JOSH GREEN, M.D.
GOVERNOR | KE KIAʻĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIAʻĀINA

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES

P.O. BOX 621
HONOLULU, HAWAII 96809

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

M. KALEO MANUEL
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

December 23, 2022

Mr. Scott Glenn, Director
Environmental Review Program
Office of Planning and Sustainable Development
235 S. Beretania Street, Room 702
Honolulu, HI 96813

SUBJECT: Final Environmental Assessment and Finding of No Significant Impacts for the West Kauaʻi Energy Project, Located at Waimea, Kauaʻi
Tax Map Keys (TMKs): (4)1-2-001: 003, 007; 1-2-001, 016, 018, 019, 023, 999; 1-4-001: 002, 003, 013; 1-4-002: 008, 035, 36, 048, 066-068, 085

Dear Mr. Glenn:

With this letter we hereby transmit the Final Environmental Assessment and Finding of No Significant Impact (FEA-FONSI) for the West Kauaʻi Energy Project for publication in the next available edition of *The Environmental Notice*.

The first Draft Environmental Assessment (EA) was published in the August 23, 2021 edition of *The Environmental Notice* and the second Draft EA was published in the September 8, 2022 edition of *The Environmental Notice.* Comments received during both 30-day comment periods and the Applicant's responses are included in the FEA-FONSI. In accordance with the Board of Land Natural Resource's approval on September 25, 2015, Item D-17, authority was delegated to the Chairperson to approve an issue a FONSI. The FONSI was issued by the Chairperson on December 22, 2022.

The FEA-FONSI will be electronically via the "Submittal Form for HRS Chapter 343 Publications in the Periodic Bulletin" along with other required information pursuant to Hawaiʻi Administrative Rule §11-200.1-22(e).

If there are any questions, please contact Lauren Yasaka at (808) 587-0431 or via email at lauren.e.yasaka@hawaii.gov.

Sincerely,

Suzanne D. Case

Suzanne D. Case
Chairperson RT

c: Dawn Huff, Joule Group

From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Wednesday, December 28, 2022 4:44:42 PM

Action Name

West Kauaʻi Energy Project Final Environmental Assessment

Type of Document/Determination

Final environmental assessment and finding of no significant impact (FEA-FONSI)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds
- (2) Propose any use within any land classified as a conservation district

Judicial district

Kauaʻi - multiple districts

Tax Map Key(s) (TMK(s))

(4) 1-2-001: 003, 007; 1-2-002: 001, 016, 018, 019, 023; 1-4-001: 002, 003, 013, 014; 1-4-002: 008, 035, 036, 048, 066, 067, 068, 085

Action type

Applicant

Other required permits and approvals

See Section 2.7

Discretionary consent required

Special Use Permit, Conservation District Use Permit, Stream Channel Alteration Permit, Stream Diversion Works Permit, County of KauaiUse Permit/Zoning Permit

Approving agency

Department of Land and Natural Resources

Agency contact name

Lauren Yasaka

Agency contact email (for info about the action)

lauren.e.yasaka@hawaii.com

Email address or URL for receiving comments

lauren.e.yasaka@hawaii.com

Agency contact phone

(808) 587-0431

Agency address

1151 Punchbowl Street, Room 220
Honolulu, HI 96813

United States
Map It

Applicant

Kauaʻi Island Utility Cooperative and AES West Kauaʻi Energy Project, LLC

Applicant contact name

Dawn Huff

Applicant contact email

admin@joulegroup.com

Applicant contact phone

(360) 483-6488

Applicant address

4463 Pahee Street, Suite 1
Lihue, HI 96766
United States
Map It

Was this submittal prepared by a consultant?

Yes

Consultant

SSFM

Consultant contact name

Scott Hayashi

Consultant contact email

shayashi@ssfm.com

Consultant contact phone

(808) 531-1308

Consultant address

501 Sumner Street, Suite 560
Honolulu, HI 96817
United States
Map It

Action summary

The Proposed Action involves the construction of a renewable energy and irrigation Project. The Proposed Action would utilize the existing Kōkeʻe Ditch Irrigation System and the Puʻu Lua, Puʻu ʻŌpae and Mānā Reservoirs, and includes both rehabilitation of existing State owned infrastructure as well as new construction of irrigation infrastructure and solar and hydroelectric facilities. This Project will require a long-term water lease from the Board of Land and Natural Resources (BLNR to divert a multi-year rolling average of 11 MGD of water into the Kōkeʻe Ditch Irrigation System from the Waiakōali, Kawaikōī, Kauaʻikinanā and Kōkeʻe Streams combined.

Reasons supporting determination

See Section 7.1

Attached documents (signed agency letter & EA/EIS)

- ERP-Transmittal-Letter-for-WKEP-FEA-FONSI-signed.pdf
- 221206-WKEP-FEA-Appendix-S_Vol-6.pdf
- 221206-WKEP-FEA-Appendix-R_Vol-5.pdf
- 221206-WKEP-FEA-Appendix-K-Q_Vol-4.pdf
- 221206-WKEP-FEA-Appendix-E-J_Vol-3.pdf
- 221206-WKEP-FEA-Appendix-D_Vol-2.pdf
- 221206-WKEP-FEA-Appendix-A-C_Vol-1.pdf
- 221206-FEA-Clean.pdf

Shapefile

- The location map for this Final EA is the same as the location map for the associated Draft EA.

Action location map

- WKEP_project-boundary.zip

Authorized individual

Dawn Huff

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

Island of Kaua'i, Hawai'i

West Kaua'i Energy Project

Final Environmental Assessment Finding of No Significant Impact

Prepared for:

Kaua'i Island Utility Cooperative

and

AES West Kauai Energy Project, LLC

November 2022

Prepared by:

SSFM International, Inc.

99 Aupuni Street, Suite 202

Hilo, Hawai'i 96720

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Final Environmental Assessment
Finding of No Significant Impact
West Kauaʻi Energy Project

Waimea Ahupuaʻa, Waimea District, Island of Kauaʻi

Tax Map Keys (TMKs): (4) 1-2-001: 003, 007; 1-2-002: 001, 016, 018, 019, 023; 1-4-001: 002, 003, 013, 014; 1-4-002: 008, 035, 036, 048, 066, 067, 068, 085

Prepared for:

Kauaʻi Island Utility Cooperative

and

AES West Kauaʻi Energy Project, LLC

Prepared by:

SSFM International, Inc.

99 Aupuni Street, Suite 202

Hilo, Hawaiʻi 96720

November 2022

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Project Summary

Project Name	West Kauaʻi Energy Project
Location	Waimea, Kauaʻi
District	Waimea
Project Site Tax Map Keys	(4) 1-2-001: 003, 007; 1-2-002: 001, 016, 018, 019, 020, 023; 1-4-001: 002, 003, 013, 014; 1-4-002: 008, 035, 036, 048, 066, 067, 068, 085
Landowners	State of Hawaiʻi Department of Land and Natural Resources (DLNR), Department of Hawaiian Home Lands (DHHL), Agribusiness Development Corporation (ADC)
State Land Uses	Conservation, Agriculture
Kauaʻi County Zoning	Conservation, Agriculture, Open
DHHL Land Uses	General Agriculture, Pastoral, Special District, Future Development
Project Site Existing Uses	Open Space, Recreation, and Agriculture
Proposed Action	The Proposed Action involves the construction of a renewable energy and irrigation Project. The Proposed Action would utilize the existing Kōkeʻe Ditch Irrigation System and the Puʻu Lua, Puʻu ʻŌpae, and Mānā Reservoirs, and includes both rehabilitation of existing State infrastructure as well as new construction of irrigation infrastructure and solar and hydroelectric facilities. This Project will require a long-term (65-year) water lease from the Board of Land and Natural Resources (BLNR) to divert a multi-year rolling average of 11 MGD of water into the Kōkeʻe Ditch Irrigation System from the Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe Streams combined.
Anticipated Impacts	No long-term impacts to any resource are anticipated with implementation of the Proposed Action. Any impacts would be during the construction phase which would be short-term, temporary and minimized to the extent practicable through the implementation of Best Management Practices (BMPs). The Proposed Action would have long-term beneficial effects, some of which include: the generation of renewable energy that would

	further help to achieve the State of Hawaiʻi's goal of 100% renewable energy by 2045 and minimizing Kauaʻi's contributions to climate change; furthering the purposes of the Hawaiian Homes Commission Act of 1921; increasing data collection on tributaries to the Waimea River; the rehabilitation of former plantation irrigation ditches and reservoirs improving public safety and increasing the value of State owned assets; providing water and infrastructure to thousands of acres of agricultural land; enabling the State and County to have water resources for fire suppression in areas where they are not currently available; increasing recreational access at Puʻu Lua Reservoir.
HRS §343-5 Triggers	(1) Use of State lands (2) Use within any land classified as a conservation district
Applicant	Kauaʻi Island Utility Cooperative, AES West Kauaʻi Energy Project, LLC
Approving Agency	Department of Land and Natural Resources
Determination	Finding of No Significant Impact (FONSI)
Approvals Required	See **Section 2.7**
EA Preparer	SSFM International 501 Sumner Street, Suite 620 Honolulu, Hawaiʻi 96817 Primary Contact: Jared Chang, AICP Email: jchang@ssfm.com Phone: (808) 356-1242
Agencies, Elected Officials, and Non-Governmental Organizations Consulted	See **Chapter 8**

Table of Contents

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Appendices

Abbreviations and Acronyms

°F	degrees Fahrenheit
μg/m³	micrograms per cubic meter
AAQS	Ambient Air Quality Standards
AC	alternating current
ADC	Agribusiness Development Corporation
AES	The AES Corporation, West Kauaʻi Energy Project, LLC
AIS	Archaeological Inventory Survey
ATV	all-terrain vehicle
BLNR	Board of Land and Natural Resources
BESS	Battery Energy Storage System
BMPs	Best Management Practices
CIA	Cultural Impact Assessment
COD	commercial operations date
CWRM	Commission on Water Resource Management
cfs	cubic feet per second
CO_2e	carbon dioxide equivalent
CRM	concrete rubble masonry
CWB	Clean Water Branch
DAR	Division of Aquatic Resources
DC	direct current
DHHL	Department of Hawaiian Home Lands
DLNR	Department of Land and Natural Resources
DOFAW	Division of Forestry and Wildlife
DOH	Department of Health
DSP	Division of State Parks
EA	Environmental Assessment
EIS	Environmental Impact Statement
FONSI	Finding of No Significant Impact

GHG greenhouse gases

GWh gigawatt hour

HAR Hawaiʻi Administrative Rules

HCEI Hawaiʻi Clean Energy Initiative

HCP Habitat Conservation Plan

HDOT Hawaiʻi Department of Transportation

HHCA Hawaiian Homes Commission Act

HIGAP Hawaiʻi GAP

HP horsepower

HRS Hawaiʻi Revised Statutes

HSHEP Hawaiian Stream Habitat Evaluation Procedure

IIFS Interim Instream Flow Standards

IFS Instream Flow Standards

KAA Kekaha Agricultural Association

KHHA Kekaha Hawaiian Homesteads Association

KIUC Kauaʻi Island Utility Cooperative

LNG liquefied natural gas

LOS level of service

LRFI Literature Review and Field Investigation

LSB Land Study Bureau

LUC Land Use Commission

MBTA Migratory Bird Treaty Act

MG million gallons

MGD million gallons per day

MMT million metric tons

MOU Memorandum of Understanding

msl mean sea level

MW megawatt

MWac megawatt alternating current

MWdc megawatt direct current

MWh megawatt-hours

NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NWI	National Wetland Inventory
O&M	operations and maintenance
PMRF	Pacific Missile Range Facility
PPA	Power Purchase Agreement
ppm	parts per million
PSH	Pumped Storage Hydropower
PUC	Hawaiʻi Public Utilities Commission
PV	photovoltaic
RFP	Request for Proposal
RLS	Reconnaissance Level Survey
ROD	Rapid ʻŌhiʻa Death
RPS	Renewable Portfolio Standards
SCADA	Supervisory Control and Data Acquisition
SHPD	State Historic Preservation Division
SLR-XA	sea level rise exposure area
TMDL	total maximum daily load
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Glossary

Adit. A horizontal passage leading into a mine for the purposes of access or drainage.

Biofuel. A fuel derived directly from living matter

Biomass. Organic matter used as a fuel, especially in a power station for the generation of electricity

Black Start. The process of restoring an electric power station or a part of an electric grid to operation without relying on the external electric power transmission network to recover from a total or partial shutdown.

Buttress. Architectural structure built against or Projecting from a wall which serves to support or reinforce the wall.

Closed Loop Pumped Storage. A type of hydroelectric energy storage configured between two water reservoirs at different elevations that are not connected to a natural body of water, and that can generate power by passing through a turbine as water moves down from one reservoir to the other.

Cofferdam. A watertight enclosure pumped dry to permit construction work below the waterline.

Common Coupling. A type of coupling where different modules share some information by using the global data.

Divide. Boundary separating areas of water flow. Water flowing on one side of a divide empties into one body of water, while water flowing on the other side empties into another.

Flowline. The path that water travels through the Project's facilities.

Fossil fuel. Fossil fuels are made from decomposing plants and animals. These fuels are found in the Earth's crust and contain carbon and hydrogen, which can be burned for energy. Coal, oil, and natural gas are examples of fossil fuels.

Voltage excursion. Unplanned fluctuations in voltage outputs of a system.

Greenhouse Gas. A greenhouse gas is a gas that absorbs and emits radiant energy within the thermal infrared range, causing the greenhouse effect. The primary greenhouse gases in Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

Headwater. Headwaters are the source of a stream or river. They are located at the furthest point from where the water body empties or merges with another.

Hydropower. Hydroelectricity, or hydroelectric power, is electricity produced from generators driven by turbines that convert potential energy of falling or fast-flowing water into mechanical energy. It is one of the oldest and largest sources of renewable energy, where water is collected or stored at a higher elevation and led downward through large pipes or tunnels to a turbine at a lower elevation to generate electricity.

Instream Flow Standards. A quantity or flow of water or depth of water which is required to be present at a specific location in a stream system at certain specified times of the year to protect fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses.

Intake. Point at which water enters a man-made system such as a ditch or pipe system.

Nameplate Capacity. The maximum electrical generating output under ideal conditions.

Open Loop Pumped Storage. A type of hydroelectric energy storage system configured between two water reservoirs at different elevations, one or both of which are connected to a natural body of water, and that can generate power by passing through a turbine as water moves down from one reservoir to the other.

Outflow. Point or location where water is flowing out of a system, pipe, or daylighting.

Pani board. Wooden boards placed into a slot within the center of a concrete dam or in a gate structure to regulate stream and ditch flow. Pani boards are used to manually regulate water flows in the stream and within a ditch system.

Penstock. A closed, pressurized pipe used for transporting water from a forebay to hydroelectric turbines in the powerhouse.

Powerhouse. The structure that houses generators and turbines at a hydropower facility.

Pumped storage hydropower. Type of hydropower Project where energy can be stored and generated by moving water between two reservoirs of differing elevations.

Regulating Structure. A control structure in a water management system that conveys water, regulates the direction or rate of flow, and/or maintains a desired water surface elevation.

Renewable energy. Renewable energy is energy that is collected from renewable resources that are naturally replenished on a human timescale. It includes sources such as sunlight, streams and rivers, wind, tides, waves, and geothermal heat.

Rolling Average. Rolling averages, also known as moving averages, refers to data collected and averaged over a select period of time. Such averaged number becomes representative of that period in a trend line.

Sluice Gate. A gate that regulates water levels and flow rates in streams or ditches. Sluice gates can also be used to release sediment from a ditch system.

Solar photovoltaic generation. A method for generating electric power by using solar cells to convert energy from the sun into a flow of electrons by the photovoltaic effect. Solar cells produce direct current electricity from sunlight which can be used to power equipment or to recharge a battery.

Spillway. A passage for surplus water from a dam.

Stilling well. A pipe, chamber, or compartment connected to a main body of water by a small inlet; such an arrangement is suitable for a recording gage.

Stoplogs. Stop logs are typical closure systems used at many dams and on ditch systems. They are commonly deployed and installed under static or no-flow conditions. Once they are in place, construction, maintenance, and other repair work may be performed on the gates in a dry environment.

Store and Release Hydropower. A type of hydroelectric energy storage and generation system that involves at least one reservoir or forebay where water is collected and stored and then released on a controlled basis into a penstock and through a turbine generating electricity. Store and release hydropower is a type of hydroelectric generation that is effective in storing water during high streamflow and/or rainy conditions and generating electricity during high periods of electrical demand.

Substation. A substation is a high-voltage electric system facility. It is used to switch generators, equipment, and circuits or lines in and out of a system. It also is used to change alternating current voltages from one level to another, and/or change alternating current to direct current or direct current to alternating current.

Weir (Control Weir). A barrier across the width of a stream or river that alters the flow characteristics of water and usually results in a change in the height of the river level. Weirs are often used as control points for measuring stream flows.

Voltage Droop. Voltage droop is the intentional loss in output voltage from a device as it drives a load. Adding droop in a voltage regulation circuit increases the headroom for load transients. All electrical systems have some amount of resistance between the regulator output and the load.

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Executive Summary

Project Background

The Kauaʻi Island Utility Cooperative (KIUC) is an operating not-for-profit electric cooperative engaged in the production, purchase, transmission, distribution, and sale of electricity on the Island of Kauaʻi. KIUC, in agreement with AES West Kauaʻi Energy Project, LLC (AES), proposes to construct and operate the West Kauaʻi Energy Project (the Project) which is an integrated renewable energy and irrigation Project that would utilize state land and water for the following objectives:

1. Renewable energy production via hydroelectric electric generation
2. Renewable energy production via solar photovoltaic (PV) generation
3. Pumped hydroelectric and battery storage to shift most of the Project's solar PV energy production for use in the evening peak, nighttime, and morning peak hours (as well as during periods of rainy or cloudy weather)
4. Irrigation delivery to support diversified agriculture on lands adjacent to the Project site, including mauka lands managed by the Department of Hawaiian Home Lands (DHHL) and Agribusiness Development Corporation (ADC), and the agricultural fields on the Mānā Plain that are controlled by ADC and managed by Kekaha Agricultural Association (KAA).

Development of the Project started more than eight years ago and was previously known as the Puʻu ʻŌpae Energy Project. The current name for the Project was adopted in 2020. Certain study reports, associated consultation, and public outreach prior to 2021 were conducted when the Project was called the Puʻu ʻŌpae Energy Project. The layout, footprint, purpose, and general design has not substantively changed from when previous field studies and consultation were conducted. Development and public outreach for the Project has continued after the name change to West Kauaʻi Energy Project. Basic parameters for volume and uses of water for the Project were established with the adoption of the Waimea Mediation Agreement by the Commission on Water Resource Management (CWRM) in 2017 (see **Section 1.2**). Through the Waimea Mediation Agreement, the CWRM approved and adopted new instream flow standards for diversions on the Kōkeʻe and Kekaha Ditch Irrigation Systems and the Waimea River downstream of both ditch systems. These instream flow standards are prescribed in two phases. The Phase One IIFS became effective upon CWRM approval of the Agreement and is currently in effect. The Phase Two IIFS goes into effect if and when the Project goes into service.

The West Kauaʻi Energy Project is expected to demonstrate the effectiveness of pairing a hydropower facility with solar PV and battery energy storage to improve grid performance with long-duration storage capability, stabilize and lower energy rates, rehabilitate state-owned infrastructure, and deliver irrigation water to adjacent lands. It would be the first Project of its kind in the world and is a critical component of Kauaʻi's renewable energy future.

The proposed Project would have the following nameplate capacity:

- Solar PV: 35 MW
- BESS: 35 MW/70 MWh
- Mānā Pumpstation: 35 MW
- Mānā Powerhouse: 20 MW
- Puʻu ʻŌpae Powerhouse: 4 MW

The proposed Project is expected to have a lifespan of 50 to 80 years. However, different components of the Project are expected to have varying life spans. The hydroelectric components generally have a life span of between 50 to 80 years or more. The solar array is expected to have a life span of approximately 30 years.

Purpose and Need

The purpose of the Project is to construct and operate an integrated renewable energy and irrigation Project, thereby providing clean, renewable energy for the island of Kauaʻi and supporting diversified agriculture adjacent to the Project site.

The Project is needed to assist KIUC in meeting the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045 (HRS Section 269-92). For all of 2021, Kauaʻi generated 69% of its energy needs from renewable sources and in recent years has been able to achieve grid operation with 100% renewable energy (primarily solar, but also hydroelectric and biomass) on sunny days, but still primarily relies on the burning of fossil-fuel for night-time electricity. The Project would significantly reduce the amount of fossil fuel burned for electricity and produce up to 25% of the total electrical energy requirements for Kauaʻi's grid, thereby allowing KIUC to achieve significant progress toward 100% renewable energy.

Proposed Action

The Proposed Action involves the construction and operation of an integrated renewable energy and irrigation Project. Water diversion is an integral part of the Project and will require a water lease from the Board of Land and Natural Resources (BLNR). The Applicant will request a long-term (65-year) lease to divert a multi-year rolling average of 11 MGD of water into the Kōkeʻe Ditch Irrigation System from the Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe Streams combined. The 11 MGD rolling average would be diverted after the Phase Two Instream Flow Standards (IIFS) is met utilizing the existing diversions at each stream and is the volume of water provided for the Project in the Waimea Mediation Agreement that was approved by CWRM. Water diverted into the Kōkeʻe Ditch Irrigation System would be delivered to Puʻu Lua Reservoir, where it would be stored until released for energy generation and irrigation.

The Proposed Action involves two main interconnected operations: Store and Release Hydroelectric with Irrigation Delivery Operation, and the Pumped Storage Operation.

Store and Release Hydroelectric Operation and Irrigation Delivery

Per the terms of the Waimea Mediation Agreement, the proposed store and release hydroelectric operation and irrigation delivery component would divert a multi-year rolling average of 11 MGD of water from streams in Kōkeʻe at four existing diversions on the Kōkeʻe Ditch Irrigation System: Waiakōali Diversion, Kawaikōī Diversion, Kauaʻikinanā Division, and Kōkeʻe Diversion. Water diverted into the Kōkeʻe Ditch System would be delivered to and stored in Puʻu Lua Reservoir. From Puʻu Lua Reservoir, water would be released and delivered to Puʻu ʻŌpae Powerhouse for store and release hydroelectric generation during non-solar hours. Irrigation deliveries would occur along the Project flow line starting at Puʻu Moe Divide and continuing through to Mānā Reservoir on Mānā Plain.

Pumped Storage Operation

The proposed pump storage operation includes a 35-megawatt (MW) PV Solar Array and battery storage system adjacent to the existing Mānā Reservoir. During the day, the PV Solar Array would generate power to pump water from Mānā Reservoir up to Puʻu ʻŌpae Reservoir through the Lower Penstock. At night and during other non-solar periods, the pumped water from Mānā Reservoir plus the store and release water from Puʻu ʻŌpae Reservoir would be delivered through the Lower Penstock to the new Mānā Powerhouse where a 20 MW turbine would produce renewable energy for delivery to the grid. For the pumped storage component of the Project, an approximate volume of 55 MG of water would flow in a circle between the Mānā and Puʻu ʻŌpae Reservoirs, and only draw additional water from the diverted 11 MGD multi-year rolling average to refill reservoirs and make up for evaporative losses.

The PV Solar Array would be operated automatically, generating energy from the available sunlight, and delivering it either directly to the utility grid, storing it in the battery system, or powering the pumps at Mānā Pumphouse.

Impacts

Minimal impacts to the surrounding environment are anticipated with implementation of the Proposed Action. The overall impact of the proposed action on the surrounding environment and native stream habitat are minimal and will be addressed through avoidance and/or minimization measures, as summarized in the following table. Impacts during the construction phase would be short-term, temporary and minimized to the extent practicable through the implementation of Best Management Practices (BMPs). The Proposed Action would have long-term beneficial effects, some of which include: the generation of renewable energy that would further help to achieve the State of Hawaiʻi's goal of 100% renewable energy by 2045 and minimizing Kauaʻi's contributions to climate change; furthering the purposes of the Hawaiian Homes Commission Act of 1921; increasing data collection on tributaries to the Waimea River; the rehabilitation of state-owned infrastructure, improving public safety and increasing the value of State owned assets; providing water and infrastructure to thousands of acres of agricultural land; enabling the State and County to have water resources for fire suppression in areas where they are not currently available; and increasing recreational access at Puʻu Lua Reservoir. A summary of potential impacts is provided in the following table.

