remnant *Koa* (*Acacia koa* Gray) forest with mixed *'Ōh'ia*.(*Ohia lehua*) Scattered through the area are tall eucalyptus trees (*Eucalyptus globulus* Labill.), some African Tulip (*Spathodea campanulata*), and guava (*Psidium gaujava* L.). Other tree species include Cook pine (*Araucaria columnaris*). Other various grasses were also observed but not identified.

According to Foote and others (Foote et al. 1972), the soils (Figure 3) that are present within the present archaeological inventory survey area are predominantly rough broken land (rRR), and Pooku Silty Clay (PmC, 8-15% slopes). The Pooku Series is comprised of well-drained soils distributed on uplands and develops in material that has weathered from basic igneous rock. Pooku soils vary from level to very steep and vary in elevation from 250 to 1000 feet. Annual rainfall ranges between 80 and 150 inches per year. Pooku soils are also geographically related to soils of the Makapili Series (Foote et al. 1972:114. Pooku soils with 8-15% slopes exhibit a slow to medium runoff and a slight to moderate erosion hazard. Typically these soils are suitable for pasture, sugarcane, water supply, woodland, and wildlife habitat. Rough broken land is characterized by very steep land with numerous intermittent drainages and typically is found in gulches and steep mountainsides. Associated soils are variable and develop over soft weathered bedrock. Some areas of colluvium and alluvium are present along drainages (Foote et al. 1972:119).

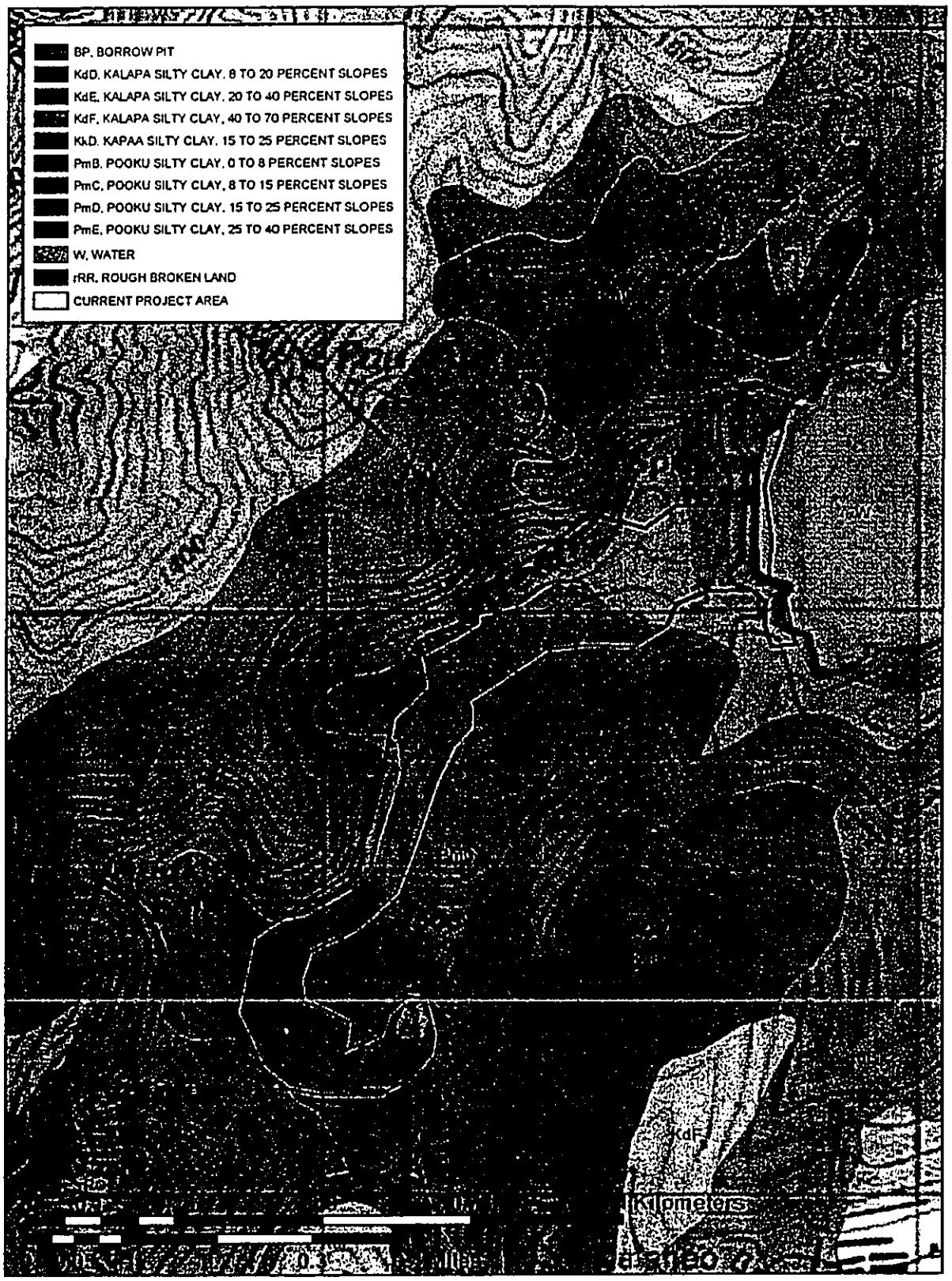

Figure 3. Portion of U.S. Geological Survey Kōloa Quadrangle showing location of project area in relation to local soil series (U.S. Department of Agriculture, Natural Resources Conservation Service 2001)

1.3.2 Built Environment

The built environment is dominated by a variety of water control and impoundment features constructed as part of the former McBryde Sugar Company, Ltd., but now utilized as infrastructure for the Kaua'i Coffee Company (KCOF). These features include Alexander Reservoir (inclusive of Alexander Dam and spillway), a forebay below the spillway and dam, an outlet tunnel from the reservoir to the forebay (collapsed), and a penstock to carry water from the forebay to the Kalāheo Hydroelectric station. An additional feature of this irrigation infrastructure is the refurbished Native Ditch. The term "Native Ditch" appears on the 1900 McBryde Sugar Company, Ltd. map. At present it does not appear to refer to any feature such as a pre-contact traditional *'auwai*. The possibility does exist that the ditch was originally a traditional *'auwai* that had been adapted and deepened by sugar company personnel. No evidence of a former traditional ditch was observed during fieldwork. The use of the term "Native Ditch" in this report only refers to the realigned and refurbished former McBryde irrigation canal that was in use into the mid-1970s and refers to no other. Alexander Dam is 600 feet in length and 113 feet in height and was constructed in 1931. Alexander Reservoir has a capacity of 810 million gallons and functions to store water for irrigation of about 1200 acres of coffee fields owned by KCOF and as a water supply for the hydroelectric station at Kalāheo . Also included within the built environment is an extensive network of flumes and ditches that are currently in use closer to the coast and Wahiawa Bay (see Figure 4)

Section 2 Methods

The archaeological inventory survey included both historic documents/references research and field survey. A separate Cultural Impact Assessment is also being conducted for the project area and will be presented as a separate document.

2.1 Field Methods

The archaeological inventory survey involved 100 percent pedestrian survey of the Native Ditch realignment corridor and access road. The project corridor was approximately 1,207 m (app. 0.75 mile) in length and varied in width between 9 and 12 m (30-40 ft). Visibility within the corridor was good to excellent and was dominated by the ditch and recently cleared access road. Fieldwork included physical examination of all new cuts, realigned sections, new sections, access road, and the entire refurbished ditch. Built features that include Alexander Dam, the forebay, remnant sections of Native Ditch, and upper end of the penstock were also examined. For this study, the penstock feature is not within the project area. Subsurface testing was deemed not necessary as all examination of all new cuts showed no evidence of buried cultural deposits or historic properties. The only feature to be impacted by the aforementioned realignment and restoration activities were segments of the Native Ditch. Given the narrowness of the project corridor, it was possible for two archaeologists to conduct one sweep through the area and completely cover the area. Total project area was approximately 3.0 acres.

2.2 Document Review

Document review included consulting Māhele records in the Waihona 'Āina database (www.waihona.com) and a series of historic maps and published book references. Maps that were consulted include the 1896 Kaua'i: 'Ele'ele to Kōloa Map by M.D. Monsarrat and a 1900 traced map using Monsarrat's 1896 map as a base. The locations of a number of the water reservoirs associated with McBryde Sugar Co. Ltd., are sketched onto this map. United States Geological Survey maps were also consulted as a comparison to earlier historic maps.

2.3 Consultation

A separate document representing a cultural impact assessment is being conducted as part of the overall EIS being completed for Kaua'i Coffee Company. Hawaiian organizations, government agencies, community members, and cultural and lineal descendants with ties to the Wahiawa area will be contacted to (1) identify potentially knowledgeable individuals with cultural expertise and knowledge of the project area and surrounding vicinity, and (2) to identify cultural concerns and potential impacts associated with project development. The community consultation process is currently ongoing as part of an accompanying Cultural Impact Evaluation.

Section 3 Background Research

Background research included a detailed examination and synthesis of historical documents and references, Māhele records (www.waihonaAina.com) and previous reports of archaeological studies that had been conducted in the area. Background research includes mythological and traditional accounts of regional history, the development of historic period economic infrastructure, plantation history, and the impact of these developments on local and regional history.

3.1 Traditional and Historical Background

3.1.1 Mythological and Traditional Accounts

Wahiawa (Wahi-awa) Valley, or "milkfish place," was named after the tradition of the Pohakuawa stone (Kikuchi 1963). The Pohakuawa stone is a large boulder with a bowl carved into its surface, formerly located "about a mile west of Brydeswood on the trail to the upper Wahiawa lands" (Sandison 1956). In traditional Hawaiian times, fishermen transporting *awa* (milkfish) from the brackish Nōmilu fishpond to a large pool in the Wahiawa Stream used the stream to keep fish alive. "The fisherman stopped the night at Pohakuawa and kept his catch alive in cool fresh water in the bowl of the rock that was draped over with vines to keep the stone cool and keep the fish from jumping out" (Sandison 1956).

Legendary accounts place a battle occurring at Wahiawa between members of the ruling family of Kaua'i (Fornander 1959). 'Aikānaka, the then king of Kaua'i, had recently been defeated in battle by his younger bother, Kawelo. Following the conquest, Kawelo divided the lands to his choosing, leaving 'Aikānaka to live in poverty with no lands and no home. 'Aikānaka settled in upland Hanapēpē, where he was later visited by Kaeleha, the son of Kawelo. The two met at Wahiawa, at the home of Ahulua. Kaeleha was shown great kindness and hospitality by 'Aikānaka, and therefore felt indebted to him.

Taking pity on 'Aikānaka for the way he was forced to live, Kaeleha instructed him on how to defeat his father, Kawelo, in battle. 'Aikānaka was told to fight Kawelo with stones because he was never taught to dodge stones thrown at him. Learning of the possible uprising by 'Aikānaka, Kawelo sent Kamalama to confirm the rumors. Kamalama returned news that 'Aikānaka and Kaeleha were gathering stones and making preparations for war. With great anger that his son would join 'Aikānaka and rebel against him, Kawelo immediately traveled to Wahiawa:

> When he [Kawelo] arrived at Wahiawa, he saw several war canoes belonging to Kaeleha and Aikanaka, just back of the great mounds of stones. On the sides of the mounds of stones, he saw women and children with stones in their stands, and all were apparently ready for the conflict. All Kawelo had in his hands were his war club, Kuikaa, and his wife's pikoi, two weapons to defend himself with.
>
> ...In the fight, Kawelo was not able to dodge the stones that were hurled at him, for a great many of them were thrown at the same time; therefore he stood in one place while the stones were hitting him from all sides. In the course of time, Kawelo was completely covered by the stones, the stones rising until his height was reached...After a while the mound of stones over Kawelo grew higher and

> higher, when at last nothing else could be seen but a great mound of stones which was like a grave for Kawelo. (Fornander 1959:104-108)

Kawelo's body was later removed from the mound of stones. The people beat his lifeless body with clubs to insure that he was dead. The body was then carried from Wahiawa to 'Aikānaka's temple at Maulili in Kōloa.

Traditional accounts of Wahiawa indicate the environment in the *ahupua'a* was suitable for the development of an extensive agricultural system that likely supported a sizable native Hawaiian population. Adequate rainfall, mild temperatures, and abundant spring and stream water in close association with arable land were ideal conditions for the cultivation of taro and other traditional staple foods. Keahi Luahine, a kama'āina raised in Wahiawa Valley, gives the following account:

> ...the taro terraces extended all the way down the valley to the *muliwai* (inlet). A short distance above the present highway bridge was a spring named Ka'ulupaniau, which watered a small group of terraces. Inland from this was Kawaikapulalo [The-sacred-water-below], and here were terraces and *wauke* (paper mulberry) plantations. Above this was *kula* land named Kawaikapuluna [The-sacred-water-above], on which were the houses and sweet-potato plantations. Continuing upstream to a point opposite Pu'u Aukai there were other terraces in the stream bed, with houses and sweet-potato plantations on *kula* land above. (Handy and Handy 1972:428-429)

Wahiawa Valley was also the location of the legendary stone, Kaua'i -iki (Little Kaua'i). A legend explains that in the process of clearing their *lo'i* of stones, a Hawaiian family came across this stone. Resembling a map of Kaua'i, they left the stone in place and gave it its name (Sandison 1956). An additional account by Keahi Luahine makes reference to the large stone that was shaped like the island of Kaua'i:

> At Wahiawa on Kaua'i was a stone called Kaua'i -iki which stood in a taro patch also called Kaua'i -iki. The taro that grew there was the finest and the largest on the island, said to be made so by the stone. When the paved road was built Alexander McBride (sic) removed the Kaua'i -iki stone so that it should not be blasted and ground up by the road workers...In ancient times people used to say that even though you had seen the entire island of Kaua'i and had not seen Kaua'i -iki, then you had not seen all of Kaua'i. This small taro patch and stone were much visited in the old days. (Pukui in Handy 1940:65).

3.2 Early Historic Period

During the early historic period, Wahiawa was again the setting of a battle over control of Kaua'i. In 1824, Kaumuali'i, the ruling chief of Kaua'i and Ni'ihau, became gravely ill. Nearing death, Kaumuali'i declared "Our 'son'" be his successor and "Let the lands be as they are; those chiefs who have lands to hold them, those who have not to have none" (Kamakau 1961:265). Following his death, Kahalai'a, nephew of Kaumuali'i and chief from Hawai'i Island, was announced as the new ruler over Kaua'i and Ni'ihau. However, the people of Kaua'i, both chiefs and commoners, expected one of Kaumuali'i's sons, Keali'iahonui or Humehume, to be named as successor.

Kahalai'a traveled to Kaua'i and settled at the former Russian Fort Elizabeth at Waimea. Soon after, a hostile sentiment spread among the people of Kaua'i over being ruled by an *ali'i* from Hawai'i. During this uneasy period, Rev. Hiram Bingham traveled to Wahiawa, leaving the following account:

> I visited the disaffected George [Humehume] at his estate - the little secluded Wahiawa. It was a small valley, running back from the sea to the mountains, containing some twenty small habitations, about a hundred souls, and some hundred acres, very little cultivated, yielding a scanty amount of the common productions of arum, bananas, cocoanuts, potatoes, sugar-cane, squashes, melons, and wild apples. At the foot of this valley, I found George living much in the original native style, in a dingy, dirty, thatched house at the sea-side, just where the surf washes a small beach between two rocky cliffs. (Bingham 1847)

The Kaua'i warriors, led by Humehume, subsequently rebelled and attacked the fort at Waimea, where the Hawai'i chiefs had gathered. Armed with guns, the men of Hawai'i were able to hold off the rebels until the arrival of reinforcements from O'ahu. More than ten ships later arrived (Kamakau 1961):

> On August 8 [1824] the battle of Wahiawa was fought close to Hanapēpē, where a fort had been hastily erected and a single cannon (named Humehume) mounted as a feeble attempt to hold back the enemy. In the evening there was an advance made, but the forces of Hawai'i retired to Hanapēpē for the night...Large numbers of Kaua'i soldiers had gathered on the battleground, but they were unarmed save with wooden spears, digging sticks, and javelins. Many women were there to see the fight. The men acted as if death were but a plaything. It would have been well if the gods had stepped in and stopped the battle. No one was killed on the field, but as they took to flight they were pursued and slain...For ten days the soldiers harried the land killing men, women, and children. (Kamakau 1961:268)

The battle of Wahiawa was later known as the "'Pig eating' (*'Aipua'a*) because the dead were left lying for the wild hogs to devour" (Kamakau 1961:233). Following the battle it was also noted:

> A great deal of property was taken, among other things horses and cattle, which had become numerous on Kaua'i because the foreigners had given many such to Kaumuali'i...After the battle the chiefs all came together and Kalanimoku redistributed the lands of Kaua'i ...It was decided that Kahalai'a should not remain as ruler, but the islands be turned over to the young king, and Kaikio'ewa was appointed governor and Kahalai'a recalled. (Kamakau 1961:268-269).

3.3 Mid- to late-1800s

3.3.1 Early Sugar Culture on Kaua'i

In 1835, a Honolulu firm, Ladd &Company, secured tenancy rights to a tract of land near Kōloa on Kaua'i for silk and sugar culture. Early accounts tell of plows being drawn by natives, crude milling methods and low sugar yields (Thrum 1901). In spite of these handicaps, 5,000 pounds of sugar and 400 gallons of molasses were produced in 1839. Early references to the use

of irrigation were noticeably absent. At that time, ownership of land was vested with the Kingdom. Prior to 1848, individuals and commoners were not able to hold title to land and any appurtenant water rights.

Although the Māhele of 1848 should have stimulated sugar enterprises, the industry declined due to a drought in 1851, and low sugar prices. The first use of irrigation to increase sugar yields occurred on the island of Kaua'i. William Harrison Rice engineered a causeway to divert water from upland streams in 1852; and finished construction of eleven miles of ditches for the Makee Plantation in 1857 (H.S.P.A. 1920). With the Union States' embargo of southern sugar plantations during the American Civil War, prices for Hawaiian sugar improved greatly in the 1860's (Dorrance 2000).

3.3.2 The Māhele

The Organic acts of 1845 and 1846 initiated the process of the *Māhele* - the division of Hawaiian lands - that introduced private property into Hawaiian society. In 1848, the crown and the *ali'i* (royalty) received their land titles. The common people received their *kuleana* (individual parcels) in 1850. It is through records for Land Commission Awards (LCAs) generated at the *Māhele* that the first specific documentation of life in Wahiawa Ahupua'a, as it had evolved up to the mid-19th century, come to light (Indices of Awards 1929) (Table 1).

Table 1 Wahiawa Ahupua'a Land Commission Awards Summary

LCA #	Claimant	Ili	Land Use	Claims Awarded
387	ABCFM (Mission)		Agriculture	2 *'āpana, kula, lo'i*
3215	Niha	Maloloiki	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 18 *lo'i*
3285	Waolani	Kanuiomalai	Agriculture	2 *'āpana*, 1 *kula*, 30 *lo'i*, 1 pigpen
3323	Papohaku	Nana	Habitation, Agriculture	1 *'āpana*, 1 house lot, 1 *kula*, 40 *lo'i*
3356	Nahuina	Kukuiopio	Agriculture	1 *'āpana*, 1 *kula*, 14 *lo'i*
3413	Pooahi	Malolonui, Kapaniau	Agriculture	2 *'āpana*, 2 *kula*, 30 *lo'i*
3595	Kanupaka	Malolonui	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 18 *lo'i*, 1 pigpen
5350	Puahiki, Nawaalau	Puuokahala	Habitation, Agriculture	1 *'āpana*, 1 house lot, 1 *kula*, 12 *lo'i*, 1 pigpen

LCA #	Claimant	'Ili	Land Use	Claims Awarded
5446	Nawaalau, Ezekiela	Puuokahala, Nana	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 18 *lo'i*
6325	Kekauonohi	Wahiawa (*ahupua'a*)	Agriculture	1 *'āpana*, 1 cattle enclosure (not awarded)
6557	Pohakahi	Kamokila	Habitation, Agriculture	1 *'āpana*, 1 house lot, 13 *lo'i*
7714B	Kekuaiwa (Kekuanaoa)	Wahiawa (*ahupua'a*)		All unclaimed land within the *ahupua'a*
8010	Aikala	Kauikuiomalai	Habitation, Agriculture	1 *'āpana*, 1 house lot, 1 *kula*, 30 *lo'i*
8256	Hohoiea	Malolonui	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 2 *lo'i*
9057	Kaanaana	Waikupenau	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 23 *lo'i* (not awarded)
10273	Meheula	Nupaiki	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 19 *lo'i*, 1 goat pen
10632	Pahao	Kahookaeo, Palanohi	Agriculture	1 *'āpana*, 14 *lo'i*, 1 pigpen (not awarded)
10686	Paele	Nupa	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 21 *lo'i*, 1 pigpen
10946	Wailele	Kaluhi	Agriculture	1 *'āpana*, 1 *kula*, 10 *lo'i*
11088	Kui	Kukuiopio	Habitation, Agriculture	1 *'āpana*, 1 house lot, 1 *kula*, 7 *lo'i*, 1 pigpen

During the *Māhele*, the *ahupua'a* of Wahiawa, consisting of approximately 5,857 acres, was awarded to Moses Kekuaīwa (LCA 7714-B). Kekuaīwa was the grandson of Kamehameha I, and as a Hawaiian *ali'i*, he was not required to prove his tenure on the land. An additional 18 claims for *kuleana* parcels within Wahiawa were made by commoners able to prove their

occupation and cultivation of the land. Of the 18 claims, 15 were awarded for parcels ranging in size from less than 1 acre to a maximum of 5 acres (LCA 10273 to Meheula). In general, the *kuleana* awards in Wahiawa were for 1 to 3 acres, which is typical of LCAs in the vicinity. The awarded lands were also situated within, or in the immediate vicinity of Wahiawa Valley and Stream, the main source of fresh water for domestic and agricultural usage within the *ahupua'a*. No maps indicating the precise locations of each of the LCAs were readily available. However, the numerous *'ili* (land section within an *ahupua'a*) names, and references to landmarks such as *pu'u* or the seashore, in the LCA documentation indicate widespread settlement throughout both the *mauka* and *makai* regions of Wahiawa Valley. References are also made to the "community of Wahiawa" located in the vicinity of the Government Road (present day Kaumuali'i Highway) (N.R. Vol. 9, p. 388-389), indicating the focus of settlement within Wahiawa Ahupua'a was likely at this locale. The LCA documentation also indicated that nearly all of the claimants received their *kuleana* land at the time of Kakio'ewa, evidence of the major redistribution of land within Wahiawa as a result of the battle of 1824.

Land Commission documents recording these *kuleana* land claims further clarify our understanding of the *'āina* from the perspective of the native Hawaiians in traditional times by defining specific land use practices within the claimed parcels (see Table 1). As the majority of the LCAs were located within Wahiawa Valley, adjacent to Wahiawa Stream, land use was focused on the cultivation of wetland taro (*lo'i*). A definite pattern is observed in the available documentation, indicating dense cultivation of taro, as evidenced by large numbers of *lo'i* within relatively small parcels of land. The claimant's house lot was also typically located within the same *'āpana* (land parcel) as his *lo'i*. Additional *'āpana* of an individual LCA were generally for discrete *kula* land located outside of Wahiawa Valley. For example, within an approximately 1 acre parcel, David Papohaku (LCA 3323) claimed 40 *lo'i*, *kula* (pasture) land, as well as a house lot. Also within the LCA 3323 documentation was the following testimony given by G.B. Rowell, a foreign missionary living in the islands:

> I send survey of a house lot of above which Mr. Pease refused to survey, joining the lot which Mr. P surveyed for him, who chose to pass his boundary line close by this house, so as to have cut the yard, rather than go round the house to give him his due, though but a few minutes labor. It belongs to Papohaku from ancient times & there is not the slightest ground for opposing the claim.
>
> I am told that Mr. Pease refused to survey the house lots of nearly all the Claimants in the Valley of Wahiawa. It is the opinion of the natives that he was bribed to do so by the konohiki. I have no time to attend to those lots, though pressed to do so by the people and I fear they must be deprived of them. G.B. Rowell (F.T. Vol. 12, p. 242)

The passage indicates one of the numerous roadblocks commoners faced in receiving their *kuleana* lands. Therefore, while LCA documentation can provide insight into land use practices and other facets of traditional life, it may not always be a good indication of actual population at the time of the *Māhele*. Settlement and cultivation of lands were likely much greater than is represented by *kuleana* land awards.