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<table>
<tr><th rowspan="2">Resource</th><th colspan="2">Proposed Action Impacts</th><th rowspan="2">No-Action Impacts</th><th rowspan="2">Minimization Measures</th></tr>
<tr><th>Construction</th><th>Operation</th></tr>
<tr><td>Water Resources
(Section 5.1)</td><td>• Sediment from soil erosion may impact water quality in streams
• Contaminants from equipment may impact surface water and groundwater</td><td>• Improved water delivery efficiency and infrastructure longevity of the Kōkeʻe Ditch System
• Diversion of 11 MGD rolling multi-year average for energy production, agriculture, and other consumptive uses, after implementing Phase Two IIFS
• Increasing data collection on tributaries to the Waimea River
• Increased Puʻu Lua storage capacity from the current 60 MG to approximately 200 MG, increase historic capacity at Puʻu ʻŌpae Reservoir from 88 MG to 100 MG, and increase Mānā Reservoir from historic capacity 44 MG to 80 MG, which would improve irrigation and power production water availability
• Maintenance of reservoirs, compliance with Dam Safety through Project life
• Increased depth and storage volume of Puʻu Lua Reservoir would likely result in lower water temperatures
• Potential increased dissolved oxygen levels within and down ditch of Puʻu Lua Reservoir due to increased flow volume in ditch
• No direct impacts associated with the powerhouses, PV Solar Array, West Kauaʻi Energy Project Substation, and the Interconnection Line</td><td>• Compliance with the IIFS set by CWRM would fall to ADC as stipulated in the Waimea Mediation Agreement
• Increased likelihood of erosion-related water quality impacts in the Kōkeʻe Ditch Irrigation System
• Increased possibilities for storm water-related erosion of unimproved access roads
• Kōkeʻe Ditch Irrigation System would remain under management of ADC and any ongoing repairs/operations would fall to the State. This could potentially result in continuance of reduced operations or closure of the system, which potentially would impact water availability to DHHL lands
• Kekaha Ditch would remain the only source of irrigation for Mānā Plain agricultural opportunities
• Puʻu Lua Reservoir would remain under management of DLNR, and the necessary repairs to meet Hawaiʻi Dam Safety requirements or actions required to decommission the reservoir would fall to the State
• Puʻu ʻŌpae and Mānā Reservoirs would remain under management of DHHL and ADC respectively and require upgrades to meet Hawaiʻi State Dam Safety standards, which would be the responsibility of the State
• No impacts associated with the powerhouses
• No impacts associated with the PV Solar Array</td><td>• Compliance with the IIFS set by CWRM
• The Applicant would obtain all required permits and comply with permit conditions
• Best Management Practices (BMPs) would be implemented to minimize impacts to the aquatic environment during construction
• BMPs would be installed prior to ground-disturbing activities and would be inspected and maintained throughout the construction period
• Instream flow requirements would remain in the natural stream channels, compliance reporting and monitoring of diversion to CWRM
• Temporary erosion control measures would be used during construction to prevent soil loss and to minimize surface runoff into adjacent wetlands and streams</td></tr>
<tr><td>Soils and Geology
(Section 5.2)</td><td>• Potential for disturbed soils in the construction areas to be eroded as a result of being carried away by storm water runoff or wind</td><td>• Increased oversight and maintenance of the Kōkeʻe Ditch System would decrease the likelihood and potential extent of soil-related impacts from events such as storms and ungulate damage
• Rehabilitated reservoirs would use either liners or rock armoring, as well as more gradual embankment slopes to eliminate or prevent soil erosion potential
• Operation of the Puʻu ʻŌpae Powerhouse and Mānā Powerhouse, Upper and Lower Penstock, PV Solar Array, West Kauaʻi Energy Project Substation, and the Interconnection Line would have no impacts to geology or soil resources
• Rehabilitated and maintained access roads would have a positive impact as there would be reduced potential for soil erosion, and reduce the State's maintenance burden</td><td>• Increased likelihood of erosion related soil impacts to the unmaintained reservoir embankments, if reservoirs remain in current condition
• Puʻu Lua Reservoir would remain under management of DLNR, and any necessary repairs to meet Hawaiʻi Dam Safety requirements or actions required to decommission the reservoir would fall to the State.
• Puʻu ʻŌpae and Mānā Reservoirs would remain under management of DHHL and ADC respectively and require upgrades to meet Hawaiʻi State Dam Safety standards, which would be the responsibility of the State.
• Increased likelihood of erosion related soil impacts to unmaintained access roads
• Road maintenance/repairs would remain under management of the State</td><td>• The Applicant would obtain all required permits and comply with permit conditions
• BMPs would be implemented to minimize impacts to the aquatic environment during construction
• BMPs would be installed prior to ground-disturbing activities and would be inspected and maintained throughout the construction period</td></tr>
<tr><td>Flora
(Section 5.3)</td><td>• Minor vegetation clearing at the diversion sites for construction access</td><td>• Maintenance activities that would include minimal vegetation clearing around Project facilities</td><td>• No construction impacts
• Ongoing operation and maintenance of existing reservoirs and Kōkeʻe Ditch Irrigation System would</td><td>• Wood from removed trees would be saved and made available to DOFAW and/or wood workers on Kauaʻi</td></tr>
</table>

Resource	Proposed Action Impacts		No-Action Impacts	Minimization Measures
	Construction	Operation		
	• Removal of mature trees on existing dam embankment at Puʻu Lua, Puʻu ʻŌpae and Mānā Reservoirs • Maintenance vegetation removal along Puʻu Lua embankment roads and reservoir inlet • A 60-foot-wide corridor would be cleared to allow construction of the Upper Penstock • A 60- to 100-foot-wide corridor would be cleared of shrubs and grasses in the fallow agricultural areas around the Lower Penstock • Removal of shrubs and trees at the Mānā Powerhouse location • Clearing of overgrown or fallow agricultural fields for the PV Solar Array and Project Substation • No vegetation clearing or grading would occur for installation of the Interconnection Line	• Minor vegetation clearing around the Kōkeʻe Ditch Irrigation System for maintenance is ongoing; therefore, there would be no change in impacts to flora from current condition • • Vegetation clearing around the PV Solar Array, Project Substation, the powerhouses, reservoirs, and access roads would be minimal and limited to the amount necessary for safe operation the Proposed Action • The Upper and Lower Penstocks would be buried and up to a 60-foot-wide corridor would be maintained over the penstock alignments (grass would be allowed to grow, but trees and shrubs would be removed) • No direct impacts associated with the Interconnection Line	remain responsibility of the State; therefore, it is likely that any current vegetation management practices would continue	• Portions of the Project would occur within critical habitat areas for special status plant species. Pre-construction surveys for special status species within these areas would occur during the optimal period of October to April (per USFWS guidance). • Hawaiian plants during the optimal period of October to April (per USFWS guidance) and biological monitoring during construction. • Should federal or state listed plants be identified during pre-construction surveys, USFWS recommendations for designated critical habitat areas and areas outside of designated critical habitat will be followed to avoid potential adverse effects to listed plants • Kōkeʻe Diversion site is within a designated critical habitat. During construction, access to the site will be via helicopter to avoid vegetation clearing. During operation, access would be through existing roads and trails, which would not involve vegetation clearing • Kauaʻikinanā Diversion site is within a designated critical habitat. Vegetation clearing will be limited to a narrow corridor of electrical conduit from the existing parking area to the diversion (approximately 75 feet). If possible, conduit will be placed above ground to limit vegetation and ground disturbance, but trenching for shallow bury may occur • Installation of Interconnection Line will occur within cleared edges of existing dirt roads; no vegetation clearing, or grading would occur. No special-status native plant species will be impacted by the installation of the Interconnection Line • Measures would be implemented to minimize the spread of Rapid ʻŌhia Death • All equipment and vehicles arriving from outside all portions of the Project area located near designated critical habitat would be washed and inspected prior to any maintenance or construction activities to avoid the unintentional introduction or transport of new invasive plant species
Fauna (Section 5.3)	• Impacts to Hawaiian forest birds could occur from construction activities in the upper watershed areas • Potential impacts to the Hawaiian hoary bat from vegetation removal • Noise and concentrated human activity have the potential to temporarily disrupt the habitat for the various species of birds and mammals that are known to exist in the area. However, all Project activity would	• Potential positive impacts associated with the increased capacity of reservoirs on waterbird populations • Enhanced fishing resources at Puʻu Lua Reservoir • Reservoir rehabilitation would provide water for firefighting activities, which would have a secondary benefit for flora and fauna by increasing firefighting capabilities	• No construction impacts • Ongoing operation and maintenance of existing reservoirs and Kōkeʻe Ditch Irrigation System would remain responsibility of the State • Decommissioning of Puʻu Lua Reservoir would result in loss of habitat for waterbirds and land-based fauna, and reduced operation or closure of Kōkeʻe Ditch	• Construction areas are in previously developed areas subject to human activity and noise associated with regular maintenance activities • Regular on-site staff would be trained to identify special status species with the potential to occur within the Project area, as well as know the appropriate measures to be taken if a special status species is identified

Resource	Proposed Action Impacts		No-Action Impacts	Minimization Measures
	Construction	Operation		
	occur in areas already developed and exposed to human activity and routine maintenance activities.	• No impacts associated with the powerhouses and co-located facilities • Limited trimming of vegetation that is overhanging or extending into access roadways may be required during operations to maintain sufficient access to the site for maintenance activities. Measures will be implemented to minimize impacts to forest birds • PV Solar Array would have minimal impacts to forest birds due to location in agricultural lands away from natural and forested habitats • No anticipated impacts to waterbirds or seabirds from the PV Solar Array • The Interconnection Line may have potential impacts to seabirds, and waterbirds	System would result in loss of habitat for waterbirds and land-based fauna	• Pre-construction surveys and biological monitoring during construction to identify the presence of Hawaiian waterbirds and the Hawaiian goose. Appropriate measures as recommended by USFWS and DOFAW will be employed if these species are identified within the Project vicinity • Pre-construction surveys and biological monitoring during construction to identify the presence of Hawaiian forest birds, including federal and state special status species, and picture-wing fly in the upper watershed area, specifically all four diversions, Pu'u Lua Reservoir, Pu'u Moe Divide and the Upper Penstock. Appropriate measures as recommended by USFWS and DOFAW will be employed if these species are identified within the Project vicinity • A vegetation maintenance plan incorporating conservation measures for Hawaiian waterbirds and the Hawaiian goose will be prepared for the operational phase of this Project. The plan will consider breeding seasons for specific species and USFWS and DOFAW recommendations for avoidance and minimization practices • Avoidance of removal of tree cover during peak Hawaiian forest bird breeding season of January 1 – June 30. Work at the diversion sites will be during the dry season (typically mid-late summer or early fall) to consider bat pupping season • Avoidance and measures including no disturbance, removal or trimming of woody plants greater than 15 feet tall during the bat birthing and pup rearing season (June 1 – September 15) • Kōke'e Diversion site is within a designated critical habitat for the picture-wing fly, the Akeke'e and the 'Akikiki. During construction, access to the site will be via helicopter to avoid vegetation clearing. During operation, access would be through existing roads and trails, which would not involve vegetation clearing, and DOFAW decontamination protocols will be followed • Kaua'ikinanā Diversion site is within a designated critical habitat for the picture-wing fly, the Akeke'e and the 'Akikiki. Vegetation clearing will be limited to a narrow corridor of electrical conduit from the existing parking area to the diversion (approximately 75 feet). If possible, conduit will be placed above ground to limit vegetation and ground disturbance but trenching for shallow bury may occur

Resource	Proposed Action Impacts: Construction	Proposed Action Impacts: Operation	No-Action Impacts	Minimization Measures
				• Measures provided by DOFAW and/or USFWS would be implemented to minimize impacts to the Hawaiian goose, Hawaiian forest birds, Hawaiian waterbirds, Hawaiian seabirds, Hawaiian hoary bat, and picture-wing fly • Measures would be implemented to minimize the spread of Rapid ʻŌhia Death • Potential impacts associated with operations are minimized, avoided, and mitigated through KIUC's Habitat Conservation Plan (HCP). Minimization measures for the installation of the Interconnection Line include removing approximately two miles of existing overhead powerlines between PMRF and Polihale; limiting height of lines and number of layers on poles to the extent possible while still complying with applicable safety codes, federal and PUC guidelines; and installing reflective or LED diverters. Focused monitoring of the Interconnection Line would occur during for at least the first year of operations, and may be extended beyond one year if data suggests further focused monitoring is needed
Stream Habitat and Biota (Section 5.3)	• Impacts to stream habitat from the placement of concrete at and below the ordinary high-water mark, vegetation clearing • Minor ground disturbance activities, which create the potential for disturbed soils in the construction areas to be eroded and conveyed to adjacent streams as a result of being carried away by storm water runoff or wind • Aquatic species may be impacted by increased turbidity and sedimentation from construction	• Implementation of the IIFS set by CWRM • Diversion of 11 MGD rolling multiyear average for energy, irrigation, and other consumptive uses • Increased oversight and maintenance of the Kōkeʻe Ditch Irrigation System would decrease the likelihood and potential extent of soil-related impacts to stream habitat from events such as storms and ungulate damage • Increasing data collection on tributaries to the Waimea River • Potential impacts to native stream animal habitat • No direct impacts associated with the powerhouses and co-located facilities, PV Solar Array, West Kauaʻi Energy Project Substation, and Interconnection Line	• No construction impacts • Ongoing operation and maintenance of Kōkeʻe Ditch Irrigation System would remain responsibility of ADC, this could potentially result in continuance of reduced operations or closure of the system • Kekaha Ditch would remain primary source of irrigation for Mānā Plain agricultural opportunities	• Implementation of the IIFS set by CWRM minimizes potential impacts of stream diversions, and compliance monitoring and reporting for diversions to CWRM • All Project construction-related materials and equipment to be placed or used in an aquatic environment would be inspected for pollutants including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use • Construction at the diversion within the high-water mark would be done in the dry • Fueling of Project-related vehicles and equipment would take place away from the aquatic environment • A contingency plan for accidental spills of petroleum products would be developed and retained on-site • Absorbent pads and containment booms would be stored on-site to facilitate clean-up of accidental petroleum releases • Project construction-related materials would not be stockpiled in or within close proximity to aquatic habitats and would be protected from erosion to prevent materials from being carried into waters by wind or rain • Temporary erosion control measures would be used during construction to prevent soil loss and to minimize surface runoff into adjacent wetlands and streams

Resource	Proposed Action Impacts		No-Action Impacts	Minimization Measures
	Construction	Operation		
				• Potential impacts from diversions are expected to be minimal due to location of the Kōkeʻe Ditch diversions at the back end of the Waimea River watershed and outside the range of the majority of migratory species of concern • New control weirs associated with stream gaging are designed to support aquatic species passage
Wetlands (Section 5.3)	• All three reservoirs are NWI-identified wetlands. However, Puʻu ʻŌpae and Mānā Reservoirs have been drained and not operational. Construction associated with the expansion of Puʻu Lua Reservoir as a NWI-identified wetlands would result in temporary impacts. • Construction of the PV Solar Array, Mānā Powerhouse and co-located facilities and the Project Substation would occur in an NWI-identified wetlands area. However, the area has been drained by ditches and pumps since the early 1900s and has been used for agricultural cultivation since that time. The Applicant is currently consulting with the USACE to determine if the area is jurisdictional. • Vegetation clearing for the PV Solar Array and the Project Substation could create the potential for disturbed soils to be eroded and conveyed to adjacent to NWI-identified Freshwater Emergent Wetland as a result of being carried away by storm water runoff or wind • Potential for disturbed soils to be transported into adjacent ditches that may drain into the ocean	• Increased oversight and maintenance of the Kōkeʻe Ditch Irrigation System would decrease the likelihood and potential extent of soil-related impacts to wetlands from events such as storms and ungulate damage • Reservoirs (NWI Freshwater Ponds) would be beneficially impacted due to freshwater reservoir levels being expanded at Puʻu Lua Reservoir, and re-instating use of Puʻu ʻŌpae and Mānā Reservoirs, and by having fresh source of water flowing through reservoirs from Kōkeʻe Ditch System and through Project flowline • Operation of the proposed PV Solar Array, powerhouses and co-located facilities, and the Project Substation on the Mānā Plain would have no impact to the surrounding Freshwater Emergent Wetlands as they are currently zoned for agricultural use and are drained by the existing ditch system that drains the Mānā Plain • No direct impacts associated with the Interconnection Line	• No construction impacts • No impacts to Freshwater Emergent Wetlands • Puʻu Lua Reservoir is currently operated at a reduced level and Puʻu ʻŌpae and Mānā Reservoirs are not operating, limiting wetlands status • Puʻu Lua Reservoir would remain under management of DLNR, and the necessary repairs to meet Hawaiʻi Dam Safety requirements or actions required to decommission the reservoir would fall to the State • Puʻu ʻŌpae and Mānā Reservoirs would remain under management of DHHL and ADC respectively and require upgrades to meet Hawaiʻi State Dam Safety standards, which would be the responsibility of the State	• All Project construction-related materials and equipment to be placed or used in an aquatic environment would be inspected for pollutants including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use • All three reservoirs are located off-stream and not connected to a natural water body. Construction at all three reservoirs would be done in the dry • Fueling of Project-related vehicles and equipment would take place away from the aquatic environment • A contingency plan for accidental spills of petroleum products would be developed and retained on-site • Absorbent pads and containment booms would be stored on-site to facilitate clean-up of accidental petroleum releases • Project construction-related materials would not be stockpiled in or in close proximity to aquatic habitats and would be protected from erosion to prevent materials from being carried into waters by wind or rain • Temporary soil stabilization techniques and erosion control measures would be used during construction to prevent soil loss and to minimize surface runoff into adjacent wetlands, streams, and ditches
Traditional and Cultural Practices and Resources (Section 5.4)	• Noise and concentrated human activity in the construction area would be disruptive to cultural practitioners (Mr. Eben Manini and his son) identified as utilizing the area to practice mālama ʻaina (custodial of land), but this would be temporary	• Operation of the Proposed Action may impact the traditional and cultural practice of malama ʻāina within a native forest due to the removal of native vegetation for the Upper Penstock and mauka section of the Lower Penstock. • No direct impacts associated with the reservoirs, powerhouses and co-located facilities, the PV Solar Array, West Kauaʻi Energy Project Substation, and the Interconnection Line.	• No construction impacts • Kōkeʻe Ditch Irrigation System would remain under management of ADC and any ongoing repairs/operations would fall to the State. This could potentially result in continuance of reduced operations or closure of the system. Reduced operations or closure of the ditch system could lead to reduced opportunities for taro and other agricultural cultivation at Puʻu ʻŌpae	• The Applicant would work directly with potential affected community members including cultural practitioners prior to and during construction in an effort to minimize or avoid potential disruption of their activities • All staff engaged with the Proposed Action would be provided cultural sensitivity training including the identification of any known culturally sensitive locations and sites in the vicinity of the Proposed Action • If human remains or burials are identified, all earth-moving activities in the area would stop, the area would be cordoned off, and SHPD, DHHL, and the

Resource	Proposed Action Impacts		No-Action Impacts	Minimization Measures
	Construction	Operation		
				Police Department would be notified pursuant to HAR Section 13-300-40 • If any potential historic properties are identified during construction activities, all activities would cease and SHPD would be notified pursuant to HAR Section 13-280-3 • Measures to minimize potential impacts to stream habitat and biota and terrestrial biological resources important to cultural practices, such as mālama i ka wai (caring for water and their ecosystems) would be implemented • All equipment and vehicles arriving from outside all portions of the Project area located near designated critical habitat would be washed and inspected prior to any maintenance or construction activities to avoid the unintentional introduction or transport of new invasive plant species
Archaeological and Historic Resources (Section 5.5)	• The following historic properties have the potential to be affected by construction of the Proposed Action: Kōkeʻe Ditch Irrigation System (SIHP #50-30-02-2417), house site (SIHP #50-30-05-2113), abandoned road (CSH 2), hearths (CSH 3), Kekaha Sugar Company field infrastructure (CSH 4), basalt wall (CSH 5), and Mānā Reservoir (CSH 7) • The Proposed Action would result in an “Effect, with agreed upon mitigation commitments” under HAR Section 13-275-7 and HAR Section 13-284-7, and an “Adverse effect” under 36 CFR Section 800.5(1) • The Kekaha Sugar Company field infrastructure (CSH 4) would be impacted by construction of the PV Solar Array • No direct impacts associated with the West Kauaʻi Energy Project Substation and Interconnection Line.	• Repairs and rehabilitation would occur for the existing inoperable infrastructure (considered historic properties) to bring it back into operation. All existing infrastructure that is considered historic properties would be maintained for the life of the Project, therefore limiting degradation due to disrepair.	• No construction impacts • The existing Kōkeʻe Ditch Irrigation System would remain under management of ADC and any repairs and ongoing operations would fall to ADC. This could potentially result in the continuance of reduced operations or closure of the system. • Puʻu Lua Reservoir would remain under the management of DLNR, Puʻu Ōpae Reservoir would remain under management of DHHL, and Mānā Reservoir would remain under management of ADC. This could result in State-funded repairs to bring the reservoirs into compliance with Hawaiʻi Dam Safety requirements or decommissioning of the reservoirs.	• Consultation with SHPD in accordance with HRS 6E. • It is recommended that archaeological monitoring be conducted during construction of the Upper Penstock as well as along the Lower Penstock between the crest of Niu Ridge and Kekaha Ditch • If human remains or burials are identified, all earth-moving activities in the area would stop, the area would be cordoned off, and SHPD, DHHL, and the Police Department would be notified • If any potential historic properties are identified during construction activities, all activities would cease and SHPD would be notified • Prepare a HAER for the Kōkeʻe Ditch Irrigation System (SIHP #50-30-02-2417) and Mānā Reservoir (CSH 7). • The four hearths (CSH 3) and basalt wall (CSH 5) would be avoided (i.e., Preservation). If avoidance is not possible, then data recovery would be performed. • Sufficient information on CSH 4 was collected during the Archaeological Inventory Survey (AIS) to mitigate the effect on the historic property • The Applicant is consulting with SHPD to determine additional historic preservation requirements
Recreational Resources (Section 5.6)	• Access to trails in Kōkeʻe State Park would be mostly unaffected during the construction period. Access to diversion sites. • Camping also occurs occasionally at Waiakōali Diversion. Public access would be restricted from this area during construction.	• Beneficial impacts to the trout fishing program and other recreation at Puʻu Lua Reservoir from improved trout habitat and improved access to Puʻu Lua due to road improvements and maintenance • Improved public safety at Puʻu Lua Reservoir from compliance with Hawaiʻi State Dam Safety Standards	• No construction impacts • Maintenance of the Kōkeʻe Ditch Irrigation System and associated public recreation considerations around the ditch system would remain with ADC • Repairs and maintenance of public access roads would remain with the State	• Schedule coordination with DLNR and DAR to minimize impacts to recreational activities during specific construction activities to the extent possible. Precedence will be placed on avoidance of construction activities during Hawaiian forest bird breeding season and Hawaiian hoary bat birthing and pup rearing

Resource	Proposed Action Impacts		No-Action Impacts	Minimization Measures
	Construction	Operation		
	• Sugi Grove campground would remain open during repairs at the Kawaikōī Intake; however, the shelter, picnic table, and fire pit would be out of commission for approximately one week during the construction period • Public access would be restricted from staging areas and active work sites • Trout fishing program at Puʻu Lua Reservoir would be suspended for one or two seasons •	• Puʻu ʻŌpae and Mānā Reservoirs are both located in gated areas and not accessible to the general public. Project operations would not change this status • No direct impacts associated with the Kōkeʻe Ditch Irrigation System, powerhouse and co-located facilities, PV Solar Array, West Kauaʻi Energy Project Substation, and the Interconnection Line	• Puʻu Lua Reservoir would remain under management of DLNR, and the necessary repairs to meet Hawaiʻi Dam Safety requirements or actions required to decommission the reservoir would fall to the State • If no repairs to Puʻu Lua Reservoir occur, it would continue to deteriorate to the point of being unusable for the trout fishing program	season. Work at diversion sites will occur during the dry season (typically mid-late summer or early fall).
Visual Resources (Section 5.7)	• Presence and staging of construction equipment; however, construction sites are primarily located in gated areas or areas not visible from public viewpoints • Rehabilitation of Puʻu Lua Reservoir would involve significant earth moving and grading activities which would significantly alter the appearance of the reservoir during the 6- to 12-month construction period; however, the reservoir would be closed to public access during construction • Vegetation removal and construction of the Puʻu Moe Regulating Structure would be visible from the public roadway • Rehabilitation of Puʻu ʻŌpae Reservoir would involve significant earth moving and grading activities which would significantly alter the appearance of the reservoir during the approximate 12-month construction period and be visible by DHHL tenants and guests in the gated Puʻu ʻŌpae lands • Rehabilitation of Mānā Reservoir would not be visible from public areas • Vegetation removal, trenching, and burying the section of the Lower Penstock traversing the bluff would be visible from the highway • Construction of Mānā Powerhouse, PV Solar Array, West Kauaʻi Energy Project Substation, and the Interconnection Line may be visible from the highway	• The repairs and rehabilitation of the existing diversions would not result in a significant change in appearance of the structures • The repairs and continued maintenance of the existing reservoirs would be beneficial to the visual environment of these areas as the current reservoirs are either operating at lower water levels, or drained and unused • The Upper Penstock would be buried and would not block any viewplanes. Vegetation clearing activities occurring on along the buried Upper and Lower Penstock alignments would be visible to DHHL tenants • The Lower Penstock would be buried. Vegetation clearing activities occurring on land above the buried Lower Penstock would be visible by DHHL tenants and the lower portion would be visible from the gated Mānā agricultural area and may also be visible from Kaumualiʻi Highway but would not block any viewplanes • The Mānā Powerhouse would be of similar height to the existing trees mauka of the reservoir, would be painted a light earth tone color, and would be visible from the highway two miles to the west of the Mānā Powerhouse location • The PV Solar Array maintains a low profile but may be visible when panels are at a certain angle; however, generally the PV Solar Array is not expected to be visible from public areas • The West Kauaʻi Energy Project Substation would not likely be visible from Kaumualiʻi Highway • Portions of the Interconnection Line would be visible from Kaumualiʻi Highway, however it would have no substantial impact to visual resources or to the mauka to makai viewplanes • The Proposed Action would only be able to divert water from Kōkeʻe Stream during higher flow events and at	• No construction impacts • Kōkeʻe Ditch Irrigation System would remain under management of ADC and any ongoing repairs/operations would fall to the State. This could potentially result in continuance of reduced operations or closure of the system. • Puʻu Lua Reservoir would remain under management of DLNR, and the necessary repairs to meet Hawaiʻi Dam Safety requirements or actions required to decommission the reservoir would fall to the State • Puʻu ʻŌpae and Mānā Reservoirs would remain under management of DHHL and ADC respectively and require upgrades to meet Hawaiʻi State Dam Safety standards, which would be the responsibility of the State.	• Puʻu Lua Reservoir site would be cleaned, graded, and either seeded, mulched, or rip-rapped along with other BMPs to restore the ground and protect against erosion • Cleared areas along the Upper and Lower Penstock would be restored through graded, seeding and mulching. Seasonal vegetation management would occur on the Upper Penstock alignment, and seasonal management would occur on the Lower Penstock alignment in any areas not used for agriculture • The Upper and Lower Penstocks would be fully buried, and not visible once construction is completed