The American Board of Commissioners for Foreign Missions (ABCFM) was also awarded a parcel of land within Wahiawa Valley (LCA 387:2). Testimony describing the claimed land indicated it was used for the cultivation of taro and was "known by the name of Kauaiki" (F.R. Vol. 2, p. 44). LCA 387:2 is located on the TMK map, immediately *makai* of Kaumuali'i

Highway. The description of the parcel as taro land known as Kauaiki, along with the account stating that the Kaua'i 'Iki stone was removed from a taro patch during road building activities (see A: Mythological and Traditional Accounts) suggests that LCA 387:2 was the original location of the legendary Kaua'i 'Iki stone and taro patch.

The earliest documentation of the population of the district of Kōloa, including Wahiawa, appears in the 1850s when missionary censuses recorded a total population of 1,296 (Schmitt 1977:12). Population totals of the entire island of Kaua'i prior to 1850 had shown rapid decline, suggesting that similar trends most likely occurred in Kōloa and Wahiawa. By 1878, the population of Kōloa bottomed out at 1,008, and then began steadily increasing to 1,500 in 1884, 1,835 in 1896 and 4,564 by 1900 (Schmitt 1977:13). Other nearby *ahupua'a* of Kaua'i demonstrates similar trends.

3.3.3 Wahiawa Ranch

Major foreign interests in Wahiawa began in the mid to late 19th century, following acts allowing for foreigners to own lands in Hawai'i. The development of large scale agricultural ventures were also stimulated by treaties governing trade between the Kingdom of Hawai'i and the United States, namely the Reciprocity Treaty of 1875. The Reciprocity Treaty allowed for certain goods, including sugar, to be exported to the U.S. duty-free.

Duncan McBryde relocated to Wahiawa from his estate in Wailua *circa* 1860 (Damon 1931). He acquired a lease for lands at Wahiawa from Victoria Kamāmalu, sister of Moses Kekuaiwa. Kamāmalu inherited the unclaimed lands at Wahiawa following the untimely death of Kekuaiwa in 1848. McBryde drove his herd of cattle across the island and began the development of the extensive Wahiawa Ranch. The McBryde family estate, known as Brydeswood, was built in the uplands of Wahiawa, *mauka* of the government road. By 1870, in addition to ranching, McBryde also ventured into sugar cane cultivation in Wahiawa and surrounding lands at Kalāheo and Lāwa'i (Damon 1931). Duncan McBryde died in 1878 at the age of 52, leaving behind his widow and six children. Soon after the death of Duncan McBryde, Mrs. Elizabeth McBryde entered into a partnership forming the "Ele'ele Sugar Plantation.

A map of 'Ele'ele to Kōloa by M.D. Monsarrat indicates the location of various structures within Wahiawa Ahupua'a *circa* 1896. In the vicinity of the current project area, a single structure is located at the shore of Wahulua (Wahiawa) Bay. Additional structures were located both within, as well as outside of Wahiawa Valley, *mauka* and *makai* of the government road. A substantial arrangement of wall segments was also located *mauka* of the government road, likely related to the Wahiawa Ranch. In the upland region of Wahiawa Valley, the "Ele'ele Ditch had also been constructed to take water from Wahiawa Stream to water the cane lands of the "Ele'ele Sugar Plantation.

3.3.4 The Hawaiian Sugar Company at Makaweli

The history of the water system found at the present-day lands of the McBryde Plantation actually owes its existence to Maui plantation owners Henry Perrine Baldwin and Samuel Thomas Alexander. In 1878, the two men had demonstrated the feasibility of carrying water from East Maui's windward region of high rainfall and delivering it to the arid, fertile isthmus of Central Maui. In 1889, Alexander & Baldwin, Ltd., had secured a long-term lease to a tract of land on the island of Kaua'i, and established the Hawaiian Sugar Company at Makaweli. In order to expand crop yields, H. P. Baldwin engineered an aqueduct to be constructed on the Kaua'i

property similar to one he had built on Maui. It consisted of 13½ miles of tunnels, open ditches, and flumes that ended with four siphons to carry the flow across the Hanapēpē River. The reported cost was $152,000 and the work was completed by April, 1891. (Thrum 1892).

Following the success of the Hawaiian Sugar Company's Hanapēpē Ditch, a 13 mile canal from Olokele Valley was constructed in 1902 (Burns 1991). Other Kaua'i plantations followed suit. The 'Ele'ele Plantation, which bordered the Hawaiian Sugar Company, relied on the surface water of the Wahiawa River. The 'Ele'ele Plantation was founded in 1884 after Bernice Pauahi Bishop sold the lands to Mrs. Duncan McBryde and August Dreier. The plantation supported its own mill and its own landing at 'Ele'ele (Conde 1973). The small plantation was then purchased in 1899 by Benjamin F. Dillingham, who then incorporated the Wahiawa Ranch, 'Ele'ele Plantation and the Kōloa Agricultural Company to form the McBryde Sugar Company. During this incorporation, more surface water sources were developed; including the Lāwa'i, Wahiawa and Kamo'o watersheds. However, in order for the McBryde Sugar Company to become profitable, underground sources of water at the headlands of the Lāwa'i and Hanapēpē Valleys were required, and reservoirs would need to be sited to impound those water sources (Gilmore 1936).

3.4 1900s

The 1900s were dominated by the Plantation era and the development of McBryde Sugar Company. It was also a time of concerted effort at consolidation and improvement in sugar cane industry infrastructure on Kaua'i.

3.4.1 The Plantation Era

In 1899, Walter D. McBryde, son of Duncan McBryde, and W.A. Kinney founded the McBryde Sugar Company. The plantation consisted mostly of land already owned by the McBryde Estate, including the Wahiawa Ranch and lands in neighboring Kālaheo and Lāwa'i. In addition, lands owned by the former Kōloa Agriculture Company and 'Ele'ele Sugar Plantation was also incorporated. To irrigate the mid-sized plantation (approximately 4,700 planted acres), between 1900 and 1907 the McBryde Plantation constructed 30 large and small reservoirs, as well as an extensive system of ditches to collect water from the uplands (Yamanaka and Fuji 2001). These ditches and reservoirs are visible on historic USGS maps of the vicinity. McBryde Plantation constructed a "New Mill" (Numila) in Wahiawa. Transportation of the cane from the fields, which stretched from Kōloa in the east to Hanapēpē in the west, to the Numila mill, and on to the harbors of Port Allen and Nāwiliwili, required the construction of a substantial system of rail lines. A map of the McBryde sugar lands shows the extent of the plantation and rail lines.

Plantation development consisted of extensive sugar cane cultivation, with associated irrigation ditches, on the upper plateau areas outside of Wahiawa Valley. It is also noted that in addition to the 'Ele'ele Ditch, several other ditches were constructed in order to take water from Wahiawa Stream to the McBryde Sugar Company cane lands. A railroad line was also constructed *mauka*, running from the McBryde Plantation Mill in the east, through Wahiawa Valley, and on to 'Ele'ele Landing in the west. Extensive development of plantation camps was made to house the large numbers of plantation laborers. The structures were concentrated in the vicinity of the rail line crossing (present day Halewili Rd.), located both within Wahiawa Valley,

as well as along the upper edge of the valley. Additional plantation camp structures were located in the *makai* portion of Wahiawa Valley.

In 1927, the construction of Alexander Dam was initiated under the supervision of Joel B. Cox, civil engineer (and later President and Chair of the Engineering Association of Hawaii). This dam was to be one of the highest hydraulic fill dams in the western United States and was designed to capture water for irrigation of McBryde Sugar Company, Ltd. sugarcane fields, and later hydroelectric power (August 1995 ASCE Newsletter, Hawaii Section). The dam failed and collapsed on March 25, 1930 with six lives lost. The collapse of Alexander Dam in 1930 also attracted the attention of Karl Terzaghi (1883-1963). Karl Terzaghi is often referred to as "The Father of Soil Mechanics" and published the first seminal study of soil mechanics entitled "Erdbaumechanik" in 1925. Terzaghi also pioneered a variety of methods and techniques for investigation, testing, data analysis, and practice that defined much of the field of geotechnical engineering. Terzaghi became interested in the collapse of Alexander Dam because of his engineering background and interest in soil mechanics. Joel Cox reconstructed the dam under the guidance and correspondence of Karl Terzaghi. Today the dam remains one of the highest hydraulic fill dams in the western United States. The collapse of Alexander Dam is currently listed among Hawai'i's greatest catastrophes with loss of life (*State of Hawaii Data Book* 2001, http://www.state.hi.us/debt/). The collapse of Alexander Dam also played a significant role in leading to a greater emphasis on the importance of site geology in civil engineering projects and is listed among a number of high-profile dam failures between 1928 and 1938 (Rogers n.d.) such as St. Francis Dam near Los Angeles in March 1928 and Saluda Dam (second largest earth fill dam in the world) near Columbia, South Carolina in February 1930.

3.4.2 McBryde Sugar Company, Ltd.

McBryde Sugar Company, Ltd., cultivated 20,000 acres in Kalāheo, Hanapēpē, 'Ele'ele, Lāwa'i and Kōloa, including an ahupua'a that reached the top of Mount Kāhili (Wilcox 1996). By 1903, the company had developed a series of reservoirs with a combined capacity of 800 million gallons. However, surface water sources were inadequate for the plans of the plantation, and new groundwater sources were sought.

Following the example of the S.T. Alexander and H.P. Baldwin system of developing water sources further afield, engineers for the McBryde Sugar Company discovered concentrated flows of fresh water in a lava tube 50 feet below sea level in the Hanapēpē River Valley. At first, the pumps for raising the underground waters to the required elevations to irrigate the upland fields were operated by steam. Built between 1900 and 1905, these coal burning pumping plants were very expensive to operate. Drilling for additional underground water sources under the Lāwa'i River Valley was successful, yet still subject to the expense of steam powered pumps. (Gilmore 1954).

Under the direction of McBryde Sugar Company, the Kaua'i Electric Company built a hydroelectric plant at Wainiha in order to replace the coal burning steam pumps with more economical electric pumps. Wainiha, is located on the northern, windward side of Kaua'i. The waters of the Wainiha River were diverted at the Wainiha East and Wainiha West channels (Larrison 1915), which were then delivered through 32 tunnels, with a total length of 17,400 feet, and eight ditches with a total length of 5,600 feet; to a point above the power plant. Water was received into a concrete-lined forebay and then dropped through a 1,612 foot long penstock pipeline. On August 4, 1906, electricity was transmitted across the island to the leeward coast.

Thirty-four miles of utility poles delivered electricity to the plantation pump system. At the time, the Wainiha Powerplant generated a higher voltage than any other plant west of the Rockies (Dean 1950).

As a subsidiary of the McBryde Sugar Company, the Kauai Railway Company was organized in 1906 to operate the landing at 'Ele'ele and transport sugar from both the Hawaiian Sugar Company and the McBryde Sugar Company mills to steamers anchored in the harbor. In 1908, the Hawaiian Sugar Company built an expensive, substantial bridge across the Hanapēpē River in order to reduce the costs of sugar transportation to the harbor.

In 1909, Alexander & Baldwin, Ltd., assumed management of McBryde Sugar, and its two subsidiaries. The Benjamin F. Dillingham-backed enterprise had expanded too quickly, and in order to save the plantation from bankruptcy, Alexander & Baldwin, Ltd., assumed both management and agency positions. In the 1910-1919 decade, McBryde Sugar made a profit every year except 1910. Earlier bonded debts had been reduced by over a million dollars, over $720,000 had been spent on improvements, and another million dollars had been returned to investors (Dean 1950).

In 1915, McBryde Sugar installed a third generator unit at the Wainiha Powerplant, increasing its capacity even further.By the end of 1919, McBryde Sugar had received such good prices for sugar during World War I, that almost half of the company's previous debts had been retired. Kauai Railway Company had become a sound operating company and was paying its' own dividends. McBryde Sugar was able to purchase the Kaua'i Electric Company as a wholly owned subsidiary. The original Wahiawa sugar mill, built in the 1890's, was entirely remodeled between 1928 and 1929 (Dean 1950).

3.4.3 Alexander Dam

Construction to impound the water of the Wahiawa Stream was begun in 1927. In order to simplify an existing expensive and complicated water supply, it was felt that expenditures required would guarantee that water sources located at Mount Wai'ale'ale could be developed, and that the runoff from Kanaele Swamp could be captured and stored. (Dean 1950).

When Alexander & Baldwin, Ltd., assumed the agency of McBryde Sugar Company in 1909, an agency agreement was also signed with a former McBryde Sugar subsidiary: the Kauai Fruit & Land Company. By 1927, Kauai Fruit & Land had become another wholly owned subsidiary of Alexander & Baldwin, Ltd., and had also become profitable. With the success of so many subsidiaries resting on the development of the Alexander Dam, it was decided to move the project foreward.

The Alexander Dam was constructed 120 feet high, 620 feet long at the crest, and 640 feet thick at the base. It was built by hydraulic fill: Embankment material was sluiced to the site. Work was done in three eight-hour shifts of sixteen men each who worked by floodlight at night. On March 26, 1930, as construction was virtually complete, the dam broke under the impact of torrential rains. The resulting mudslide took six lives and injured two. The dam was rebuilt and finished December 1932 at a cost of $358,394. It is the second highest earthen dam in Hawai'i.

The completion of the Alexander Dam resulted in a reservoir with a storage capacity of 800 million gallons. A hydroelectric powerplant located in Kalāheo was built in using waters stored behind the Alexander Dam. Once this powerplant was completed, McBryde Sugar was able to

service all of its plantation needs, and sell excess electricity to other industrial businesses located in Kōloa and Olokele.

3.4.4 Historic Map Data

There were two maps that provided significant information in terms of bracketing the construction of the Native Ditch. These are an 1896 M.D. Monsarrat Survey map of Kaua'i from 'Ele'ele to Kōloa and a later map dated to 1900 for McBryde Sugar Company showing the locations of various plantation features such as reservoirs, ditches, and tunnels that used the 1896 Monsarrat map as a base map. The 1896 Monsarrat map does not show the Native Ditch unlike that appended 1900 map. Both maps however show the location of McBryde's residence (Brydeswood) constructed between 1860 and 1870. The Native Ditch is depicted as capturing a portion of the upper Wahiawa Stream/'Ele'ele Ditch flow and diverting it through a 160-foot tunnel at Nāhalekapuahi. The Native Ditch then was engineered to direct flow downslope to a series of water reservoirs constructed as part of the McBryde Plantation. Flow was into Reservoir No. 3 with a capacity of 90 million gallons. This reservoir corresponds to the present day Elua Reservoir at Kalāheo . The course of the Native Ditch between the short tunnel and Reservoir No. 3 also roughly corresponds to the course of a constructed penstock feature between the forebay below the present Alexander Dam and the Kalāheo Hydroelectric station. Neither the 1896 nor 1900 map show the forebay feature, penstock or Alexander Dam as these features were all constructed later.

3.4.5 Modern Land Use

The land use patterns of the study area include the current use of Alexander Dam, the refurbished ditch, forebay, and penstock. These features function to provide reliable water flow to Kalāheo hydroelectric station to provide electricity to customers and to provide irrigation water to fields owned and operated by the Kauai Coffee Company. The interrelationships of these constructed features to other similar features in Wahiawa Ahupua'a and adjacent areas are displayed in Figure 4.

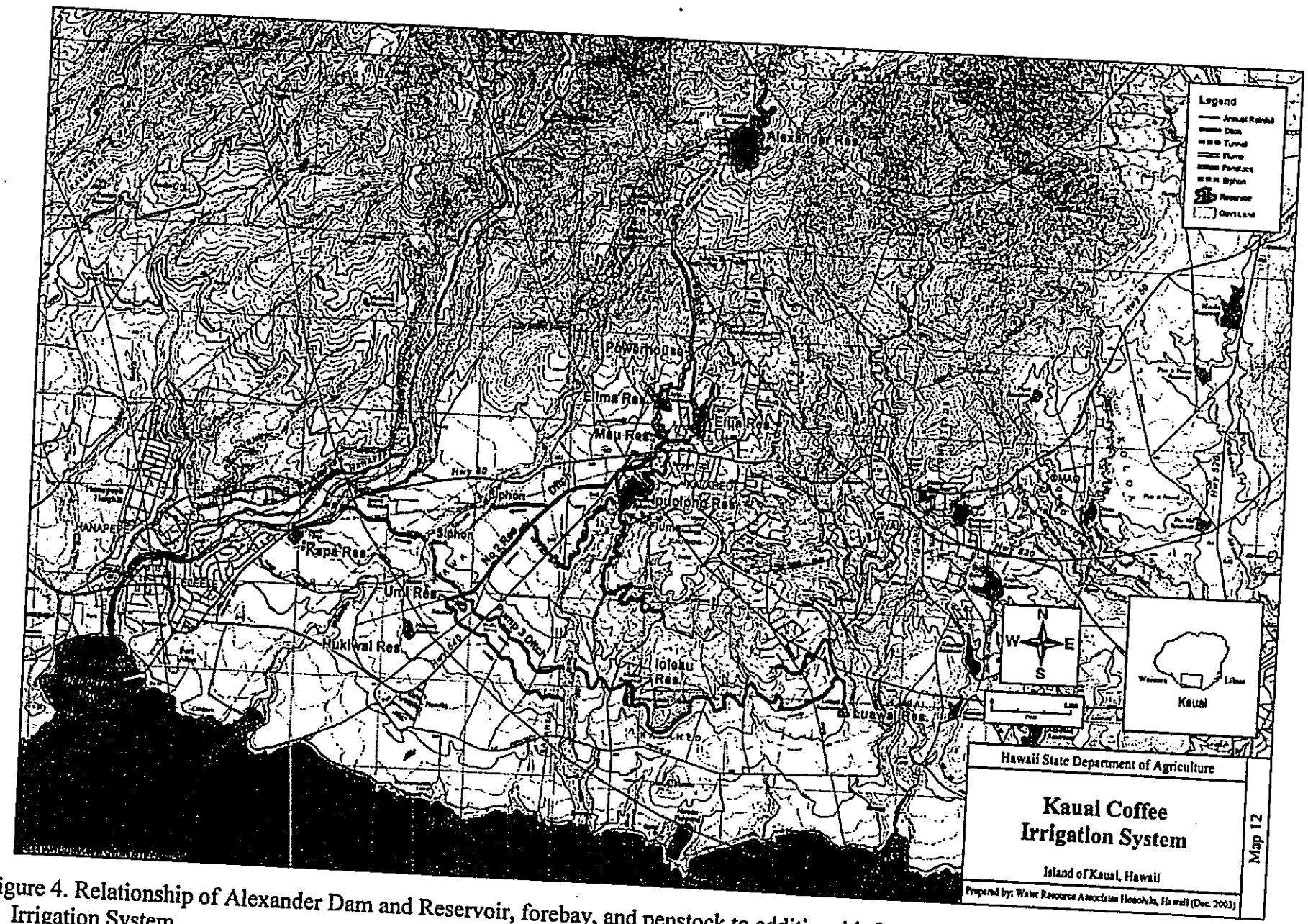

Figure 4. Relationship of Alexander Dam and Reservoir, forebay, and penstock to additional infrastructure of the Kauai Coffee Irrigation System

3.5 Previous Archaeological Research

The earliest attempt to record archaeological remains in Wahiawa Ahupua'a was made by Thrum (1906) (Table 2). *Heiau* located throughout the state were documented, with four *heiau* reported in Wahiawa. Kaunuolono, located in Wahiawa, was described as "a large heiau of square shape; part of its walls are still standing. Class unknown" (Thrum 1906:37). Kahilinai, located in Wahiawa-uka, was described as "a walled heiau of large size, long since destroyed" (Thrum 1906:37).

Wendell C. Bennett performed the first systematic archaeological survey of the island of Kaua'i in 1929 (Bennett 1931). Bennett attempted to relocate sites previously described by Thrum, as well as identify additional significant sites. In the *ahupua'a* of Wahiawa, he records three sites (Sites 61-63).

Site 61, designated as taro terraces in Wahiawa Valley, is described as "remarkable in places for their number on a small area of land" (Bennett 1931:115). Bennett also noted "there are platform house sites in the valley; burial caves and petroglyphs also reported" (Bennett 1931:115). Sites 62 and 63 are *heiau* originally described by Thrum (1906) and relocated by Bennett in 1929. However, both were destroyed by the time of Bennett's survey. Site 62, Waiopili Heiau, was described as:

> in Wahiawa Valley, on the bluff on the east side, a short distance on the seaward side of the government road. This structure is described by Thrum as "An oblong heiau of good size, walls still standing." The cane fields have now been run close to the edge of the bluff, and in clearing the fields of stone the heiau has been obscured so far as any plan is concerned. (Bennett 1931:115)

Site 63, Huhu'akai Heiau, was described as:

> on Wahulua [Wahiawa] Bay, Wahiawa. Thrum says "A medium sized heiau; portion of its walls may yet be seen. Class unknown." It is mostly destroyed. A platform of irregular shape is left, the front part of which is paved with small stones and the rest roughly paved. Nothing that would identify it as a heiau now remains. (Bennett 1931:115).

In 1963, Kikuchi conducted an archaeological reconnaissance survey of the Kona District of Kaua'i, from Makaweli in the west to Kīpū-Kai in the east (Kikuchi 1963). In Wahiawa Ahupua'a, Kikuchi revisited Bennett's sites, as well as recorded newly identified sites in the area. A total of 15 sites were described, 8 encircling Ahulua (Wahiawa) Bay and 7 located *mauka* of the Halewili Bridge over Wahiawa Stream. The *mauka* cluster of sites (i.e. Sites 8-14), included a shelter cave, petroglyphs, a grind stone, a house site, and an old Japanese plantation camp (Kikuchi 1963). Along the coast, on the western edge of Ahulua (Wahiawa) Bay, Kikuchi described Sites 15 through 19, including a cave shelter, a rock pile, calcified midden, and an adze grinding stone (Kikuchi 1963). Site 20, near the sandy shoreline of Ahulua Bay, was "Camp One," a plantation camp that was destroyed by the tidal wave of 1946 (Kikuchi 1963).

Kikuchi designates Site 21 as potential remains of Hu'ahu'akai Heiau, one of the two *heiau* described by Bennett, and offers the following description:

Table 2 Previous Archaeological Investigations in Wahiawa *Ahupua'a*

Reference	Type of Investigation	General Location	Findings
Thrum 1906	Documentation of *Heiau*	Island Wide, including Wahiawa	Four *heiau* reported in Wahiawa Ahupua'a
Bennett 1931	Reconnaissance Survey	Island Wide, including Wahiawa	Three sites, agricultural terraces and two previously documented *heiau*
Kikuchi 1963	Reconnaissance Survey w/ Subsurface Testing	Kona District, including Wahiawa	15 sites, shelter caves, petroglyphs, grind stones, house site, old plantation camps, rock pile, calcified midden, and previously described *heiau*
Hammatt 1992	Inspection of Exposed Burials	Wahiawa, Kaua'i Aggregates Quarry	Site -1893, 6 pre-historic burials exposed, likely burial ground
Glidden et al. 1993	Archaeological Monitoring	Wahiawa, McBryde Sugar Mill	No sites identified
Tulchin and Hammatt 2004	Archaeological Inventory Survey	Kaua'i Aggregates Quarry	The survey identified two sites comprising three features. Sites are 50-30-09-393 and 50-30-09-1893 (previously located –see Hammatt 1992).

> Along the eastern slope of the mouth of Wahiawa valley, on the slopes facing Ahulua [Wahiawa] Bay, a peculiar wall was seen about 30 feet above the road leading to the shore...Upon closer examination the wall proved to be quite thick, 4-5 feet, and about 5 feet high. No other structures were seen back of the wall. The wall may prove to be just another wall constructed during recent times but it may also be the portion of Hu'ahu'akai *heiau* that Bennett described (Kikuchi 1963:18).

Site 22 refers to the Weli shelter site excavated by the Bishop Museum in the summer of 1959, in which the entire area is "now considered hopelessly destroyed [by vandals] even though small areas are untouched" (Kikuchi 1963:22).

Archaeological monitoring was conducted at the site of the McBryde Sugar Mill at Numila, in association with the proposed construction of a NEXRAD radar station (Glidden et al. 1993).

Monitoring of the removal of a large boulder pile did not reveal the presence of any cultural material.

In May 1992, the State Historic Preservation Division was notified of the discovery of human remains adjacent to the Kaua'i Aggregates Quarry (Log No. 5330, Doc. No. 1925w). The burials were located within the current project area, near the mouth of Wahiawa Stream. The SHPD was informed that in December 1991, during efforts to improve the drainage of Wahiawa Stream, heavy equipment had exposed human burials along the west bank of Wahiawa Stream. An SHPD archaeologist and burials program staff people made a field check of the exposed burials, and determined that human burials had been inadvertently disturbed. Work in the area was halted and the SHPD recommended the Kaua'i Aggregates Quarry hire a consulting archaeological firm to further assess the situation.

Hammatt (1992) made an inspection of the inadvertently exposed human burials along the western bank of Wahiawa Stream. The burials, designated as State Site 50-30-09-1893, were located approximately 500 ft. (152 m) *mauka* of the stream outlet into Wahiawa Bay. A minimum of six individuals was exposed, situated in flexed positions indicating a pre-contact age. Inspection of the surrounding slope area revealed the presence of numerous *ahu* (cairns) and pavings interpreted to be probable burial sites. One burial was also located in an overhanging ledge in the vicinity. It was also noted:

> It is likely that the entire slope between the stream level and the top of the cliff, which covers an area of perhaps ½ acre, contains Hawaiian burials interred in the rocky slope deposits. (Hammatt 1992:6)

Recommended treatment of the exposed human remains included restoration of the stream bank with soil and boulder fill.

In 2004, archaeologists from Cultural Surveys Hawai'i, Inc., conducted an archaeological inventory survey for a proposed construction waste disposal facility at the Kaua'i Aggregates Quarry (Tulchin and Hammatt 2004). The total survey area was approximately 28 acres. There were two historic properties comprising three individual features located along the western bank and upper slopes of Wahiawa Valley. State site 50-30-09-393 consists of two terraces along the western bank and is believed to be a prehistoric temporary habitation. Site 50-30-09-1893 is a single human burial located within an overhanging ledge and adjacent burial ground. Although field personnel were not able to relocate the adjacent burial ground it was still believed to be present. Both sites and areas were recommended for preservation through avoidance.

3.6 Background Summary and Predictive Model

3.6.1 Background Summary

From research of historic documents, cultural documentation, and previous archaeological studies, it is apparent that land use in Wahiawa Ahupua'a is long and varied, extending from pre-contact times into the modern era. The presence of multiple *heiau* within the *ahupua'a* suggests the relative importance of Wahiawa in traditional times. *Heiau* were located in both the uplands and near the shore. Cultural accounts, as well as LCA documentation indicated settlement within the *ahupua'a* was focused on Wahiawa Valley and the immediate area. Abundant stream and spring water was available for the cultivation of wetland taro, as well as other traditional staple foods, within the fertile stream valley. Research indicated dense agricultural terracing

throughout the interior of Wahiawa Valley from the uplands to the sea. Habitation areas were noted both within the valley, as well as on the *kula* land above The sheltered waters and sandy shoreline of Wahiawa Bay would have allowed for harvesting of marine resources and provided an ideal landing site for canoes. Traditional burial interment practices included cave burials within the slopes of Wahiawa Valley, and burials in the sandy sediments on the banks of Wahiawa Stream and *muliwai*.

Larrison (1913:69) provides a brief mention of historic traditional fishing practices for Wainiha River [stream] east and west channels above the Kaua'i Electric Co. power house. At the juncture of the east and west channels "The natives build fish dams at the point where the river divides above the stations, and this shifts the water from one channel to the other".

Land use in the early historic period came to be dominated by livestock ranching. Historic documentation suggested that cattle and horses were widespread in Wahiawa from the time of Kaumuali'i. Extensive commercial agriculture ventures; including ranching and sugar cane cultivation later came to dominate land use in Wahiawa Ahupua'a. Major land disturbance by plantation agriculture was for the most part restricted to the upper plateau areas suitable for sugar cane cultivation, though several ditches were constructed to draw irrigation water from Wahiawa Stream. Plantation Camps were constructed to house the large number of plantation laborers. The camps were generally located within Wahiawa Valley, centered around the railroad crossing (present day Halewili Rd.), and at the shore of Wahiawa Bay. Modern land use included the conversion of the sugar cane fields to coffee and the excavation of the Kaua'i Aggregates Quarry within the current project area.

3.6.2 Predictive Model

Traditional Hawaiian activities in the vicinity of the current project area may have included agriculture, habitation, transportation/pathways, religious activities including burial interment, and resource gathering. Traditional sites may include agricultural terraces and associated *'auwai*, and habitation terraces or platforms both within Wahiawa Valley, as well as in the immediate vicinity. Previously documented human burials (Site 50-30-09-1893) are also known to exist closer to the coast.

Within the current project area, remnants of the ranching and sugar plantation era may also exist. Historic sites related to commercial plantation irrigation, including historic ditches, flumes, pipelines, and other features may exist. Plantation camp infrastructure may also be present. Historic homesteads and ranching may have also left physical. Barbed wire fences, stone walls, wooden or stacked stone enclosures, water troughs, and historic habitation deposits, including structure foundations, retaining walls, and refuse dumps. The remains of a Chinese laborers camp (inclusive of building foundations) are also reported to be located somewhere on the opposite site of Alexander Dam but beyond the area encompassed by this inventory survey.

Section 4 Results of Fieldwork

Archaeological inventory survey was conducted on April 22, 2005 by two archaeologists from Cultural Surveys Hawai'i, Inc. Field effort included examination of all exposed cuts and excavations and 100% pedestrian inspection of the corridor for the realigned and restored "Native Ditch" and access road along the ditch. There were no subsurface cultural deposits identified during pedestrian survey identified three constructed features that are considered as historic properties within the project area (Figure 5).

4.1 Survey Findings

4.1.1 Feature Types

There were three historic properties identified during survey that are related to the existing water control infrastructure. These properties include one irrigation ditch constructed between 1900 and 1905, Alexander Dam constructed in 1931, and a forebay structure that appears to have been constructed at about the same time as Alexander Dam.

4.1.2 Feature Functions

All features that were identified during the archaeological inventory survey are functionally related as part of an existing water impoundment and water control infrastructure. This infrastructure not only provides water to the Kalāheo hydroelectric station, but also provides the only source of irrigation water to 1200 acres of coffee trees owned by the Kauai Coffee Company. Functions that are fulfilled by this infrastructure include irrigation, water supply, and hydroelectric power. The existing irrigation system, of which these features represent a crucial link, taps a portion of the Wahiawa watershed that includes Kanaele Swamp (Water Resource Associates 2003:139). Alexander Dam and Reservoir were constructed to capture the runoff from Wahiawa watershed. At the time the dam and reservoir were constructed only McBryde and Kōloa plantations on Kaua'i and Wailua Sugar Company on O'ahu had developed any significant capacity for water storage. The construction of Alexander Dam was accompanied by the construction of a hydropower plant at Kalāheo . The dam provided enough water to power an 1100 kW generator.

4.1.3 Feature Age Determination

Historical documentation provides the basis for age determinations for the historic properties identified during the inventory survey. All three features represent a portion of the irrigation infrastructure that was developed and constructed by McBryde plantation, later McBryde Sugar Company, over a period of time from 1900 into the early 1930s (Water Resource Associates 2003:139). The "Native Ditch" does not appear as a mapped feature on an 1896 map of Kaua'i from 'Ele'ele to Kōloa (Monsarrat 1896). However, the ditch course does appear on a 1900 tracing of the same map (Monsarrat 1900) and also shows the locations and capacity of additional reservoirs and irrigation ditches comprising the McBryde plantation irrigation system. Construction on Alexander Dam was initiated in 1927 but a catastrophic collapse of the dam during construction killed six people. The dam was re-engineered by Joel Cox, a civil engineer, with significant guidance from Karl Terzaghi, and was completed in 1931.

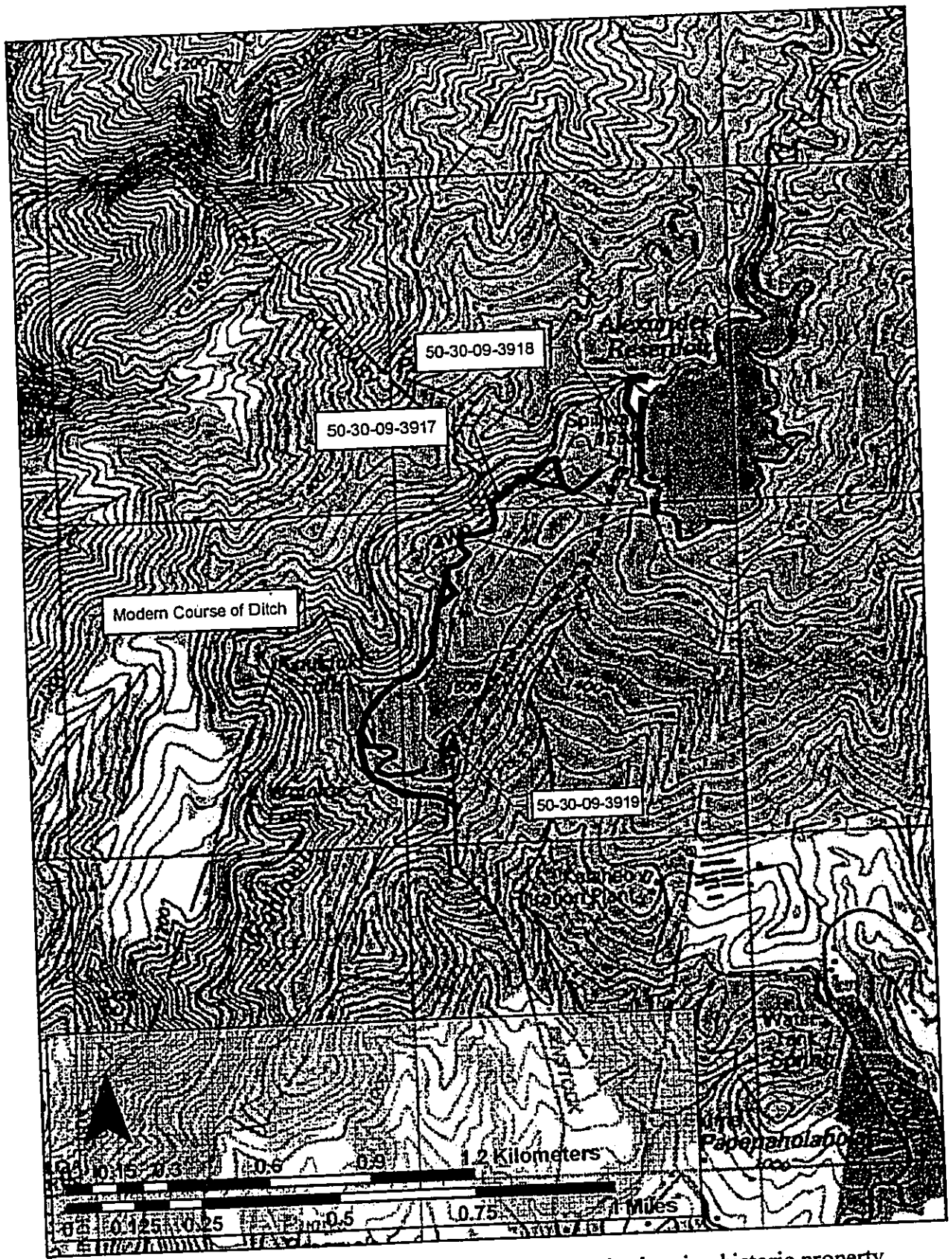

Figure 5. Portion of U.S. Geological Survey Kōloa Quadrangle showing historic property locations identified during inventory survey

4.2 Site Descriptions

There are three facilities that are considered as historic properties that are located within the course of the realigned and restored "Native Ditch". These include the remnant portions of the Native Ditch, the Forebay, and Alexander Dam.

SIHP #	50-30-09-3917
FUNCTION:	Water Control
SITE TYPE:	Irrigation Ditch and Outlet Tunnels
TOTAL FEATURES:	1
DIMENSIONS:	2011 m by 3.0 m
CONDITION:	Fair
AGE	Plantation

DESCRIPTION: This facility is labeled as Native Ditch on historic maps but is known to have been constructed sometime between 1900 and 1905, probably as part of the early efforts of the McBryde Sugar Company. It was designed to carry water from Alexander Reservoir to irrigate sugar cane fields. This feature had been in use up until the mid-1970s and had probably been intermittently maintained throughout its use history. The upper portion of the ditch below the tunnel outlets (Figure 6) is in better condition than the lower portion below the forebay feature. The intact loop section (upper portion) is approximately 3.0 meters in depth and 3.5 to 4.0 meters in width (due to erosion and bank slumping), and varies in bottom width from 1.0 to 1.5 meters (again due to erosion and bank slumping) (Figure 7 and Figure 8). This section has been isolated from the original course of the ditch by excavation of a new ditch segment to provide a straighter course for irrigation waters exiting the outlet tunnels to flow downslope to the forebay. The lower section below the forebay is considerably more filled in with silt and decayed vegetation but dimensions appear similar. Due to time constraints it was not possible to clear a section of the lower ditch to obtain measurements. The 1900 M.D. Monsarratt survey map indicates that the Native Ditch is 6600 feet long (2,011 m). Since it was not feasible to walk the entire course of the ditch, this measurement is used to provide an estimate of the original ditch. The course of the Native Ditch closely follows ground contour along a slope as it exits the tunnels below Alexendar Dam towards its terminus at the forebay.

The Native Ditch is located to the west of the current tunnel system and follows a course from Alexander Reservoir to Puana Reservoir. Approximately three-quarters of a mile of the Native Ditch was rehabilitated to receive flow from the outlet tunnels below Alexander Dam.

A project report details the work done and its impact on the "Native Ditch" and is summarized below:

- A ca. 500-foot section of ditch near Alexander Dam was realigned to provide a more direct path to the existing reservoir outlet. This left a section of the "Native Ditch" untouched and intact just below Alexander Dam.
- A new ditch segment of approximately 500 feet was excavated to bypass a tunnel just downstream of the reservoir outlet (Figure 9). This decision was made to bypass the

tunnel segment to avoid similar future problems and because the condition of the tunnel interior was unknown.

- An additional segment of ditch was excavated approximately ten feet to the northwest of the original ditch course to avoid an old *koa* tree near the "Native Ditch".
- Lastly, a segment of the ditch near the forebay feature was rerouted to avoid a stand of *koa* and to enable the ditch to terminate at the forebay (Figure 10 and Figure 11).

Restoration and rehabilitation of the Native Ditch had several impacts upon the original course. Grading, grubbing and vegetation clearance along the original ditch course was conducted to remove vegetation and silt blocking the ditch and the access road. Excavation activities were conducted to not only restore the original course in places but, also to deepen and widen the existing feature to provide sufficient capacity to handle maximum expected flows. The re-engineering of the original ditch was also done to increase system dependability in case of sediment collapses or obstructions such as fallen trees. An additional impact upon the Native Ditch was the creation of a number of back cuts into the slope above the ditch to improve stability. The combination of deepening and widening the original course and the back cuts above reduced the visible portion of the original ditch to a small shoulder that shows a portion of the upper surface and a portion of the side wall. During construction activities, backfilling along the corridor was necessary. In some areas where new sections of ditch were created, excavated material was utilized to backfill the original ditch course.

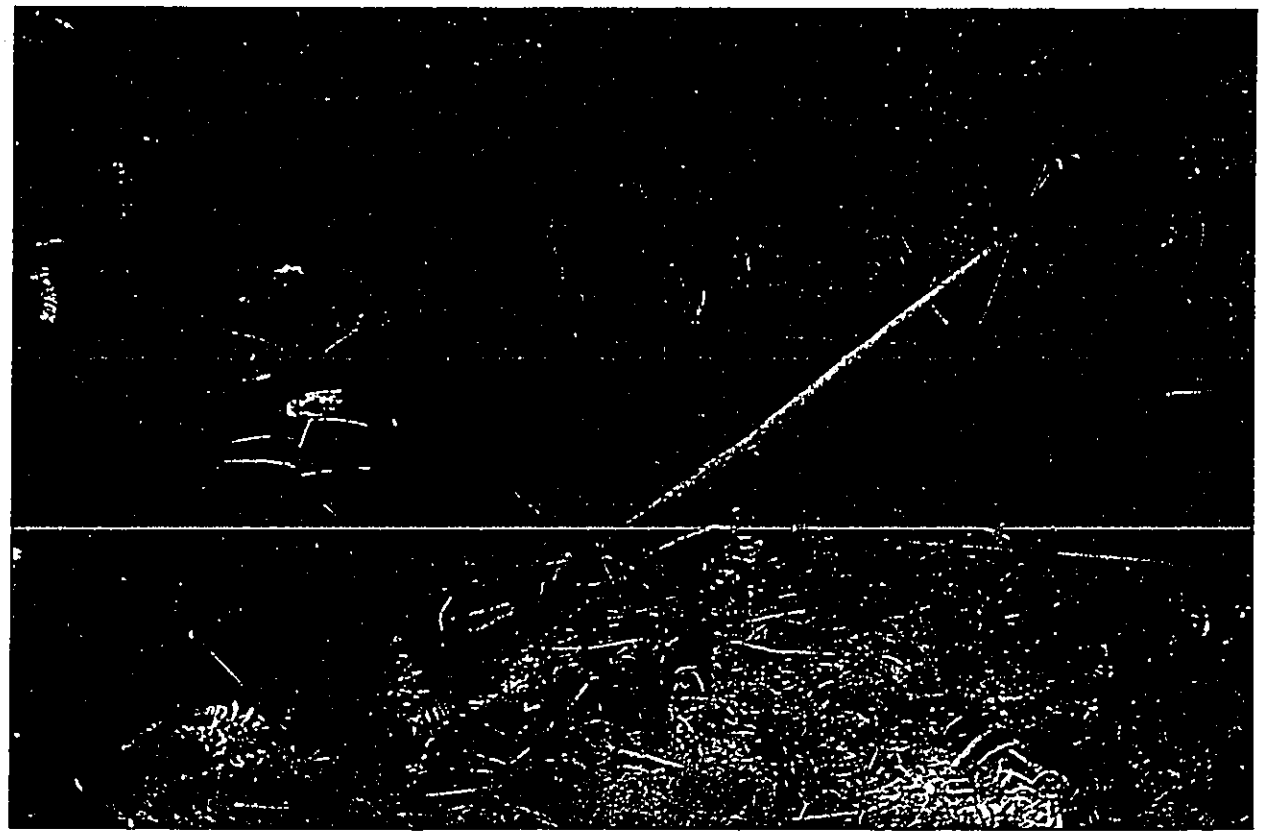

Figure 6. Outlet tunnels and start of Native Ditch below Alexander Dam, view to east

Figure 7. Base of Native Ditch that has not been cleaned out or restored to accept flow, view to southeast

Figure 8. Native Ditch showing condition of feature just downstream from outlet tunnels below Alexander Dam

Figure 9. New ditch excavation following old course of Native Ditch (Native Ditch invert remnant visible on right and above current channel invert), view east

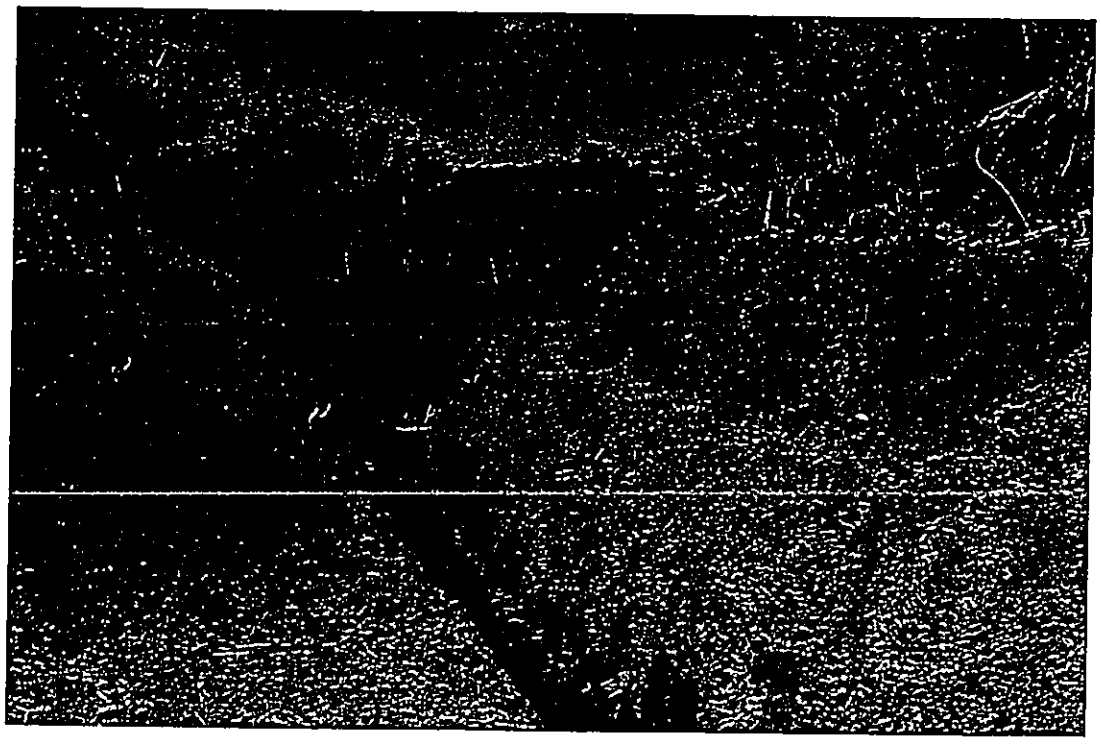

Figure 10. New excavated segment of ditch approaching forebay (note presence of saprolitic cobbles and boulders in cut in lower right), view west

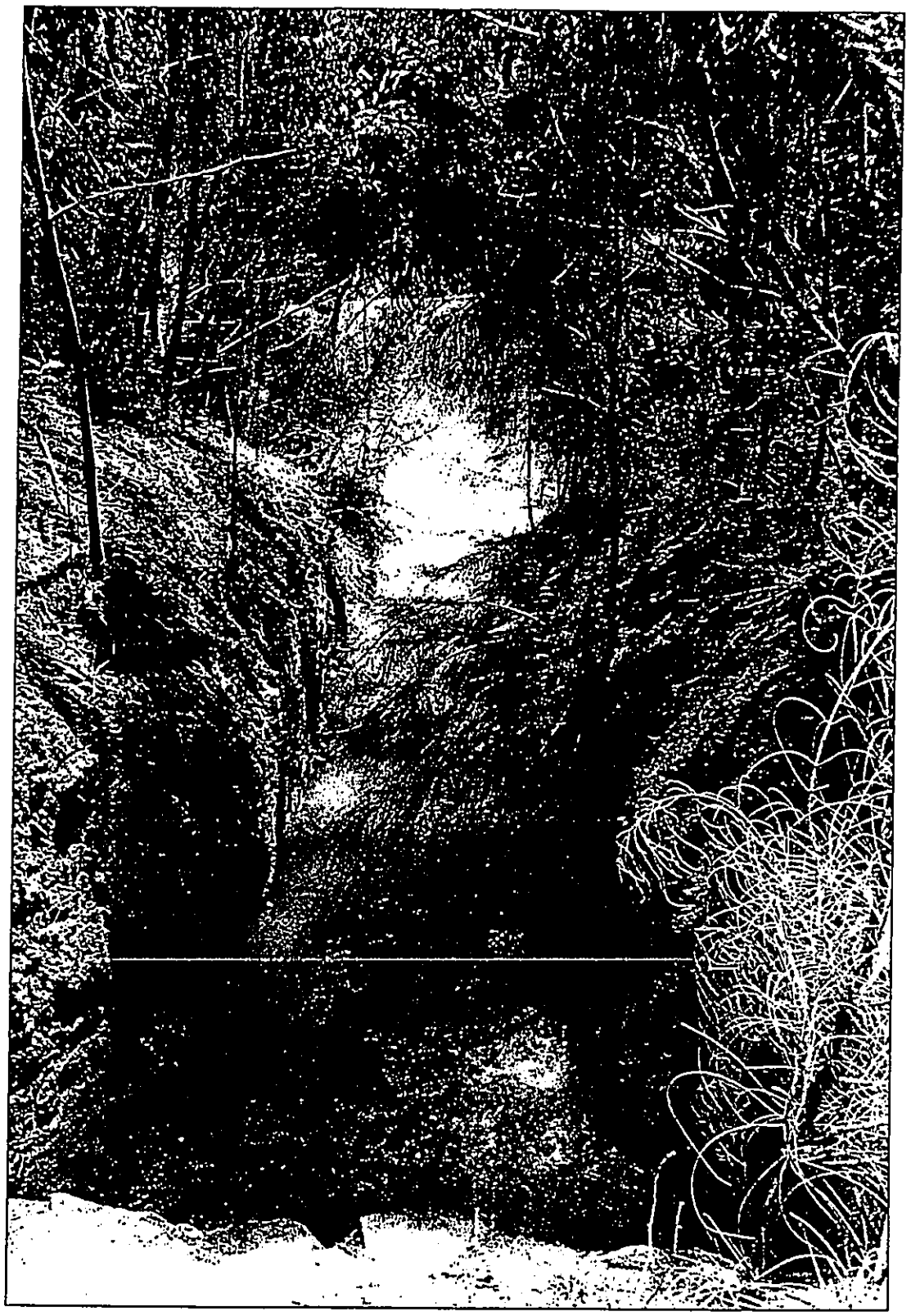

Figure 11. New ditch course to direct ditch flow into forebay beneath new culvert, view to west

SIHP #	50-30-09-3918
FUNCTION:	Water Control
SITE TYPE:	Dam
TOTAL FEATURES:	3
DIMENSIONS:	188.976 x 36.27 m
CONDITION:	Excellent
AGE	Plantation

COMPLEX DESCRIPTION: Alexander Dam and Alexander Reservoir were constructed in 1931 (Figure 12. Figure 13). The dam itself is 188.976m (620 ft) in length and 36.27 m (119 ft) in height and represents the highest dam in Hawai'i. The maximum storage capacity is 2,540 acre-feet and normal storage is 1,070 acre-feet. This dam, spillway, and reservoir were constructed for irrigation, hydroelectric power, and as a water supply. The method of construction was by hydraulic fill. Alexander Dam is the highest hydraulic fill dam in the western U.S. During construction in 1927, the dam failed claiming six lives but was rebuilt and completed by 1931 by civil engineer Joel B. Cox. Cox was also the 1944-1945 chair and president of the Engineering Association of Hawaii.