Resource	Proposed Action Impacts		No-Action Impacts	Minimization Measures
	Construction	Operation		
		least 1.2 MGD (estimated 86% of total streamflow) would remain in the stream at all times and therefore have minimal impact on natural flow expected at Waipoʻo Falls		
Roadways and Traffic (Section 5.8)	• No significant impact on traffic in the area during construction	• Minimal impacts to roadways and traffic since the Proposed Action would be operated automatically and monitored remotely around the clock by means of a SCADA system and a combination of West Kauaʻi Energy Project employees and KIUC dispatchers • Maintenance of Puʻu Lua Access Road and Dam Embankment Road, Trail 1 Road, Puʻu ʻŌpae Access Road, and existing roads on Mānā Plain would be a beneficial impact for access throughout the area	• No construction impacts • Repairs and maintenance of Project access roads would remain with the State	• Construction-related deliveries a during the weekday morning and afternoon peak hours (6:30 AM to 7:30 AM and 4:00 PM to 5:00 PM) would be avoided to the extent possible. • If night work occurs, appropriate permitting and monitoring would be employed • Workers would be encouraged to carpool from an off-site location to the extent possible • All loading and unloading activities would be coordinated to ensure all construction vehicles can be accommodated on site to minimize construction vehicle queues on adjacent roadways. • Heavy equipment transportation and truck traffic would be limited as much as possible to weekdays and during daytime hours. • If heavy equipment and truck traffic occur after normal working hours, appropriate permitting would be employed.
Socioeconomics (Section 5.10	• Benefits associated with the pre-construction/development work necessary for construction, the rehabilitation of existing structures, and construction of new facilities	• Benefits associated with job creation and the resulting direct, indirect, and induced spending in the local economy as a result of ongoing operations and maintenance of the Proposed Action • The savings derived from the Proposed Action are equivalent to 12,430 person-years of employment • The estimated total earnings generated by the payroll of the Proposed Action would amount to $951.9 million over 78 years (2010 to 2088), or $12.2 million per year • Add $3.2 million to State tax revenues and $76,403 to County tax revenues annually • Absorbing and offsetting State expenditures by providing long-term maintenance of the legacy Kōkeʻe Ditch Irrigation System and the three state owned reservoirs • Lease payments to the State for use of the required lands • Lower cost locally-generated clean energy created by the Proposed Action which would save the Kauaʻi rate payers money • Support diversified agriculture through subsidized irrigation delivery	• No construction or operation related benefits for the local economy • Meeting 100% renewable may involve expensive battery storage and would likely involve increased costs to address low inertia caused by additional inverter-based generation as opposed to hydro turbines, both of which may result in increased electrical rates • Kōkeʻe Ditch Irrigation System would remain under management of ADC and any ongoing repairs/operations and associated cost would fall to the State. This could potentially result in continuance of reduced operations or closure of the system • Puʻu Lua Reservoir would remain under management of DLNR, and the necessary repairs to meet Hawaiʻi Dam Safety requirements or actions required to decommission the reservoir would fall to the State • Puʻu ʻŌpae and Mānā Reservoirs would remain under management of DHHL and ADC respectively and require upgrades to meet Hawaiʻi State Dam Safety standards, which would be the responsibility of the State • The cost and practical implementation of delivery of water, repair of roads, and installation of electrical	• N/A

Resource	Proposed Action Impacts		No-Action Impacts	Minimization Measures
	Construction	Operation		
		• Bring financial resources to DHHL and ADC via lease rent payments for lands that are currently not in active use • Encumbering approximately 350 acres of agricultural land for the solar array in an area where several thousands of acres are currently available; however, the solar area would be made available for compatible agricultural activities • Furthering the purposes of the Hawaiian Homes Commission Act of 1921	distribution to DHHL mauka lands would fall to DHHL, which is not part of DHHL's 20-year plan leaving the lands not viable for the foreseeable future	
Noise (Section 5.11)	• The proposed rehabilitation of the existing Kōkeʻe Ditch Irrigation System, Puʻu Lua Reservoir, and the jeep access roads located in Kōkeʻe State Park, which is a highly utilized area for recreation, would have short-term and temporary noise impacts • Noise from construction may reduce the enjoyment for recreationists in the vicinity of construction of publicly available areas	• Some steady low-level noise from rotating machinery and building ventilation fans would be present when the powerhouses are operating within an approximate 200-foot vicinity • The renewable energy created by the Proposed Action would offset energy that would otherwise be produced by loud existing legacy fossil generation units at either Port Allen or Kapaia, resulting in a net decrease in noise emissions for Kauaʻi's electricity generation • No noise increases to existing noise environment from the operation of the PV Solar Array, West Kauaʻi Energy Project Substation, and the Interconnection Line	• No construction impacts • There would not be an offset of energy production at the existing legacy fossil generation units at Port Allen and Kapaia, resulting in current levels of regional noise impacts	• Noise generated from short-term construction activities and the use of machinery would be minimized by requiring contractors to adhere to State and County noise regulations • Construction activities are generally planned to be conducted on weekdays and in daytime hours • If work occurs after normal working hours (i.e., at night or on weekends), or if permissible noise levels are exceeded, appropriate permitting and monitoring, as well as development of administrative and engineering controls, would be employed
Air Quality and GHG Emissions (Section 5.12)	• Potential air quality impacts from diesel and/or gasoline-powered construction equipment and motor vehicles, as well as from fugitive dust emissions	• KIUC would use approximately 7.8 million less gallons of naphtha fuel and 775,000 less gallons of ultra-low sulfur diesel fuel during a full year of production, which would result in an estimated annual reduction of about 80,000 tons of CO_2e • Increase in generation of renewable energy from the Proposed Action would decrease the required generation of electricity from fossil fuel sources and the resultant GHG emissions	• No construction impacts • Continued reliance on energy generated from fossil fuels would continue to contribute NOx, CO_2, SO_2, and GHG emissions that affect local and statewide air quality	• A dust control plan would be developed and implemented to minimize fugitive dust during construction • Contractors would be required to maintain equipment with emissions controls
Natural Hazards (Section 5.13)	• No impacts associated with construction	• The rehabilitation of the Kōkeʻe Ditch Irrigation System, Puʻu Moe Regulating Structure and Upper Penstock, reservoirs, and access roads would increase the stability and integrity of the structures for the long-term against future natural hazard • The long-term maintenance and operation of the Puʻu Lua Reservoir, Puʻu ʻŌpae Reservoir and Mānā Reservoir would provide reliable sources of water for helicopters during firefighting operations, thereby improving fire protection in these areas • Critical infrastructure associated with the PV Solar Array would be located on the mauka side of the Mānā Plain at higher elevation and outside of FEMA Flood Zone A	• Without improvements to the Kōkeʻe Ditch Irrigation System the system will become more susceptible to degradation and negative impacts from flooding events • Puʻu Lua Reservoir would remain under management of DLNR, and the necessary repairs to meet Hawaiʻi Dam Safety requirements or actions required to decommission the reservoir would fall to the State. Rehabilitation is necessary to continue safe, long-term operations of Puʻu Lua Reservoir	• All existing and proposed facilities are unmanned, and continuous real-time monitoring of the Project would be performed by the SCADA system • The diversions on the Kōkeʻe Ditch Irrigation System will have automated intakes to limit ditch flow during high streamflow events • Personnel would respond to any emergency messages or alerts, as appropriate, to ensure their safety during these visits to the facilities • The proposed solar, hydroelectric and irrigation infrastructure and facilities would be constructed according to engineering standards associated with natural hazards during operation

Resource	Proposed Action Impacts		No-Action Impacts	Minimization Measures
	Construction	Operation		
		• The design of the proposed PV Solar Array would be compatible with being in the flood hazard zone and SLR-XA and would be able to withstand inundation during the prime lifetime of the facility • The substation for the Proposed Action would be designed in accordance with engineering standards for high water level events associated with both flood inundation and tsunami events and would be sited on the mauka side of the Mānā Plain at higher elevation in FEMA Flood Zone X.		• The rehabilitated Puʻu Lua, Puʻu ʻŌpae, and Mānā Reservoirs would bring the reservoirs into compliance with Hawaiʻi State Dam Safety Standards, which greatly decrease the risk of a breach during flood conditions • Rehabilitations will have embankment, spillways, low level outlets, internal drains, and level monitoring all designed to modern standards to ensure integrity and maximize public safety during natural hazard events • Water level monitoring at all three reservoirs will provide real time information if water levels increase due to flood events • Ability to drain all three reservoirs, in the case of a natural hazard water related emergency
Climate Change and Sea Level Rise (Section 5.14)	• No impacts from sea level rise • Increased tropical cyclones in the Pacific due to climate change is occurring and may impact construction of the Project if construction were to occur during hurricane season • Diesel and/or gasoline-powered construction equipment and motor vehicles would contribute to global GHG emissions	• Substantial beneficial impacts by reducing the State and Kauaʻi's reliance on fossil fuels and their contribution to global climate change by moving closer to the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045 • The proposed PV Solar Array located on the low-lying Mānā Plain would potentially be impacted by flooding due to sea level rise • KIUC would use approximately 7.8 million less gallons of naphtha fuel and 775,000 less gallons of ultra-low sulfur diesel fuel during a full year of production, which would result in an estimated annual reduction of about 80,000 tons of CO_2e • Increase in generation of renewable energy from the Proposed Action would decrease the required generation of electricity from fossil fuel sources and the resultant GHG emissions	• Kauaʻi would continue for a longer period of time to rely heavily on energy generated from fossil fuels that contribute to global climate change and would exacerbate coastal hazards due to sea level rise.	• Construction personnel would respond to any County of Kauaʻi emergency alerts, as appropriate, to ensure safety during construction • Contractors would be required to maintain construction equipment with emissions controls • Design of the proposed PV Solar Array would be compatible with being in the flood hazard zone and SLR-XA and would be able to withstand high water inundation during the prime lifetime of the facility

1 Introduction

The Kauaʻi Island Utility Cooperative (KIUC) is an operating not-for-profit electric cooperative engaged in the production, purchase, transmission, distribution, and sale of electricity on the Island of Kauaʻi. KIUC, in agreement with AES West Kauaʻi Energy Project, LLC (AES), proposes to construct and operate the West Kauaʻi Energy Project (the Project), an integrated renewable energy and irrigation Project. The Project will pair hydropower energy generation with solar PV and battery energy storage to improve grid performance with long-duration storage capability, stabilize and lower energy rates, rehabilitate state-owned infrastructure, and deliver irrigation water to adjacent lands. It would be the first Project of its kind in the world and is a critical component of Kauaʻi's renewable energy future.

The Project would utilize state land and water for renewable energy production and therefore is subject to the State environmental review process prescribed under Chapter 343 (Environmental Impact Statements), Hawaiʻi Revised Statutes (HRS), as amended, also known as the Hawaiʻi Environmental Policy Act, and Title 11, Chapter 200.1 (Environmental Impact Statement Rules), Hawaiʻi Administrative Rules (HAR). Under these regulations, nine specific types of action are identified that "trigger" environmental review. This Project triggers the State environmental review process under HRS Section 343-5(a)(1) because the Project Area is located on and involves the use of State lands, and it triggers HRS Section 343-5(a)(2) because the Project Area is located on lands that are classified as Conservation District by the State Land Use Commission.

The Draft Environmental Assessment (EA), which was published in the Environmental Review Program's September 8, 2022 edition of *The Environmental Notice*, was provided to federal agencies, specifically U.S. Army Corps of Engineers (USACE) and U.S. Fish and Wildlife Service (USFWS), for their review. The application has initiated consultation with USACE and discussed the Project with USFWS, however USACE jurisdiction over project components has not been determined at this time. Based on information available at this time, the Project does not appear to meet the definition of a major federal action pursuant to NEPA and its implementing regulations. However, as the Project will ultimately require the issuance of permits by USACE, future determination by USACE, as an approving federal agency, may define the Project as a major federal action. Accordingly, USACE would become the federal agency responsible for ensuring compliance with NEPA requirements. Prior to issuance of the permits and Project construction, USACE would need to determine the extent of the Project requirements that would be addressed to fulfill NEPA.

Development of the Project started more than eight years ago and was previously known as the Puʻu ʻŌpae Energy Project. The name for the Project changed in 2020. Certain study reports, associated consultation, and public outreach prior to 2021 were conducted when the Project was called the Puʻu ʻŌpae Energy Project. The layout, footprint, purpose, and general design has not substantively changed from when previous field studies and consultation were conducted. Development and public outreach for the Project has continued after the name change to West Kauaʻi Energy Project.

A full assessment of potential impacts associated with the Proposed Action as defined in **Section 4.1** was conducted and are reported in this Final Environmental Assessment (EA). With the implementation of minimization, avoidance and mitigation measures, no long-term significant impacts to any resource were identified or are anticipated with implementation of the Proposed Action, as identified in **Section 7.1**. Any impacts would occur during the construction phase, which would be short-term and temporary. In the absence of long-term significant impacts, an Environmental Impact Statement (EIS) is not anticipated per HRS Section 343-5 and HAR Section 11-200.1-13.

Development of the Project has been influenced by several important factors as described in this introductory chapter. This begins with the historical background including pre-contact and post-contact uses for historical context, relationship of the Project to provide irrigation water to Department of Hawaiian Home Lands (DHHL) Puʻu ʻŌpae lands, and consistency with the Waimea Mediation Agreement approved by the Commission on Water Resources Management (CWRM) on April 18, 2017.

1.1.1 Pre-Contact

1.1.1.1 Political System and Land Tenure

The political system in the pre-contact era placed an aliʻi nui with supreme authority at the head of a territory, which he then carved into districts that were ruled by trusted chiefs, the aliʻi. These aliʻi further divided the land into subdivisions ruled by lower chiefs. At the bottom of the system were the makaʻainana, or common people, who worked the land. The surplus product of the makaʻainana moved upwards to support the lower chiefs, chiefs, and aliʻi nui.

The land use institution, the ahupuaʻa, organized the wide-ranging use of the land. The ahupuaʻa was a "self-sufficient economic and administrative unit of land running from the summit of the mountain to a broad coastal base" (Lâm, 1989). The ahupuaʻa was composed of all the types of terrain, resources, and species utilized by the Hawaiians. Ahupuaʻa varied in form and expanse depending on the resources available. The Project would be located in the Waimea ahupuaʻa. The large size of Waimea ahupuaʻa is seen as unusual, as a single ahupuaʻa does not typically occupy a large percentage of land area. One thought behind its large size is that the low agricultural productivity of the Mānā Plain, due to its scarcity of water, is the reason it is included in the Waimea ahupuaʻa.

1.1.1.2 Land Use

The Waimea district is thought to have first been settled by voyagers from Tahiti, led by Kūalu-nui-kini-akua. The origin of this place name is attributed to the first settlers of the area who utilized a native tree they named Waimea (also known as māmaki; *Waimea pipturus* or *Pipturus albidus*) to make kapa (cloth) until the wauke (mulberry; *Broussonetia papyrigera*) trees they had brought with them were mature enough to be used (Wichman, 2003).

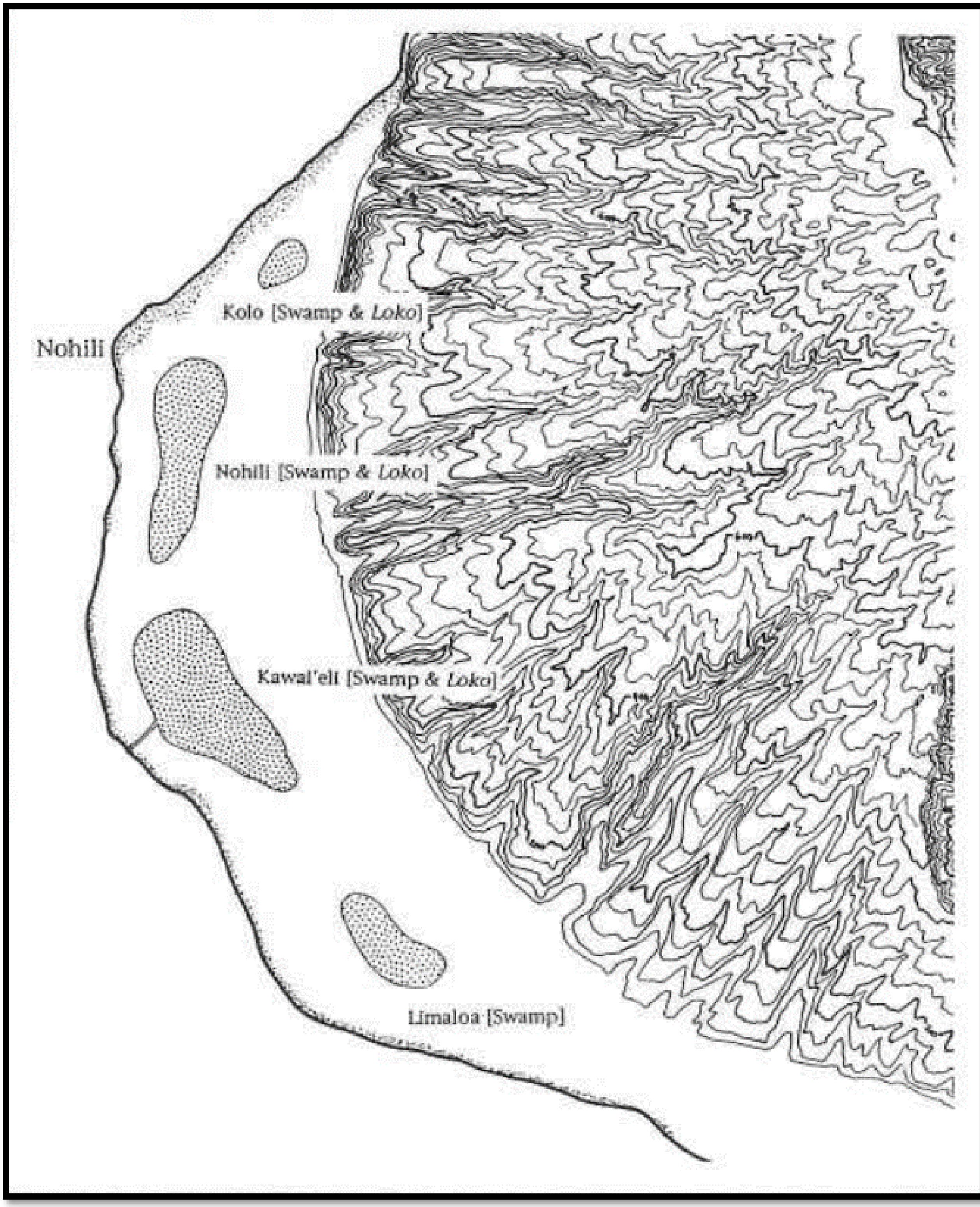
Hawaiian settlements on the Mānā Plain were small and concentrated along the foothills and mauka upland valleys, while temporary habitation, including fishing camps, occurred on the coastal sand dunes. In addition, since Waimea was one of the two areas on Kauaʻi (the other being Wailuā) that served as the domain of the high chiefs, the aliʻi nui, it required resources such as koa trees and feathers of forest birds from the large upland regions of Kōkeʻe and Alakaʻi.

The presence of marine cliffs throughout Kaua'i attest to the effects of the sea and Pleistocene submergence and emergence on the lands. In the case of the Mānā Plain, where the sea retreated there remained a coastal plain of swamps and marshes that were suitable for the development of aquaculture ponds by early inhabitants (Kikuchi, 1987). Ponds of water, which were referred to as loko pu'uone, were formed by bodies of water being stranded by a natural sand barrier. The loko pu'uone of the Mānā Plain were Kawai'eli, Kolo, and Nohili, and they contained mostly brackish water, which produced a highly productive estuarine environment that was suitable for the stocking of fish. The types of fishes that could be found in the ponds included 'anae (mullet), awa (milkfish), āholehole/āhole (flagtail), pāpio/ulua (jackfish), 'ō'io (bonefish), nehu (anchovy), awa'aua (tarpon), 'o'opu (goby), kāku (barracuda), moi (threadfish), weke (surmullet), and many others (Keala, 1990). Since the ponds produced an ever-available supply of fresh seafood, it was most likely that the ponds were under the jurisdiction of the area's ali'i. The konohiki (land overseer) of Mānā would have managed these ponds with the assistance of the kia'i loko (resident pond keeper) (Keala, 1990). The brackish water ponds, marshes, and wetlands of Mānā also provided important habitat and nesting environment for Hawaiian waterbirds, such as the koloa maoli (duck), 'auku'u (night heron), āe'o (stilt), 'alae 'ula (gallinule), and the 'alae kea (coot). Historic fishpond distribution on the Mānā Plain is shown in **Figure 1.1**.

Waimea, Kaua'i was also a site of great significance for po'e kuhikuhi pu'uone (site experts) and po'e kilo hoku holo moana (navigators) of the Pre-Contact era. Po'e kilo hoku (astronomers) of O'ahu and Kaua'i, "who were very skilled in discerning the ways of the sun, the moon, and the stars, as well as knowing the configuration of the earth (papa hulihonua)" (Kamakau, 1976), gathered in Waimea, Kaua'i to make their observations.

Fredrick Wichman's work *Nā Pua Ali'i o Kaua'i (Ruling Chiefs on Kaua'i)* offers a description of the Waimea area, specifically the land ashore of the Waimea River. Wichman describes the abundance of water provided by the river, which fed the agricultural fields, "There was abundant water from the swift rivers and streams that flowed within a protected canyon complex. The climate was warm and dry, useful for people who wore clothes of beaten bark. The area was cooled by Wai-paoa ("Scooped Water"), a daytime breeze from the sea, and Wai-pa'u ("Water Drenched") from the mountains at night. There was good soil within the canyon valleys behind the cliff that blocked easy access into the interior. . . Taro could easily be grown in fields that took water from the river upstream, fed by ditches to each connected lo'i (taro patch) before returning the water to the river. Sweet potatoes and yams grew well…" (Wichman, 2003).

Figure 1.1. Historic Fishpond Distribution on the Mānā Plain



Source: Flores, 1991

1.1.2 Early Historic Period

Contact occurred when the British vessels Discovery and Resolution, under the command of Captain James Cook, anchored at Waimea Bay on January 20, 1778. By that time the ahupuaʻa of Waimea had long been a focus of settlement, agriculture, and aliʻi (chiefly) residence on Kauaʻi. The well-watered valley and delta of the Waimea River were ingeniously developed and engineered for wetland agriculture and represent the epitome of the typical Hawaiian and Kauaʻi-type valley settlement (Handy and Handy, 1972). The most active part of the village was near the beach where trading for pigs, fowl, and roots took place. Captain Cook's observations during an excursion on shore in 1778 reveal the agriculture development that occurred in Waimea by the latter eighteenth century: "The greatest part of the ground was quite flat, with ditches full of water intersecting different parts, and roads that seemed artificially raised to some height. The interspaces were, in general, planted with taro, which grows here with great strength, as the fields are sunk below the common level, so as to contain the water necessary to nourish the roots. This water probably comes from the same source, which supplies the large pool from which we filled our casks. On the drier spaces were several spots where the cloth-mulberry was planted in regular rows; also growing vigorously and kept very clean. The cocoa-trees were not in so thriving a state and were all low; but the plantain-trees made a better appearance, though they were not large." (Cook, 1821).

In 1786 and 1787, two fur-trading ships made a stop in Waimea. William Broughton, who served under the command of one of the captains, George Dixon, made similar observations as Captain Cook of the many loʻi that ran from the valley down to the beach. Broughton also noted that the loʻi were surrounded with trenches so that they could be watered or drained from the river and were "entirely along the river-side", while houses were located westward.

Captain George Vancouver provided the first western account of the Menehune Ditch during his visit in March 1792: "As we proceeded, our attention was arrested by an object that greatly excited our admiration, and at once put an end to all conjecture on the means to which natives resorted for the watering of their plantations. A lofty perpendicular cliff now presented itself, which, by rising immediately from the river, would have effectually stopped our further progress in to the country, had it not been for an exceedingly well constructed wall of stones and clay about twenty-four feet high, raised from the bottom by the side of the cliff, which not only served as a pass into the country, but also as an aqueduct, to convey water brought thither by great labor from a considerable distance; the place where the river descends from the mountains affording the planters an abundant stream, for the purpose to which it is so advantageously applied. This wall, which did no less credit to the mind of the Projector than to the skill of the builder, terminated the extent of our walk; from which we returned through the plantations, whose highly improved state impressed us with a very favorable opinion of the industry and ingenuity of the inhabitants." (Vancouver, 1798).

In 1839, the Bill of Rights of the Hawaiian Islands was enacted, which guaranteed that people's lands would not be taken from them. In 1840, the first Constitution of Hawaiʻi was enacted, which made it clear that people had an interest in the land "greater than that of the bounty and produce of the land (RE3 LLC, 2004). In 1845, the Land Commission was created by Kamehameha III to award land claims. However, the feudal system of land tenure still existed, and individuals did not hold title to the land (RE3 LLC, 2004). 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. On January 27, 1848, the Crown and the aliʻi began to receive their land titles as Konohiki (land manager) awards. The ahupuaʻa of Waimea was retained by the monarch, Kamehameha III, as crown land.

On October 19, 1849, the Hawaiian Privy Council adopted resolutions to protect the rights of native tenants, the makaʻāinana, or the “common” people. The Kuleana Act of 1850 confirmed these rights. Over 150 kuleana awards were granted in Waimea. The records associated with these awards illuminate the character of the Hawaiian settlement and livelihood within Waimea by 1850. The upper and lower valley were extensively cultivated. Interspersed among the loʻi were house sites, small plots of kula (field and/or pastureland) on which were cultivated traditional native dry land crops as well as introduced ones, and pastureland. In the upper canyon, the degree of settlement thinned out greatly with loʻi and house sites dispersed along the banks of the Waimea River.

1.1.3 Plantation Era

1.1.3.1 Commercial Agriculture

Traditional Hawaiian endeavors were becoming less apparent, as evidenced by the loss of taro loʻi and the conversion to rice fields and sugarcane in the second half of the nineteenth century. The availability of taro lands throughout the islands in the late 1800s reflected the decreasing demand for taro as the Native Hawaiian population started to decline. The people of the Waimea ahupuaʻa were struck in May 1826 by an influenza epidemic and a great flood that wreaked havoc upon taro loʻi and damaged structures built by the missionaries. It was estimated that ten deaths were occurring for every birth (Kauaʻi Bicentennial Committee, 1977). By 1838, the population was 3,272; in 1840 it was 2,819; and in 1841, it was 2,779 (Schmitt, 1973).

Rice cultivation by Chinese farmers began in Waimea Valley in the 1860s. Groups of Chinese began leasing former taro lands for conversion to rice farming. The Chinese had originally come to Hawaiʻi to work on the sugar plantations as the commercial sugar industry expanded throughout the Hawaiian Kingdom. Upon completion of their contracts, a number of immigrants remained in Hawaiʻi and went on to become merchants or rice farmers.

The Reciprocity Treaty of 1875 between the United States and Hawaiʻi gave impetus for the expansion of the sugar industry throughout the islands. The treaty allowed goods including sugar to be admitted into all ports of the United States free of duty. The first commercially grown sugarcane on the west side of Kauaʻi was planted during 1878 near Kekaha by Valdemar Knudsen and Captain Han L’Orange (Hawaiian Sugar Planters’ Association, 2004). Knudsen came to Hawaiʻi from Norway and settled at Waiawa in 1854 where he eventually worked as a sugar planter. Knudsen would go on to control the entire district, excluding kuleana lands, from Nuʻalolo to Waimea, including all of the upland areas (Knudsen and Noble, 1945). Valdemar’s son Eric described Kekaha and the surrounding environment as he knew it in the second half of the nineteenth century:

> “A row of grass houses extended all the way along the foothills from Waimea to Mānā. Every house site had a name. To find a man you had to find his house name. The natives seemed to know every name and would keep sending you along until you finally came to the spot you were looking for…Food was plentiful, cattle roamed all over the land [. . .] Taro and sweet potatoes, rice and milk, yams and watermelons were plentiful. The Mānā

> natives raised wonderful melons and they didn't charge you 9 cents a pound either. Every now and then Mānā fisherman would come past with huge packs of dried squid and give some to father. Somehow we children never took to them. Eggs and chickens were plentiful. Turkey wandered about in large flocks and when you wanted one all you had to do was to go out and shoot one. For fruit we had figs, papaias, mangoes and fresh hau cocoanuts. There was no market for beef cattle, they were killed and boiled down for tallow and the hides dried." (Knudsen, 1991).