The dam has an all concrete spillway that consists of large squares that were probably poured in place (Figure 12). The spillway slopes back to the west at a 20-25 degree angle. The back of the spillway is also concrete and is about 3.04 m (10 feet) in height with an angle between 60-70 degrees. The dam itself is stepped in appearance and slopes back to the west at about a 50 degree angle. In profile the dam has a shouldered or stepped appearance (Figure 14, Figure 15). The shoulder appears to serve as a walkway along the dam face. The dam is very well-faced by quarried basalt material that was apparently split by drilling and later percussion shaped by hammers before placement (Figure 16, Figure 17). Small fragments and percussion flakes were used as chinking between larger pieces of stone to create a dense fabric of rockwork on the dam face. Located at the far southern edge of the reservoir below the access road is a large retaining wall constructed of large basalt boulders that may have been constructed to provide support for the access road and function as a water impounding feature (Figure 18).

Figure 12. Concrete spillway on Alexander Reservoir, view northwest

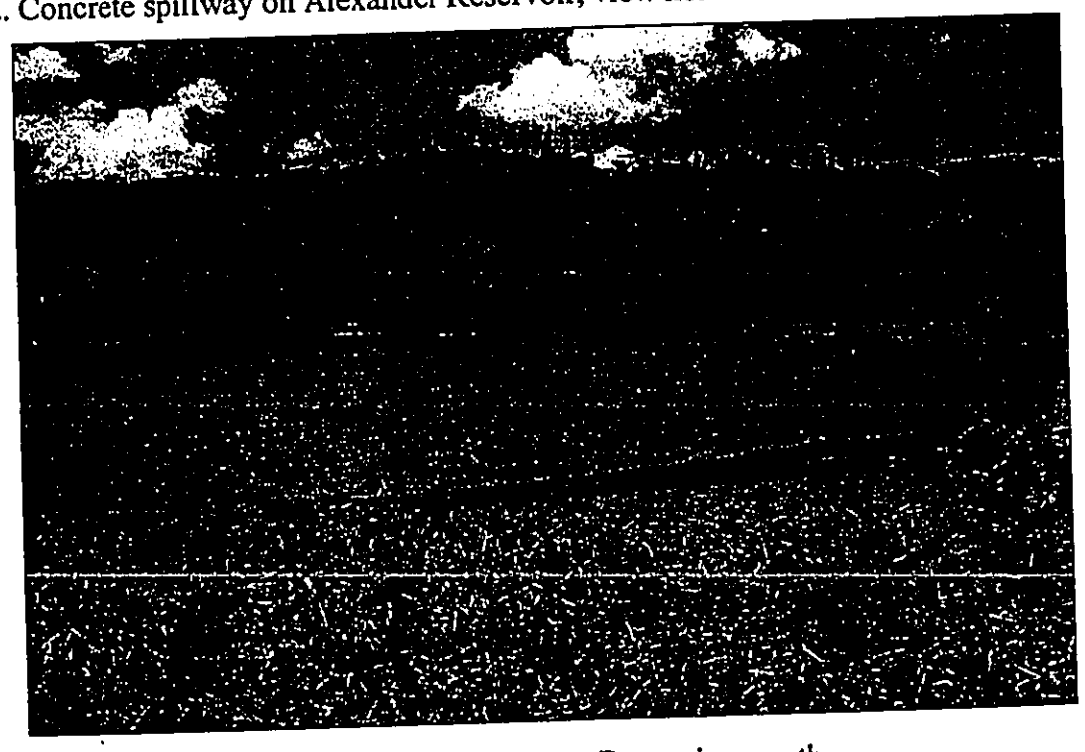

Figure 13. Alexander Reservoir from atop Alexander Dam, view south

Figure 14. Alexander Dam front showing rockwork, view south

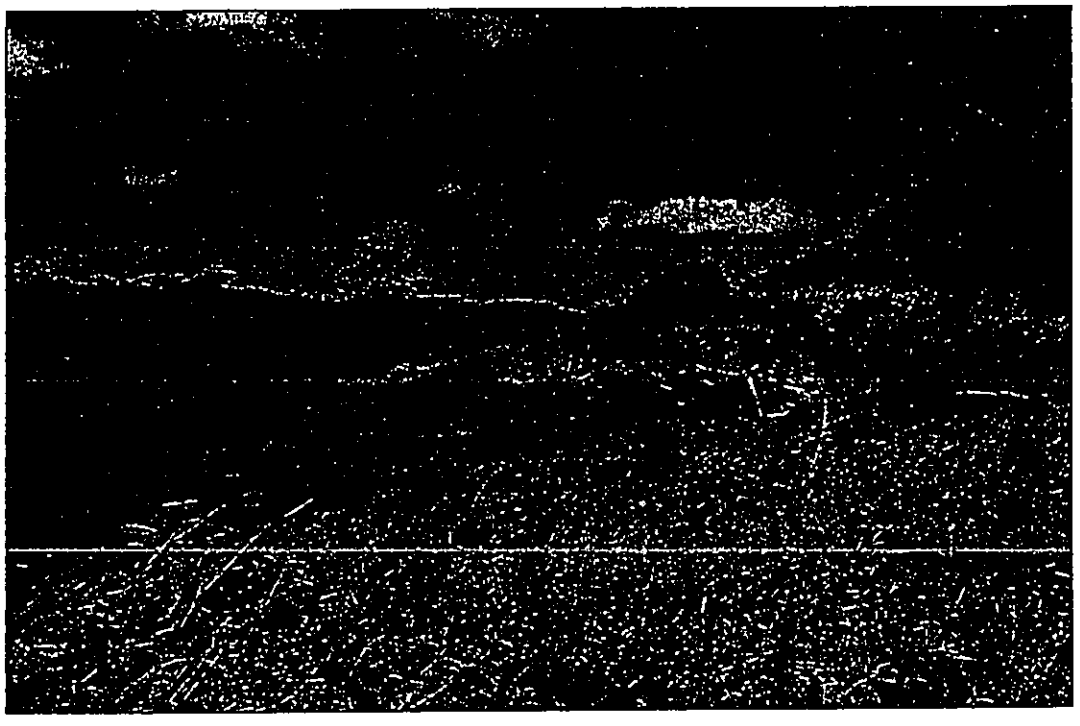

Figure 15. Alexander Dam from south showing rockwork on front and side

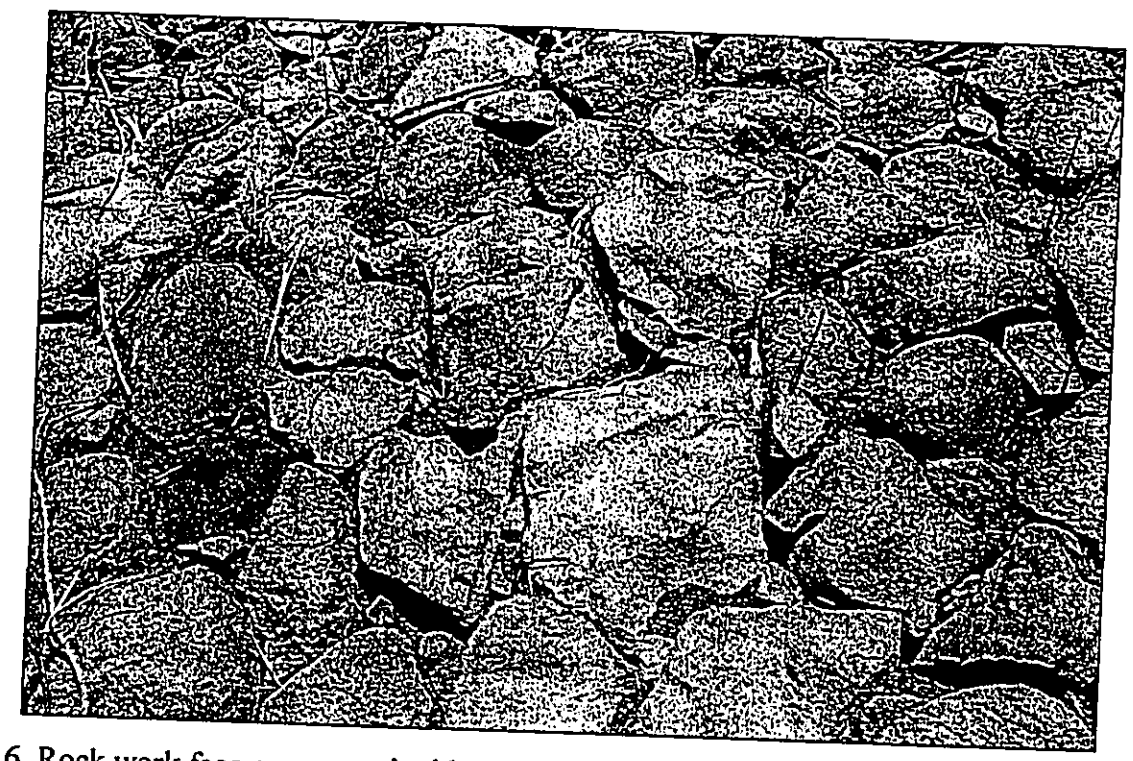

Figure 16. Rock work face on reservoir side of Alexander Dam (note percussion scars on split boulders)

Figure 17. Close-up of rock work face showing drill holes and percussion scars (note angular fragments and percussion flakes used as chinking)

Figure 18. Possible boulder impounding wall on south edge of Alexander Reservoir, view northwest

SIHP #	50-30-09-3919
FUNCTION:	Water Control
SITE TYPE:	Forebay
TOTAL FEATURES:	1
DIMENSIONS:	n/a
CONDITION:	Good
AGE	Plantation

DESCRIPTION: The forebay is an excavated earth water impoundment facility situated downslope from Alexander Dam (Figure 19, Figure 20). Prior to collapse in 2001, a tunnel from the reservoir carried water from the dam and fed the northeast end of the forebay. At the southeast corner a metal riveted pipe called a penstock (Figure 21) carries water from the forebay to the Kalāheo hydroelectric station and KCOF coffee tree fields as irrigation water. The forebay site is about 1.65 acres in area. Along the western edge, a new entry has been excavated to allow water from the newly realigned and refurbished ditch to drain into the forebay (see Figure 11 and Figure 20).

Figure 19. Top of forebay, view north

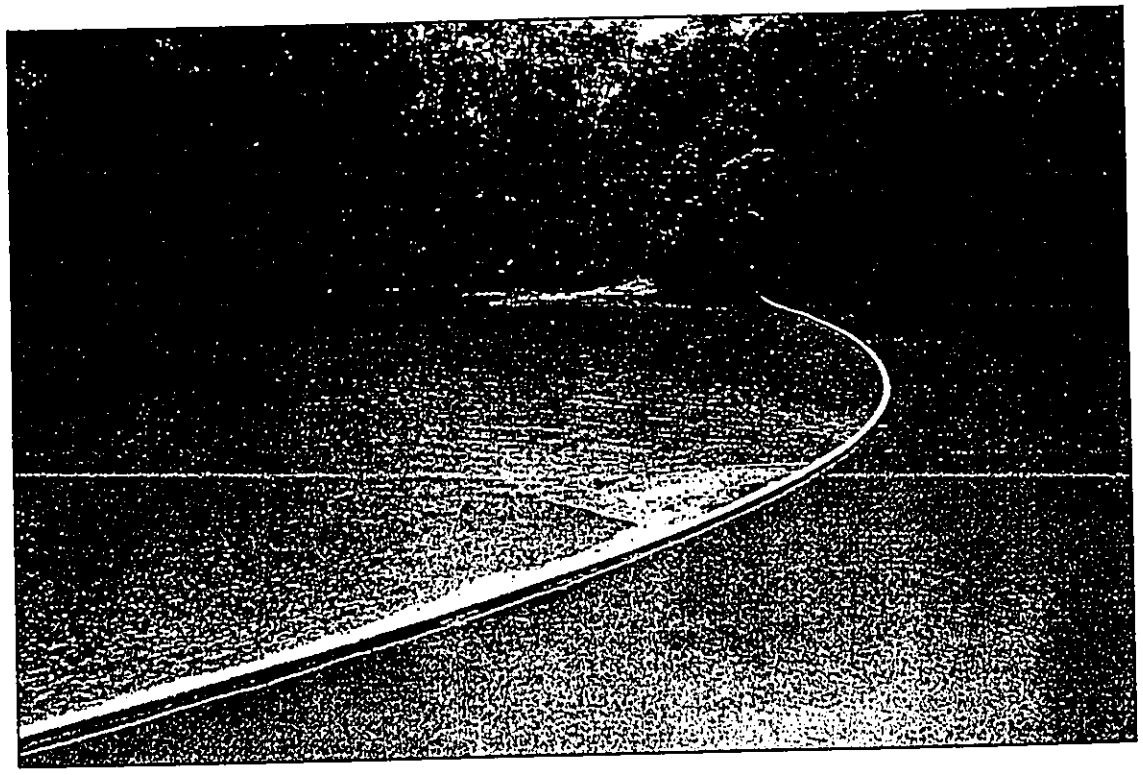

Figure 20. Bottom of forebay at new ditch entrance, view west

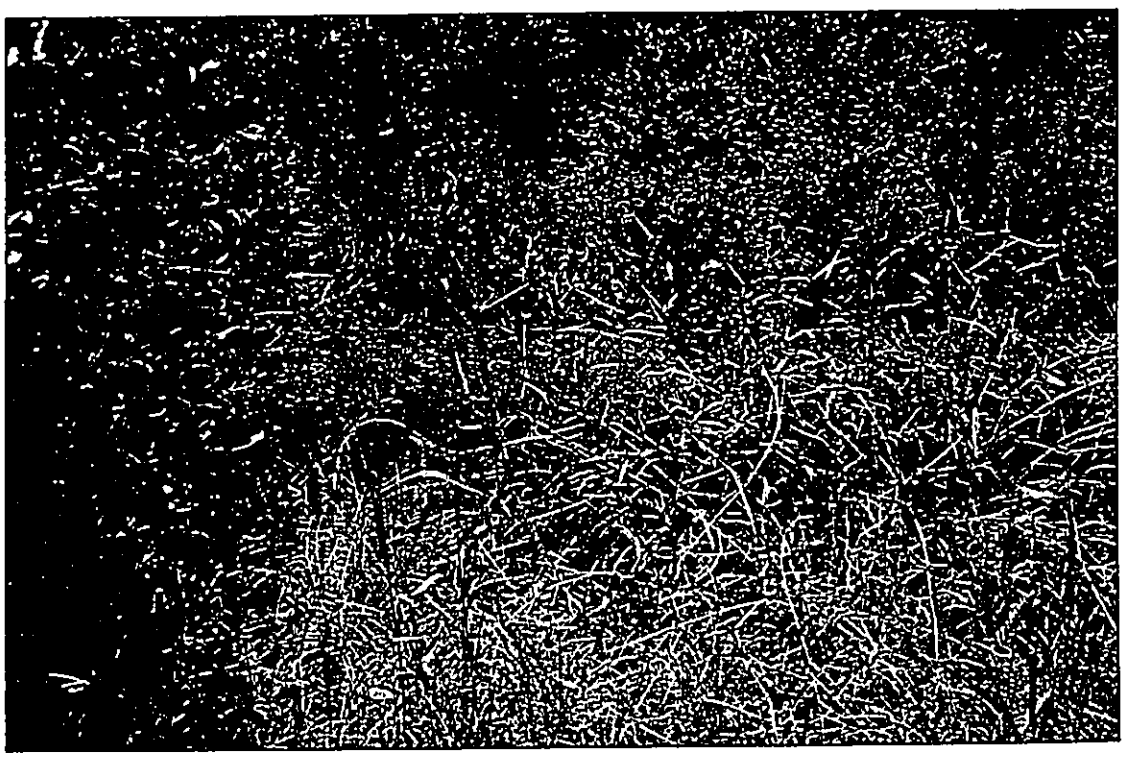

Figure 21. Original penstock pipe taking water from forebay to Kalāheo hydroelectric station, view west (outside project area).

Section 5 Summary and Interpretation

The archaeological inventory survey of the corridor encompassing the restored portions of the Native Ditch, newly excavated portions of the ditch realignment, and access road resulted in the identification of three historic properties. The corridor encompassed an area from Alexander Dam and Reservoir down to a forebay feature.

These features represent a portion of the original irrigation and water control infrastructure developed on Kaua'i from 1900 to the 1930s as part of the growing sugar industry. The McBryde irrigation system represents an engineering accomplishment within the state of Hawai'i and has a history much like the East Maui Irrigation system. The origins of both systems represent the foresight and planning of Samuel T. Alexander and Henry P. Baldwin. Alexander Dam is also significant as a historical engineering marvel for being among the highest hydraulic dams in Hawai'i and the western United States. The foresight of Alexander and Baldwin in recognizing the feasibility of designing and implementing water transportation systems that would carry water from areas of high rainfall to more arid portions of Kaua'i. In many ways, the success of the irrigation system developed on south Kaua'i owes much of its success to the efforts to design the East Maui Irrigation system. Both systems followed a similar history of development.

The start of the Kaua'i system began with a 13.5-mile aqueduct system of tunnels, open ditches, flumes and siphons to transport water across the Hanapēpē River and was completed in 1891. This system was designed for the Hawaiian Sugar Company at Makaweli. By 1902 an additional 13-mile canal had been constructed from Olokele Valley. Also at this time other plantations on Kaua'i began to design and construct similar systems while others continued to rely on surface waters from adjacent streams.

After 1900, it was apparent that in order to remain successful, sugar plantations had to consider ways to develop more sources of surface water that could take advantage of adjacent watersheds: Lawā'i, Wahiawa, and Kamo'o. Benjamin F. Dillingham consolidated and incorporated lands of Wahiawa Ranch, 'Ele'ele Plantation, and the Kōloa Agricultural Company to form the McBryde Sugar Company. To increase profitability of the sugar plantations, underground sources of water were tapped at the headlands of the Lawā'i and Hanapēpē valleys. To augment these underground sources, surface impoundments were created.

From 1899, onward, to about 1930 marks the relative heyday of development of the Kaua'i irrigation infrastructure associated with McBryde Sugar Company. Between 1900 and 1907, McBryde Plantation constructed 30 large and small reservoirs and an extensive system of flumes and ditches to collect and control water from the valley headlands. Extensive development of plantation camps across the plantation was also initiated.

The construction of Alexander Dam from 1927 to 1931 is representative of the engineering effort that developers were willing to expend to harness flow from the valley watersheds. Alexander Dam played a significant role in the water control infrastructure. Interestingly, it also plays a significant role in early engineering and soil mechanics as a scientific discipline with its collapse in 1931 and reconstruction by civil engineer Joel Cox in 1932 with the assistance and advice of Karl Terzaghi. Waters behind Alexander Dam were used to operate a hydroelectric station at Kalāheo to meet all electrical needs of the McBryde Sugar Company. Excess electricity was sold to other industrial businesses within Olokele and Kōloa.

Features such as the forebay and penstock appear to have been constructed at about the same time as Alexander Dam and the reservoir. Based on historic maps and documents, the Native Ditch appears to have been constructed some time around 1896 to 1900 and was in use up until the mid-1970s. Both the forebay and Alexander Dam continue to be utilized as integral parts of the water control and impoundment infrastructure associated with KCOF irrigation efforts. Flow from the forebay via the penstock pipe still provides water to the hydroelectric station at Kalāheo as well.

Section 6 Significance Assessments

Significance evaluations are provided for each historic property in accord with guidelines and evaluation criteria established and set forth according to the National Register of Historic Places via the Historic Sites Act (1935) and the National Historic Preservation Act (1966) and in accord with the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (Federal Register 48(190), 1983). The National Historic Preservation Act of 1966 expanded the Secretary of the Interior's authority to extend the recognition of historic properties to include properties of state and local significance. Significance assessments represent evaluations of importance according to American history, architecture, archaeology, engineering, and culture.

6.1 Significance Assessments

Significance assessments of historic properties are developed in accord with the following criteria as set forth in the Code of Federal Regulations, Title 36, Part 60. The specifics of each criterion are provided below:

A. That are associated with events that have made a significant contribution to the broad patterns of our history; or

B. That are associated with the lives of persons significant in our past; or

C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. That have yielded, or may be likely to yield, information important in prehistory or history.

A fifth criterion is included that has been developed for the State of Hawai'i Register of Historic Places as set forth in HAR 13-275-6.

E. Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events, or oral accounts—these associations being important to the group's history and cultural identity.

Site 50-30-09-3917, the uppermost remnant portion of the Native Ditch and a corresponding section outside the current project corridor are considered significant under NRHP Criterion D for the potential for additional information to be recorded.

Site 50-30-09-3918, Alexander Dam is considered significant under NRHP Criteria A, B, C, and D. The dam is considered significant under Criterion A because of its association with the development of irrigation systems related to McBryde Sugar Company. The dam is also considered significant because of its failure and collapse during construction in 1931 claiming six lives. This dam is listed along with a number of other dam collapses in the United States as having a significant influence upon engineering science and soil mechanics. Alexander Dam is considered significant under Criterion B due to its association with Duncan McBryde of McBryde Sugar Company. The dam is also believed to represent a unique piece of engineering and architecture because it is one of the highest hydraulic fill dams in Hawai'i and in the western

United States. The dam is significant under Criterion D because of the potential for additional information to be retrieved from this feature.

Site 50-30-09-3919, the forebay feature is considered significant under Criterion D for its potential to reveal additional information related to the Plantation era on Kaua'i and in Hawai'i.

Section 7 Project Effect and Mitigation Recommendations

Factors that directly impact the consideration of the historic properties discussed in this report include the fact that they are all presently significant components of a functioning irrigation and hydroelectric power infrastructure. Project effects and mitigation recommendations are developed herein in consideration of these factors and under the realization that these historic properties continue to operate within the limits of their originally intended functions.

7.1 Project Effect

In accord with HAR 13-7 Chapter 190, Subchapter 4, the owner of a dam is to provide for "adequate and timely maintenance, operation, and inspection of their dams and reservoirs". The rules also specify a list of tasks that can be considered as "emergency work" which may be undertaken by the owner without prior notification or approval by the Department of Land and Natural Resources (Hawai'i Administrative Rules 13-7-190) and would appear from a reading of the rules and regulations to apply not only to the dam but also to "appurtenant works". "Appurtenant works" are defined as "the ancillary features of a dam, such as the spillway, reservoir, and its rim, powerhouse outlet, tunnel, pipeline, and penstock (HAR 13-7-190-2 Definitions). These actions are considered not to impair the safety of the dam or ancillary features and are listed below:

- "Stockpiling materials such as riprap, earth fill, sand, sandbags, and plastic sheeting;"
- "Lowering the reservoir level by making releases through the outlet or a gated spillway, by pumping or by siphoning; however, when large releases are to be made, the department shall be notified. Lowering the water level by excavating the spillway or embankment is prohibited unless failure is imminent. In this situation, the department shall be notified as soon as reasonably possible of any emergency condition that exists and any emergency action taken;"
- "Armoring eroded areas by placing sandbags, riprap, plastic sheeting, or other available material;"
- "Plugging leakage entrances on the upstream slope;"
- "Increasing freeboard by placing sandbags or temporary earth fill on the dam;"
- "Diverting floodwaters to prevent them from entering the reservoir basin;"
- "Constructing training berms to control floodwaters;"
- "Placing sandbag ring dikes around boils at the downstream toe to provide back pressure;" and
- "Removing obstructions from outlet or spillway flow areas;"

Scheduled maintenance, safety inspections, and such emergency tasks are obviously necessary for continued dam safety and operation and to remain in compliance with state rules and regulations. The overall impact of such tasks on Alexander Dam is considered acceptable even with its identification as a historic property and should continue to be conducted as they have been in the past. The regulations are very clear on requiring the approval of the Department

of Land and Natural Resources for tasks or modifications that would alter the design of the dam. The above tasks will not impact the original design of Alexander Dam.

The other features identified as historic properties include the realigned ditch and forebay. A series of basic maintenance tasks are also necessary for the continued safe and effective operation of these facilities. Examples of these tasks were discussed in a meeting with KCOF and Alexander and Baldwin staff and are provided below but are not considered to a negative impact on the features themselves:

- Weed control
- Access road repair and periodic maintenance
- Vegetation clearance by hand and power tools
- Mowing
- Silt removal from the forebay structure every four to five years
- Periodic maintenance and repair of the penstock riveted pipe feature
- Removal of vegetation, trees, and weed control of the spillway

The realignment and restoration of portions of the Native Ditch could represent one aspect of impact upon remaining historical integrity of the original ditch course. Impacts include excavation of the original ditch and deepening the course in sections and complete burial with excavated backfill in areas where the ditch course was realigned for various reasons. As discussed earlier in the report, there are essentially only two segments of the original Native Ditch course that were not impacted by work to restore flow in the ditch. These areas are located below the outlet tunnels and below the forebay (with this section being outside the project area). An additional segment of the Native Ditch is intact but consists of a tunnel segment in roughly the middle of the ditch corridor. Consideration of the fact that the Native Ditch was in use until the mid-1970s draws into question how much integrity remained of the original construction prior to actions taken by KCOF in 2001. That the archaeological inventory survey was conducted after KCOF had conducted their work negated our ability to assess the total impact because it was not possible to observe the original ditch condition and configuration prior to restoration. It is assumed that the modified portions of the old ditch were comparable to the still intact section that we were able to observe just below the outlet tunnels—silted in, partially collapsed from erosion and bank slumping, and overgrown with vegetation.

7.2 Mitigation Recommendations

The efforts to restore flow along portions of the Native Ditch and to realign other segments to streamline ditch flow between the outlet tunnels and forebay impacted the original course of the Native Ditch. The results of KCOF actions resulted in only two segments of the original ditch course remaining intact: a portion just below the outlet tunnels and a segment below the forebay but outside the project area (but still included within the SIHP number for the Native Ditch). Additional impacts are the new ditch flow entrance into the southwest portion of the forebay.

It is recommended that Alexander Dam, the remnant sections of original Native Ditch, and the forebay structure be considered as historic properties. Since the work to restore flow and realign portions of the Native Ditch has already been completed, it is recommended that the intact

remnants be preserved through avoidance. If future work is developed that will impact either the upper portion or the lower portion of the Native Ditch, it is recommended that additional archaeological documentation be conducted prior to any ground disturbance activities in either area.

Activities conducted by KCOF had no impact upon Alexander Dam and a minimal impact upon the forebay feature (excavation of a new inlet from a realigned section of new ditch). These features will continue to be significant facilities associated with the present irrigation and hydroelectric power infrastructure. In this respect, contingencies must be made for their continued maintenance. The types of maintenance discussed above would appear to have little significant impact upon the historical integrity of either Alexander Dam or the forebay structure. To be realistic, it may be necessary to consider design upgrades for safety reasons in the future as these features continue to age.

It would also be feasible for KCOF to consider development of a historic preservation plan to manage these historic properties and other cultural resources that may be part of the overall irrigation infrastructure originally constructed by the McBryde Sugar Company. An SHPD approved historic preservation plan in place would allow KCOF to more effectively monitor and manage irrigation facilities and assist in mitigating future negative impacts to historic properties.

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APPENDIX C

Cultural Impact Assessment for the Restoration of the Alexander Dam Irrigation Ditch Project

Prepared by Cultural Surveys Hawaii, Inc.

Cultural Impact Assessment

for the Restoration of the Alexander Dam Irrigation Ditch Project, Wahiawa Ahupua'a, Kona District, Island of Kaua'i

TMK (4) 2-4-08:002, 2-4-09:001, and 2-4-09:003

DRAFT

by

Auli'i Mitchell, B.A.
Rodney Chiogioji, B.A.
and
Hallett H. Hammatt Ph.D.

Prepared for
Wilson Okamoto Corporation

by
Cultural Surveys Hawai'i, Inc.
(Job Code: WAHI 5)
September 2005

MANAGEMENT SUMMARY

Title	Cultural Impact Assessment for the Restoration of the Alexander Dam Irrigation Ditch Project, Wahiawa Ahupua'a, Kona District, Island of Kaua'i (TMK: (4) 2-4-08:002, 2-4-09:001 and 2-4-09:003)
Date	August 2005
Project Number	Cultural Surveys Hawai'i Inc. (CSH) Job Code: WAHI 5
Agencies	State of Hawai'i Department of Health / Office of Environmental Quality Control (DOH / OEQC)
Project Land Jurisdiction	A portion of the project area is owned and operated by the Kaua'i Coffee company, Inc. (KCOF) and a portion of the project area is owned by the state and under the jurisdiction of the Department of Agriculture and Forestry (in accord with Executive Order No. 1083).
Project Description	In July of 2001, personnel from Kaua'i Coffee Company (KCOF) accomplished emergency repairs to a key portion of the water system in Kalāheo after the main outlet tunnel from Alexander Reservoir had collapsed. These repairs were conducted to prevent overtopping of water behind Alexander Dam and to reestablish irrigation water and hydroelectric power to KCOF coffee growing and processing activities.
Project Acreage	3 acres
Area of Potential Effect (APE)	The area of potential effect (APE) includes the corridor for the realigned and refurbished irrigation ditch and the associated access road. Also included in the APE are the forebay and Alexander Dam.
Document Purpose	The project requires compliance with the State of Hawai'i environmental review process [Hawai'i Revised Statutes (HRS) Chapter 343], which requires consideration of a proposed project's effect on traditional cultural practices. At the request of Wilson Okamoto Corporation, CSH undertook this cultural impact assessment to provide information pertinent to the assessment of the proposed project's impacts to cultural practices. The document is intended to support the project's environmental review by cultural consultation efforts [per the OEQC's *Guidelines for Assessing Cultural Impacts*]. The report may also serve to support the project's historic preservation review under HRS Chapter 6E-42 and Hawai'i Administrative Rules Chapter 13-284.
Consultation Effort	Hawaiian organizations, agencies and community members were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the project area and the vicinity. The organizations consulted included the State Historic Preservation Division (SHPD), the Office of Hawaiian Affairs (OHA), the Kaua'i/Ni'ihau Islands Burial Council, the Kaua'i Historic Preservation Review Commission, and Hui Malama I Nā Kūpuna O Hawai'i Nei. Cultural anthropologist Aulii Mitchell conducted the consultation effort under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator).

Identified Cultural Issues	None of the community contacts queried for this assessment identified any cultural sites in the project area, or recalled anyone entering the project area – either in the past or present – for any traditional cultural practice. Based on the evidence gathered, at present no contemporary or continuing cultural practices occur within the project area.
Cultural Impact Recommendations	Based on the findings of this assessment, the restoration of the Alexander Dam Irrigation Ditch Project and the future maintenance of the restored ditch, has had and will have minimal impact upon native Hawaiian cultural resources, beliefs and practices. It should be noted, however, that subsurface properties associated with former traditional Hawaiian activities in the project area, such as artifacts and cultural layers, may be present despite the decades of sugar plantation activities. As a precautionary measure, personnel involved in the ongoing maintenance of the irrigation ditch should be informed of the possibility of inadvertent cultural finds, and should be made aware of the appropriate notification measures to follow (including consultation with the State Historic Preservation Division and, as may be appropriate, with Kaua'i community cultural organizations).

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I. INTRODUCTION

A. Project Background

At the request of Wilson Okamoto Corporation, Cultural Surveys Hawai'i is preparing a Cultural Impact Assessment for the Restoration of the Alexander Dam Irrigation Ditch Project, Kalāheo (Wahiawa), Kaua'i (TMK: (4) 2-4-08:002, 2-4-09:001 and 2-4-09:003)(Figures 1 & 2).

A portion of the project area is owned and operated by the Kaua'i Coffee company, Inc. (KCOF) and a portion of the project area is owned by the state and under the jurisdiction of the Department of Agriculture and Forestry (in accord with Executive Order No. 1083).

The project area is a narrow arcing strip extending from the downslope side of the Alexander Dam to the "Old Native Ditch" (including at least three segments of new ditch) extending down to the downslope side of the Forebay site. The project area, comprising approximately 3 acres, is approximately ¾ mile long including the immediate margins of the old ditch, new ditches, and a road.

The purpose of the cultural impact assessment is to assess impacts to traditional cultural practices as a result of the restoration of the Alexander Dam Irrigation Ditch Project. It is our understanding that the project area is quite limited including only areas immediately adjacent to lands impacted in the 2001 emergency repair project.

In July of 2001, personnel from Kaua'i Coffee Company (KCOF) accomplished emergency repairs to a key portion of the water system in Kalāheo after the main outlet tunnel from Alexander Reservoir had collapsed. These repairs were conducted to prevent overtopping of water behind Alexander Dam and to reestablish irrigation water and hydroelectric power to KCOF coffee growing and processing activities.

The 2001 collapse of the main outlet tunnel from Alexander Dam resulted in a loss of the abilities to release water from Alexander Reservoir except through the spillway and the to provide irrigation water to 1200 acres of KCOF plantation, but also the loss of the ability to generate necessary electricity. Alexander Dam provides the only water source for the KCOF plantation and provides hydropower to operate the KCOF factory.

The project requires compliance with the State of Hawai'i environmental review process [Hawai'i Revised Statutes (HRS) Chapter 13-343], which requires consideration of a project's effect on traditional cultural practices. This CIA provides information pertinent to the evaluation of the project's cultural impacts. This document is intended to facilitate the project's state environmental review (per the Office of Environmental Quality Control's *Guidelines for Assessing Cultural Impacts*). This report provides documentation of the project's consultation efforts under applicable state historic preservation legislation. A companion CSH archaeological inventory survey for the same project area provides further documentation to facilitate the project's required historic preservation review and consultation.

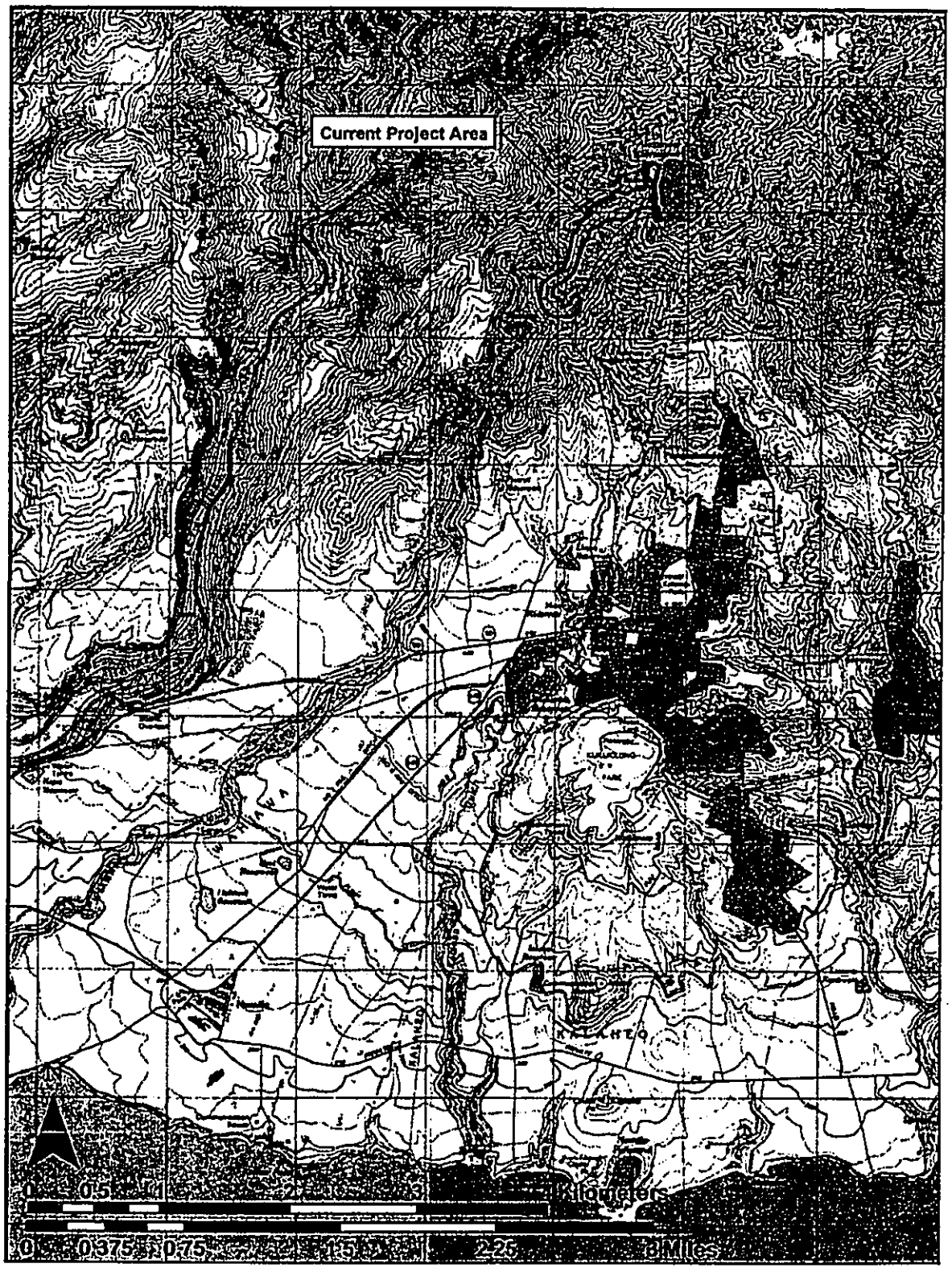

Figure 1. Portion of U.S. Geological Survey Kōloa Quadrangle showing location of general project area in relation to Alexander Reservoir and Kalāheo Town

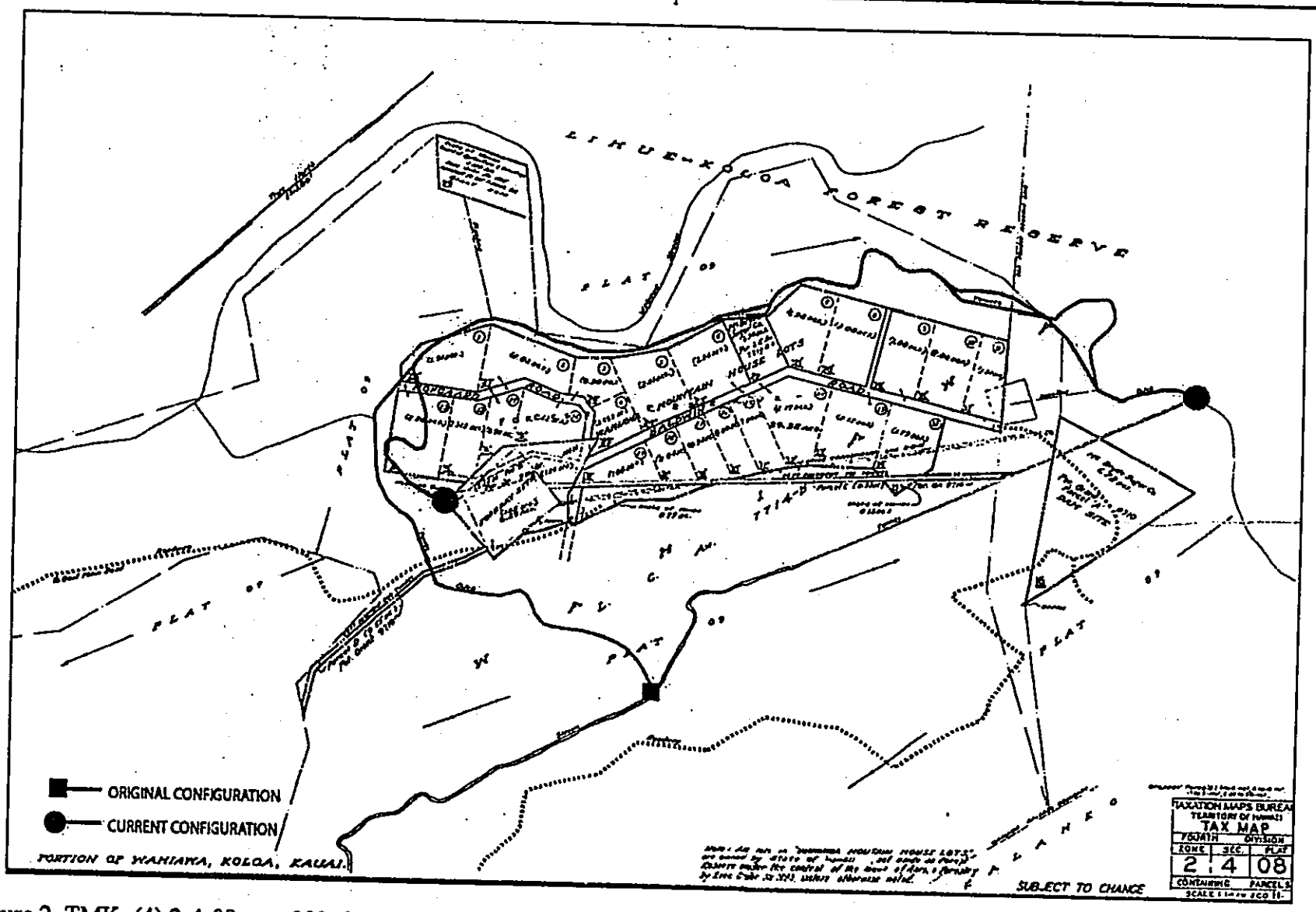

Figure 2. TMK: (4) 2-4-09: por 003 showing location of original Native Ditch (blue) course and realigned portions of ditch (red) (also note locations of Alexander Dam and forebay structures)

B. Scope of Work

The scope of work included:

1. Examination of historical documents, Land Commission Awards, historic maps, with the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal and other resources or agricultural pursuits as may be indicated in the historic record.
2. A review of the existing archaeological information pertaining to the general region as it may allow us to reconstruct traditional land use activities and identify and describe the cultural resources, practices, and beliefs associated with the harbor area prior to construction.
3. Contact persons knowledgeable about the historic and traditional practices in the project area and region by letter and telephone.
4. Preparation of a report on items 1-3 summarizing the information gathered related to traditional practices and land use. The report will assess the impact of the proposed action on the cultural practices and any features identified.

C. Work Accomplished

Historical documents, maps, and photographs were researched at: the Kaua'i Historical Society, the Hawai'i State Archives; the Survey Office of the Department of Accounting and General Services; the Hawai'i State Library; the Bernice Pauahi Bishop Museum archives and library; Hamilton Library at the University of Hawai'i at Mānoa; the Mission Houses Museum Library; the State Historic Preservation Division (SHPD) library; and the library of Cultural Surveys Hawai'i.

Hawaiian organizations, government agencies, community members and cultural and lineal descendants with ties to Wahiawa Ahupua'a and the Kona District of Kaua'i were contacted to: (1) identify potentially knowledgeable individuals with cultural expertise and knowledge of the project area and the surrounding vicinity, and (2) identify cultural concerns and potential impacts within the project area. Results of the community contact process are presented in Section V.

D. Natural Setting

Wahiawa Ahupua'a is located in the Kona District of southern Kaua'i, bordered by Kalāheo Ahupua'a to the east and Hanapēpē Ahupua'a to the west. In general, the *makai* portion of Wahiawa Ahupua'a consists of a gently rolling, raised plateau, with Wahiawa Valley running along the western border of the *ahupua'a*.

II. MYTHOLOGICAL AND TRADITIONAL ASSOCIATIONS OF WAHIAWA AHUPUA'A

Wahiawa (Wahi-awa) Valley, or "milkfish place," was said to have been named after the tradition of the Pohakuawa stone (Kikuchi 1963). The Pohakuawa stone is a large boulder with a bowl carved into its surface, formerly located "about a mile west of Brydeswood on the trail to the upper Wahiawa lands" (Sandison 1956). It is noted that the stone was used in traditional Hawaiian times by fisherman transporting *awa* (milkfish) from the brackish Nōmilu fishpond to a large pool in the Wahiawa Stream. "The fisherman stopped the night at Pohakuawa and kept his catch alive in cool fresh water in the bowl of the rock that was draped over with vines to keep the stone cool and keep the fish from jumping out" (Sandison 1956).

Legendary accounts place a battle occurring at Wahiawa between members of the ruling family of Kaua'i (Fornander 1959). 'Aikānaka, the then king of Kaua'i, had recently been defeated in battle by his younger bother, Kawelo. Following the conquest, Kawelo divided the lands to his choosing, leaving 'Aikānaka to live in poverty with no lands and no home. 'Aikānaka settled in upland Hanapēpē, where he was later visited by Kaeleha, the son of Kawelo. The two met at Wahiawa, at the home of Ahulua. Kaeleha was shown great kindness and hospitality by 'Aikānaka, and therefore felt indebted to him.

Taking pity on 'Aikānaka for the way he was forced to live, Kaeleha instructed him on how to defeat his father, Kawelo, in battle. 'Aikānaka was told to fight Kawelo with stones because he was never taught to dodge stones thrown at him. Learning of the possible uprising by 'Aikānaka, Kawelo sent Kamalama to confirm the rumors. Kamalama returned news that 'Aikānaka and Kaeleha were gathering stones and making preparations for war. With great anger that his son would join 'Aikānaka and rebel against him, Kawelo immediately traveled to Wahiawa:

> When he [Kawelo] arrived at Wahiawa, he saw several war canoes belonging to Kaeleha and Aikanaka, just back of the great mounds of stones. On the sides of the mounds of stones, he saw women and children with stones in their stands, and all were apparently ready for the conflict. All Kawelo had in his hands were his war club, Kuikaa, and his wife's pikoi, two weapons to defend himself with.
>
> ...In the fight, Kawelo was not able to dodge the stones that were hurled at him, for a great many of them were thrown at the same time, therefore he stood in one place while the stones were hitting him from all sides. In the course of time, Kawelo was completely covered by the stones, the stones rising until his height was reached...After a while the mound of stones over Kawelo grew higher and higher, when at last nothing else could be seen but a great mound of stones which was like a grave for Kawelo. (Fornander 1959:104-108)

Kawelo's body was later removed from the mound of stones. The people beat his lifeless body with clubs to insure that he was dead. The body was then carried from Wahiawa to 'Aikānaka's temple at Maulili in Koloa.