During 1884, Hans Peter Fayé founded H.P. Fayé & Company, which was a sugar plantation in Mānā. A railway system was also built in 1884 to transport sugar cane from the fields to Waimea Sugar Mill for processing, and then to the pier at Waimea Landing. In 1898, the Kekaha Sugar Company was established through the consolidation of three Kaua‘i sugar interests: the Meyer, Kruse, and Fayé plantations.

Plantation agriculture in the arid zones of the Waimea ahupua‘a depended on the development of water supply in the twentieth century. After droughts and water overuse occurred in the late nineteenth century, the salt content increased in groundwater, while well water levels decreased. The Waimea River was looked to as a source of sugar cane irrigation, which initiated the Kekaha Ditch Project in 1906. **Figure 1.2** shows the uses of the Mānā Plain as of June 30, 1906.

In 1906 Fayé acquired the Waimea Sugar Mill, which had been founded in 1884. By 1910, approximately 7.5 miles of drainage ditches were dug to move surplus irrigation water and rainfall water away from the cane fields on the Mānā Plain's higher elevation hinterland. The drainage system, which consists of approximately 34 miles of interceptor, side, and arterial ditches, had assumed its contemporary operational configuration by this point in time. Its primary functions were (1) to support agricultural production during the growing season by maintaining the water table below the root zone, and (2) to divert storm runoff from the adjacent uplands away from farmland.

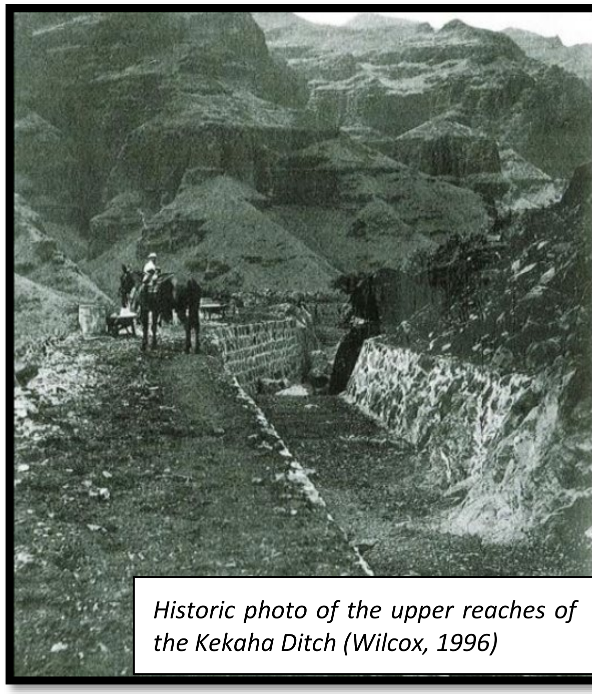
By the early 1930s, about 670 acres of land was cultivated by the Waimea Sugar Mill Company. Most of Waimea Town's commercial buildings were constructed during this period of the sugar industry's growth. At the time of statehood in 1959, H.P. Fayé & Company was incorporated as Kīkīaola Land Company. Rice farming declined sharply throughout the islands after the first decade of the twentieth century. Though rice continued to be grown at Waimea into the 1930s, many of the rice fields were being reclaimed for sugar planting.

The landscape of the Mānā Plain changed dramatically once the wetlands began to be drained for the purpose of sugar cane cultivation. A drainage system (Mānā Plain Storm Drainage System) was created by routing streams that discharged into the ocean into man-made ditches that discharged into the ocean. The first connection to the ocean by the ditch system was established at Kawai‘ele in 1878, First Ditch had been completed by 1907, Cox Drain and Kīkīa‘ola Harbor Drain were in use by 1910, and Nohili Ditch was excavated in 1922. Kekaha Sugar Company acquired the leases on the land used for rice cultivation in 1922 and installed large-capacity drainage pumps and extended the ditch system on the Mānā Plain. During this time, the Kekaha Sugar Plantation systematically drained low lying "swamp lands" on the Mānā Plain to expand sugarcane production. Most of the remaining wetlands surrounding the ponds at Kawai‘ele, Kolo, and Nohili had been drained by 1931. What amounted to the largest land reclamation Project in the Territory's history was completed when the final parcel was drained and planted in 1959.

Figure 1.2. Agriculture on the Mānā Plain (June 30, 1906)

Source: Hawai'i Territory Survey, Walter E. Wall, Surveyor. Andrew B. Graham Co., Lithographers, Washington, D.C. (1906)

1.1.3.2 Irrigation Infrastructure



Historic photo of the upper reaches of the Kekaha Ditch (Wilcox, 1996)

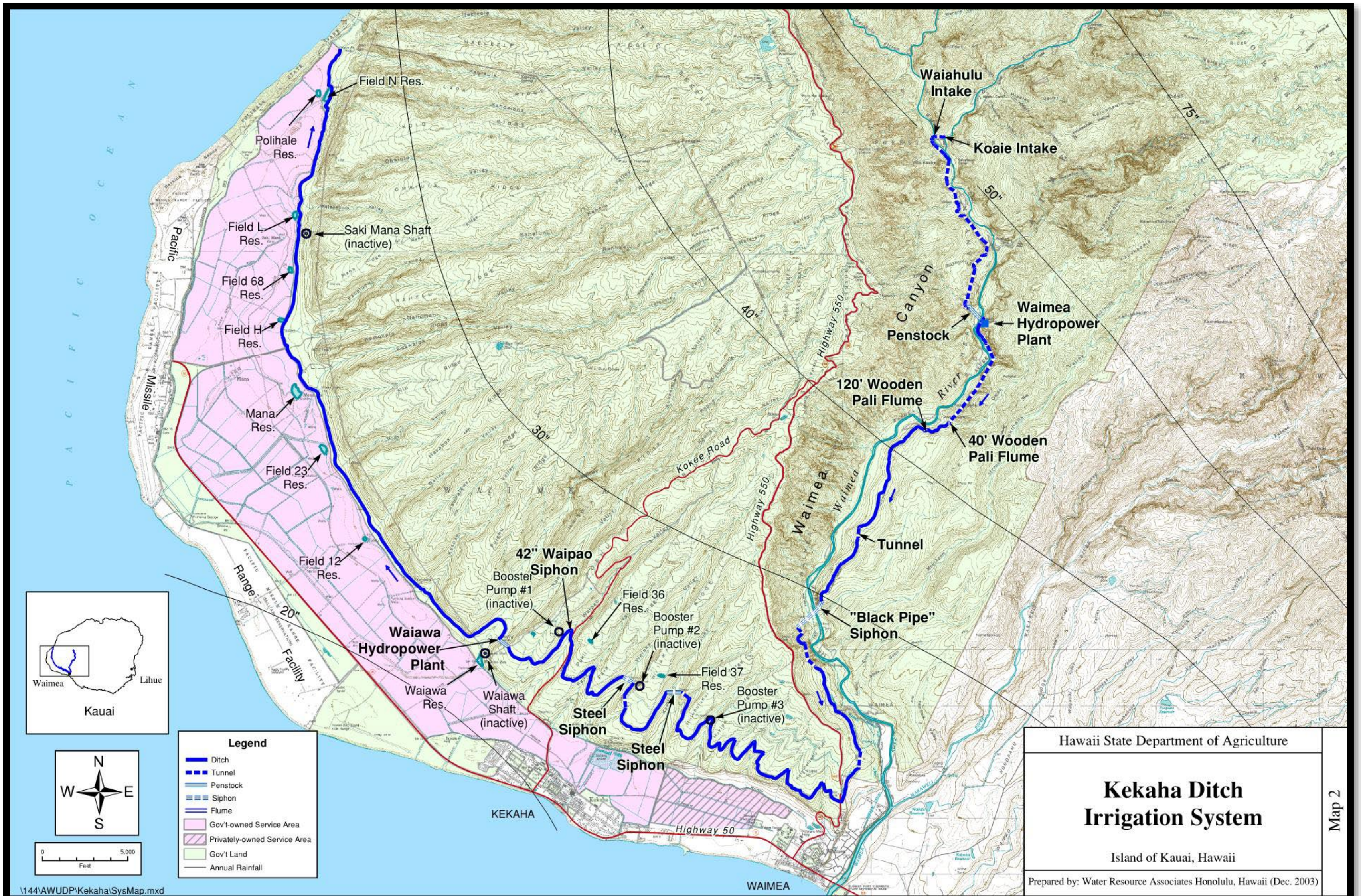
Development of the basal groundwater wells in the lava flows under the Mānā Plain began in the early 1880s (MacDonald et al., 1960; Burt, 1979). By 1890, there were approximately a dozen wells near Kekaha and Mānā (Burt, 1979). Groundwater was initially used to irrigate cane fields and rice paddies, with spring water being supplemented by well water from 1890. A year after these wells were drilled, the water in most became too salty to use (Burt, 1979). After a series of crop failures, Valdemar Knudsen, founder of Kekaha Sugar Company, looked to the Waimea River as a source of sugar cane irrigation. The Waimea Ditch was constructed in 1903. In addition, shafts and tunnels were drilled into the base of the Na Pali lava cliffs near Kekaha starting in 1931 (Burt, 1979). Between 1931 and 1957, six shafts were installed along the inland edge of the plain to supply irrigation and domestic water.

Kekaha Ditch (University of Chicago)

Construction of the Kekaha Ditch started in May 1906 and was completed in September 1907. Kekaha Ditch was designed to convey water diverted from the Waiahulu Stream, Koaiʻe Stream, and Waimea River and originally extended through 16 miles of mauka lands and 4 miles through the lowlands (Wilcox, 1996). The diversions on Kekaka Ditch were constructed as typical plantation style passive diversions that diverted all water into the ditch system during low and normal flows. This water was used to irrigate plantation lands of the Kekaha- Mānā Plain. By this time, approximately 50 or more wells were drilled throughout the plain for the irrigation of rice and sugarcane. By 1920, water from Kekaha Ditch, which connected with the pre-existing Mānā Pump Ditch, was being used to irrigate approximately 2,700 acres of land. The Kekaha Ditch Irrigation System is shown in **Figure 1.3**.

In 1908 the Waiawa hydro was constructed on the lower portion Kekaha Ditch on the Mānā Plain. In 1911 the Mauka hydro was constructed on the upper portion of Kekaha Ditch in Waimea Canyon. The Waiawa hydro has 500 kW capacity whereas the Mauka hydro has 1.2 MW capacity. Both hydros were constructed to provide power for operation of the sugar mills in the area. These two hydros currently supply 10% of KIUC's renewable energy (KAA, 2015).

Figure 1.3. Kekaha Ditch Irrigation System



From 1923 to 1926 the construction of the Kōkeʻe Ditch was undertaken by the Kekaha Sugar Company to further irrigate plantation lands. Kōkeʻe Ditch diverted flow from the upper tributaries of the Waimea River including the Mōhihi, Kauaʻikinanā, Kawaikōī, Waiakōali, and Kōkeʻe streams. In addition, there were smaller intakes along Kōkeʻe Ditch that diverted flow from unnamed and intermittent tributaries. Similar to the Kekaha Ditch diversions, the diversions along Kōkeʻe Ditch were typical plantation style passive diversions that diverted all water into the ditch system during low and normal flows. The Mōhihi Intake and Ditch have since been abandoned due to storm damage to both the intake on the section of ditch between Mōhihi and Waiakōali. The Kōkeʻe Ditch skirts the upper end of Waimea Canyon and enters Puʻu Lua Reservoir. From Puʻu Lua Reservoir, Kōkeʻe Ditch follows the western rim of Waimea Canyon to the irrigated mauka lands for a distance of approximately 10 miles. At Puʻu Moe Divide, Kōkeʻe Ditch splits to form the Kitano and Puʻu ʻŌpae branches. The amount of flow diverted to each branch was determined by the amount of flow in Kōkeʻe Ditch and the irrigation requirements in the respective cane field lands.

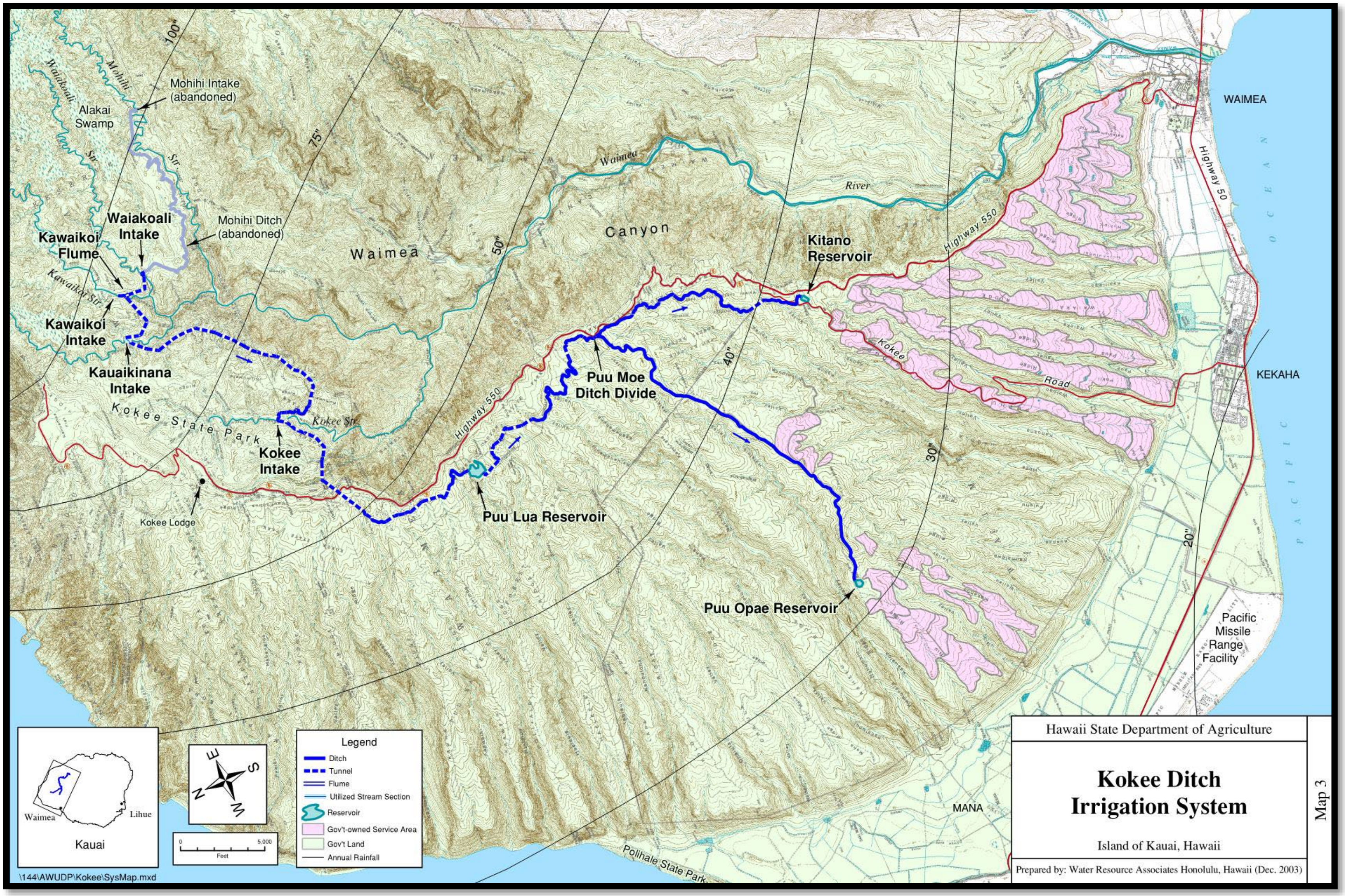
The historical capacity of the Kōkeʻe Ditch Irrigation System entering Puʻu Lua Reservoir was 55 million gallons per day (MGD) while the ditch leading into the Puʻu Moe Divide was 26 MGD. The historical ditch capacity from the Puʻu Moe Divide to Puʻu ʻŌpae Reservoir was approximately 7 MGD, and the historical ditch capacity from Puʻu Moe Divide to Kitano Reservoir was approximately 19 MGD. The Kōkeʻe Ditch Irrigation System was constructed with a maximum diversion capacity of 105 MGD and a total storage capacity of 361 MG. The Kōkeʻe Ditch Irrigation System is shown in **Figure 1.4**.

Puʻu Lua Reservoir with a capacity of 262 MG was constructed in 1927 at an elevation of 3,260 feet above mean sea level (msl) as a major storage facility for the Kōkeʻe Ditch Irrigation System. The 36 MG capacity Kitano Reservoir (approximately 2,120 feet above msl) and the 88 MG capacity Puʻu ʻŌpae Reservoir (approximately 1,480 feet above msl) were constructed at the terminus of the Kōkeʻe Ditch Irrigation System. During the Plantation Era, the Kōkeʻe Ditch Irrigation System served the upland sugarcane fields above the Kekaha coastal plain by storing and routing water from these three storage reservoirs.

1.1.4 Transitional Period

During World War II the U.S. Army Corps of Engineers (USACE) used Waimea Sugar Company's plantation shop yard as their headquarters, which prevented the use of Waimea Sugar Mill for processing sugar cane. During this time, the sugar cane was processed at Kekaha Sugar Mill. Following World War II, the fortunes of the Waimea Sugar Mill Company changed. The Waimea Sugar Mill stopped operating in 1945, though the Waimea Sugar Company continued to cultivate cane on its lands until 1969. The milling equipment was sold, and the mill building was used for grain storage. After the company closed, its fields were leased to the Kekaha Sugar Company. Kekaha Sugar Company was the first in the Territory to switch from steam engines to diesel power. In June 1928, the first diesel locomotive in the Islands was placed in service at Kekaha. Diesel was found to be more cost effective than steam and persisted as the primary means of transporting sugar cane until the 1940s when transportation by truck proved more efficient. In 1947, the railroad system was eliminated, completing the full conversion to truck transport.

Figure 1.4. Kōkeʻe Ditch Irrigation System



In 1950, the Waimea Sugar Mill Co. was reorganized into the Waimea Sugar Mill, Inc., which continued to process cane, and the Kīkīaola Land Company, which was created to manage the property. In 1982, one of the former plantation cottages opened as a vacation rental and was so successful that the Fayés decided to construct a plantation-type resort. The renovated plantation houses, built between 1900 and 1920, became part of the Waimea Plantation Cottages, which was opened in 1992 and now operates with 48 rental units and a conference center. Kekaha Sugar Company continued to produce sugar until November 17, 2000, when the parent company, AmFac, closed the factory down due to financial hardship.

1.1.5 Post-Plantation Era

Sugar had been an important part of the Hawaiian economy. By 1980, which was the peak of sugar production in Hawaiʻi, fourteen plantations and about 550 independent sugar growers in Hawaiʻi used about 220,000 acres of land for growing sugar cane and they were producing about 1.1 million tons of raw sugar each year. Most of this raw sugar was sent to the continental United States where it was refined and sold as C & H Sugar (California and Hawaiʻi) primarily to the western and mid-western states. Hawaiʻi supplied about one-tenth of the sugar used by the 215 million people in the United States in 1980.

Agricultural land on the Mānā Plain has never been in private ownership. Originally bestowed as "Crown Land" in 1848, it became "Public Land" when the Republic of Hawaiʻi was created in 1893. This designation was retained after the islands became a territory of the United States in 1898, and subsequently a state. Some land was initially leased to commercial rice growers and antecedents of Kekaha Sugar Company. After sugar operations ceased, lands previously under contract to Kekaha Sugar Company reverted back to the State of Hawaiʻi. These lands were subsequently divided among multiple state agencies based on use and management strategies. Land on the Mānā Plain is currently owned by ADC. Additional information about land ownership in the Project area is provided in **Section 1.1.6.1**.

During recent decades, growth in Waimea has focused on development of the former sugar plantation lands and structures into tourist-oriented facilities and diverse agricultural development. In the mauka portion of Waimea Ahupuaʻa, land was divided and preserved by the creation of state parks such as Kōkeʻe State Park and Waimea Canyon State Park. The 20th century history of Kōkeʻe State Park and Waimea Canyon State Park include the following chronology of activities: the presence of cattle during the first decades of the century, the opening of leased cabin sites at Kōkeʻe beginning in 1919, the planting of tree stands and construction of new trails by the Civilian Conservation Corps during the 1930s and ʻ40s, the construction of military and communications facilities beginning in the 1960s, and the development of the parks themselves, beginning in the late 1940s at the instigation of Joseph M. Souza, Jr. Views of the Kōkeʻe Ditch Irrigation System are embedded throughout the landscape of Kōkeʻe and Waimea Canyon State Parks, providing a tangible sense of history within the natural environment. The Waimea Canyon Lookout restroom is provided with non-potable water from the Kōkeʻe Ditch system.

The Kekaha agricultural lands have supported the production of seed corn, sweet corn, melons, tropical fruits, various vegetable crops, and sugar cane. Seed crops have proven to be profitable agricultural products in Kekaha, of which corn seeds make up more than 90% in sales value. After some failed attempts, in recent years shrimp farming on Mānā Plain has become successful.

1.1.6 Current Use

Current uses in the Project area include agriculture and the associated irrigation infrastructure, hydropower generation, recreation, and military use. Current land use is shown on **Figure 1.5**.

Details about the current condition and use of the components of the Kōkeʻe and Kekaha Ditch Irrigation Systems and the Mānā Plain Ditch System are provided in **Section 4.1.2**.

1.1.6.1 Land Ownership

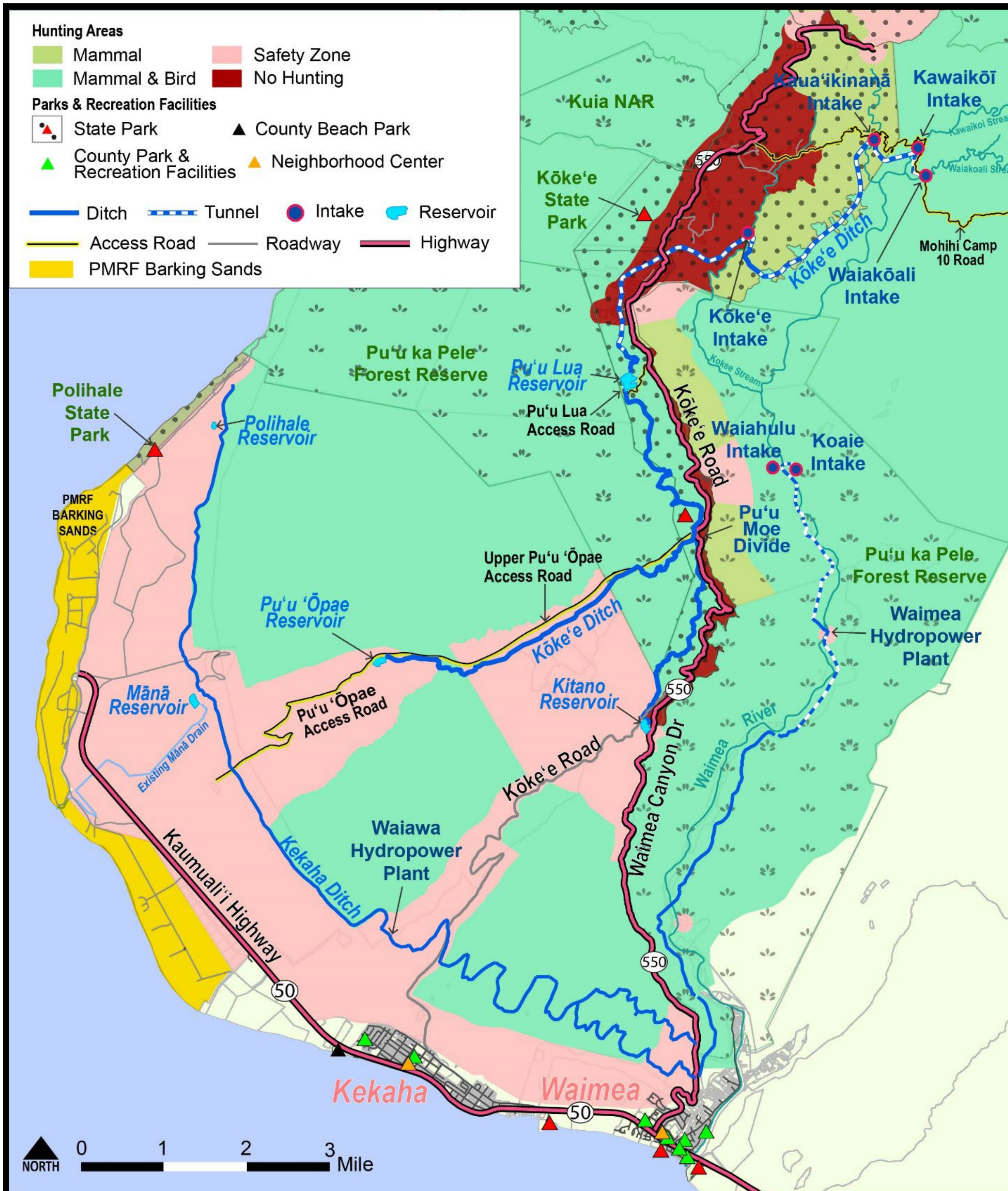
Current land ownership and management in the Project vicinity includes DHHL, the Department of Land and Natural Resources (DLNR) (including Land Division, Division of State Parks [DSP], and Division of Forestry and Wildlife [DOFAW]), and ADC. **Figure 1.6** shows the major landowners.

ADC assumed management control of the 12,500 acres of State-owned agricultural lands, Kōkeʻe and Kekaha Ditch Irrigation Systems, Waimea Mauka and Waiawa hydroelectric facilities and other related infrastructure on the Mānā Plain in 2003 under Governors Executive Order No. 4007 and Governors Executive Order No. 4287. The area is one of the most productive farming regions in the State with an estimate farm gate value of crops produced between $35 and $50 million (Southichack, et.al., 2005). ADC has issued long term licenses to farmers for agricultural use, but only a fraction of the former plantation lands are currently being cultivated at this time. As per ADC's 2020 Annual Report, 4,337 acres are currently occupied (ADC, 2020). The crops that are cultivated are far less water-intensive than sugar cane and the current emphasis is on diversified agriculture. ADC has an agreement with Kekaha Agriculture Association (KAA) for the operation and maintenance of common areas and agricultural and existing hydroelectric infrastructure. KAA is a non-profit agricultural cooperative made up of farmers on ADC's lands in Kekaha and on Mānā Plain.

The lands transferred to DHHL have remained largely undeveloped. Existing land use of DHHL lands include 475 acres pastoral (5 lots: 3 leased and 2 vacant), 840 acres vacant, 20 acres of diversified agriculture, 26 acres military (U.S. Navy ammunition storage depot), and 13,600 acres DLNR Game management. There are also designated no hunting zones and hunting safety zones. The possession of a loaded weapon or the discharge of firearms or other weapons is prohibited in a designated "safety zone." Safety zones in the Project area include a 0.5-mile strip east of Kōkeʻe Road along the western rim of Waimea Canyon between the Halemanu and Kukui Trails, all sugar cane fields within and adjacent to public hunting areas, a 0.5-mile strip around DHHL Puʻu ʻŌpae lands, lands within 40 yards of a paved public highway, lands within 50 yards of an inhabited building. All the DHHL Waimea lands are located within the State Agricultural land use designation except for a small strip designated Conservation along the Nā Pali side of the property. DHHL's *Kauaʻi Island Plan* identifies the following proposed land uses (see **Figure 1.7**):

- 202 acres residential (141 one-acre lots)
- 214 acres subsistence agriculture (50 three-acre lots)
- 475 acres pastoral
- 12,527 acres general agriculture
- 1,258 acres Special District
- 42 acres community use
- 343 acres Conservation

Figure 1.5. Current Land Use



Current Land Use

West Kauaʻi Energy Project – Kauaʻi, Hawaiʻi

SSFM International

Figure 1.6. Major Landowners

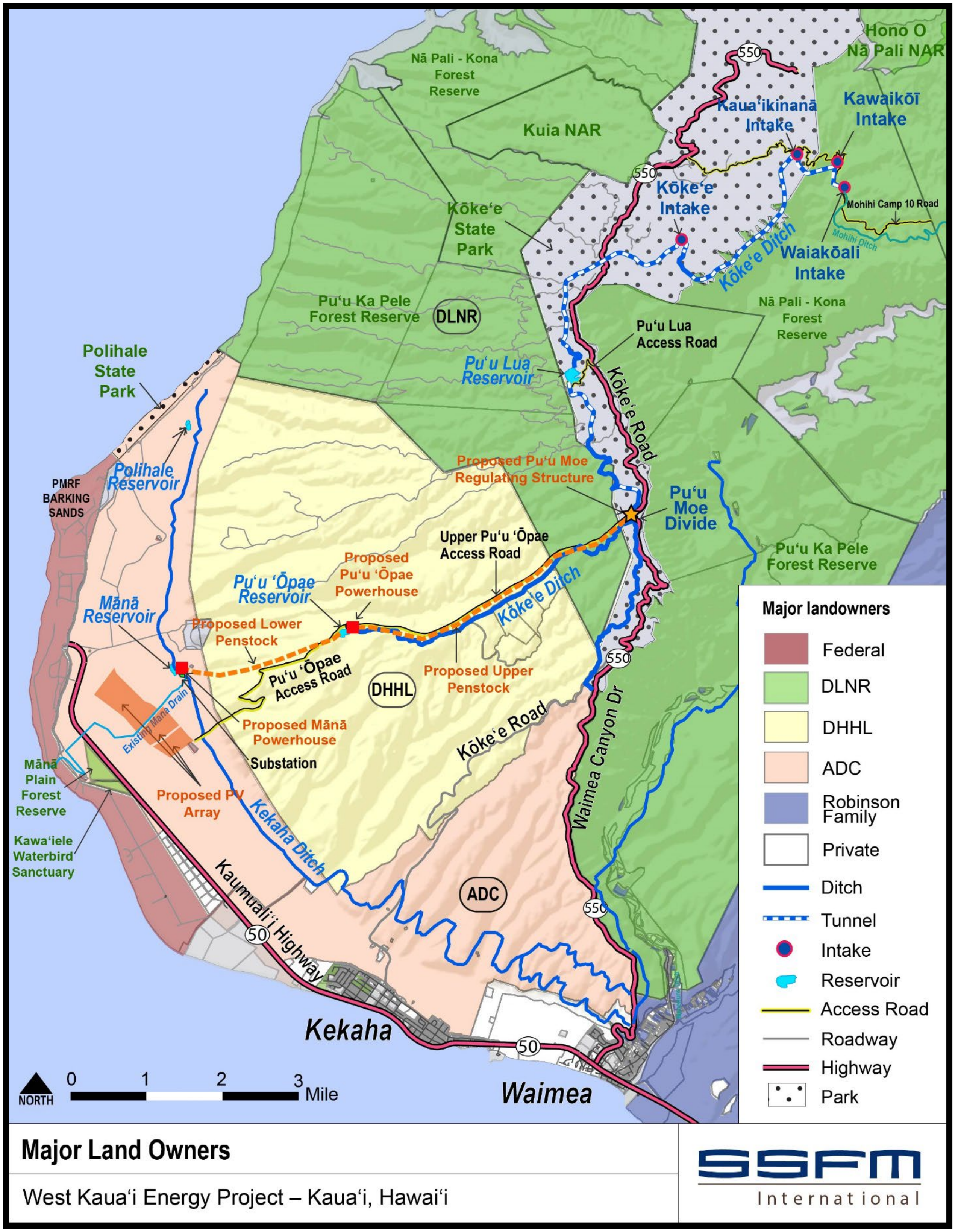
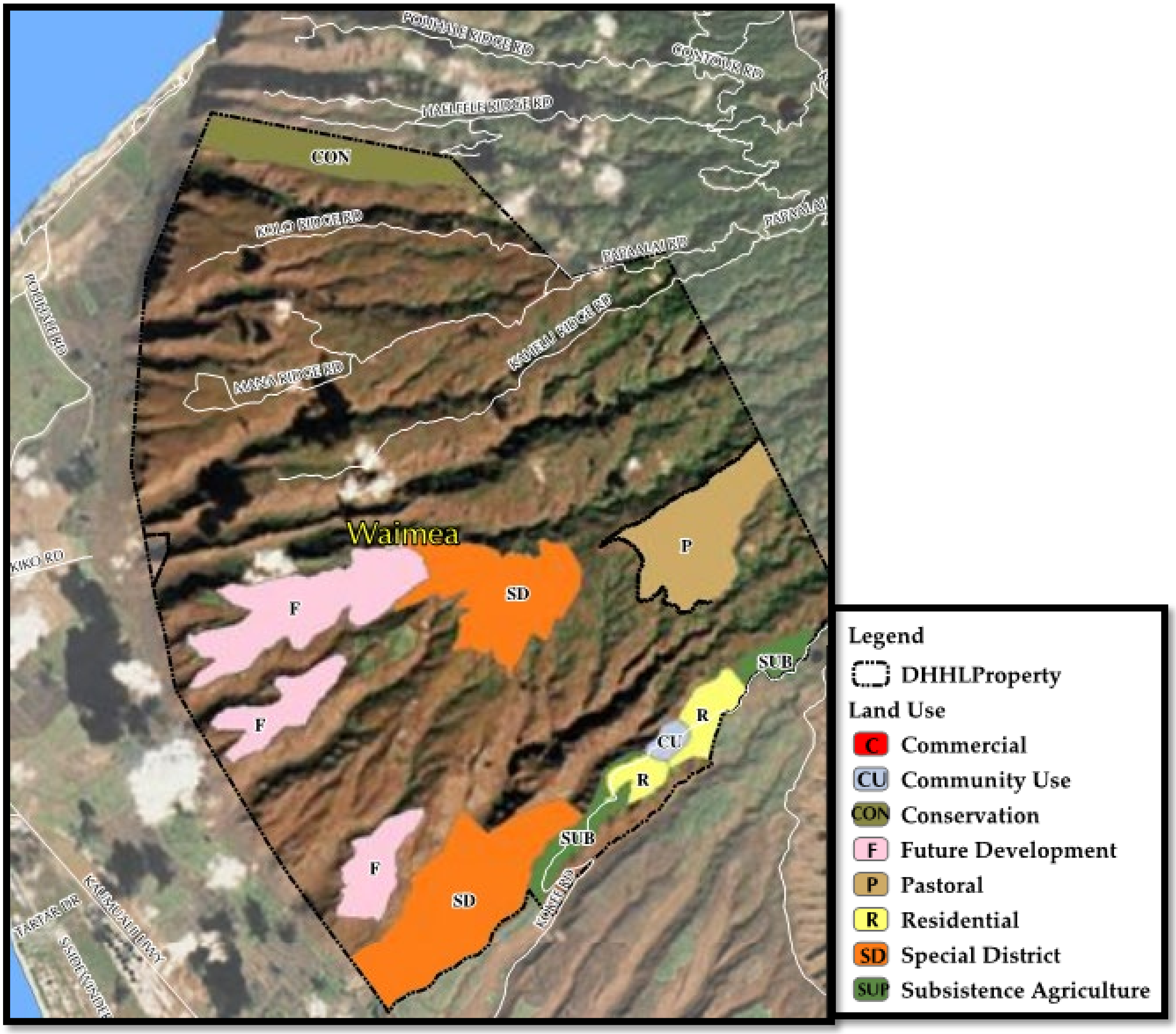


Figure 1.7. DHHL Proposed Land Uses



Source: DHHL West Kauaʻi Regional Plan, February 2011

1.1.6.2 Irrigation Infrastructure

Irrigation systems built during the Plantation Era, including the Kōkeʻe Ditch Irrigation System and Kekaha Ditch Irrigation System for water delivery and storage, as well as hydroelectric infrastructure including the Waimea Mauka and Waiawa hydropower plants, still occupy areas within and near the Project area. Less is known about the origins and construction of the Menehune Ditch, but it is thought to pre-date the arrival of Polynesians. Menehune Ditch is located along Menehune Road in Waimea valley and is still in operation today. Contemporary land use patterns makai (seaward) of the Project area, such as for agriculture and homesteading, rely upon a supply of diverted water for daily activities.

The Kōkeʻe and Kekaha Ditch Irrigation Systems provide water to KAA members and other farmers on Mānā Plain, kuleana and taro farmers using the Menehune Ditch, DHHL, DLNR for recreational fishing and public sanitation benefiting tourism, and Kaua`i County to operate the Kekaha landfill. Water from the ditch systems is also used for fighting wildfires. The water stored in Puʻu Lua Reservoir can be accessed by helicopters for fighting wildland fires at higher elevations. Puʻu ʻŌpae and Mānā Reservoirs can no longer be used for this purpose as they are not currently operational. At lower elevations, helicopters can access the water stored in the various irrigation reservoirs on the Kekaha Ditch Irrigation System as well as a rectangular-shaped dip pool located adjacent to the Kekaha Ditch Irrigation System (Spengler et.al., 2017).

Kōkeʻe Ditch Irrigation System

The Kōkeʻe Ditch Irrigation System is the only source of water on mauka lands. The Kōkeʻe Ditch Irrigation System was built by the Kekaha Sugar Plantation in the 1920s to provide an irrigation source for the production of sugar on the mauka (landward) lands above Waimea. At one time the system was fed by as many as 15 diversions that started with the Mōhihi Intake located at 3,497 feet msl on the Mōhihi Stream and was followed by main diversions on the Waiakōali, Kawaikōī, Kauaʻikinanā , and Kōkeʻe Streams. The diversions were designed and constructed to divert all water in the streams during low and median flow periods. The Mōhihi Diversion and Ditch are both now abandoned and the highest point on the system is the Waiakōali Stream Intake. All the streams diverted to the Kōkeʻe Ditch are tributaries to the Waimea River. There are two unlined earthen reservoirs on the Kōkeʻe Ditch Irrigation System: Puʻu Lua Reservoir and Puʻu ʻŌpae Reservoir. Puʻu Lua Reservoir is currently operating at reduced capacity, whereas Puʻu ʻŌpae Reservoir is currently drained.

There are three existing unlined earthen reservoirs associated with the Proposed Action: the Puʻu Lua Reservoir and Puʻu ʻŌpae Reservoir, which are part of the Kōkeʻe Ditch Irrigation System; and Mānā Reservoir, which is part of the Kekaha Ditch Irrigation System. The Puʻu Lua Reservoir, serves as water storage and a public game fishing site. A trout hatchery and fingerling holding pen are located in the reservoir and are managed by the DLNR (DOA, 2003).

At Puʻu Moe Divide the ditch flow is split, with a majority of the flow going to the Kitano Reservoir which serves the upland acreages above Waimea. A limited amount of flow goes to the Puʻu ʻŌpae Reservoir, which serves only a small area above Mānā Plain on mauka lands. The Puʻu ʻŌpae leg consists of a smaller ditch, with less flow than the Kitano leg (DOA, 2003).

Per DOA's *Agricultural Water Use and Development Plan 2003*, there has been a significant decrease in ditch flow in both the Kōkeʻe Ditch Irrigation System and the Kekaha Ditch Irrigation System since the Kekaha Plantation closed in the late 1990s. The decrease in flow may be due partly to a long running drought or reduced maintenance of the systems.

In 2009, management of the Kōkeʻe Ditch System and the Kekaha Ditch System was transferred to ADC.

Kekaha Ditch Irrigation System

Contemporary land use patterns makai (seaward) of the Project area, such as for agriculture and homesteading, rely upon a supply of diverted water for daily activities. The Kekaha Ditch

Irrigation System is the primary source of irrigation water on the Mānā Plain, which can be supplemented by a number of drilled wells in the area. There are a number of small unlined earthen reservoirs on the Kekaha Ditch Irrigation System, the largest of which is Mānā Reservoir that is currently drained.

The Kekaha Ditch Irrigation System consists of approximately 27 miles of ditches, tunnels, steel siphons, and wooden flumes, and two hydropower plants (DOA, 2003). From the intakes on Koaiʻe and Waiahulu Streams, water flows through tunnels on the west side of Waimea Canyon to a steel penstock. The penstock then crosses under Waimea River to the Waimea Mauka Hydropower Plant on the east bedrock bank. Water flow continues down the east side of Waimea Canyon through a series of tunnels, ditches, and wooden flumes until it crosses from the east to the west side of the canyon through a steel pipe inverted siphon, which is buried under a riverbed in a concrete jacket. The ditch continues down south along the western wall of Waimea Canyon until it gets near Waimea Town, where it turns westward. At Waiawa gulch, the ditch flow is dropped 280 feet in a steel penstock to the Waiawa Hydropower Plant.

The Waimea Mauka Hydropower Plant is capable of producing up to 1.0 megawatts of electricity, while the Waiawa Hydropower Plant is capable of producing 0.5 megawatts. The generation equipment at the Waiawa Hydropower Plant is in the process of being replaced with a downsized turbine capacity of 230 kilowatts and with a maximum flow capacity of 10.15 MGD. The hydropower plants provide relatively inexpensive electricity for farm operations. Power generated by these hydropower plants not used for farming operations is sold to KIUC through a Power Purchase Agreement.

In addition to Kekaha Ditch System, there are a number of wells that are active on Mānā Plain that were developed during the plantation era. Both PMRF and Polihale State Park use wells, and KAA uses wells as back up to the Kekaha Ditch Irrigation System.

1.1.6.3 Mānā Plain Drainage System

The Mānā Plain Drainage System is shown in **Figure 1.8**. The pumping station at Kawaiʻele presently discharges approximately 14.8 MGD of water from the drainage ditches into the Pacific Ocean through Kinikini Ditch (Gomez, 2021). This water is derived from the following: leaks in the unlined portion of Kekaha Ditch, upward seepage of groundwater, and water leaking from artesian wells and shafts in the basaltic aquifer (Gomez, 2021). Most of the energy required to pump water collected in the drainage ditches is generated by the Waiawa and Waimea Mauka hydroelectric power plants on Kekaha Ditch.

Figure 1.8. Mānā Plain Ditch System

Water levels in the drainage ditch system on the Mānā Plain rise after large rainstorms because the higher elevation backshore deposits that buffer the agricultural land from marine influences prevent water from groundwater seepage, localized rainfall, and stormwater runoff from mauka lands from draining directly into the ocean (Gomez, 2021). The pumping station at Kawaiʻele has a capacity of approximately 50 MGD (Gomez, 2021). Gravity flows are relied upon to deliver the majority of storm runoff to the ocean. Excess runoff that accumulates in low-lying areas of the Mānā Plain is removed by increasing the rate of pumping in the days or weeks following a storm (Gomez, 2021).

ADC has submitted an NPDES permit to Department of Health for operation of the storm drainage system and is currently implementing extensive water quality testing to identify the sources and levels of pollutants in the storm drainage system on Mānā Plain.

The storm drainage system is critical to the safety of the PMRF because it prevents flooding of the low-lying agricultural coastal plain surrounding the coastal facility (DOA, 2003).

1.1.6.4 Recreation

Kōkeʻe State Park and Waimea Canyon State Park draw many visitors and residents to Waimea Ahupuaʻa today. Campgrounds are located in the park near the Waiakōali and Kawaikōī Stream diversions, and people also visit the Kauaʻikinanā Stream and Kōkeʻe Stream diversions although they are less frequented. Hunting and fishing are both popular activities in Kōkeʻe and Waimea Canyon State Parks. Many people frequent the Puʻu Lua and Kōkeʻe areas during the summer season to collect plums.

Kōkeʻe Lodge is located in the heart of Kōkeʻe State Park. Kōkeʻe Lodge is a “cozy and historic place to eat and drink” (Kōkeʻe Lodge, 2022). There are five cabins at Kōkeʻe Lodge, which many local families use for vacation get-aways. Kōkeʻe Lodge has live music in the afternoon every day except Monday and Thursday as well as on occasional weekends. Kōkeʻe Lodge also hosts fine dining dinners throughout the year (Kōkeʻe Lodge, 2022).

There are several scenic lookouts in the area that are frequented by visitors to the area. These include the Poʻomau Canyon Lookout near the Waiakōali Intake, the Kumuwela and Cliff Trail View Points near the Kōkeʻe Intake, and Waimea Canyon Lookout near the Puʻu Moe Divide.

The Kekaha Game Management Area, which is located on DHHL land and is managed by DOFAW under an agreement between DHHL and DOFAW, is open for hunting feral pigs, feral goats, black-tailed deer, and game birds during specified periods throughout the year.

The Nā Pali-Kona Forest Reserve, Puʻu Ka Pele Forest Reserve, and Kuʻia Natural Area Reserve provide recreational opportunities. Public uses of the Nā Pali-Kona Forest Reserve include hunting; camping; fishing; hiking; horseback riding; dirt bike, all-terrain vehicle (ATV), and mountain bike riding; non-timber forest product collection (i.e., gathering of plants); and picnicking (DLNR, 2009a). Public uses of the Puʻu Ka Pele Forest Reserve include hunting; camping; bird watching; fishing; hiking; horseback riding; dirt bike, ATV, and mountain bike riding; gather of plants; and picnicking (DLNR, 2009b). The Kuʻia Natural Area Reserve is used for hiking and hunting (DOFAW, 2022).

Puʻu Lua Reservoir trout fishing is a well-known and very popular activity among Kauaʻi residents. Puʻu Lua Reservoir is stocked with rainbow trout by DLNR. The Kōkeʻe Public Fishing Area is typically open to the public during daylight hours from June to September. In 2021, the season opened on June 21 and ran through September 30. The daily bag limit was seven trout per fisher. Fishing is only allowed from the banks of the reservoir. Puʻu Lua Reservoir is currently operating at a capacity of 50 to 60 million gallons, which is well below its original capacity of 260 million gallons.

1.1.6.5 Conservation

Kawaiʻele Waterbird Sanctuary

The Kawaiʻele Waterbird Sanctuary encompasses approximately 37 acres within the Mānā Plains Forest Reserve. The Mānā Plain Wetland Restoration Project seeks to expand the sanctuary to include 105 acres immediately north of the site. The two sites are bordered by Kaumualiʻi Highway on the north-east and the Pacific Missile Range Facility Barking Sands (PMRF) on the north and north-west sides. Based on previous surveys of native birds conducted between 2005 to 2007, the Kawaiʻele Waterbird Sanctuary provides open water and wetland habitat for approximately 21 species of non-native, introduced birds and 27 species of native resident or migratory birds. Four species of endangered Hawaiian waterbirds, including the Hawaiian stilt (Himantopus mexicanus knudseni), Hawaiian moorhen (Gallinula galeata sandvicensis), Hawaiian coot (Fulica alai), and Hawaiian duck (Anas wyvilliana), are known to nest at the sanctuary. The sanctuary and the Mānā Plain Wetland Restoration Project are part of DOFAW's conservation and recovery efforts to provide habitat for the four species of endangered endemic Hawaiian waterbirds.

An expansion of the waterbird sanctuary to the north is currently underway. Water delivered through the storm drainage system to the waterbird sanctuary is one option for maintaining suitable habitat during dry conditions. A primary ditch branch of the storm drainage system runs directly adjacent to the area under expansion before it delivers water to Kawaiʻele pump station.

Protected seabird colonies in Hono O Nā Pali NAR and Honopu

The Hono O Nā Pali Natural Area Reserve (NAR) occupies 3,579 acres on the north side of Kauaʻi and is part of the Natural Area Reserves System administered by DOFAW. The Hono O Nā Pali NAR was designated in 1983 by Executive Order 3161 and was expanded in 2009 by Executive Order 4270 to preserve native natural communities in the Hanalei and Waimea Districts, which include the Hanakapiai, Hanakoa, and Waiahuakua ahupuaʻa. The reserve includes perennial streams, riparian and ridgeline habitat, lowland and montane forests, rare plants, endemic stream fauna, and forest bird and seabird habitat. This reserve is significant to forest birds and seabirds due to the habitat diversity, high proportion of native plant communities, which provide high quality bird habitat, and the remote location, which puts greater distance between known threats to birds including cats, feral ungulates, powerlines, and artificial lights.

Surveys of the upper plateau of the reserve have found breeding locations and activity for three rare species of seabirds; the federally threatened ʻaʻo or Newellʻs shearwater (Puffinus auricularis newelli), the federally endangered ʻuaʻu or Hawaiian petrel (Pterodroma sandwichensis) and the ʻākeʻakē or band-rumped storm-petrel (Oceanodroma castro), a candidate for listing. There are seven established and protected seabird colonies in Hono O Nā Pali NAR, that KIUC manages as part of their Habitat Conservation Plant. The coastal areas and cliffs of the reserve provide habitat for other seabird species including ʻiwa (Fregata minor), brown booby (Sula leucogaster), and both red and white-tailed tropicbirds (Phaethon rubricauda and P. lepturus, respectively).

West of the Hono O Nā Pali NAR is Honopū Valley, which has near vertical cliffs up to approximately 3,600-ft. in elevation that drop down to 400-ft, and a lower beach and coastal area only accessible by boat. Honopū Valley runs through the Na Pali Kona Forest Reserve and the Kōkeʻe State Park. In the upland areas of Honopū are native forest and shrub land that are bisected by four intermittent streams, which provide habitat for rare and endangered plant and bird species. Surveys of the Honopū area located burrows of the endangered Newell's shearwater, which represents the only known dry mesic forest colony of this species. There are two separate protected seabird colonies within the Honopū area.

1.1.6.6 Military Use

The Pacific Missile Range Facility Barking Sands (PMRF) is a Navy facility located on the Mānā Plain on the shoreline in between Kekaha and Polihale with additional facilities just north of the Mānā Reservoir approximately 2,000 feet west of the Project area at its closest point. On-base drinking water at the PMRF comes from the Mānā Well and the County's Waimea-Kekaha system.

PMRF was originally named Mānā Airport and was established by the Army in 1940 and was transferred to the Navy in 1957. During World War II and the Cold War years, the base was expanded and grew into a missile defense testing facility and established a meteorological mission by installing an antenna mast for NASA. PMRF is the world's largest instrumented multi-environmental range capable of supported surface, subsurface, air, and space operations simultaneously. There are over 1,100 square miles of instrumented underwater range and over 42,000 square miles of controlled airspace. PMRF is a premier facility for supporting operations that vary from small, single-unit exercises up to large-scale, multiple-unit battle group scenarios. PMRF is currently the third-largest employer on Kauaʻi with nearly 1,000 personnel, including defense personnel and civilian contractors. Defense spending has infused roughly $80-100M annually into Kauaʻi County (DBEDT, 2022).

1.2 Waimea Mediation Agreement

The Waimea Mediation Agreement between Pōʻai Wai Ola/West Kauaʻi Watershed Alliance, ADC, KAA, DHHL, and KIUC was approved by CWRM on April 18, 2017. The Waimea Mediation Agreement establishes the Interim Instream Flow Standards (IIFS) for the Proposed Action. The instream flow standards established in the Mediation Agreement are prescribed in two phases, which are discussed in more detail in **Section 1.2.2**. The Phase One IIFS became effective upon CWRM approval of the Waimea Mediation Agreement and is currently in effect. The Phase Two IIFS goes into effect if the Proposed Action goes into service. The Waimea Mediation Agreement is included as **Appendix A** in this Final EA.

1.2.1 Background

On July 24, 2013, Earthjustice on behalf of two Kauaʻi based community groups, Pōʻai Wai Ola and West Kauaʻi Watershed Alliance, submitted a petition to amend the instream flow standards for Waimea River and its headwaters and tributaries along with a complaint and petition for declaratory order against waste on the Kōkeʻe and Kekaha Ditch Irrigation Systems by ADC and KAA. The complaint alleged that waste of diverted water resulted from the diversion volumes on both ditch systems exceeding the water needs and uses since the closure of Kekaha Sugar Plantation.

In November of 2013, through a letter to Commission on Water Resource Management (CWRM) staff, KIUC requested to be a party to any proceedings resulting from the petition and complaint due to KIUC's development of a renewable energy Project utilizing the Kōkeʻe Ditch Irrigation System. DHHL also requested to be a party to any proceedings due to DHHL lands served by both the Kōkeʻe and Kekaha Ditch Irrigation Systems.

In response to the filing, CWRM delegated authority to the Chairperson to appoint an investigator, and a contract was executed with Element Environmental, LLC on May 27, 2014, to collect information that would assist the CWRM on the Earthjustice complaint. A summary of initial investigations was presented to the CWRM on February 18, 2015, by Steve Spengler from Element Environmental, LLC. On April 28, 2015, the CWRM held a limited meeting to view aspects of the Kōkeʻe and Kekaha Ditch Irrigation Systems. On April 29, 2015, the CWRM held a public meeting on Kauaʻi regarding the matter. On May 11, 2015, the CWRM requested additional information from ADC and KAA regarding water use from the Kōkeʻe and Kekaha Ditch Irrigation Systems. On October 20 and 21, 2015, the CWRM held a limited meeting for the purpose of visiting various sites on the Kōkeʻe and Kekaha Ditch Irrigation Systems including the Waimea Hydropower Plant. A report summarizing investigations by Element Environmental, LLC and titled *Investigation of Kōkeʻe and Kekaha Ditch Irrigation Systems*, was shared with the CWRM in October 2016 and is available on the CWRM website.[1] The report summarized the investigations and findings of the work conducted by Element Environmental, LLC.