Traditional accounts of Wahiawa indicate the environment in the *ahupua'a* was suitable for the development of an extensive agricultural system that likely supported a sizable native Hawaiian population. Adequate rainfall, mild temperatures, and abundant spring and stream

water in close association with arable land were ideal conditions for the cultivation of taro and other traditional staple foods. The following account is given by Keahi Luahine, a *kama'āina* raised in Wahiawa Valley:

> ...the taro terraces extended all the way down the valley to the *muliwai* (inlet). A short distance above the present highway bridge was a spring named Ka'ulupaniau, which watered a small group of terraces. Inland from this was Kawaikapulalo [The-sacred-water-below], and here were terraces and *wauke* (paper mulberry) plantations. Above this was *kula* land named Kawaikapuluna [The-sacred-water-above], on which were the houses and sweet-potato plantations. Continuing upstream to a point opposite Pu'u Aukai there were other terraces in the stream bed, with houses and sweet-potato plantations on *kula* land above. (Handy and Handy 1972:428-429)

Wahiawa Valley was also the location of the legendary stone, Kaua'i-iki (Little Kaua'i). A legend explains that in the process of clearing their *lo'i* of stones, a Hawaiian family came across this stone. Resembling a map of Kaua'i, they left the stone in place and gave it its name (Sandison 1956). An additional account by Keahi Luahine makes reference to the large stone that was shaped like the island of Kaua'i:

> At Wahiawa on Kauai was a stone called Kauai-iki which stood in a taro patch also called Kauai-iki. The taro that grew there was the finest and the largest on the island, said to be made so by the stone. When the paved road was built Alexander McBride (sic) removed the Kaua'i-iki stone so that it should not be blasted and ground up by the road workers...In ancient times people used to say that even though you had seen the entire island of Kauai and had not seen Kauai-iki, then you had not seen all of Kauai. This small taro patch and stone were much visited in the old days. (Pukui in Handy 1940:65)

III. HISTORICAL BACKGROUND

A. Early Historic Period

During the early historic period, Wahiawa was again the setting of a battle over control of Kaua'i. In 1824, Kaumuali'i, the ruling chief of Kaua'i and Ni'ihau, became gravely ill. Nearing death, Kaumuali'i declared "Our 'son'" be his successor and "Let the lands be as they are; those chiefs who have lands to hold them, those who have not to have none" (Kamakau 1961:265). Following his death, Kahalai'a, nephew of Kaumuali'i and chief from Hawai'i Island, was announced as the new ruler over Kaua'i and Ni'ihau. However, the people of Kaua'i, both chiefs and commoners, expected one of Kaumuali'i's sons, Keali'iahonui or Humehume, to be named as successor.

Kahalai'a traveled to Kaua'i and settled at the former Russian Fort Elizabeth at Waimea. Soon after, a hostile sentiment spread among the people of Kaua'i over being ruled by an *ali'i* from Hawai'i. During this uneasy period, Rev. Hiram Bingham traveled to Wahiawa, leaving the following account:

> I visited the disaffected George [Humehume] at his estate - the little secluded Wahiawa. It was a small valley, running back from the sea to the mountains, containing some twenty small habitations, about a hundred souls, and some hundred acres, very little cultivated, yielding a scanty amount of the common productions of arum, bananas, cocoanuts, potatoes, sugar-cane, squashes, melons, and wild apples. At the foot of this valley, I found George living much in the original native style, in a dingy, dirty, thatched house at the sea-side, just where the surf washes a small beach between two rocky cliffs. (Bingham 1847)

The Kaua'i warriors, led by Humehume, subsequently rebelled and attacked the fort at Waimea, where the Hawai'i chiefs had gathered. Armed with guns, the men of Hawai'i were able to hold off the rebels until the arrival of reinforcements from O'ahu. More than ten ships later arrived (Kamakau 1961):

> On August 8 [1824] the battle of Wahiawa was fought close to Hanapēpē, where a fort had been hastily erected and a single cannon (named Humehume) mounted as a feeble attempt to hold back the enemy. In the evening there was an advance made, but the forces of Hawai'i retired to Hanapēpē for the night...Large numbers of Kaua'i soldiers had gathered on the battleground, but they were unarmed save with wooden spears, digging sticks, and javelins. Many women were there to see the fight. The men acted as if death were but a plaything. It would have been well if the gods had stepped in and stopped the battle. No one was killed on the field, but as they took to flight they were pursued and slain...For ten days the soldiers harried the land killing men, women, and children. (Kamakau 1961:268)

The battle of Wahiawa was later known as the "'Pig eating' (*'Aipua'a*) because the dead were left lying for the wild hogs to devour" (Kamakau 1961:233). Following the battle it was also noted:

> A great deal of property was taken, among other things horses and cattle, which had become numerous on Kaua'i because the foreigners had given many such to Kaumuali'i...After the battle the chiefs all came together and Kalanimoku redistributed the lands of Kaua'i ...It was decided that Kahalai'a should not remain as ruler, but the islands be turned over to the young king, and Kaikio'ewa was appointed governor and Kahalai'a recalled. (Kamakau 1961:268-269).

B. Mid- to late-1800s

1. Early Sugar Culture on Kaua'i

In 1835, a Honolulu firm, Ladd &Company, secured tenancy rights to a tract of land near Kōloa on Kaua'i for silk and sugar culture. Early accounts tell of plows being drawn by natives, crude milling methods and low sugar yields (Thrum 1901). In spite of these handicaps, 5,000 pounds of sugar and 400 gallons of molasses were produced in 1839. Early references to the use of irrigation were noticeably absent. At that time, ownership of land was vested with the Kingdom. Prior to 1848, individuals and commoners were not able to hold title to land and any appurtenant water rights.

Although the Māhele of 1848 should have stimulated sugar enterprises, the industry declined due to a drought in 1851, and low sugar prices. The first use of irrigation to increase sugar yields occurred on the island of Kaua'i. William Harrison Rice engineered a causeway to divert water from upland streams in 1852; and finished construction of eleven miles of ditches for the Makee Plantation in 1857 (H.S.P.A. 1920). With the Union States' embargo of southern sugar plantations during the American Civil War, prices for Hawaiian sugar improved greatly in the 1860's (Dorrance 2000).

2. The Māhele

The Organic acts of 1845 and 1846 initiated the process of the *Māhele* - the division of Hawaiian lands - that introduced private property into Hawaiian society. In 1848, the crown and the *ali'i* (royalty) received their land titles. The common people received their *kuleana* (individual parcels) in 1850. It is through records for Land Commission Awards (LCAs) generated at the *Māhele* that the first specific documentation of life in Wahiawa Ahupua'a, as it had evolved up to the mid-19th century, come to light (Indices of Awards 1929) (Table 1).

Table 1. Wahiawa Ahupua'a Land Commission Awards Summary

LCA #	Claimant	'Ili	Land Use	Claims Awarded
387	ABCFM (Mission)		Agriculture	2 *'āpana, kula, lo'i*
3215	Niha	Maloloiki	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 18 *lo'i*
3285	Waolani	Kanuiomalai	Agriculture	2 *'āpana*, 1 *kula*, 30 *lo'i*, 1 pigpen

LCA #	Claimant	'Ili	Land Use	Claims Awarded
3323	Papohaku	Nana	Habitation, Agriculture	1 *'āpana*, 1 house lot, 1 *kula*, 40 *lo'i*
3356	Nahuina	Kukuiopio	Agriculture	1 *'āpana*, 1 *kula*, 14 *lo'i*
3413	Pooahi	Malolonui, Kapaniau	Agriculture	2 *'āpana*, 2 *kula*, 30 *lo'i*
3595	Kanupaka	Malolonui	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 18 *lo'i*, 1 pigpen
5350	Puahiki, Nawaalau	Puuokahala	Habitation, Agriculture	1 *'āpana*, 1 house lot, 1 *kula*, 12 *lo'i*, 1 pigpen
5446	Nawaalau, Ezekiela	Puuokahala, Nana	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 18 *lo'i*
6325	Kekauonohi	Wahiawa (*ahupua'a*)	Agriculture	1 *'āpana*, 1 cattle enclosure (not awarded)
6557	Pohakahi	Kamokila	Habitation, Agriculture	1 *'āpana*, 1 house lot, 13 *lo'i*
7714B	Kekuaiwa (Kekuanaoa)	Wahiawa (*ahupua'a*)		All unclaimed land within the *ahupua'a*
8010	Aikala	Kauikuiomalai	Habitation, Agriculture	1 *'āpana*, 1 house lot, 1 *kula*, 30 *lo'i*
8256	Hohoiea	Malolonui	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 2 *lo'i*
9057	Kaanaana	Waikupenau	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 23 *lo'i* (not awarded)
10273	Meheula	Nupaiki	Habitation, Agriculture	2 *'āpana*, 1 house lot, 1 *kula*, 19 *lo'i*, 1 goat pen
10632	Pahao	Kahookaeo, Palanohi	Agriculture	1 *'āpana*, 14 *lo'i*, 1 pigpen (not awarded)
10686	Paele	Nupa	Habitation,	2 *'āpana*, 1 house lot, 1 *kula*, 21 *lo'i*, 1

LCA #	Claimant	Ili	Land Use	Claims Awarded
			Agriculture	pigpen
10946	Wailele	Kaluhi	Agriculture	1 *'āpana*, 1 *kula*, 10 *lo'i*
11088	Kui	Kukuiopio	Habitation, Agriculture	1 *'āpana*, 1 house lot, 1 *kula*, 7 *lo'i*, 1 pigpen

During the *Māhele*, the *ahupua'a* of Wahiawa, consisting of approximately 5,857 acres, was awarded to Moses Kekuaīwa (LCA 7714-B). Kekuaīwa was the grandson of Kamehameha I, and as a Hawaiian *ali'i*, he was not required to prove his tenure on the land. An additional 18 claims for *kuleana* parcels within Wahiawa were made by commoners able to prove their occupation and cultivation of the land. Of the 18 claims, 15 were awarded for parcels ranging in size from less than 1 acre to a maximum of 5 acres (LCA 10273 to Meheula). In general, the *kuleana* awards in Wahiawa were for 1 to 3 acres, which is typical of LCAs in the vicinity. The awarded lands were also situated within, or in the immediate vicinity of Wahiawa Valley and Stream, the main source of fresh water for domestic and agricultural usage within the *ahupua'a*. No maps indicating the precise locations of each of the LCAs were readily available. However, the numerous *'ili* (land section within an *ahupua'a*) names, and references to landmarks such as *pu'u* or the seashore, in the LCA documentation indicate widespread settlement throughout both the *mauka* and *makai* regions of Wahiawa Valley. References are also made to the "community of Wahiawa" located in the vicinity of the Government Road (present day Kaumuali'i Highway) (N.R. Vol. 9, p. 388-389), indicating the focus of settlement within Wahiawa Ahupua'a was likely at this locale. The LCA documentation also indicated that nearly all of the claimants received their *kuleana* land at the time of Kakio'ewa, evidence of the major redistribution of land within Wahiawa as a result of the battle of 1824.

Land Commission documents recording these *kuleana* land claims further clarify our understanding of the *'āina* from the perspective of the native Hawaiians in traditional times by defining specific land use practices within the claimed parcels (see Table 1). As the majority of the LCAs were located within Wahiawa Valley, adjacent to Wahiawa Stream, land use was focused on the cultivation of wetland taro (*lo'i*). A definite pattern is observed in the available documentation, indicating dense cultivation of taro, as evidenced by large numbers of *lo'i* within relatively small parcels of land. The claimant's house lot was also typically located within the same *'āpana* (land parcel) as his *lo'i*. Additional *'āpana* of an individual LCA were generally for discrete *kula* land located outside of Wahiawa Valley. For example, within an approximately 1 acre parcel, David Papohaku (LCA 3323) claimed 40 *lo'i*, *kula* (pasture) land, as well as a house lot. Also within the LCA 3323 documentation was the following testimony given by G.B. Rowell, a foreign missionary living in the islands:

> I send survey of a house lot of above which Mr. Pease refused to survey, joining the lot which Mr. P surveyed for him, who chose to pass his boundary line close by this house, so as to have cut the yard, rather than go round the house to give him his due, though but a few minutes labor. It belongs to Papohaku from ancient times & there is not the slightest ground for opposing the claim.

> I am told that Mr. Pease refused to survey the house lots of nearly all the Claimants in the Valley of Wahiawa. It is the opinion of the natives that he was bribed to do so by the konohiki. I have no time to attend to those lots, though pressed to do so by the people and I fear they must be deprived of them. G.B. Rowell (F.T. Vol. 12, p. 242)

The passage indicates one of the numerous roadblocks commoners faced in receiving their *kuleana* lands. Therefore, while LCA documentation can provide insight into land use practices and other facets of traditional life, it may not always be a good indication of actual population at the time of the *Māhele*. Settlement and cultivation of lands were likely much greater than is represented by *kuleana* land awards.

The American Board of Commissioners for Foreign Missions (ABCFM) was also awarded a parcel of land within Wahiawa Valley (LCA 387:2). Testimony describing the claimed land indicated it was used for the cultivation of taro and was "known by the name of Kauaiki" (F.R. Vol. 2, p. 44). LCA 387:2 is located on the TMK map, immediately *makai* of Kaumualiʻi Highway. The description of the parcel as taro land known as Kauaiki, along with the account stating that the Kauaʻi ʻIki stone was removed from a taro patch during road building activities (see A: Mythological and Traditional Accounts) suggests that LCA 387:2 was the original location of the legendary Kauaʻi ʻIki stone and taro patch.

The earliest documentation of the population of the district of Kōloa, including Wahiawa, appears in the 1850s when missionary censuses recorded a total population of 1,296 (Schmitt 1977:12). Population totals of the entire island of Kauaʻi prior to 1850 had shown rapid decline, suggesting that similar trends most likely occurred in Kōloa and Wahiawa. By 1878, the population of Kōloa bottomed out at 1,008, and then began steadily increasing to 1,500 in 1884, 1,835 in 1896 and 4,564 by 1900 (Schmitt 1977:13). Other nearby *ahupuaʻa* of Kauaʻi demonstrates similar trends.

3. Wahiawa Ranch

Major foreign interests in Wahiawa began in the mid to late 19th century, following acts allowing for foreigners to own lands in Hawaiʻi. The development of large scale agricultural ventures were also stimulated by treaties governing trade between the Kingdom of Hawaiʻi and the United States, namely the Reciprocity Treaty of 1875. The Reciprocity Treaty allowed for certain goods, including sugar, to be exported to the U.S. duty-free.

Duncan McBryde relocated to Wahiawa from his estate in Wailua *circa* 1860 (Damon 1931). He acquired a lease for lands at Wahiawa from Victoria Kamāmalu, sister of Moses Kekuaiwa. Kamāmalu inherited the unclaimed lands at Wahiawa following the untimely death of Kekuaiwa in 1848. McBryde drove his herd of cattle across the island and began the development of the extensive Wahiawa Ranch. The McBryde family estate, known as Brydeswood, was built in the uplands of Wahiawa, *mauka* of the government road. By 1870, in addition to ranching, McBryde also ventured into sugar cane cultivation in Wahiawa and surrounding lands at Kalāheo and Lāwaʻi (Damon 1931). Duncan McBryde died in 1878 at the age of 52, leaving behind his widow and six children. Soon after the death of Duncan McBryde, Mrs. Elizabeth McBryde entered into a partnership forming the "Eleʻele Sugar Plantation.

A map of ʻEle'ele to Kōloa by M.D. Monsarrat indicates the location of various structures within Wahiawa Ahupuaʻa *circa* 1896. In the vicinity of the current project area, a single

structure is located at the shore of Wahulua (Wahiawa) Bay. Additional structures were located both within, as well as outside of Wahiawa Valley, *mauka* and *makai* of the government road. A substantial arrangement of wall segments was also located *mauka* of the government road, likely related to the Wahiawa Ranch. In the upland region of Wahiawa Valley, the "Ele'ele Ditch had also been constructed to take water from Wahiawa Stream to water the cane lands of the "Ele'ele Sugar Plantation.

4. The Hawaiian Sugar Company at Makaweli

The history of the water system found at the present-day lands of the McBryde Plantation actually owes its existence to Maui plantation owners Henry Perrine Baldwin and Samuel Thomas Alexander. In 1878, the two men had demonstrated the feasibility of carrying water from East Maui's windward region of high rainfall and delivering it to the arid, fertile isthmus of Central Maui. In 1889, Alexander & Baldwin, Ltd., had secured a long-term lease to a tract of land on the island of Kaua'i, and established the Hawaiian Sugar Company at Makaweli. In order to expand crop yields, H. P. Baldwin engineered an aqueduct to be constructed on the Kaua'i property similar to one he had built on Maui. It consisted of 13½ miles of tunnels, open ditches, and flumes that ended with four siphons to carry the flow across the Hanapēpē River. The reported cost was $152,000 and the work was completed by April, 1891. (Thrum 1892).

Following the success of the Hawaiian Sugar Company's Hanapēpē Ditch, a 13 mile canal from Olokele Valley was constructed in 1902 (Burns 1991). Other Kaua'i plantations followed suit. The 'Ele'ele Plantation, which bordered the Hawaiian Sugar Company, relied on the surface water of the Wahiawa River. The 'Ele'ele Plantation was founded in 1884 after Bernice Pauahi Bishop sold the lands to Mrs. Duncan McBryde and August Dreier. The plantation supported its own mill and its own landing at 'Ele'ele (Conde 1973). The small plantation was then purchased in 1899 by Benjamin F. Dillingham, who then incorporated the Wahiawa Ranch, 'Ele'ele Plantation and the Kōloa Agricultural Company to form the McBryde Sugar Company. During this incorporation, more surface water sources were developed; including the Lāwa'i, Wahiawa and Kamo'o watersheds. However, in order for the McBryde Sugar Company to become profitable, underground sources of water at the headlands of the Lāwa'i and Hanapēpē Valleys were required, and reservoirs would need to be sited to impound those water sources (Gilmore 1936).

C. 1900s

The 1900s were dominated by the Plantation era and the development of McBryde Sugar Company. It was also a time of concerted effort at consolidation and improvement in sugar cane industry infrastructure on Kaua'i.

1. The Plantation Era

In 1899, Walter D. McBryde, son of Duncan McBryde, and W.A. Kinney founded the McBryde Sugar Company. The plantation consisted mostly of land already owned by the McBryde Estate, including the Wahiawa Ranch and lands in neighboring Kālaheo and Lāwa'i. In addition, lands owned by the former Kōloa Agriculture Company and 'Ele'ele Sugar Plantation was also incorporated. To irrigate the mid-sized plantation (approximately 4,700 planted acres), between 1900 and 1907 the McBryde Plantation constructed 30 large and small

reservoirs, as well as an extensive system of ditches to collect water from the uplands (Yamanaka and Fuji 2001). These ditches and reservoirs are visible on historic USGS maps of the vicinity. McBryde Plantation constructed a "New Mill" (Numila) in Wahiawa. Transportation of the cane from the fields, which stretched from Kōloa in the east to Hanapēpē in the west, to the Numila mill, and on to the harbors of Port Allen and Nāwiliwili, required the construction of a substantial system of rail lines. A map of the McBryde sugar lands shows the extent of the plantation and rail lines.

Plantation development consisted of extensive sugar cane cultivation, with associated irrigation ditches, on the upper plateau areas outside of Wahiawa Valley. It is also noted that in addition to the 'Ele'ele Ditch, several other ditches were constructed in order to take water from Wahiawa Stream to the McBryde Sugar Company cane lands. A railroad line was also constructed *mauka*, running from the McBryde Plantation Mill in the east, through Wahiawa Valley, and on to 'Ele'ele Landing in the west. Extensive development of plantation camps was made to house the large numbers of plantation laborers. The structures were concentrated in the vicinity of the rail line crossing (present day Halewili Rd.), located both within Wahiawa Valley, as well as along the upper edge of the valley. Additional plantation camp structures were located in the *makai* portion of Wahiawa Valley.

In 1927, the construction of Alexander Dam was initiated under the supervision of Joel B. Cox, civil engineer (and later President and Chair of the Engineering Association of Hawaii). This dam was to be one of the highest hydraulic fill dams in the western United States and was designed to capture water for irrigation of McBryde Sugar Company, Ltd. sugarcane fields, and later hydroelectric power (August 1995 ASCE Newsletter, Hawaii Section). The dam failed and collapsed on March 25, 1930 with six lives lost. The collapse of Alexander Dam in 1930 also attracted the attention of Karl Terzaghi (1883-1963). Karl Terzaghi is often referred to as "The Father of Soil Mechanics" and published the first seminal study of soil mechanics entitled "Erdbaumechanik" in 1925. Terzaghi also pioneered a variety of methods and techniques for investigation, testing, data analysis, and practice that defined much of the field of geotechnical engineering. Terzaghi became interested in the collapse of Alexander Dam because of his engineering background and interest in soil mechanics. Joel Cox reconstructed the dam under the guidance and correspondence of Karl Terzaghi. Today the dam remains one of the highest hydraulic fill dams in the western United States. The collapse of Alexander Dam is currently listed among Hawai'i's greatest catastrophes with loss of life (*State of Hawaii Data Book* 2001, http://www.state.hi.us/debt/). The collapse of Alexander Dam also played a significant role in leading to a greater emphasis on the importance of site geology in civil engineering projects and is listed among a number of high-profile dam failures between 1928 and 1938 (Rogers n.d.) such as St. Francis Dam near Los Angeles in March 1928 and Saluda Dam (second largest earth fill dam in the world) near Columbia, South Carolina in February 1930.

2. McBryde Sugar Company, Ltd.

McBryde Sugar Company, Ltd., cultivated 20,000 acres in Kalāheo, Hanapēpē, 'Ele'ele, Lāwa'i and Kōloa, including an ahupua'a that reached the top of Mount Kāhili (Wilcox 1996). By 1903, the company had developed a series of reservoirs with a combined capacity of 800 million gallons. However, surface water sources were inadequate for the plans of the plantation, and new groundwater sources were sought.

Following the example of the S.T. Alexander and H.P. Baldwin system of developing water sources further afield, engineers for the McBryde Sugar Company discovered concentrated flows of fresh water in a lava tube 50 feet below sea level in the Hanapēpē River Valley. At first, the pumps for raising the underground waters to the required elevations to irrigate the upland fields were operated by steam. Built between 1900 and 1905, these coal burning pumping plants were very expensive to operate. Drilling for additional underground water sources under the Lāwa'i River Valley was successful, yet still subject to the expense of steam powered pumps. (Gilmore 1954).

Under the direction of McBryde Sugar Company, the Kaua'i Electric Company built a hydroelectric plant at Wainiha in order to replace the coal burning steam pumps with more economical electric pumps. Wainiha, is located on the northern, windward side of Kaua'i. The waters of the Wainiha River were diverted at the Wainiha East and Wainiha West channels (Larrison 1915), which were then delivered through 32 tunnels, with a total length of 17,400 feet, and eight ditches with a total length of 5,600 feet; to a point above the power plant. Water was received into a concrete-lined forebay and then dropped through a 1,612 foot long penstock pipeline. On August 4, 1906, electricity was transmitted across the island to the leeward coast. Thirty-four miles of utility poles delivered electricity to the plantation pump system. At the time, the Wainiha Powerplant generated a higher voltage than any other plant west of the Rockies (Dean 1950).

As a subsidiary of the McBryde Sugar Company, the Kauai Railway Company was organized in 1906 to operate the landing at 'Ele'ele and transport sugar from both the Hawaiian Sugar Company and the McBryde Sugar Company mills to steamers anchored in the harbor. In 1908, the Hawaiian Sugar Company built an expensive, substantial bridge across the Hanapēpē River in order to reduce the costs of sugar transportation to the harbor.

In 1909, Alexander & Baldwin, Ltd., assumed management of McBryde Sugar, and its two subsidiaries. The Benjamin F. Dillingham-backed enterprise had expanded too quickly, and in order to save the plantation from bankruptcy, Alexander & Baldwin, Ltd., assumed both management and agency positions. In the 1910-1919 decade, McBryde Sugar made a profit every year except 1910. Earlier bonded debts had been reduced by over a million dollars, over $720,000 had been spent on improvements, and another million dollars had been returned to investors (Dean 1950).