On August 11, 2015, the CWRM discussed an approach to mediation on the matter of the petition and complaint filed by Earthjustice. The CWRM did not take action, but instead requested that the parties move forward in meaningful discussion and report back on its progress. On September 14, 2015, and October 6, 2015, CWRM staff met with Earthjustice, ADC, KAA, DHHL, and KIUC to begin discussions on mediation and identify specific issues to be addressed. On September 24, 2015, the CWRM requested additional information from DHHL on all current water users on DHHL lands receiving water from the Kōkeʻe Ditch Irrigation System and a list of future water use demand Projects. On September 30, 2015, the CWRM requested additional information from ADC and KAA regarding estimates of water use of licensees and the amount of electricity produced by the Waimea and Waiawa hydropower plants with a further breakdown of electricity used by KAA and sold to KIUC through a Power Purchase Agreement (PPA). On November 6 and December 4, 2015, CWRM staff hosted a working group meeting of hydrologists representing Earthjustice, KAA, and KIUC to seek agreement on the estimation of natural streamflow rates and the availability of water upstream of existing diversions. This information was intended to serve as a starting point for further discussions as part of mediation.

[1] https://files.hawaii.gov/dlnr/cwrm/activity/2060/20161001_KokeeKekahaReport.pdf

On November 26, 2015, the CWRM received additional information from DHHL, and subsequently on November 27, 2015, the CWRM received from DHHL a Petition for Reservation of Surface Water of 33.145 MGD originating from the Waimea River watershed and diverted by the Kōkeʻe and Kekaha Ditch Irrigation Systems for use on Hawaiian Home Lands.

On December 16, 2015, CWRM staff reported to the CWRM that mediation is a viable option to address both the petition to amend Interim Instream Flow Standards (IIFS) and to address the waste complaint, and that all parties had voiced a willingness to participate in mediation. At this same meeting, the CWRM delegated authority to the Chairperson to hire a mediator, authorized the Chairperson to enter into a mediation services contract to conduct mediation, and determined that the proposed mediation work is exempt from preparing an EA.

After the December 16, 2015, CWRM meeting, CWRM staff corresponded with Robert Alm regarding his serving as the mediator. Mr. Alm had preliminary discussions with all the participants in the process and drafted a Terms of Reference document for CWRM review. On February 16, 2016, the CWRM approved the Terms of Reference as proposed. The Terms of Reference are summarized below:

1. The mediator will secure the agreement of the CWRM to undertake the mediation process and the scope and framework for that process.
2. The mediator will seek input from other interested entities to determine their concerns and needs and how they might be addressed.
3. The mediator will meet with parties in group or individual sessions as appropriate to share information including scientific and technical studies, to clarify misunderstandings, to determine real interest of the parties, and align interests as much as possible while at all times comporting with the State Water Code.
4. The issues to be covered based on the original complaint:
    a. Waste
    b. IIFS
    c. Metering

    Additional issues that may be included in mediation:

    a. Agricultural uses, including DHHL pastoral leases
    b. Hydropower uses
    c. Recreational uses, including game management
    d. Environmental issues
    e. Flood control
    f. Water system preservation and maintenance
    g. Hawaiian Home Lands Homestead leases

5. The mediation will be under an initial six-month time limit, subject to extension by the CWRM if progress is being made. The mediator may discontinue and notify the CWRM if at any time he finds parties are no longer acting in good faith.
6. The discussions and negotiations will be kept confidential by the parties and the mediator.
7. Any proposed settlement will be submitted by the mediator to the CWRM for approval. The CWRM may accept or reject the proposed settlement in its entirety only. If rejected, the settlement and terms will remain confidential.

Mediation of the parties resulted in the Waimea Mediation Agreement (see **Appendix A**), which was unanimously approved by the CWRM on April 18, 2017. In general, the Agreement contains seven sections as listed below with a brief summary of what is contained in each section.

A. Statement of Guiding Principles. A summary of the guiding principles underlying the Agreement it is executing

B. Modification of Diversions. Diversion modification commitments by KIUC and ADC and associated timelines for those commitments

C. Permits and Approvals. A general recognition that KIUC's renewable energy Project would require compliance with HRS Chapter 343 as well as several permits and approvals, and a summary of the various access and land use agreements needed with DHHL and ADC for the renewable energy Project

D. IIFS Numbers. Establishment of Phase One and Phase Two IIFS numbers, which are discussed in more detail in **Section 1.2.2**

E. Monitoring Stations. Monitoring station related commitments by KIUC and ADC

F. Operating Protocols. A summary of general protocols for operation of the Kōkeʻe and Kekaha Ditch Irrigation Systems under the Agreement including provisions for the following:

- Streamflow maintains the highest priority, and water not needed for agricultural, or energy Projects would remain in the stream
- Irrigation needs on both ditch systems for ADC, KAA, kalo farmers on Menehune Ditch, and DHHL
- 11 MGD rolling average for KIUC's renewable energy Project and DHHL's water reservation
- Minimum flows needed to maintain structural integrity of ditches
- Waiawa Hydropower Plant
- If Phase Two IIFS goes into operation, the CWRM will reexamine the amounts diverted to take into account energy and agricultural needs served by the KIUC Project

G. Infrastructure Agreements. Summary of Phase One as current operations, and Phase Two infrastructure responsibilities of KIUC through the implementation of the renewable energy Project and ADC infrastructure responsibilities after implementation of the energy Project

Since CWRM approval of the Agreement, the parties meet regularly with CWRM staff to provide updates and discuss issues and concerns. In addition, CWRM staff and the parties provided updates to the CWRM during the CWRM's public meeting held in November 2020.

1.2.2 Establishment of Instream Flow Standards

Under HRS Chapter 174C, State Water Code, the Commission on Water Resource Management (CWRM) has the responsibility of establishing an IFS on every stream whenever necessary to protect the public interest in waters of the State. Per HRS §174C-71(1)(C), "flows shall be expressed in terms of variable flows of water necessary to protect adequately fishery, wildlife, recreational, aesthetic, scenic, or other beneficial instream uses in the stream in light of existing and potential water developments including the economic impact of restriction of such use." As defined in HRS Chapter 174C, an "instream use" is the "beneficial uses of stream water for significant purposes which are located in the stream, and which are achieved by leaving the water in the stream. Instream uses include, but are not limited to: (1) Maintenance of fish and wildlife habitats; (2) Outdoor recreational activities; (3) Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation; (4) Aesthetic values such as waterfalls and scenic waterways; (5) Navigation; (6) Instream hydropower generation; (7) Maintenance of water quality; (8) The conveyance of irrigation and domestic water supplies to downstream points of diversion; and (9) The protection of traditional and customary Hawaiian rights." Due to the complexity of establishing an IFS for the estimated 376 perennial streams around the State, CWRM set an interim IFS (IIFS) at status quo levels. The IIFS were defined as the amount of water flowing in each stream (with consideration for the natural variability in stream flow and conditions) at the time the administrative rules governing them were adopted in 1988 and 1989. Since that time and guided by the Hawaiʻi Supreme Court, CWRM has taken steps to assess stream flow characteristics and develop quantitative IIFS for streams around the State through a robust and established process that includes steps such as inventorying the best available information, agency review and comments, public fact gathering, evaluation of new information, and preparation of an Instream Flow Standard Assessment Report (IFSAR).

The IFSAR is a compilation of the hydrology, instream uses, and non-instream uses related to a specific stream, in this case the Waimea River and its tributaries. As defined in HRS Chapter 174C, a "noninstream use" is "the use of stream water that is diverted or removed from its stream channel and includes the use of stream water outside of the channel for domestic, agricultural, and industrial purposes." Independent to the Waimea Mediation process, CWRM staff conducted an instream flow assessment, and in August 2016 produced the *Instream Flow Standard Assessment Report for the Island of Kauai Hydrologic Unit 2060, Waimea* (Waimea IFSAR), a copy of which is in **Appendix B**. The Waimea IFSAR has 13 main sections including a general introduction to CWRM's mandate and the process for setting IFS, description of unit characteristics, hydrology, maintenance of fish and wildlife habitat, outdoor recreational activities, maintenance of ecosystems, aesthetic values, navigation, instream hydropower generation, maintenance of water quality, conveyance of irrigation and domestic water supply, protection of Traditional and Customary Hawaiian Rights, and non-instream uses.

Through the Waimea Mediation Agreement, the CWRM approved and adopted new instream flow standards for diversions on the Kōkeʻe and Kekaha Ditch Irrigation Systems and the Waimea River downstream of both ditch systems. These instream flow standards are prescribed in two phases. The Phase One IIFS became effective upon CWRM approval of the Agreement and is currently in effect. The Phase Two IIFS goes into effect if and when the Proposed Action goes into service.

1.2.2.1 Phase One IIFS

Implementation of the Phase One IIFS diversion modifications and monitoring is being carried out in stages by both ADC and KIUC and is not part of the Proposed Action. The first and immediate actions involved the removal of boards and adjustment of gates on both ditch systems to allow for the maximum possible restoration of streamflow while simultaneously working on plans and permitting for structural modifications on both ditch systems. This stage has been completed and has resulted in some streamflow restoration at all diversions on both ditch systems. However, accurate and reliable implementation of the Phase One IIFS during low and moderate flows requires structural modifications to diversions on both ditch systems due to the style and design of the diversions and ditch inlets. The Phase One IIFS Rules for the Kōkeʻe Ditch Irrigation System and Kekaha Ditch Irrigation System are shown in **Table 1-1** and **Table 1-2**, respectively.

Table 1-1. Phase One IIFS Rules for the Kōkeʻe Ditch Irrigation System

Stream	IIFS
Kōkeʻe	Natural flow
Kauaʻikinanā	0.7 MGD
Kawaikōī	4.9 MGD
Waiakōali	1.4 MGD

Table 1-2. Phase One IIFS Rules for the Kekaha Ditch Irrigation System

Stream	IIFS
Koaiʻe	2 MGD
Waimea below Waiahulu Diversion	8 MGD
Waimea River at USGS 16031000	25 MGD with a minimum flow of 6 MGD at Hukipo Flume

KIUC received approval from CWRM and other parties to the Waimea Mediation Agreement for the Kōkeʻe Diversion Modification Project, a separate and independent Project from the Proposed Action, which involves Phase One IIFS modifications on the Kōkeʻe Ditch Irrigation System and associated installation of flow monitoring equipment. These Phase One IIFS modifications require permits and land use agreements prior to implementation.

A timeline of KIUC's efforts and progress with regard to the implementation of diversion modifications and installation of flow monitoring equipment is provided below:

- **September 2017.** KIUC submitted proposed plans for implementation of the Phase One IIFS for the Kōkeʻe Diversion modifications to CWRM staff and all the parties involved in the mediation process, including Earthjustice on behalf of Pōʻai Wai Ola and West Kauaʻi Watershed Alliance. These diversion modifications are necessary for implementation of the monitoring.
- **October 2017**. KIUC submitted proposed plans for installation of flow monitoring equipment to CWRM staff and all the parties involved in the mediation process, including Earthjustice on behalf of Pōʻai Wai Ola and West Kauaʻi Watershed Alliance. These plans were reviewed and discussed at meetings with CWRM staff and the mediation parties, all of whom provided specific feedback to improve the proposed plans.
- **April 2018**. Based on comments received, KIUC submitted revised plans for both diversion modifications and installation of flow monitoring equipment to CWRM staff and the mediation parties for review that incorporated the comments received on the initial proposed plans.
- **May 2018.** KIUC received approval to proceed with these revised plans from CWRM and the other mediation parties, including Earthjustice on behalf of Pōʻai Wai Ola and West Kauaʻi Watershed Alliance.
- **June 2018.** KIUC initiated consultation with various regulatory agencies identified as potentially having jurisdiction over some aspect of the Project. KIUC also requested certain information from land and infrastructure owners to inform permit applications necessary for the Project.
    - During consultation with regulatory agencies, KIUC submitted a permit determination request to DLNR's Office of Conservation and Coastal Lands (OCCL) and CWRM to determine if an EA or an EIS would be required, and which permits would be required from each agency for the proposed scope of work.
- **July 2018**. Permit determinations were received from CWRM. This was followed by a revised permit determination in September 2019.
- **February 2019.** A permit determination was received from OCCL, including a finding that the proposed modifications and monitoring installations were actions exempt from HRS Chapter 343.
- **April 2019.** A permit determination was received from the USACE.
- **April 2019.** A Site Plan Approval Application was submitted to OCCL.
- **May 2019.** HRS Chapter 6E request was submitted to the State Historic Preservation Division (SHPD).
- **May 2019.** Nationwide Permit 46 application was submitted to USACE.
    - Section 7 consultation conducted with United States Fish and Wildlife Service (USFWS)
    - Section 106 consultation conducted with SHPD

- **May 2019.** Clean Water Act Section 401 permit application was submitted to the State of Hawaiʻi Department of Health (DOH), Clean Water Branch (CWB). Permit application was deemed complete by DOH-CWB in December 2020 since it required issuance of Nationwide Permit 46 prior to submission.
- **June 2019.** Stream Channel Alteration Permit application was submitted to CWRM (based on first permit determination).
- **January 2020.** Stream Channel Alteration Permit and Stream Diversion Works Permit applications were submitted to CWRM (based on second permit determination).

The following permits have been received:

- Nationwide Permit 46 received April 2020
- Stream Channel Alteration Permit and Stream Diversion Works Permit received September 2020, including a finding that the permitted actions were exempt from HRS Chapter 343
- Clean Water Act Section 401 permit received February 2021
- Site Plan Approval from OCCL (dependent on completion of HRS 6E) received in March 2022
- HRS Chapter 6E Determination from SHPD received in March 2022

As of the date of publication of this Final EA, the following items necessary to implement the Phase One work are outstanding:

- Easements for DLNR land use

The modifications necessary to implement the Phase One IIFS for the four diversions on the Kōkeʻe Ditch Irrigation System will be completed by KIUC after all permits, approvals, and necessary land easements are received for the work. These modifications are a separate and independent Project from the Proposed Action.

Once all permits, approvals and necessary land easements are received for the Kōkeʻe Diversion Modification Project, KIUC will commence with the Phase One modifications irrespective of the status of the Proposed Action. Prior to completion of the Kōkeʻe Diversion Modification Project, the diversions on the Kōkeʻe Ditch Irrigation System will continue to divert all or most stream flow during low and average flow conditions due to the constraints of the original structural design at each diversion. Some portion of that diverted water is returned to the stream of origin a short distance downstream at sluice gates.

1.2.2.2 Phase Two IIFS

The Phase Two IIFS that would be effective during operation of the Proposed Action are provided in **Table 1-3.** The Phase Two IIFS is comprised of two different flows at each stream: one for low-flow periods and one for moderate and higher flow periods. The "Established Value" in the second column of was determined during the Waimea Mediation process through group discussion and consensus lead by CWRM's hydrologist Ayron Strauch. The Established Value is roughly equal to a Q70 value on the flow duration curve for each stream, which is the flow that is met or exceeded 70% of the time. The low-flow period Phase Two IIFS values were set as a variable flow equal to two-thirds of the natural streamflow, which gives the stream and aquatic habitat more than half the water during the high stress dry periods when stream flows are below the Established Value, but still allows one-third of the water to be diverted so that the energy and agriculture operations are not shut down during those dry periods. The higher flow portion of the Phase Two IIFS values are shown in the right column and represent set values determined through group consensus of the parties to the Waimea Mediation process. These set volumes would be maintained in the stream at all times when streamflows are above the Established Value. For example, if the natural streamflow in Kawaikōī Stream was 8.0 MGD (above the Established Value), the Phase Two IIFS would be 4.0 MGD (the set value) and the diverted volume would be 4.0 MGD. If the natural streamflow in Kawaikōī Stream was 3.0 MGD (below the Established Value), the Phase Two IIFS would be 2.0 MGD and the diverted volume would be 1.0 MGD.

Table 1-3. Phase Two IIFS Rules for the Proposed Action

Stream	Established Value (MGD)	IIFS	IIFS if stream flow is below or equal to established value	IIFS if streamflow is above the established value (MGD)
Kōkeʻe	0.2	Natural flow up to 1.2 MGD	n/a	n/a
Kauaʻikinanā	1.2		2/3 of stream flow	0.6
Kawaikōī	6.4		2/3 of stream flow	4.0
Waiakōali	1.3		2/3 of stream flow	0.8

Additional details of the Phase Two IIFS are contained in the Waimea Mediation Agreement, which is included for reference as **Appendix A**.

Modifications on the Kōkeʻe Ditch Irrigation System necessary for implementation of the Phase Two IIFS are part of the Proposed Action and discussed in more specific detail in **Section 4.1.2**. Phase Two IIFS for the Kōkeʻe Ditch Irrigation System would be implemented and maintained at each of the four diversions at all times during operation of the Proposed Action prior to diversion of water into the Kōkeʻe Ditch Irrigation System for irrigation and hydroelectric generation. As outlined in the Waimea Mediation Agreement, all flows above the Phase Two IIFS flow values may be used by the Proposed Action, but diversion volumes are also limited by the ditch capacity.

The Waimea Mediation Agreement also contains a provision that if Phase Two IIFS goes into effect, the CWRM will examine the amounts being diverted at the Koaiʻe and Waiahulu diversions on the Kekaha Ditch Irrigation System with the goal of increasing the total IIFS numbers for these two streams. This provision is at the discretion and under the purview of CWRM and is not part of the Proposed Action or evaluated in this Final EA. The current Phase Two IIFS rules for the Kekaha Ditch Irrigation System are shown in **Table 1-4**.

Table 1-4. Phase Two IIFS Rules for the Kekaha Ditch Irrigation System

Stream	IIFS
Koaiʻe	2 MGD
Waimea below Waiahulu Diversion	8 MGD
Waimea River at USGS 16031000	25 MGD with a minimum flow of 6 MGD at Hukipo Flume

1.3 Department of Hawaiian Home Lands Water Reservation

As noted in **Section 1.2.2**, the Waimea Mediation Agreement (see **Appendix A**) provides for DHHL's water reservation of 6.903 MGD from the Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe Streams for use on Hawaiian Home Lands (Section A.4. of the Waimea Mediation Agreement), and notes that this water reservation will be delivered by the "energy Project" (i.e., the proposed Project) (Section A.6. and F.6. of the Waimea Mediation Agreement).

As part of CWRM staff's efforts in September 2015 to explore potentially mediating some issues raised by the petition and complaint filed by Earthjustice (**Section 1.2.2.1**) on September 24, 2015, CWRM staff requested from DHHL information on its existing uses as well as its future water use projections and information to substantiate each DHHL water demand. In response to this request, DHHL filed with CWRM a petition for a surface water reservation in the Waimea River watershed of 33.145 MGD on November 17, 2015. Subsequently, DHHL participated in mediation discussions and was a party to the CWRM-approved Waimea Mediation Agreement.

In a Memorandum dated April 25, 2017, DHHL submitted to CWRM a Modified Reservation Petition for 6.903 MGD from the four streams diverted into the Kōkeʻe Ditch System (see **Appendix C**). This Modified Reservation Petition was consistent with Section A.4. of the Waimea Mediation Agreement, Statement of Guiding Principles, and reserves water for DHHL current and near-term needs. In the Memorandum, DHHL maintained the right to file additional water reservations for the Waimea River watershed at future dates, and all parties to the Waimea Mediation Agreement acknowledged DHHL's rights to water as set for in the Hawaiian Homes Commission Act; the Hawaiʻi Constitution; and HRS Chapter 174C, the State Water Code. At a meeting on June 20, 2017, CWRM staff submitted a request to CWRM to approve DHHL's request to reserve 6.903 MGD from the Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe Streams for use on Hawaiian Home Lands. The request was unanimously approved by CWRM.

The DHHL Memorandum notes the following: "Other parts of the Mediation Agreement collectively offer the Department an unprecedented opportunity to secure a partnership with the KIUC that if realized, will provide a reliable means to transmit water to its lands and will shift costs of rehabilitating, maintaining, and improving key infrastructure from the Department to KIUC" (Section I). The partnership would be through the implementation of the Project.

DHHL owns and manages a little over 15,000 acres in Waimea, Kauaʻi and developed a water plan for these lands that estimated near-term development needs for homesteading and related beneficiary uses. These lands, which are part of the original lands set aside by Congress in 1921 for this trust in the Hawaiian Homes Commission Act, comprise 73% of DHHL's holdings on Kauaʻi. Water for development of these lands is almost entirely dependent on the Kōkeʻe Ditch Irrigation

System with a small percentage of water being provided for by the Kekaha Ditch Irrigation System. DHHL plans that considered and support the water reservation include the *Department of Hawaiian Home Lands General Plan* (2002), *Water Policy Plan* (2013), *Hoʻomaluʻō Energy Policy* (2009), *Kauaʻi Island Plan* (2004), *West Kauaʻi Regional Plan* (2011), and the Draft Beneficiary Plan (2014). Following land analysis and community engagement, the Hawaiian Homes Commission assigned the Waimea lands land use designations in the *Kauaʻi Island Plan* as shown in **Table 1-5**.

Table 1-5. Kauaʻi Island Plan Waimea Land Use Designations

Specific Land Use	Description	Units	Water Demand (MGD)
Mauka Village	Residential	141 dwelling units	**0.07**
	Agriculture (Ag subsistence lots)	150 acres	**0.51**
		50 dwelling units	**0.025**
	Community Use	42 acres	**0.168**
Puʻu ʻŌpae Mauka	Agriculture	508 acres	**1.72**
	Kalo Cultivation	15 acres total, max 10 acres in cultivation at any given time	**1.5**
Puʻu ʻŌpae Makai	Agriculture	709 acres	**2.41**
Puʻu ʻŌpae Pastoral	Pastoral	475 acres	**0.5**
		Total	**6.903**

Table 1-5 provides a summary of the water demand estimated by DHHL, which is extracted from the DHHL Memorandum (Section III.B.). It is noted in DHHL's April 25, 2017, Memorandum to CWRM that the "Department's fundamental water needs for homesteading and beneficiary agricultural uses are based on conservative, reasonable and fact-based estimates." Further details regarding the basis for the determination of DHHL water needs and specifics on each Land Use is provided in the April 25, 2017, DHHL Memorandum (**Appendix C**).

Within the Puʻu ʻŌpae Mauka acreage, on April 17, 2017, the Hawaiian Homes Commission issued a license to the Kekaha Hawaiian Homestead Association (KHHA) for 231 acres at Puʻu ʻŌpae for the purposes of KHHA's Puʻu ʻŌpae Farm and Irrigation Project. Of the five existing pastoral lots totaling 475 acres, three of those lots are in use by the Manini family who maintains a herd of cattle.

The DHHL Memorandum also notes the Waimea Mediation Agreement "describes potential partnership(s) with non-consumptive water uses that are compatible with agricultural homesteading (i.e., hydroelectric generating facilities, including pumped storage and/or solar renewable energy projects) that will assist with financing the infrastructure (e.g., access, roads, water systems) and operations required to implement the Department's planned agricultural uses as envisioned..." (Section IV). More information on how the Project supports DHHL's water reservation, specifically through the provision of water infrastructure and delivery, can be found in **Section 4.1.2**.

1.4 Relationship of Project to the Puʻu ʻŌpae Kuleana Homestead Settlement Plan

The Hawaiian Home Lands Program was started with the passage of the Hawaiian Homes Commission Act, 1920, as amended (HHCA), due to the efforts of Prince Jonah Kūhiō Kalanianaʻole. Passed by Congress and signed into law by President Warren Harding on July 9, 1921 (chapter 42, 42 Stat. 108), the HHCA provides for the rehabilitation of the native Hawaiian people through a government-sponsored homesteading program. Native Hawaiians are defined as individuals having at least 50 percent (%) Hawaiian blood.

The main method by which DHHL serves beneficiaries is through the 99-year homestead lease. The leases are provided for Residential, Pastoral, and Agricultural uses for an annual fee of one dollar. According to the 2004 *Kauaʻi Island Plan*, DHHL owns 14,959 acres in Waimea and has awarded five Pastoral Homestead lots. This Puʻu ʻŌpae Kuleana Homestead Settlement Plan focuses on the development of a Kuleana Homestead on the mauka Waimea lands. DHHL intends to provide Kuleana Subsistence Agriculture and Pastoral homestead lots on 230 acres of land in the vicinity of Puʻu ʻŌpae.

This Project is significantly related to the Puʻu ʻŌpae Kuleana Homestead Settlement Plan, a Final EA for which was published in July 2020. The Puʻu ʻŌpae Kuleana Homestead Settlement Project is intended to carry out the mission of the DHHL to effectively manage the Hawaiian Home Lands Trust and to develop lands for native Hawaiians. The planned Kuleana Homesteads Settlement will keep the former sugar plantation lands in agricultural cultivation and provide opportunities for beneficiaries to return to their agricultural roots and stewardship desires. It will also include Community Use Areas to promote community cohesion and provide opportunities to expand economic agricultural opportunities. The steep ridge and natural drainageway areas are identified as having the best potential for native plant restoration and have been designated as Special District Areas that will remain undeveloped.

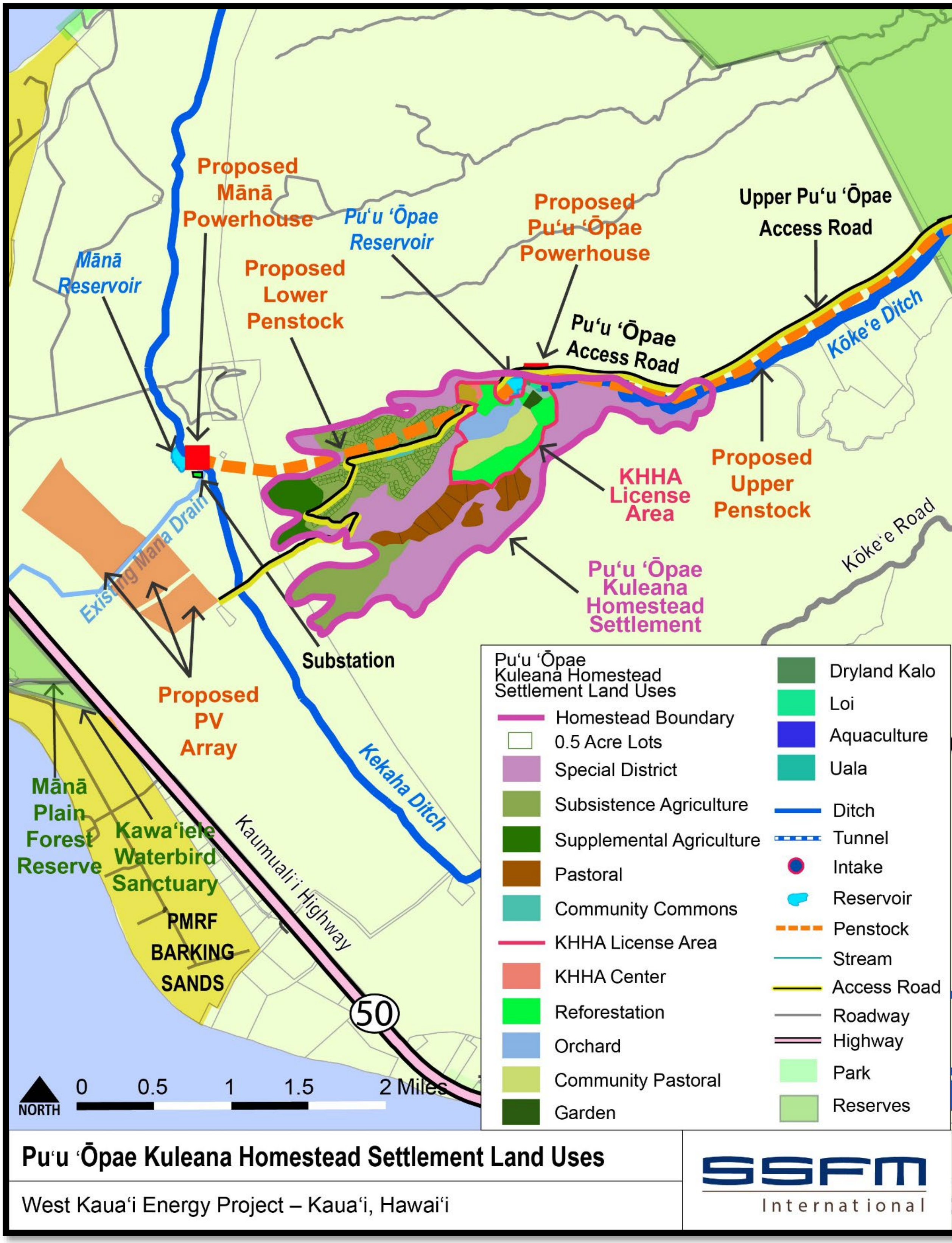
The ability to successfully implement the Puʻu ʻŌpae Kuleana Homestead Settlement Plan is heavily dependent on and intertwined with the successful implementation of the West Kauaʻi Energy Project. The provision of water delivery to these lands, the availability of electrical power, and the improvement of roads and other infrastructure will allow for the Puʻu ʻŌpae Kuleana Homestead Settlement Plan to move forward and will affect the timing by which Homestead users will be able to fully use the water reservation made for this Project by the CWRM.

Stated in the alternative, as is discussed more in the No-Action Alternative section (**Section 4.2**), if the West Kauaʻi Energy Project is not implemented, it will be unlikely that other financial resources will be provided to DHHL to allow for a timely implementation of the Puʻu ʻŌpae Kuleana Homestead Settlement Plan.

The location of the Puʻu ʻŌpae Kuleana Homestead Settlement is shown in **Figure 1.9**. The site plan for the Puʻu ʻŌpae Kuleana Homestead Settlement is shown in **Figure 1.10**.

Figure 1.9. Puʻu ʻŌpae Kuleana Homestead Settlement Location

Figure 1.10. Puʻu ʻŌpae Kuleana Homestead Settlement Site Plan



2 Project Description

2.1 Overview of Proposed Project and Technology

The West Kauaʻi Energy Project demonstrates the effectiveness of pairing a hydropower facility with solar PV and battery energy storage to improve grid performance with long-duration storage capability, stabilize and lower energy rates, reduce greenhouse gas emissions, rehabilitate state-owned infrastructure, and deliver irrigation to adjacent lands. It will be the first Project of its kind in the world and is a critical component of Kauaʻi's renewable energy future.

In 2009, 91% of Kauaʻi's power was generated by fossil fuel with 9% coming from hydropower, a renewable energy source. By 2021, fossil fuel energy generation was reduced to 31% and renewable energy sources, including solar, biomass, and hydropower, made up 69% of energy generation, which is a significant shift towards less reliance on fossil fuels. By 2025, KIUC is planning to reduce the reliance on fossil fuels by more expansion of renewable energy sources. The West Kauaʻi Energy Project is anticipated to account for up to 25% of Kauaʻi's power and increase renewable energy production above 80% for the island. It is also a legacy Project that is expected to serve Kauaʻi's energy needs for 100 years or more.

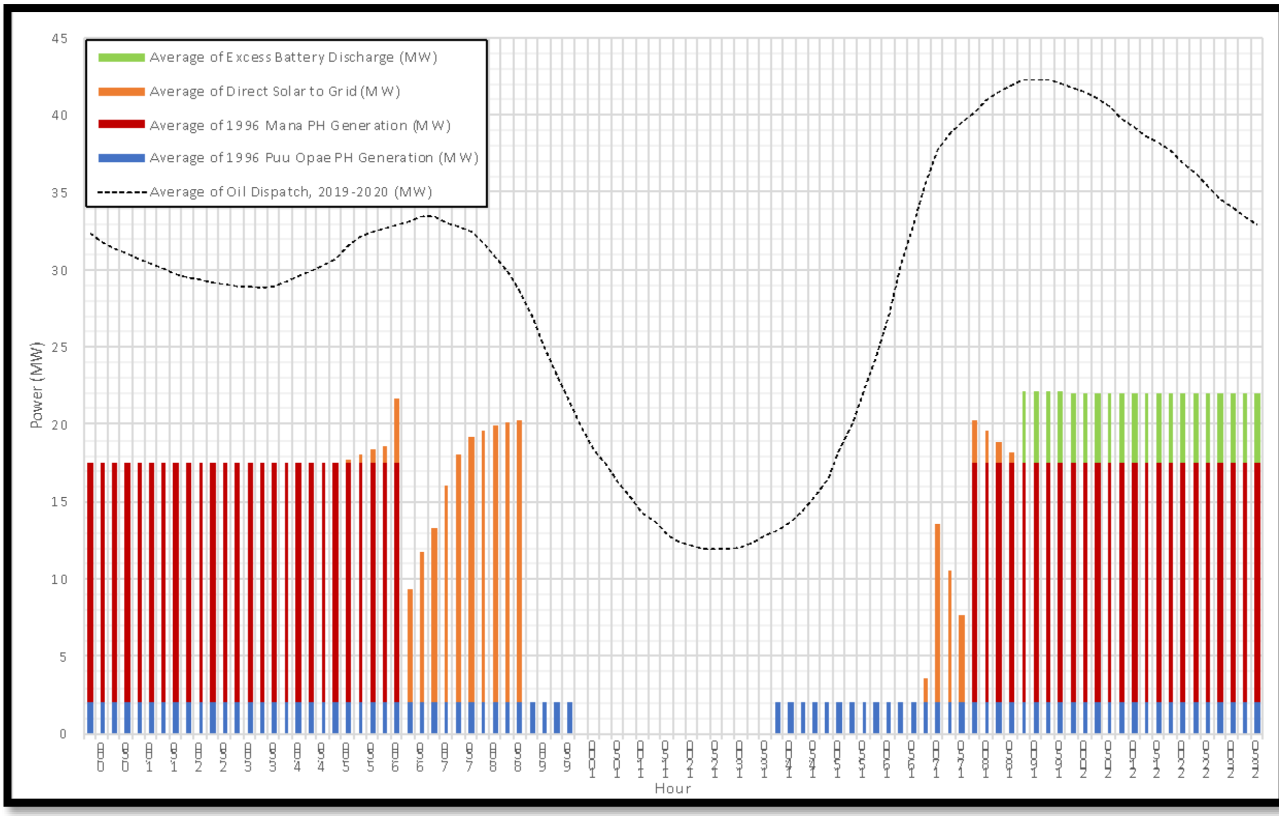
The proposed Project would have the following nameplate capacity:

- Solar PV: 35 MW
- BESS: 35 MW/70 MWh
- Mānā Pumpstation: 35 MW
- Mānā Powerhouse: 20 MW
- Puʻu ʻŌpae Powerhouse: 4 MW

The proposed Project is expected to have a lifespan of 50 to 80 years. However, different components of the Project are expected to have varying life spans. The hydroelectric components generally have a life span of between 50 to 80 years or more. The solar array is expected to have a life span of approximately 30 years.

In order to illustrate how the generation portions of the entire Proposed Action would operate, **Figure 2.1** shows the current oil-fired generation dispatch in comparison with the one-day forecast of typical daily operation of the Proposed Action. The black trace shows Average Oil Dispatch and the colored columns beneath show the output of each component of the Proposed Action and how they each offset oil generation during an average day of the modeling that used 1996 stream flow data.

Figure 2.1. Typical Daily Energy Production of the Proposed Action



In 2005, KIUC began investigations of hydroelectric potential on Kaua‘i. Starting in 2010, KIUC conducted feasibility studies on multiple hydroelectric resource sites including several that could employ pumped storage. Six viable sites were identified. In 2015, the West Kaua‘i Energy Project, using the Kōke‘e Ditch System, was selected as the most beneficial renewable energy project available to KIUC; the other five sites were determined not to be viable hydroelectric resources. From 2015 through 2017 KIUC initiated preliminary engineering and environmental surveys for the Project. In April 2017, the Mediation Agreement for the Waimea Watershed Area was approved by CWRM (see **Section 1.2**), which included the proposed Project and provided water for the proposed Project. In June 2017, DHHL, with KIUC, conducted two beneficiary consultation meetings on the proposed Project. In August 2017, the Hawaiian Homes Commission held a public hearing on Kaua‘i to review and accept the beneficiary report for the Project. In May 2018, KIUC and DHHL executed a right-of-entry (ROE) with an embedded lease for the use of DHHL lands and water delivery to DHHL lands through the Project. In August 2017, KIUC and ADC executed licenses with embedded leases for the use of ADC infrastructure and land and water delivery to ADC lands through the proposed Project.

From 2013 to the present, KIUC has conducted community outreach in various forms including open public meetings, small group gatherings, one-on-one discussions, media releases, mass email, direct mail, social media channels, and its quarterly magazine. In 2018 to 2019, design and engineering continued along with environmental studies, and the 60% engineering plans were completed in 2020. In late 2020, KIUC signed a development agreement with AES and filed a PPA with the Hawaiʻi Public Utilities Commission (PUC) in PUC Docket No. 2020-0218, a copy of which can be found at the following link:

https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A21A05B22519H00102.[2]

2.1.1 Store and Release Hydroelectric Operation and Irrigation Delivery

The proposed store and release hydroelectric operation and irrigation delivery component would divert a multi-year rolling average of 11 MGD of water from streams in Kōkeʻe at four existing diversions on the Kōkeʻe Ditch Irrigation System: Waiakōali Diversion, Kawaikōī Diversion, Kauaʻikinanā Division, and Kōkeʻe Diversion. Diversion operations would be continuous, but the diversion volume into Kōkeʻe Ditch at each stream would be based on multiple considerations:

- Volume of water in the stream after the IIFS is left in stream
- Capacity of the ditch to deliver water to Puʻu Lua Reservoir – 55 MGD after Kōkeʻe Diversion (combined flow of all diversions)
- Capacity of Puʻu Lua Reservoir to store water – 200 MG
- Capacity of Project to use the water for beneficial uses – renewable energy and/or agriculture

Continuous real-time monitoring of stream and ditch flow and automatic gates would control the diversions and ensure that the IIFS, as discussed in **Section 1.2.2**, is maintained. Water that cannot be used by the Project for renewable energy generation and/or irrigation would flow over the diversion and remain in the streams. The diverted water would be delivered via the existing Kōkeʻe Ditch Irrigation System to Puʻu Lua Reservoir where up to 200 million gallons of water would be stored.

During non-solar hours (evenings and rainy periods when solar is not operating or operating at a reduced capacity), water would be released from Puʻu Lua Reservoir at a variable rate of between 2 MGD and at a rate of up to 26 MGD based on what is available in Puʻu Lua Reservoir into the existing section of open ditch between Puʻu Lua Reservoir and Puʻu Moe Divide. Based on modeled hydrology, it is estimated that 2 MGD would be available 100% of the time and 26 MGD would be available approximately 34% of the time. DSP would take approximately 20,000 GPD from the open ditch section between Puʻu Lua Reservoir and Puʻu Moe Divide to supply water to DLNR's park restrooms.

At Puʻu Moe Divide, up to 1.3 MGD would be released into an existing open ditch that runs south along Kōkeʻe Highway for DHHL and ADC uses on the mauka lands near Kitano Reservoir. After this irrigation release, the remaining volume of water in Kōkeʻe Ditch (up to 24.68 MGD) would enter a new buried pipeline, the Upper Penstock, which would run between Puʻu Moe Divide and Puʻu ʻŌpae Reservoir. At the DHHL boundary an irrigation delivery of up to 500,000 GPD would be made directly from the pipeline to a new 10,000-gallon storage tank for agricultural needs at the DHHL pastoral lots.

[2] Additional information submitted in PUC Docket No. 2020-0218 can be found at the following link and entering "2020-0218" in the Docket Quick Link: https://dms.puc.hawaii.gov/dms/.

After this irrigation release, the remaining volume of water in the ditch (up to 24.18 MGD) would be delivered via the Upper Penstock to a new four MW hydroelectric turbine for energy generation at the new Puʻu ʻŌpae Powerhouse. After being used for energy generation, all water that entered to turbine (up to 24.18 MGD) would be discharged into Puʻu ʻŌpae Reservoir where it would be available to DHHL who would take the remainder of the DHHL water reservation (5.63 MGD at Puʻu Ōpae).

After irrigation uses are withdrawn from Puʻu ʻŌpae Reservoir, the remaining water (up to 18.55 MGD) would be delivered to Mānā Reservoir via buried pipeline, the Lower Penstock, to a new 20 MW hydroelectric turbine for energy generation at the new Mānā Powerhouse. After being used for energy generation, all the water that entered the turbine (up to18.55 MGD) would be discharged into Mānā Reservoir where it would be available for agricultural uses on Mānā Plain.

In addition to irrigation uses and DSP, other water needs would be withdrawn from the 11 MGD multi-year rolling average diverted into and stored at Puʻu Lua Reservoir. These uses include refilling of reservoirs and some minimal ditch losses on sections of open ditch. It is expected that reservoir levels will drop during dry times and be refilled during rainy periods.

Kōkeʻe Ditch water released from Puʻu Lua Reservoir and used for renewable energy generation at Puʻu ʻŌpae and Mānā Powerhouses, would be discharged at Mānā Reservoir for a number of beneficial uses on Mānā Plain. Discharge from Mānā Reservoir would be delivered directly to fields adjacent to Mānā Reservoir or piped into KAA's irrigation system, or both. Discharge from Mānā Reservoir may also be delivered through KAA's irrigation system to open floodable spaces being developed by KAA near Nohili. KIUC and AES are working with ADC and KAA in the exploration of other beneficial uses of Project discharge from Mānā Reservoir. Explorations into other beneficial uses of Project discharge include the potential for KAA to use Project discharge to refill smaller reservoirs to increase storage on Mānā Plain in other areas of Mānā Plain. The frequency and volume of discharge associated with the West Kauaʻi Energy Project would vary through the life of the Project and is based on several factors including the following:

- Streamflow variability
- Maintenance of the Phase Two IIFS
- Kōkeʻe Ditch capacity above and below Puʻu Lua Reservoir
- Puʻu Lua Reservoir storage capacity
- Irrigation uses along the West Kauaʻi Energy Project flow path
- Generation needs during non-solar hours
- Reservoir make-up water used for reservoir refilling and for evaporative losses at all three reservoirs
- Water for beneficial uses – renewable energy and/or agriculture

A more detailed discussed regarding the discharge is in **Section 4.1.2.14**. As discussed later in **Section 3.1**, one of the primary functions of the Project is irrigation delivery. **Figure 2.2** shows the delivery points and use along the Project flowline. **Figure 2.3** shows a diagram of the store and release hydroelectric operation and irrigation delivery component of the Project.

Figure 2.2. Water Diversion Volumes and Use

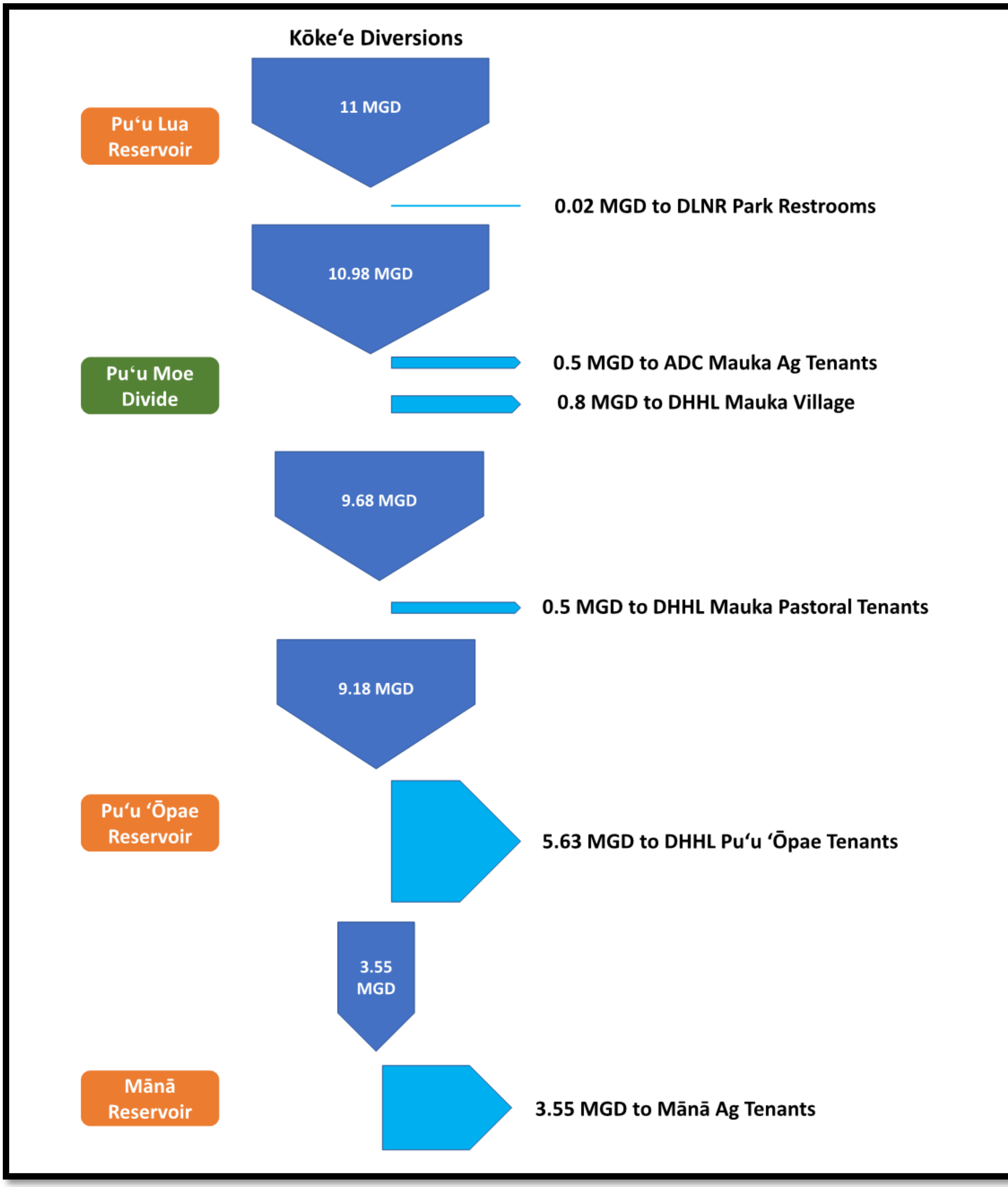
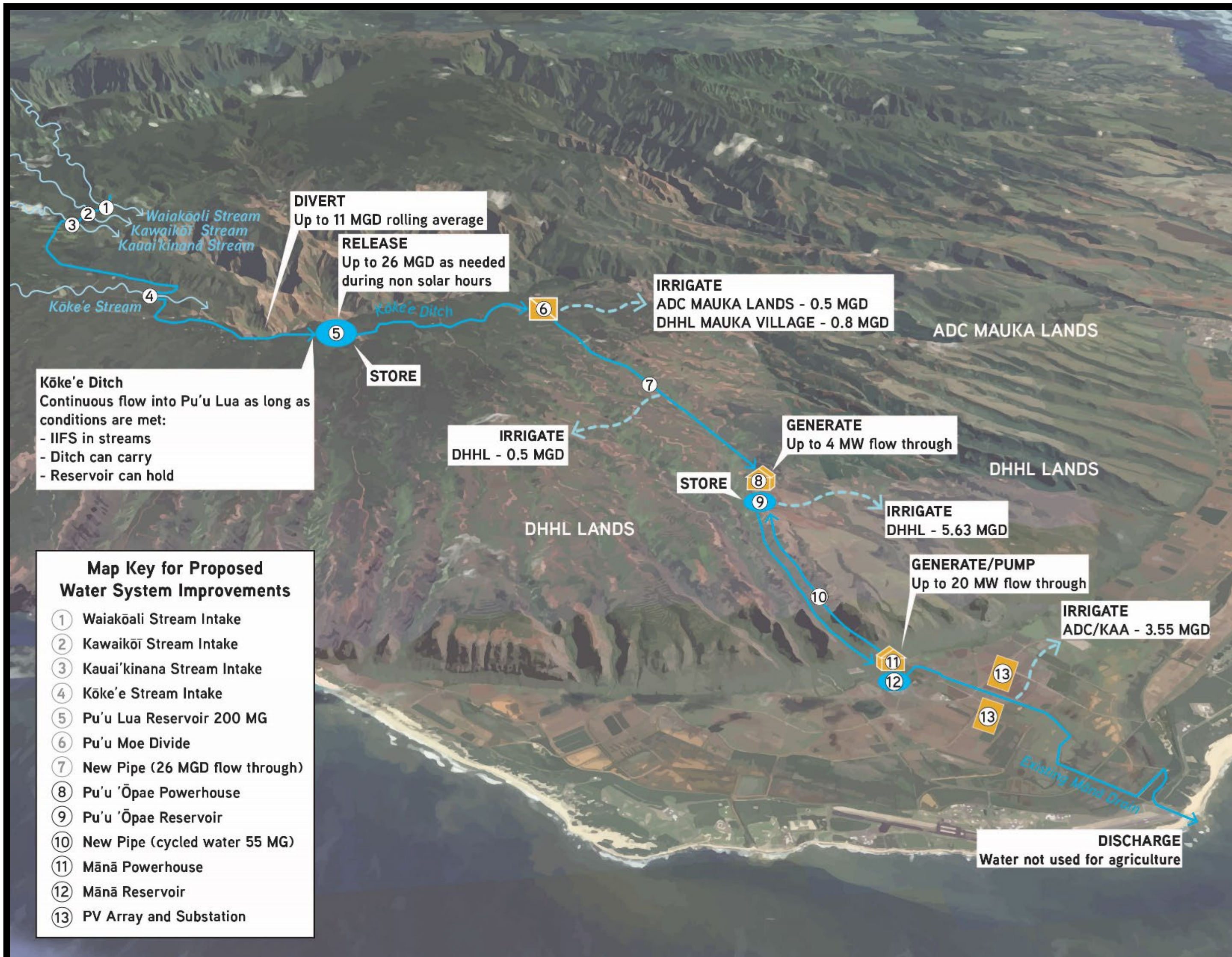


Figure 2.3. Water Flow Diagram for Store and Release Hydroelectric Operation and Irrigation Delivery



The operational goals for the store and release hydroelectric operation are:

- Maximizing storage at Puʻu Lua Reservoir during high stream flow events
- Maximizing generation using available stored water in Puʻu Lua and Puʻu ʻŌpae Reservoirs
- Providing firm renewable energy to the grid during non-solar hours
- Managing reservoir levels to provide energy and energy reserves

The operational goals for the water delivery portion of the Project are:

- Making reliable water deliveries to all users along the system within the limitations of streamflow availability
- Managing diversions and reservoirs to maximize efficiency of the delivery system
- Managing reservoirs and deliveries to maintain stored reserves for periods between rain events

2.1.2 Pumped Storage Operation

The proposed pumped storage operation includes a 35-megawatt (MW) PV Solar Array and battery storage system and a 35 MW Pumphouse adjacent to the existing Mānā Reservoir. During the day, the PV Solar Array would generate power to pump water from Mānā Reservoir up to Puʻu ʻŌpae Reservoir through the Lower Penstock. At night, the pumped water from Mānā Reservoir plus the store and release water from Puʻu ʻŌpae Reservoir would be delivered through the Lower Penstock to the new Mānā Powerhouse where a 20 MW turbine would produce renewable energy for delivery to the grid. For the pumped storage component of the Project, an approximately volume of 55 MG of water would flow back and forth between the Mānā and Puʻu ʻŌpae Reservoirs, and only draw additional water from the diverted 11 MGD multi-year rolling average to refill reservoirs and make up for evaporative losses. **Figure 2.4** shows a diagram of the pumped storage component of the Project.