In 1915, McBryde Sugar installed a third generator unit at the Wainiha Powerplant, increasing its capacity even further.By the end of 1919, McBryde Sugar had received such good prices for sugar during World War I, that almost half of the company's previous debts had been retired. Kauai Railway Company had become a sound operating company and was paying its' own dividends. McBryde Sugar was able to purchase the Kaua'i Electric Company as a wholly owned subsidiary. The original Wahiawa sugar mill, built in the 1890's, was entirely remodeled between 1928 and 1929 (Dean 1950).

3. Alexander Dam

Construction to impound the water of the Wahiawa Stream was begun in 1927. In order to simplify an existing expensive and complicated water supply, it was felt that expenditures required would guarantee that water sources located at Mount Wai'ale'ale could be developed, and that the runoff from Kanaele Swamp could be captured and stored. (Dean 1950).

When Alexander & Baldwin, Ltd., assumed the agency of McBryde Sugar Company in 1909, an agency agreement was also signed with a former McBryde Sugar subsidiary: the Kauai Fruit & Land Company. By 1927, Kauai Fruit & Land had become another wholly owned subsidiary of Alexander & Baldwin, Ltd., and had also become profitable. With the success of so many subsidiaries resting on the development of the Alexander Dam, it was decided to move the project foreward.

The Alexander Dam was constructed 120 feet high, 620 feet long at the crest, and 640 feet thick at the base. It was built by hydraulic fill: Embankment material was sluiced to the site. Work was done in three eight-hour shifts of sixteen men each who worked by floodlight at night. On March 26, 1930, as construction was virtually complete, the dam broke under the impact of torrential rains. The resulting mudslide took six lives and injured two. The dam was rebuilt and finished December 1932 at a cost of $358,394. It is the second highest earthen dam in Hawai'i.

The completion of the Alexander Dam resulted in a reservoir with a storage capacity of 800 million gallons. A hydroelectric powerplant located in Kalāheo was built in using waters stored behind the Alexander Dam. Once this powerplant was completed, McBryde Sugar was able to service all of its plantation needs, and sell excess electricity to other industrial businesses located in Kōloa and Olokele.

4. Historic Map Data

There were two maps that provided significant information in terms of bracketing the construction of the Native Ditch. These are an 1896 M.D. Monsarrat Survey map of Kaua'i from 'Ele'ele to Kōloa and a later map dated to 1900 for McBryde Sugar Company showing the locations of various plantation features such as reservoirs, ditches, and tunnels that used the 1896 Monsarrat map as a base map. The 1896 Monsarrat map does not show the Native Ditch unlike that appended 1900 map. Both maps however show the location of McBryde's residence (Brydeswood) constructed between 1860 and 1870. The Native Ditch is depicted as capturing a portion of the upper Wahiawa Stream/'Ele'ele Ditch flow and diverting it through a 160-foot tunnel at Nāhalekapuahi. The Native Ditch then was engineered to direct flow downslope to a series of water reservoirs constructed as part of the McBryde Plantation. Flow was into Reservoir No. 3 with a capacity of 90 million gallons. This reservoir corresponds to the present day Elua Reservoir at Kalāheo . The course of the Native Ditch between the short tunnel and Reservoir No. 3 also roughly corresponds to the course of a constructed penstock feature between the forebay below the present Alexander Dam and the Kalāheo Hydroelectric station. Neither the 1896 nor 1900 map show the forebay feature, penstock or Alexander Dam as these features were all constructed later.

5. Modern Land Use

The land use patterns of the project area include the current use of Alexander Dam, the refurbished ditch, forebay, and penstock. These features function to provide reliable water flow to Kalāheo hydroelectric station to provide electricity to customers and to provide irrigation water to fields owned and operated by the Kauai Coffee Company. The interrelationships of these constructed features to other similar features in Wahiawa Ahupua'a and adjacent areas are displayed in Figure 3.

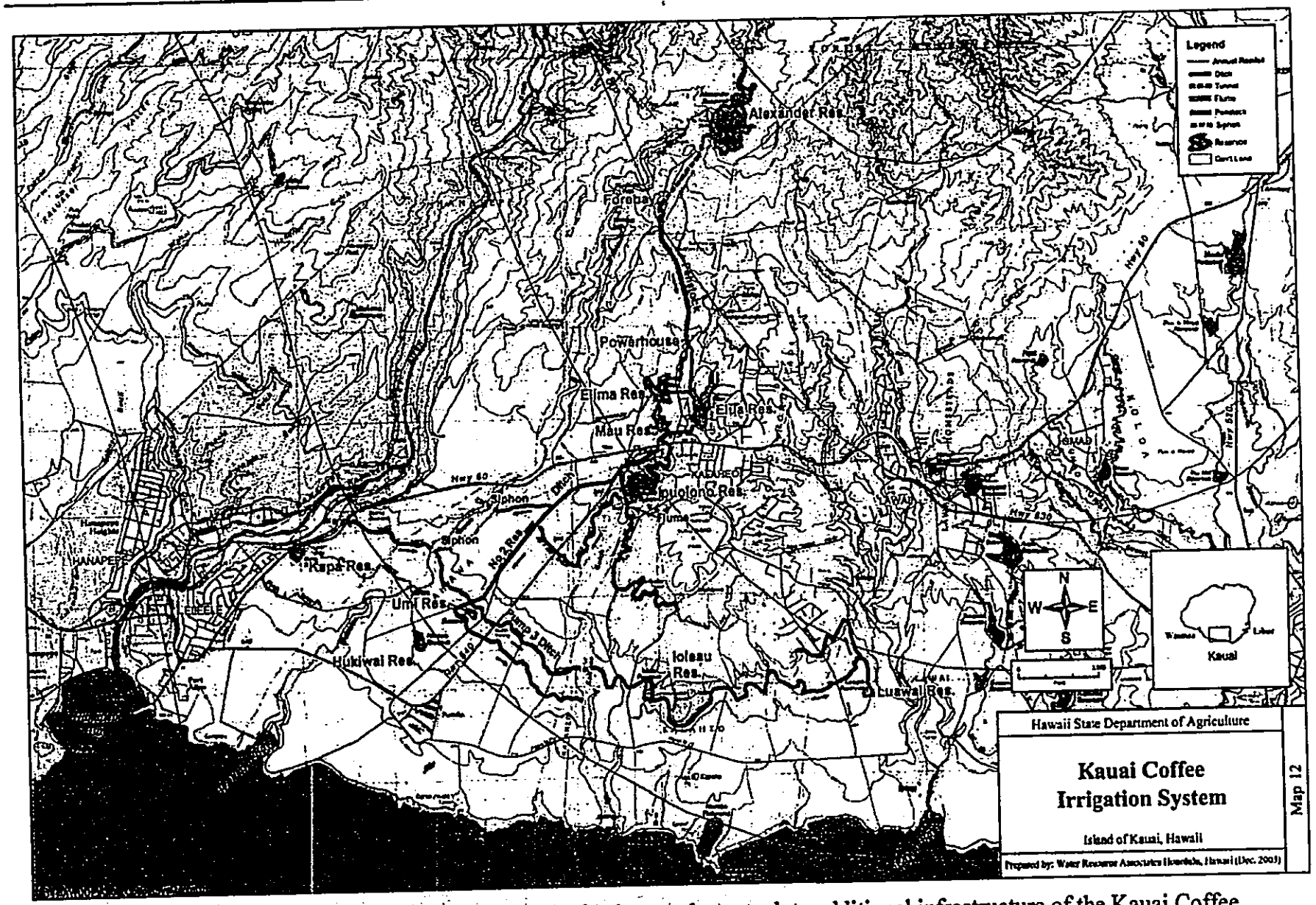

Figure 3. Relationship of Alexander Dam and Reservoir, forebay, and penstock to additional infrastructure of the Kauai Coffee Irrigation System

IV. ARCHAEOLOGICAL RESEARCH IN WAHIAWA AHUPUA'A

The earliest attempt to record archaeological remains in Wahiawa Ahupua'a was made by Thrum (1906) (Table 2). *Heiau* located throughout the state were documented, with four *heiau* reported in Wahiawa. Kaunuolono, located in Wahiawa, was described as "a large heiau of square shape; part of its walls are still standing. Class unknown" (Thrum 1906:37). Kahilinai, located in Wahiawa-uka, was described as "a walled heiau of large size, long since destroyed" (Thrum 1906:37).

Wendell C. Bennett performed the first systematic archaeological survey of the island of Kaua'i in 1929 (Bennett 1931). Bennett attempted to relocate sites previously described by Thrum, as well as identify additional significant sites. In the *ahupua'a* of Wahiawa, he records three sites (Sites 61-63).

Site 61, designated as taro terraces in Wahiawa Valley, is described as "remarkable in places for their number on a small area of land" (Bennett 1931:115). Bennett also noted "there are platform house sites in the valley; burial caves and petroglyphs also reported" (Bennett 1931:115). Sites 62 and 63 are *heiau* originally described by Thrum (1906) and relocated by Bennett in 1929. However, both were destroyed by the time of Bennett's survey. Site 62, Waiopili Heiau, was described as:

> in Wahiawa Valley, on the bluff on the east side, a short distance on the seaward side of the government road. This structure is described by Thrum as "An oblong heiau of good size, walls still standing." The cane fields have now been run close to the edge of the bluff, and in clearing the fields of stone the heiau has been obscured so far as any plan is concerned. (Bennett 1931:115)

Site 63, Huhu'akai Heiau, was described as:

> on Wahulua [Wahiawa] Bay, Wahiawa. Thrum says "A medium sized heiau; portion of its walls may yet be seen. Class unknown." It is mostly destroyed. A platform of irregular shape is left, the front part of which is paved with small stones and the rest roughly paved. Nothing that would identify it as a heiau now remains. (Bennett 1931:115).

In 1963, Kikuchi conducted an archaeological reconnaissance survey of the Kona District of Kaua'i, from Makaweli in the west to Kīpū-Kai in the east (Kikuchi 1963). In Wahiawa Ahupua'a, Kikuchi revisited Bennett's sites, as well as recorded newly identified sites in the area. A total of 15 sites were described, 8 encircling Ahulua (Wahiawa) Bay and 7 located *mauka* of the Halewili Bridge over Wahiawa Stream. The *mauka* cluster of sites (i.e. Sites 8-14), included a shelter cave, petroglyphs, a grind stone, a house site, and an old Japanese plantation camp (Kikuchi 1963). Along the coast, on the western edge of Ahulua (Wahiawa) Bay, Kikuchi described Sites 15 through 19, including a cave shelter, a rock pile, calcified midden, and an adze grinding stone (Kikuchi 1963). Site 20, near the sandy shoreline of Ahulua Bay, was "Camp One," a plantation camp that was destroyed by the tidal wave of 1946 (Kikuchi 1963).

Kikuchi designates Site 21 as potential remains of Hu'ahu'akai Heiau, one of the two *heiau* described by Bennett, and offers the following description:

Table 2. Previous Archaeological Investigations in Wahiawa *Ahupua'a*

Reference	Type of Investigation	General Location	Findings
Thrum 1906	Documentation of *Heiau*	Island Wide, including Wahiawa	Four *heiau* reported in Wahiawa Ahupua'a
Bennett 1931	Reconnaissance Survey	Island Wide, including Wahiawa	Three sites, agricultural terraces and two previously documented *heiau*
Kikuchi 1963	Reconnaissance Survey w/ Subsurface Testing	Kona District, including Wahiawa	15 sites, shelter caves, petroglyphs, grind stones, house site, old plantation camps, rock pile, calcified midden, and previously described *heiau*
Hammatt 1992	Inspection of Exposed Burials	Wahiawa, Kaua'i Aggregates Quarry	Site -1893, 6 pre-historic burials exposed, likely burial ground
Glidden et al. 1993	Archaeological Monitoring	Wahiawa, McBryde Sugar Mill	No sites identified
Tulchin and Hammatt 2004	Archaeological Inventory Survey	Kaua'i Aggregates Quarry	The survey identified two sites comprising three features. Sites are 50-30-09-393 and 50-30-09-1893 (previously located –see Hammatt 1992).

> Along the eastern slope of the mouth of Wahiawa valley, on the slopes facing Ahulua [Wahiawa] Bay, a peculiar wall was seen about 30 feet above the road leading to the shore...Upon closer examination the wall proved to be quite thick, 4-5 feet, and about 5 feet high. No other structures were seen back of the wall. The wall may prove to be just another wall constructed during recent times but it may also be the portion of Hu'ahu'akai *heiau* that Bennett described (Kikuchi 1963:18).

Site 22 refers to the Weli shelter site excavated by the Bishop Museum in the summer of 1959, in which the entire area is "now considered hopelessly destroyed [by vandals] even though small areas are untouched" (Kikuchi 1963:22).

Archaeological monitoring was conducted at the site of the McBryde Sugar Mill at Numila, in association with the proposed construction of a NEXRAD radar station (Glidden et al. 1993). Monitoring of the removal of a large boulder pile did not reveal the presence of any cultural material.

In May 1992, the State Historic Preservation Division was notified of the discovery of human remains adjacent to the Kaua'i Aggregates Quarry (Log No. 5330, Doc. No. 1925w). The burials were located within the current project area, near the mouth of Wahiawa Stream. The SHPD was

informed that in December 1991, during efforts to improve the drainage of Wahiawa Stream, heavy equipment had exposed human burials along the west bank of Wahiawa Stream. An SHPD archaeologist and burials program staff people made a field check of the exposed burials, and determined that human burials had been inadvertently disturbed. Work in the area was halted and the SHPD recommended the Kaua'i Aggregates Quarry hire a consulting archaeological firm to further assess the situation.

Hammatt (1992) made an inspection of the inadvertently exposed human burials along the western bank of Wahiawa Stream. The burials, designated as State Site 50-30-09-1893, were located approximately 500 ft. (152 m) *mauka* of the stream outlet into Wahiawa Bay. A minimum of six individuals was exposed, situated in flexed positions indicating a pre-contact age. Inspection of the surrounding slope area revealed the presence of numerous *ahu* (cairns) and pavings interpreted to be probable burial sites. One burial was also located in an overhanging ledge in the vicinity. It was also noted:

> It is likely that the entire slope between the stream level and the top of the cliff, which covers an area of perhaps ½ acre, contains Hawaiian burials interred in the rocky slope deposits. (Hammatt 1992:6)

Recommended treatment of the exposed human remains included restoration of the stream bank with soil and boulder fill.

In 2004, archaeologists from Cultural Surveys Hawai'i, Inc., conducted an archaeological inventory survey for a proposed construction waste disposal facility at the Kaua'i Aggregates Quarry (Tulchin and Hammatt 2004). The total survey area was approximately 28 acres. There were two historic properties comprising three individual features located along the western bank and upper slopes of Wahiawa Valley. State site 50-30-09-393 consists of two terraces along the western bank and is believed to be a prehistoric temporary habitation. Site 50-30-09-1893 is a single human burial located within an overhanging ledge and adjacent burial ground. Although field personnel were not able to relocate the adjacent burial ground it was still believed to be present. Both sites and areas were recommended for preservation through avoidance.

V. COMMUNITY CONTACT PROCESS

Throughout the course of this assessment, an effort was made to contact and consult with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge of and/or concerns about traditional cultural practices specifically related to the project area. This effort was made by letter, e-mail, telephone and in person contact. In the majority of cases, letters along with a map of the project area were mailed with the following text:

> At the request of Wilson Okamoto Corporation, Cultural Surveys Hawai'i is preparing a Cultural Impact Assessment for the after-the-fact Restoration of the Alexander Dam Irrigation Ditch Project, Kalāheo (Wahiawa), Kaua'i (TMK: 2-4-09:01) (Figure 1 and Figure 2).
>
> The proposed project area is a narrow arcing strip extending from the downslope side of the Alexander Dam to the "Old Native Ditch" (including at least three segments of new ditch) extending down to the downslope side of the Forebay site. The project area is approximately ¾ mile long including the immediate margins of the old ditch, new ditches, and a road.
>
> The purpose of the cultural impact assessment is to assess potential impacts to traditional cultural practices as a result of the future restoration of the Alexander Dam Irrigation Ditch Project.
>
> We are seeking your *kōkua* or help and guidance regarding the following aspects of our study:
>
> General history and present and past land use of the project area.
>
> Knowledge of cultural sites which may be impacted by future development of the project area - for example, historic sites, archaeological sites, and burials.
>
> Knowledge of traditional gathering practices in the project are – both past and ongoing.
>
> Cultural associations of the project area, such as legends and traditional uses.
>
> Referrals of *kūpuna* or elders who might be willing to share their cultural knowledge of the project area and the surrounding *ahupua'a* lands.
>
> Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the project area.

The individuals, organizations, and agencies attempted to be contacted and the results of any consultations are presented in the table below. More extensive responses were provided by *Kupuna* Nani Rogers of Hui Ho'okipa O Kaua'I and Ms. Stella Burgess, Manager of Hawaiian Culture for the Hyatt Regency Hotels & Resorts. These are presented in full below the table.

Table 3. Community Contacts

Name	Background/Affiliation	Comments
Ako, Val	Kupuna/Kama'āina	Contacted
Ayau, Halealoha	Hui Mālama O Nā Kūpuna O Hawai'i Nei	Referred to Kehaulani Kekua.
Burgess, Stella	Hyatt Hotels & Resorts Manager of Culture/*Kama'āina*	See below.
Kapaka-Arboleda, La France	Kaua'i/Ni'ihau Island Burial Council/Chair/Office of Hawaiian Affairs/Community Resource coordinator	No comment at this time.
Kekua, Kehaulani	Kaua'i Heritage Center of Hawaiian Culture & Arts/Director/Kumu Hula	No comment at this time.
Killermen, Andy	Former Alexander Dam Irrigation Supervisor	Fishing and hunting was always done by McBryde Employee. There is a bog that was later cared for by the Sierra Club. There are native plants in the bog. The pipeline was put in by McBryde to water the cane fields.
Lauretta, Mike	DLNR-Kaua'i Land Division	No comment at this time.
McMahon, Nancy	State Historic Preservation Division Kaua'i Archaeologist	No response.
Napōka, Nathan	State Historic Preservation Division Culture and History	Referred to Land Commission Awards
Pavao, Patrick	Former McBryde Employee	See interview.
Perry, Warren	Royal Order of Kamehameha, Kaumuali'i Chapter No. 3	No response.
Rogers, Nani	Hui Ho'okipa O Kaua'i	See below.
Smith, Earl	Former McBryde Employee	See interview.
Tsuchiya, Rick	Kaua'i Historic Preservation Review Commission/Kaua'i County Planning	Contacted.

In an email dated June 7, 2005 to Cultural Surveys Hawai'i, Ms. Nani Rogers, Po'o of the Native Hawaiian Organization of Hui Ho'okipa O Kaua'i mentioned:

> Sometime in the '30s, the dam broke and there was a disastrous flood. The flood killed numerous people living makai in the Wahiawa Valley. Many of the victims were never found. Wally said that the McBryde Co. built the dam. That's Alexander & Baldwin, A & B. Why the dam was named Alexander. Herb Brun told me that the Alexander Dam was for irrigating the cane fields from the reservoir. It also went to a powerhouse by way of a huge pipe to generate electricity but when oil fuel came into play, the water powerhouse was discontinued. It's water content was never used for drinking water. Also, I know a Glen Silva, part Hawaiian, who claims that are (dam) used to belong to his family (Māhele award and that it was "stolen.

Ms. Stella Burgess, Manager of Culture at the Hyatt Hotels & Resorts commented in an e-mail to Cultural Surveys Hawai'i Inc. on June 8, 2005:

> The area was noted for *kia manu* or bird catchers. In Kāhili-na-i there was a battle between two cousins-where *pōhaku* were used as weapons....the legends talk about *heiau* structures but not certain at this time where they are located.

VI. COMMUNITY INTERVIEWS

Presented below are summaries and excerpts of the three community informant interviews conducted for this cultural impact assessment. The summaries and excerpts focus on the information in the interviews related to land uses and traditional cultural resources, practices and beliefs related to the Alexander Dam Irrigation Ditch project area. Additional information on the wider Wahiawa Ahupua'a context is also included.

A. Patrick Pavao

Mr. Patrick Pavao was born in 1941. He began working for McBryde Sugar Company in 1968 and continued with the company until operations shut down in the mid-1990s. His work with McBryde included supervisor in the transportation department. He subsequently worked for Kauai Coffee Company until his recent retirement. Additionally, Mr. Pavao's father worked for McBryde at the Alexander Dam and Reservoir. On June 3, 2005 Mr. Pavao participated in a telephone interview with Cultural Surveys Hawai'i Inc.

Asked when and the Alexander Dam and irrigation ditch was built, Mr. Pavao mentioned:

> *It was built in the 1930s. The dam and ditch were built at the same time. When it fell in, the Kaua'i Coffee Company cleaned the area in 2001 and they dug the ditch to the forebay. A & B Properties should have more information.*
>
> *There was the dam. The ditch was all below the forebay. It was used to irrigate the cane.*

When asked if the area was restricted to McBryde employees Mr. Pavao mentioned:

> *There were two gates that led to the Alexander Dam. The first gate was located down by the highway and was owned and locked by the State. The second gate was located up by the dam and owned by McBryde. The second gate was kind of restricted. So the area was pretty much restricted.*

Mr. Pavao recalls his visits to the Alexander Dam with his father, a former McBryde employee who used to work on the dam, and what sites were there:

> *My father worked for McBryde and he worked on the dam. We used to go up and check the dam. I would go with him and fish. We would catch blue gill. I was around 8 years old.*
>
> *The only sites I recall were a girl's camp or reserve in the late '40s during the war time. The Army had little stations located a little further down from the dam. There was a lake up there that we called "Black Lake" because of the soil.*

When asked about any trails leading to the Alexander Dam or the witnessing of any cultural practices within the project area, Mr. Pavao stated:

There used to be a trail that guided us to a pond. The trail started by the first gate and led us to the big pond (lake). There were many little ponds. Later in high school we would wait until the dam overflowed and hikes up to swim. It would create this big waterfall.

I never witnessed any cultural practices. The only native plant up there was the mountain apple in which we used to pick on our way up to swim.

B. Earl Smith

Mr. Earl Smith was born in Kalihi on the island of O'ahu in 1921. Mr. Smith worked for McBryde Sugar Company from 1958 to 1978, ending up as department head in planning and development. Mr. Smith was interviewed by telephone on June 6, 2005.

Mr. Smith recalls the construction of the Alexander Dam and Ditch:

The building of the dam was before my time, probably the 1930s. Both the dam and ditch were built around the same time. I remember the ditch went above Wahiawa Stream then it came down on the right from the main highway. The function of the ditch was to bring water to the cane fields. As you go down to Wahiawa Valley on the right there is a road that went mauka *so the McBryde ditchmen could walk along the ditch.*

There was a pipeline made that went down to the hydro-electric station located quite a bit below the dam behind Kalāheo. There is a road that goes up there.

When asked if he had witnessed any cultural practices such as hunting, fishing, gathering of native plants, Mr. Smith mentioned:

The area was not always accessible because there were two gates. One located at the bottom near the highway and the second gate was always kept locked by McBryde. I never witnessed any cultural practices in the area nor do I recall any native plants.

Mr. Smith mentioned that he did assist a friend with the Civil Engineers on a visit un-related to his work:

Once I went up with the civil engineers to look for a place to put a TV tower up there. We hiked all the way up. Jack Wada put a television tower up there. He also had a mobile radio antenna there for us to use.

C. Kūpuna Olga Pualani Kali, Wilma Healani Holi and Gwen Pualani Holi

On July 8, 2005 Cultural Surveys Hawai'i conducted an interview with Kupuna Olga Pualani Kali and her daughters Wilma Healani Holi and Gwen Pualani Holi while driving through the *ahupua'a* Hanapēpē, Wahiawa and Kalāheo. Kupuna Olga was born in 1924 in Hanapēpē where

she and her husband Albert Kali raised their children. Wilma Healani Holi was born in 1948 and her sister Gwen Pualani Holi was born in 1951; both are very familiar with the project area within Wahiawa and its cultural association with the bordering *ahupua'a* of Hanapēpē and Kalāheo.

While stopped at the look-out over the Waimea Valley, Wilma Holi pointed to what is the Hanapēpē Valley and recalls:

> *It is important to look at the adjacent* ahupua'a *to see what the relationship was to the adjoining* ahupua'a for *some of the activities that took place in one* ahupua'a *maybe related to activities that took place in the adjacent* ahupua'a. *Maybe one* ahupua'a *had the* kuleana *of producing* kalo *and fishing in the other.*
>
> *As we look into the Hanapēpē Valley which quite overgrown today was once full of cultural activities including the planting of* kalo. *Then we look up towards that mountain peak is the* wailele *or waterfall of Manawaiopuna. It is located at the top of Wahiawa and feeds into this valley. Wai'ale'ale is located in the pack, so we are looking inside of Kaua'i.*
>
> *So looking out over this scenery you have Hanapēpē and right next door is Wahiawa and then you have the plains of Wahiawa. The Alexander Dam is located in that area.*
>
> *There were* heiau *dedicated to hula both in Hanapēpē and Wahiawa. The kāne danced in Hanapēpē and the* wahine *danced in Wahiawa.*

Heading *mauka* we made another stop off the Kaumuali'i Highway (in front of the Cabral Family's home) which looks right into Wahiawa Valley. This valley is marked by a huge mango tree where the road now cuts across; *kupuna* Healani mentioned:

> *Where the mango tree is located used to be the house site of the Luahine Family. There are still remnants of the house. The Luahine* 'ohana *had lo'i not far from their home site. They were the keepers of the Kauai iki stone. It was in their* lo'i *and that is where the* mana *came for their abundance of taro.*
>
> *We are on the east side of Wahiawa River and just a hundred yards away from the bridge across the river looking mauka where the flood came through. So when the flood occurred in the 1930s it wiped out this valley. Most of the people that died in that particular flood were the plantation workers and dam workers. My father, Albert Kali, who was a diver, was asked to go look for them and recover some of the drowning victims.*

As we continued east on Kaumuali'i Highway we stop along the new mill road; Kupuna Wilma recalled:

From this vantage point you can see into the Wahiawa Valley and on the left hand side of the valley you have the steep pali *and on the right hand side you have the more soft rolling hills kind of topography. Behind the rolling hills is where the bog is. The only access for the people is from the back side of Kalāheo. The valley of Wahiawa is very narrow compared to the valley of Kalāheo.*

The waterfall I mentioned earlier or Manawaiopuna flows into Hanapēpē River. Part of that water is diverted to Gay and Robinson Family going to Makaweli and the rest trickles down to Hanapēpē River.

When asked if there are any ongoing practices within the project area, the *kūpuna* mentioned:

I really do not know of anything currently, but maybe in the days of old. There could have been some sites of cultural significance, like on the backside of Mount Kāhili and we are also on the backside of Wai'ale'ale, so a lot of people traversed through that area to get to other parts by trails. The trails are by the bog.

I do not know if the bog was used for anything it sure has plenty of water. The area was probably rich in cultural resources and activities it would seem to support the idea that the entire ahupua'a *itself had related activities from* mauka *to* makai *and* ahupua'a *to* ahupua'a. *Maybe there were certain kind of plants that grew in the* mauka *region and these were used for ceremonial purposes. There is plenty of* maile *and* mokihana *up there today. There are plenty of both on the back side. Now we know that those are the adornments dedicated to* hula.

VII. TRADITIONAL CULTURAL LANDSCAPE OF WAHIAWA AHUPUA'A AND THE PROJECT AREA

Discussions of specific aspects of traditional Hawaiian culture as they may relate to the project area and Wahiawa Ahupua'a are presented below.

A. Hawaiian Habitation and Agriculture

Based on archaeological studies, historical accounts and Land Commission Award records, traditional Hawaiian habitation and irrigated agriculture in Wahiawa Ahupua'a were situated within or in the immediate vicinity of Wahiawa Valley and Stream, the main source of fresh water for domestic and agricultural usage within the *ahupua'a*. No maps indicating the precise locations of each of the mid-nineteenth century Land Commission Award parcels in Wahiawa were readily available. However, the numerous *'ili* (land section within an *ahupua'a*) names, and references to landmarks such as *pu'u* or the seashore, in the LCA documentation indicate widespread settlement throughout both the *mauka* and *makai* regions of Wahiawa Valley.

No traditional Hawaiian habitation or agricultural activities have been identified in historic documentation or community interviews specifically within the present project area. However, stream resources in the area and vicinity could have been utilized for irrigated agricultural pursuits.

B. Gathering for Plant Resources

No specific native Hawaiian gathering practices for plant resources were identified within the project area in the historical documentation, archaeological investigations, or community contact process. However, interviewee Wilma Holi spoke about the maile and mokihana that grows in the vicinity of the project area today. She mentioned that there are plenty of both native plants and that these are the native plants used as adornments dedicated to the hula. Mr. Patrick Pavao mentioned that the only familiar plant he had seen in his time working in the vicinity of the project area was the mountain apple.

C. Aquatic Resources

Native stream animals supplied the Hawaiian diet with a rich source of protein. Wahiawa Stream, the main water course through the *ahupua'a,* would have given Hawaiian inhabitants of Wahiawa access to native fish, shrimp, and mollusks including: *'o'opu, 'ōpae,* and *hihiwai.* The incorporation of the Wahiawa Ahupua'a lands surrounding the stream into sugarcane fields and cattle pasturage in the late 19th and early 20th centuries would have also restricted access to Wahiawa Stream for cultural usage in the project area and vicinity.

None of the community contacts queried identified any ongoing fishing activities within any of the water features within the present project area. Mr. Patrick Pavao did mention that when he was eight years old, while his father worked for McBryde and worked on the Alexander Dam, and he and his father would go fishing for bull gill in a lake they called "Black Lake" because of its soil.

D. Traditional Hawaiian Sites

Historical documentation has not identified any other traditional Hawaiian sites within the project area. None of community contacts were aware of any traditional sites. However, *Kupuna* Wilma Holi did mention that in ancient times there was a *heaiu* dedicated to the hula in Wahiawa Ahupua'a. Only the *wahine* danced in Wahiawa. The *heiau*, however, was not within the project area.

E. Burials

No human burials have been have been identified in historic documentation or community interviews specifically within the present project area. .

F. Native Hawaiian Hunting Practices

No specific native Hawaiian hunting practices were identified within the project area in the historic documentation, archaeological investigations, or community informants.

Game animals hunted on Kaua'i include pigs, goats, black-tailed deer and a variety of game birds. Black-tailed deer were introduced in 1961 and are not found near the project area. The vicinity of the project area is not shown to have either concentrated or sparse densities of either pigs or goats (according to species distribution maps in Van Riper and Van Riper III 1982: 25, 34). No hunting of game birds (all exotic introductions) has been reported within the project area.

G. Hawaiian Trails

Trails served to connect the various settlements throughout the ahupua'a and districts of the Hawaiian Islands in traditional times. No traditional trails were identified within the present project area on historic maps or by community informants. In the general vicinity, however, as Mr. Patrick Pavao noted: "There used to be a trail that guided us to a pond. The trail started by the first gate and led us to the big pond (lake)."

H. *Wahi Pana* (Storied Places)

No storied places were identified within or in the immediate vicinity of the project area.

I. The Project area within the Wahiawa Ahupua'a Context

From research of historic documents, cultural documentation, and archaeological studies, it is apparent that traditional Hawaiian habitation and activity within Wahiawa Ahupua'a and the current project area extended well back in pre-contact times. The presence of multiple *heiau* within the *ahupua'a* suggests the relative importance of Wahiawa in traditional times. *Heiau* were located in both the uplands and near the shore. Cultural accounts, as well as LCA documentation indicated settlement within the *ahupua'a* was focused on Wahiawa Valley and the immediate area. Abundant stream and spring water was available for the cultivation of wetland taro, as well as other traditional staple foods, within the fertile stream valley. Research indicated dense agricultural terracing throughout the interior of Wahiawa Valley from the uplands to the sea. Habitation areas were noted both within the valley, as well as on the *kula* land

above. The "Community of Wahiawa" was said to have been centered near the government road (present day Kaumuali'i Hwy.). The sheltered waters and sandy shoreline of Wahiawa Bay would have allowed for harvesting of marine resources and provided an ideal landing site for canoes. Traditional burial interment practices included cave burials within the slopes of Wahiawa Valley, and burials in the sandy sediments on the banks of Wahiawa Stream and *muliwai.*

Two of the interviewees, Ms. Stella Burgess and *Kupuna* Wilma Holi, mentioned that Wahiawa was known for the cultural activities of bird catching and hula in the days of old.

Within the overall *ahupua'a* context, during traditional Hawaiian times, the present project area could have sustained less intensive agricultural endeavors and would have been a source of *hala, kukui* and other upland resources. Providing agricultural products and plant materials for the inhabitants of Wahiawa may have comprised the primary role of the project area and vicinity in traditional Hawaiian times.

VIII. SUMMARY OF FINDINGS

A. Findings

Reviewing the information provided by the elements of this cultural impact evaluation – historical documentation, archaeological research, and community contacts – there emerges a more detailed picture of the traditional landscape of Wahiawa Ahupua'a and the present project area.

Nineteenth-century documents – Land Commission Award records and historic maps – indicate parcels containing house sites and irrigated taro fields along Wahiawa Stream. These parcels were the likely remnants of the traditional Hawaiian settlement pattern that had survived the first seven decades of western contact. It thus appears that, in traditional Hawaiian times, the lower stream lands were primarily a focus of habitation and agriculture. Additionally, based on an account by a nineteenth century missionary, this area at the foot of Wahiawa Valley was the site of the house of Humehume, son of Kaumuali'i, the ruling chief of Kaua'i and Ni'ihau

By the early decades of the 20th century, western commercial entrepreneurial interests had transformed the Wahiawa landscape into sugarcane fields and pasture lands, and had dispersed remaining native residents.

As confirmed by historical records and archaeological investigations, sugarcane cultivation and development of plantation infrastructure was the dominating land use activity within Wahiawa Ahupua'a throughout the 20th century. The construction of Alexander Dam and reservoir from 1927 to 1931 in the uplands of Wahiawa is representative of the major landscape transformations wrought by development of commercial sugar interests. These transformations – and the sense that areas like the reservoir were private property – restricted access to the present project area to sugar company employees for most of the 20th century.

None of the community contacts queried for this assessment identified any cultural sites in the project area, or recalled anyone entering the project area – either in the past or present – for any traditional cultural practice. Based on the evidence gathered, at present no contemporary or continuing cultural practices occur within the project area.

B. Alexander Dam Water System Operation, Maintenance and Repair Activities

Additional concerns related to the restoration of the Alexander Dam Irrigation Ditch Project are procedures required for the continued integrity of the restored irrigation ditch. These procedures are outlined in Table 4 below.

Table 4. Alexander Dam Water System, Operation, Maintenance and Repair Activities

1. Maintenance and repair of existing roads in accordance with an approved Soil and Water Conservation Plan. A. Roadside weed control activities, including application of Round-Up. B. Removal of vegetation, as necessary, to maintain passable roads. C. Maintenance grading and clearing of existing roadways. D. Clearing landslides, as necessary, to maintain passable roads.
2. Maintenance and repair of the existing ditch in accordance with an approved Soil and Water Conservation Plan. A. Ditch-side weed control, including application of Rodeo. B. Removal of fallen trees, landslides, vegetation, and other debris from the ditch, as necessary, to maintain flow.
3. Maintenance and repair of existing power lines. A. Replacement of fallen or damaged lines or poles. B. Removal of trees growing underneath power lines to prevent damage to the power lines.
4. Maintenance and repair of the existing penstock to the Kalaheo hydroelectric plant and buried 10-inch PVC irrigation lines. A. Welding, patching, and other repairs and maintenance to address leaks in the lines. B. Repair or replacement of penstock piping supports. C. Replacement of segments of the line that are not practicable to repair due to deterioration. D. Removal of trees growing under or adjacent to the penstock or water lines in order to prevent damage to the lines.
5. Maintenance and repair of the forebay in accordance with an approved Soil and Water Conservation Plan. A. Weed control in the vicinity of the forebay. B. Periodic cleaning of the forebay to remove accumulated sediment and maintain the forebay's capacity. C. On-site stockpiling of excavated soil from the forebay for use in road repair and maintenance work.

If, as detailed in Table 4, the procedures are confined to the irrigation ditch, its appurtenances, and the immediate vicinity, this assessment's findings on the restoration project are valid for the operation, maintenance and repair activities.

C. Conclusions

Based on the findings of this assessment, the restoration of the Alexander Dam Irrigation Ditch Project and the future maintenance of the restored ditch has had and will have minimal impact upon native Hawaiian cultural resources, beliefs and practices. It should be noted, however, that subsurface properties associated with former traditional Hawaiian activities in the project area, such as artifacts and cultural layers, may be present despite the decades of sugar plantation activities. As a precautionary measure, personnel involved in the ongoing maintenance of the irrigation ditch should be informed of the possibility of inadvertent cultural finds, and should be made aware of the appropriate notification measures to follow (including consultation with the State Historic Preservation Division and, as may be appropriate, with Kaua'i community cultural organizations).

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APPENDIX D

Compliance with NRCS Soil and Water Conservation Practice Standards

Prepared by Kauai Coffee Company

EXHIBIT 5
COMPLIANCE WITH
NRCS SOIL AND WATER CONSERVATION PRACTICE STANDARDS

The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) has recommended soil and water conservation practice standards for various types of agricultural activities, including construction of irrigation canals and access roads. A comparison of work practices employed by KCOF with the relevant conservation practice standards follows.

Conservation Practice Standard for Irrigation Canal or Lateral (Code 320)

The NRCS *Conservation Practice Standard for Irrigation Canal or Lateral* incorporates the following requirements:

- Capacity requirements – The capacity must be capable of conveying surface runoff that is allowed to enter the ditch and adequate to meet the water delivery needs of the irrigation systems served.

  The restored irrigation ditch satisfies these criteria. The maximum outflow from the Alexander Dam is in the range of 15 million gallons per day. The ditch is designed with an estimated capacity of about 25 million gallons per day, more than adequate to handle flow from the reservoir as well as anticipated additional runoff that may enter the ditch along its 0.75 mile length.

- Velocities – Canals and laterals are to be designed at velocities that are nonerosive for the soil types through which the channel passes. Local information on velocity limits for specific soils is to be used if available, or else design criteria as referenced in the standard are to be used.

  Due to the urgency of the situation, the ditch was restored on a "design-build" basis and no engineering calculations were used in the design of the ditch. However, the alignment of the restored ditch adhered as closely to possible to that of the existing native ditch, which in all likelihood had been more formally engineered. Where deviations from the original ditch configuration were necessary, the experience of the KCOF field supervisor was relied upon to determine the appropriate design. The end result, based on observations of water quality within the ditch and at the forebay, is that no significant erosion of the ditch is occurring as a result of the flow velocities resulting from the ditch configuration. Accordingly, the intent of this criterion has been met.

- Freeboard – The standard specifies minimum freeboard of 0.5 feet and at least one third of the design flow depth.

The restored ditch was intentionally made deeper than the native ditch to ensure that capacity was more than adequate to manage the expected maximum flow. Flow tests conducted shortly after completion of the project at the maximum outflow from the reservoir demonstrated more than adequate freeboard has been provided. Again, while no formal engineering calculations have been conducted, the intent of this criterion has been met.

- Water surface elevations – Water surface elevations are to be designed to provide adequate hydraulic head for operation of the system.

  This criterion has been met, as evidenced by the successful operation of the restored ditch since it was completed in 2001.

- Side slopes – Canals and laterals are to be designed with stable side slopes. Local information on side slope limits for specific soils is to be used in the design if available, or else design criteria as referenced in the standard are to be used.

  Side slopes were cut and terraced in a manner that provides stability and protects them from erosion. Due to the urgency of the situation, the ditch was restored on a "design-build" basis and no engineering calculations were used in the design of the ditch. However, examination of the condition of the restored ditch over three years after its completion indicates that the side slopes are indeed stable and that the intent of this criterion has been met.

- Canal or lateral banks – The top width of lateral banks is to be designed to ensure stability, prevent excessive seepage, and facilitate maintenance. A minimum width of two feet is specified.

  This criterion has been met.

- Protection from surface waters – Protection from runoff is to be provided wherever practical, or where runoff may enter the canal side slopes must be protected from erosion and the canal must have adequate capacity to dispose of the water.

  This criterion has been met. Examination of the condition of the restored ditch over three years after its completion indicates that the side slopes are adequately protected from erosion.

- Related structures – Related structures are to be constructed in accordance with applicable NRCS standards.

  Related structures include the access road and two culverts constructed at existing road crossings. The access road was restored/constructed in general accordance with the relevant NRCS standard, as described below. Culverts were field engineered and constructed according to standard KCOF practices; the relevant NRCS standard was not directly referred to.

- Linings – Linings are recommended for soils with moderately rapid to rapid permeability or where erosive water velocities will occur.

  Soils in the project vicinity are silty clay soils with relatively low permeability and slight to moderate erosivity. As noted above, erosive velocities have not been observed in the restored ditch. Linings are therefore not appropriate for this ditch.

- Maintenance access – Provisions are to be made for ditch maintenance operations.

  This criterion has been met.

- Other considerations – The standard recommends that various other elements be considered when planning the construction of irrigation canals and laterals, including the movement of sediment by runoff to surface waters and using buffers to remove sediment from runoff water.

  An existing vegetated buffer of dense underbrush exists between the project site and the nearest surface water, Wahiawa Stream. In addition, with limited exceptions areas adjacent to the project site that had been cleared have largely revegetated, either naturally or as a result of limited plantings by KCOF. At its closest point, the stream is estimated to be about one-half mile downslope from the project site. URS noted no evidence that sediment, if present in runoff from the project site, would impact the stream.

- Operations and maintenance – The standard calls for a site-specific operations and maintenance plan, to include guidance on periodic and post-storm inspections to detect and minimize damage to the canal, and requirements for removal of accumulated sediment and debris from the channel, repair of banks, and removal of undesired vegetation.

  KCOF has standard practices in place for the operation and maintenance of its ditch systems, and intends to apply these same practices to the restored ditch. Where required for specific maintenance activities, appropriate permission for work in the conservation district will be obtained prior to the work commencing.

From the foregoing it is clear that many of the criteria included in the NRCS standards were incorporated into the project and the intent of the standards was substantially met.

<u>Conservation Practice Standard for Irrigation Access Road (Code 560)</u>

The NRCS *Conservation Practice Standard for Access Road* incorporates the following requirements:

- Location – Roads are to be located to serve the intended purpose, to facilitate the control and disposal of surface and subsurface water, to control or reduce erosion, and to make best use of topographic features, generally following natural contours and

slopes to minimize disturbance of drainage patterns. Roads should be located away from watercourses and buffers should be utilized where possible to protect water bodies.

The access road along the restored ditch is for the most part located on the downslope side of the ditch. In this manner, runoff from above the road is directed into the ditch rather than passing over and potentially eroding the roadway. Although the road was not designed with engineered drainage ways, some runoff from the road itself is naturally directed into the ditch as well. To the extent possible, the roadway follows the natural topography. An existing vegetated buffer of dense underbrush exists between the access road and the nearest surface water, Wahiawa Stream. The road is located approximately one-half mile above the stream at its nearest point. The intent of these criteria has therefore been met.

- Alignment – The grade and horizontal alignment of access roads are to be adapted to the intended use. In general, grades should not exceed ten percent except for short lengths, and maximum grades of 18 percent should only be exceeded in specified circumstances. Stream crossings should be aligned so that they are perpendicular to the channel as much as possible.

  The access road meets these criteria. Although the road grade was not formally engineered and has not been measured, field observations indicate the grade is less than ten percent throughout the project with the exception of the section just below the ditch crossing at the discharge to the forebay. There are no stream crossings, and all culverts over the ditch are installed perpendicular to the ditch.

- Width – The standard specifies minimum roadway and shoulder widths and minimum turnout widths, and calls for either gravel or grassed shoulders.

  The access road satisfies these criteria.

- Side slopes – The standard requires stable slopes with a minimum of two horizontal to one vertical. Steeper slopes may be permitted for short lengths, in rocky areas, or on very steep hillsides if soil conditions warrant and special stabilization measures are installed.

  For the most part, the access road appears to meet the side slope criteria, although no direct measurements have been made. Side slopes were primarily constrained by the topography; however, owing to the amount of material generated by excavation of the native ditch, the access road was generally widened from the original configuration. Soil stabilization was achieved through limited plantings along the banks and natural revegetation throughout much of the project. However, revegetation failed to occur in two areas (nearest the forebay and near the old koa tree at about the middle of the project site) due to poor soil fertility. The lack of significant erosion in the three years since the project was completed indicates that the side slopes were adequately stabilized.

- Drainage – The standard specifies minimum design storm frequencies for various road types (two year – 24 hour storm for forest and farm access roads) and specifies various drainage measures that can be used, including culverts, roadside ditches, water bars, and surface crowning.

  The access road is located adjacent to the restored irrigation ditch, providing a measure of drainage through natural runoff from the roadway. In addition, the location of the ditch relative to the road serves to prevent runoff onto the road from upslope areas. No roadside drainage ditches or other special drainage features were incorporated into the access road construction.

- Surfacing – The standard calls for surfacing of roadways where required due to the traffic needs, soil, climate, erosion control, or particulate matter control.

  The access road is a limited use roadway with controlled access. No special surfacing is therefore warranted.

- Construction operations – The standard calls for removal of trees, stumps, roots, brush, weeds, and other unsuitable materials from the roadbed area, and grading, sub-grade preparation, compaction, and surfacing as needed. Measures to minimize the generation of particulate matter during construction are also called for.

  These criteria were substantially met. Although no special measures were employed during construction to minimize generation of particulate matter, wet conditions and the clay soils in the area served to minimize dust emissions during the project.

- Traffic safety – The standard includes criteria for traffic safety, including turnouts, passing lanes, and other measures as needed for safe traffic flow.

  Adequate turnouts are provided. This access road is a limited use roadway with controlled access. Traffic is therefore expected to be minimal.

- Erosion control – The standard calls for revegetation of disturbed areas as soon as possible. Other conservation practices (e.g., filter strips, sediment control basins) are to be used and maintained "as needed".

  Upon completion of the project, KCOF attempted to revegetate disturbed areas through limited plantings of native koa trees, as well as other plants. For the most part, these replantings did not survive; however, much of the project area has naturally revegetated. In two areas of the project (one area adjacent to an old koa tree near the center of the project site, and the second area in the vicinity of the discharge to the forebay), vegetation has not returned and the soil remains largely bare. In both of these areas, larger amounts of excavated spoils were generated from rerouting the existing irrigation ditch, and this soil was used to construct/widen the adjacent access road. These soils are considered poor topsoil with low fertility, which is believed to be contributing to the lack of vegetation. KCOF has provided

soil samples from these areas for analysis by the University of Hawaii Cooperative Extension Service, and will be requesting their further assistance in determining appropriate soil amendments and types of vegetation best suited for these areas. In the meantime, the existing vegetation adjacent to these disturbed areas appears to be providing adequate erosion control. In addition, as noted previously, an existing vegetated buffer of dense underbrush exists between the access road and the nearest surface water, Wahiawa Stream.

- Other considerations – The standard recommends that various other elements be considered when planning the construction of irrigation canals and laterals, including the overall effects on erosion and the movement of sediment from construction activities, establishing vegetation on road shoulders, and limiting the number of vehicles and vehicle speed to reduce the potential for generation of particulate matter.

  Erosion considerations have been thoroughly addressed above. Dust emissions are controlled by limiting access to the roadway, thereby limiting its usage, and by speed limits imposed by the terrain and by limited site distances.

- Operations and maintenance – The standard calls for an operations and maintenance plan, to include guidance on periodic and post-storm inspections to detect and minimize damage to the roadway, maintaining vegetated areas and minimizing damage to vegetated buffers, filling of low areas and regrading as needed to maintain the road cross section, and conservation practices to limit dust emissions.

  KCOF has standard practices in place for the operation and maintenance of its farm road systems, and intends to apply these same practices to the access road along the Alexander Dam ditch. Where required for specific maintenance activities, appropriate permission for work in the conservation district will be obtained prior to maintenance work commencing.

As with the ditch work, from the foregoing it is clear that many of the criteria included in the NRCS standards were incorporated into the project and the intent of the standards was substantially met.