The operational goals for the pumped storage operation are:

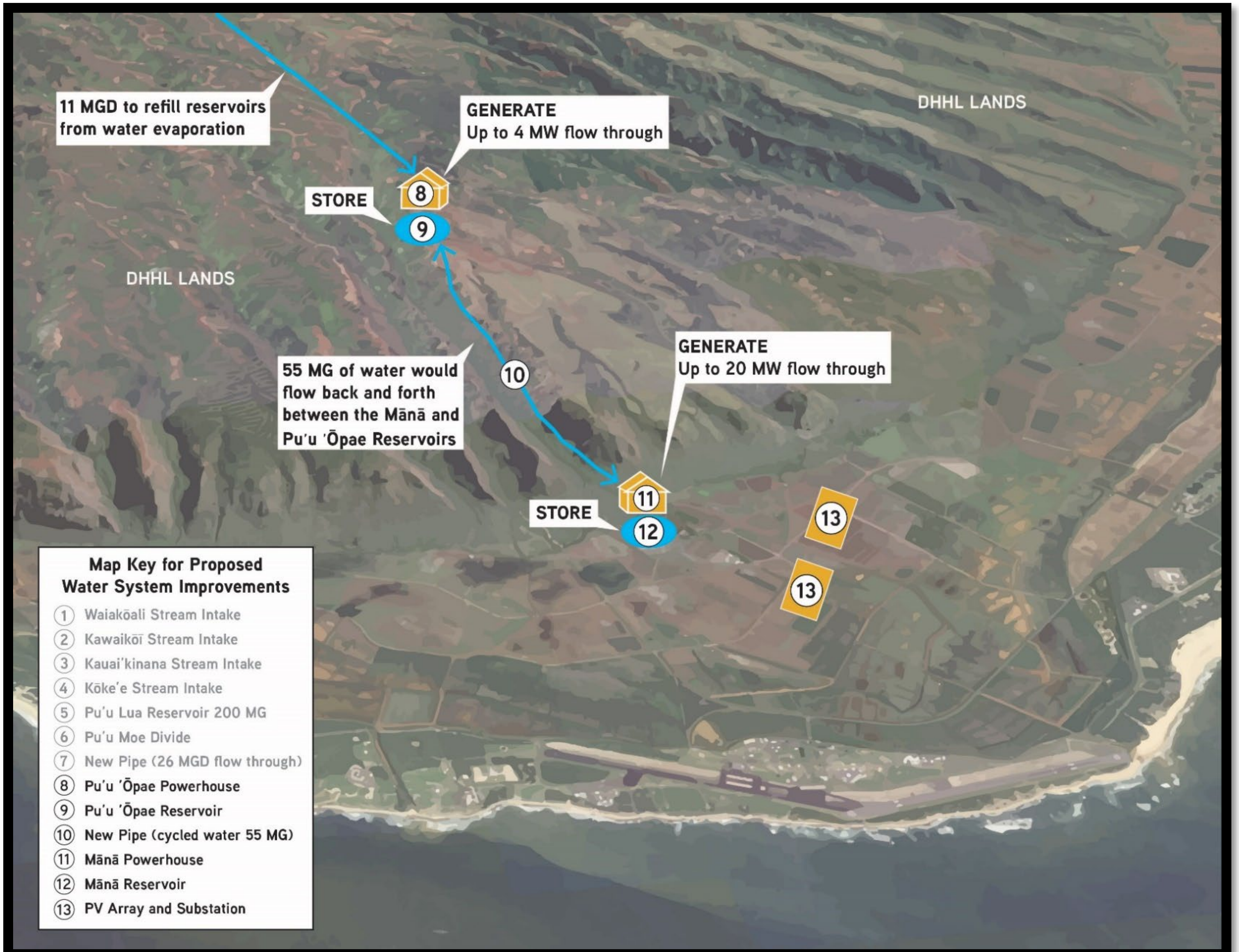
- Provide long duration bulk energy storage via pumping water uphill using solar PV energy
- Provide firm, renewable hydroelectric electric generation
- Reduce greenhouse gas emissions by displacement of fossil fuel generation
- Increase grid reliability

The PV Solar Array would be operated automatically, generating energy from the available sunlight, and delivering it either directly to the utility grid, storing it in the battery system, or powering the Mānā Pumphouse.

The operational goals for the PV Solar Array operation are:

- Maximizing total PV generation
- Pumping water uphill from Mānā Reservoir to Puʻu ʻŌpae Reservoir with a renewable resource during the day for energy storage to be dispatched during non-solar periods
- Supporting grid reliability with support from the battery
- Smoothing solar PV output via a battery energy storage system

Figure 2.4. Water Flow Diagram for Pumped Storage Operation



2.2 Power Purchase Agreement

As mentioned in **Section 2.1**, KIUC signed a development agreement with AES and filed a PPA with the PUC in late-2020. A PPA is a contract wherein KIUC agrees to purchase the capacity and energy from the Project, in exchange for AES financing, constructing, operating, and maintaining the Project. The cost that KIUC pays to AES will be passed on to the electric rate, without any mark-up. The PPA between KIUC and AES is attached as Exhibit 1 to the Application filed in Docket No. 2020-0218.[3]

KIUC and AES agreed to the following:

1. An energy rate/charge of $81.00 per MWh ($71.60 per MWh if the currently available State of Hawaiʻi Refundable Tax Credit remains available) of "Net Solar and Battery Energy Storage System (BESS) Output" (as said term is defined in Appendix A of the PPA) from the PV/BESS Facility as set forth in Section 3.2.2(b) of the PPA; and
2. Two separate monthly capacity charges as set forth in Appendix F of the PPA and summarized below:
    a. A "Hydropower-only Monthly Capacity Charge" of $205,005.75 per month that is related to the 4 MW of capacity to be provided by the Puʻu ʻŌpae Powerhouse (i.e., the Hydropower-only component of the Project), which is expected to produce an annual average of 13 gigawatt hours (GWh) and will enable an additional annual average of 13 GWh to be sent to the lower segment of the Project as discussed in Section III.A.1 (Upper Segment – Traditional Hydroelectric Portion of Project), without any energy charge, and
    b. A "PSH Monthly Capacity Charge" of $538,649.25 per month that is related to the 20 MW of capacity to be provided by the Mānā Powerhouse (i.e., the Pumped Storage Hydropower [PSH] component of the Project), which is expected to produce an annual average of 34 GWh from water pumped uphill plus an additional 13 GWh using the same water that was used by Puʻu ʻŌpae Powerhouse, as discussed in Section III.A.2 (Lower Segment – Solar PV/BESS and PSH Portion of the Project), also without any energy charge.
3. Term length as follows: 25 years for the energy (solar) rate, 40 years for the PSH monthly capacity charge, and 50 years for the hydropower-only monthly capacity charge. Section 2.1 of the PPA states that the 25-year energy rate and 40-year PSH monthly capacity charge both commence on the PV/BESS/PSH commercial operations date (COD), and the 50-year hydropower-only monthly capacity charge commences on the Hydropower-Only COD. In the event the Hydropower-Only COD occurs after the Outside Hydropower-Only COD, the term of the PPA will be reduced to 40 years from the PV/BESS/PSH COD.

[3] https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A21A05B22519H00102

2.3 Project Benefits

The West Kauaʻi Energy Project would allow KIUC to spend less money (versus the Project cost of fossil fuel) to provide electricity to the island at a more fixed and stable pricing structure, while also producing locally-generated clean, firm, and dispatchable energy and providing various grid and reliability benefits. The Project would also provide numerous other environmental and public interest benefits to KIUC, its members/customers, the Kauaʻi community, the public and the State at large, all of which would be lost if the Project does not come to fruition. The benefits provided to the West Kauaʻi community and to the entire 30,000 KIUC members include environmental benefits, reliability benefits, PPA pricing benefits, and other community/economy/public interest benefits as shown in **Table 2-1**.

Table 2-1. Benefits of the Proposed Project

Category	Benefit
Environmental	Provide significant renewable energy to KIUC's grid, contributing approximately 23.6% to KIUC's Renewable Portfolio Standards (RPS) in 2024 (year 1) and 18.1% in 2048 (year 25). This would assist KIUC in achieving the State's RPS.
	Allow KIUC to utilize approximately 8.5 million fewer gallons of fuel annually, resulting in approximately 212 million gallons less fuel being used over the initial 25-year term of the PPA. This would provide a significant positive effect on reducing KIUC and the State's reliance on fossil fuels, on fuel and energy price volatility, on export of funds for fuel imports, and on fuel supply reliability risk, consistent with HRS Section 269-6. To demonstrate just how significant this impact would be, for all of 2021, KIUC utilized just under 13.5 million gallons of fuel.
	Significantly reduce KIUC's greenhouse gas (GHG) emissions, also consistent with HRS Section 269-6. KIUC estimates that the Project would result in an estimated net reduction in GHG of approximately 2,018,487 $MTCO_2e$ for the Project's operation stage and 2,508,877 $MTCO_2e$ for the Project's lifecycle over 25 years, which would have beneficial impacts on air quality, global warming, and climate change.
	Result in additional air quality improvements by reducing the production and release of various air pollutants by an estimated annual amount of (1) 30.5 tons of carbon monoxide; (2) 13.9 tons of particulate matter; (3) 0.4 tons of sulfur oxides; (4) 294.7 tons of nitrogen oxides; (5) 6.0 tons of volatile organic compounds, and (6) 1.5 tons of ammonia.
	Decrease overall noise emissions from electricity generation.
Reliability	Provide KIUC with firm capacity that KIUC would have dispatch control over, and without the intermittent nature and variability associated with PV and other non-firm renewable energy sources. KIUC would be able to determine when to release the water stored in the reservoirs to generate hydropower electric renewable energy from the Puʻu ʻŌpae Powerhouse and the Mānā Powerhouse for delivery to KIUC's system at any time and in any manner that is most beneficial to KIUC's system.

Table 2.1. Benefits of the Proposed Project (Cont.)

Category	Benefit
Reliability	Provide KIUC with an improved ability to address and respond to system reliability issues caused by fluctuations in PV solar output during the daytime hours. In doing so, none of the energy from the Project is expected to be delivered to KIUC's grid during the mid-day solar saturation period at times when excess solar energy production from distributed energy resources is available. As a result, the PV generation from the Project is not anticipated to exacerbate the existing minimum daytime load conditions on KIUC's system. Energy production under the PPA to KIUC's grid during the daytime would occur mostly during the early morning and late afternoon hours each day, when higher-cost fossil-generation can be displaced, during periods of cloudy/rainy weather when solar PV Projects are delivering little to no energy to KIUC's grid, and to address fluctuations in PV output to KIUC's grid caused by cloud cover to stabilize and minimize impacts to the KIUC grid.
	Assist KIUC in continuing to meet its adequacy of supply requirements established by the PUC.
	Provide meaningful and significant advantages over a BESS in terms of (1) the duration of storage capability; (2) the ability to capture additional water from the upper segment of the Project, further increasing the storage duration; and (3) the use of a rotating, synchronous generator as discussed immediately below.
	Through the use of a rotating, synchronous generator, provide increased inertia, voltage support, and fault current to the KIUC grid as compared to similarly sized inverters. This increased inertia, voltage support and fault current would help to further assist KIUC with grid stability and reliability, which will become even more and more critical as KIUC continues to increase its ability to operate for longer and longer periods at 100% renewable energy.
	Provide black start and micro-grid capability, which under certain circumstances would allow KIUC to bring loads back online through the Project without the need for an external power source and/or to segregate the Project to operate on a stand-alone basis due to operational, reliability, or other issues on other portions of KIUC's grid.
	Operate as a natural dispatch hedge to solar PV through their different reliance on weather patterns (e.g., in general, excessive rain increases the ability for hydropower electric generation to offset decreased solar PV capacity during cloudy-rainy periods; and conversely, during periods of little to no rainfall and thus likely maximum solar PV production, there is a decreased potential for hydropower water availability).
	Through the Mānā Powerhouse, have the potential to provide synchronous condensing capability when not generating real power (i.e., during the mid-day period).
	Have the ability to support grid reliability when the power generation mode of the 20 MW Mānā Powerhouse turbine is offline, through the Project's multiple points of common coupling. This would assist KIUC in supporting voltage on the west side of the island and provide short circuit current for system protection.
	Be designed to allow for the addition of two new future distribution breakers at the Project Substation, which would be connected in parallel with the 4 MW Puʻu ʻŌpae Powerhouse points of common coupling. The ability to feed load from the Project Substation would allow for increased reliability for the PMRF and Mānā Substation loads. This would also allow KIUC to better service its customers/members through improved switching capacity from the Project and to maintain KIUC's safety in clearing faults as quickly as possible via additional short circuit current from the 20 MW Mānā Powerhouse.
	Program the Project inverters to be grid forming with fast response, fault ride-through, and frequency and voltage droop capability.

Table 2.1. Benefits of the Proposed Project (Cont.)

Category	Benefit
Reliability	Through the Project pumps, provide significant interruptible load/under-frequency load shed capability. As part of KIUC's under-frequency load shed scheme, the Project would have automatic under-frequency load shed for pumps as a first priority load shed rather than automatic opening of distribution circuits, and frequency and voltage fast droop response to dampen frequency and voltage excursions.
	By building the Project Substation in accordance with engineering standards for high water level events associated with both flood inundation and tsunami events (which would allow for decommissioning of the Mānā Substation), the Project may provide enhanced flood protection to KIUC's system from water inundation.
	Not result in any expected curtailment for the Project since the solar portion of the Project would be combined with enough pump load and battery storage to either use or store all of the solar energy that can be produced by the Project.
PPA Pricing	Provide estimated savings to KIUC and its members/customers of between $157 and $172 million (net present value using a 5% discount rate) over the 25-year PPA term of the PV/BESS Facility.
	Provide PPA pricing stability. The energy rate and capacity charges under the subject PPA would not increase and are intended to remain fixed or stable for their applicable terms (25-years for the energy rate, 40-years for the PSH Monthly Capacity Charge, and 50-years for the Hydropower-only Monthly Capacity Charge). This would provide stability for KIUC's members and is materially lower than the forecasted cost of oil generation that the PPA would displace, which would result in savings and lower effective rates for KIUC's members.
Community/ Economy/ Public Interest **Community/ Economy/ Public Interest**	Provide the ability to reliably deliver water for irrigation to support diversified agriculture on lands adjacent to the Project site, consisting of mauka lands managed by both DHHL and ADC (which includes lands owned by ADC), and the agricultural fields on the Mānā Plains that are managed by KAA. This would provide an increased agricultural potential for thousands of acres of public lands on the west side of Kauaʻi.
	Rehabilitate the existing Puʻu ʻŌpae, Puʻu Lua, and Mānā Reservoirs, which are at or near the end of their useful lives, and related ditch system infrastructure. These reservoirs are currently not up to current Hawaiʻi State dam safety standards. The rehabilitation and long-term maintenance component of the Project would offer numerous benefits to the State, the local communities of Kekaha and Waimea, and the island of Kauaʻi. Since these improvements and upgrades, along with their ongoing maintenance, is 100% necessary for the production of renewable energy from the Project, these ancillary enhanced benefits to the State, the local communities of Kekaha and Waimea, and the island of Kauaʻi would come at no additional cost to the members/customers of KIUC.
	Transfer the assumption of the rehabilitation and maintenance responsibilities of the above reservoirs and ditch infrastructure from various State agencies to the Project. This assumption of responsibilities from State agencies is especially important given that the reservoirs are currently not up to current Hawaiʻi State dam safety standards as noted above, and as such, the assumption of these responsibilities can relieve the State from various risks and potential negative impacts arising from the current condition of the existing infrastructure if the Project did not occur.

Table 2.1. Benefits of the Proposed Project (Cont.)

Category	Benefit
Community/ Economy/ Public Interest **Community/ Economy/ Public Interest**	Provide the ability to immediately respond to changing weather and flows. As a result of the rehabilitation efforts, the diversions would operate on a fully automatic basis. This automatic operation would allow responsive diversion flow management as the stream flow changes by regulating the amount of water admitted to the ditch. This eliminates the dependency on site access by ditch operators, which is often limited or not possible in the more remote areas. Automation of the diversion operations would reliably ensure compliance with IIFS requirements, decrease water waste, improve energy production, and decrease demands on operation personnel. The automatic control/monitoring of the water levels would also help to decrease the likelihood of soil related impacts from storms and ungulate damage.
	Provide increased water flow data collection on tributaries to the Waimea River. This would include the installation of three new stream gages at the Kawaikōī, Kauaʻikinanā and Kōkeʻe Streams, and three new ditch gages at the Kawaikōī, Kauaʻikinanā and Kōkeʻe Diversions. The gages' data would contribute to knowledge of the watershed, operation of Project, and the Watershed Agreement's Phase Two IIFS compliance. The addition of flow measurement points and recording devices to the diverted steam and ditches would support efficient and compliant use of the water resources, including data collection of natural stream flows on all four streams. The data gathered regarding stream flows would be made available to the State and would be used to help inform decisions regarding reservoir management and energy generation.
	Provide public safety improvements including the ability to mitigate future flood risks. The Project would rehabilitate old plantation irrigation ditches, reservoirs, and access, which would in turn improve public safety and increase the stability and integrity of the structures for the long-term against future natural hazards. This would also decrease the risk of a future dam breach thereby providing some protection from flooding of downstream lands. In addition, the automation of the diversions and water level monitoring systems to be installed at each reservoir and flow gages in the streams and ditches would provide information to the control system and allow for responsive diversion flow management as the stream flow changes.
	Provide increased public access and recreational opportunities associated with the Puʻu Lua Reservoir. More specifically, the improved and upgraded infrastructure and rehabilitation of the Puʻu Lua Reservoir would enhance the benefit of this reservoir as an already popular trout fishing resource and provide improved shoreline access for fishing. In addition, both roads on DHHL property that provide access to the Puʻu ʻŌpae Reservoir would be repaired and maintained as part of the Project, which would remain open to DHHL beneficiaries that are granted access by DHHL. In total, over nine miles of State-owned unpaved access roads would be repaired and maintained as part of the scope of the Project.
	Provide employment opportunities in both the short-term and the long-term, additional tax base to the State and County, and lease revenues to DHHL and ADC. It is estimated that approximately 200 short-term jobs would be created during the construction phase of the Project. As stated in a socioeconomic impact assessment for the Project, "[t]he construction, long-term operation and maintenance expenditures, and the savings from the petroleum offset will create a total of 27,320 person-years of employment over 78 years. The construction and [Operation and Maintenance] payroll will generate a sum of $788.3 million of earnings in Kauaʻi throughout the Project. The Project will also add an estimated $207.4 million and $4.9 million to the State and County tax base, respectively."
	Enhance firefighting capabilities in West Kauaʻi and in Kōkeʻe through increased access and availability of water from the reservoirs. Specifically, the Project would provide water for fire suppression in areas where water is not currently available and would provide reliable sources of water for helicopters during firefighting operations, thereby improving fire protection in these areas.

2.4 Project Location

The Project site is located approximately four miles north of the town of Kekaha and six miles northwest of the town of Waimea on the Island of Kauaʻi, as shown on **Figure 2.5.** The Project site is located on lands owned and managed by the DLNR, DHHL, and ADC. The affected lands include areas within the State Conservation District, Kōkeʻe State Parks, and lands designated for agricultural use. The Project site was selected in large part due to the presence of the existing Kōkeʻe Ditch and the location of the three existing reservoirs; and that the Project flowline would traverse DHHL land and could deliver water for DHHL combined with the unique topography of the area.

As discussed in **Section 6.2.2**, the Project location is within the Conservation and Agricultural State Land Use Districts. Specifically, the portion of the Project from the diversions to the Puʻu Lua Reservoir, as well as approximately 0.75-mile of the Upper Penstock, are in the Conservation District, Resource Subzone. The portion of the Project within the Conservation District, Resource Subzone would comprise of the store and release hydroelectric generation operations and irrigation delivery, as illustrated in **Figure 2.3**. There would be approximately 41.09 acres of temporary disturbance during construction, and 28.21 acres of permanent facilities within the Conservation District. There would be approximately 519.41 acres of temporary disturbance during construction, and 374.36 acres of permanent facilities within the Agricultural District. A discussion of the Project's compliance with the Conservation District regulation HRS Chapter 183C and HAR Section 13-5 is provided in **Section 6.2.3**.

2.5 Land Use Agreements Required for the Project

Construction and operation would require a variety of different land and use agreements. These agreements include the following:

- **Lease:** An agreement between the landowner and an individual or entity for the development or improvement of a specific portion of landowner's property for a determined length of time.
- **Water License:** An agreement between the State and an individual or entity for the diversion and use of water from streams.
- **Exclusive Easement/License:** An agreement between the landowner and an individual or entity for the exclusive right to cross or otherwise use landowner's property for a specified purpose for a determined length of time.
- **Non-exclusive Easement:** An agreement between the landowner and an individual or entity for the non-exclusive right to cross or otherwise use landowner's property for a specified purpose for a determined length of time.
- **Right-of-Entry (ROE):** An agreement between the landowner and an individual or entity for the right to enter onto landowner's property.
- **Special Use Permit (SUP):** Permit from the County for non-designated permitted use of land.
- **Mediation Agreement:** Written agreement between parties documenting the terms of a settlement.
- **Memorandum of Understanding (MOU):** Agreement between parties that expresses a convergence of will between the parties indicating an intended common line of action.

All land agreements needed for the proposed Project by facility are shown in Table 2-2.

Figure 2.5. Project Location Map

Table 2-2. Land Use Agreements

Facility	Area	Entity(s)	Tax Map Key(s)	Purpose	Agreement
Diversions and Ditch	Diversions/Ditch (full Length)	ADC	(4) 1-2-001:003; (4) 1-2-001:007; (4) 1-2-002:023; (4) 1-4-001:002; (4) 1-4-001:003; (4) 1-4-001:013; (4) 1-4-001:014	Repair, use, and maintenance	License
	Lands adjacent to Waiakōali and Kawaikōī Diversions	DLNR – BLNR, DOFAW	(4) 1-4-001:003	New structures, use and maintenance of existing infrastructure	License
	Lands adjacent to Kauaʻikinanā and Kōkeʻe Diversions	DLNR – BLNR, DSP	(4) 1-4-001:013	New structures, use and maintenance of existing infrastructure	License
	Lands adjacent to ditch	DLNR-BLNR, DOFAW, DSP	(4) 1-2-001:003; (4) 1-2-001:007; (4) 1-2-002:023; (4) 1-4-001:002; (4) 1-4-001:003; (4) 1-4-001:013; (4) 1-4-001:014	Use and maintenance	Non-exclusive Easement
	Lands adjacent to ditch between Puʻu Lua and Puʻu Moe	DLNR – BLNR, DSP	(4) 1-4-001:002; (4) 1-2-001:003	Repairs, use, and maintenance	Non-exclusive Easement
	Access Roads to Diversions	DLNR – BLNR, DOFAW	(4) 1-2-001:003; (4) 1-2-001:007	Construction	Non-exclusive Easement
	Access Roads to Diversions	DLNR – BLNR, DSP	(4) 1-2-001:003; (4) 1-2-001:007	Construction and operation	Non-exclusive Easement
Water	Diverted Water at Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe Streams	DLNR - BLNR	(4) 1-4-001:003; (4) 1-4-001:013	Long-term diversion of water at four streams contributing to the Kōkeʻe Ditch	Water License
		Earthjustice, ADC, KAA, DHHL, and KIUC		Stipulates amount of water diverted for Proposed Action and Irrigation amounts to be delivered to ADC and DHHL	Waimea Mediation Agreement
Puʻu Lua Reservoir	Reservoir and areas around reservoir	DLNR-BLNR	(4) 1-4-001:002; (4) 1-4-001:014	Studies and Construction	ROE
		DLNR-BLNR		Operation and Maintenance	Non-exclusive Easement

Table 2-2. Land Use Agreements (Cont.)

Facility	Area	Entity(s)	Tax Map Key(s)	Purpose	Agreement
		DHHL, ADC, KAA, DLNR DAR, DLNR DOSP, West Kauaʻi Energy Project		Operations Agreement for Kōkeʻe Ditch users	MOU
Puʻu Moe Divide Intake	Land around ditch at Puʻu Moe Divide	DLNR – BLNR, DSP	(4) 1-2-001:003	New structures, use and maintenance of existing infrastructure	License
Upper Penstock and Access Road	Upper portion of Penstock Corridor and portion of Trail 1 Road above DHHL gate	DLNR – BLNR, DSP	(4) 1-2-001:003; (4) 1-2-001:007	New structures, use and maintenance of existing infrastructure	Non-exclusive easement
	Portion of Trail 1 Road from Waimea Canyon Rd to DHHL gate	DLNR – BLNR, DOFAW, DSP	(4) 1-2-001:007	Construction	Non-exclusive Easement
				Use and maintenance	Non-exclusive Easement
	Lower Portion of Penstock Corridor and Trail 1 Road below DHHL gate	DHHL	(4) 1-2-002:023	New structures, use and maintenance of existing infrastructure	Lease, Non-exclusive Easement
Puʻu ʻŌpae Reservoir and Powerhouse	Reservoir and areas around reservoir	DHHL	(4) 1-2-002:023	New structures, use and maintenance of existing infrastructure	Lease with water use/delivery agreements
Lower Penstock and Access Road	Lower penstock corridor and access road below Puʻu ʻŌpae Reservoir	DHHL	(4) 1-2-002:023	New structures, use and maintenance of existing infrastructure	Lease, Non-exclusive Easement
	Lower portion of Lower Penstock corridor and access road	ADC	(4) 1-2-002:001	New structures, use and maintenance of existing infrastructure	Lease, Non-exclusive Easement
Mānā Reservoir, Powerhouse & Substation	Reservoir and areas around reservoir	ADC	(4) 1-2-002:001	New structures, use and maintenance of existing infrastructure	Lease
PV BESS, Project, Substation and Interconnection Line	Mānā fields for PV solar arrays, BESS, Project Substation and Interconnection Line	ADC	(4) 1-2-002:001	New structures, use and maintenance of existing infrastructure	Lease

2.6 Project Schedule

It is expected that the HRS Chapter 343 process will be complete by the end of 2022. Upon completion of the HRS Chapter 343 process, permits would be obtained, as documented in **Section 2.7**. Construction of the Proposed Action is expected to begin upon completion of all necessary and required permits and approvals, which is estimated to be in 2023 or the first quarter of 2024 and be completed by late-2025.

2.7 Permits and Approvals That May Be Required

In addition to the environmental disclosure requirements of HRS Chapter 343 implementation of the Proposed Action would require coordination with federal, state, and county agencies for permits or approvals. The permits and approvals presented in **Table 2-3** may be required for the Proposed Action. Permit requirements will be determined through continued agency coordination during the HRS Chapter 343 and NEPA processes.

Table 2-3. Permits and Approvals That May Be Required for the Proposed Action

Permit or Approval	Description	Regulation(s)	Administrative Authority
License for Water Use	Long-term (65-year) lease to divert water from the Waiakōali, Kawaikōī, Kauaʻikinanā , and Kōkeʻe Stream diversions on the Kōkeʻe Ditch Irrigation System.	• HRS Section 171-58 • Act 216 (amendment to HRS Section 171-58)	BLNR
Power Purchase Agreement (PPA)	Gives the PUC the power to direct public utilities to acquire electricity generated from available non-fossil fuel sources.	• HRS Section 269-27.2	Public Utilities Commission (PUC)
Special Use Permit	Special Use Permit required to allow for the use of land within the State Agricultural District for the solar field.	• HAR Section 15-15	Land Use Commission (LUC) County of Kauaʻi Planning Commission
National Pollutant Discharge Elimination System (NPDES) Permit	NPDES Individual Permit required for stormwater discharge associated with construction activities.	• Clean Water Act, Section 401 • HAR Section 11-55	Department of Health (DOH)-Clean Water Branch (CWB)
NPDES, Dewatering Permit	NPDES Individual Permit required for discharges associated with construction activity dewatering.	• HAR Section 11-55	DOH-CWB
Community Noise Permit/Community Noise Variance	Required for construction projects exceeding 78 decibels (dBA) or has a total cost of more than $250,000.	• HRS Chapter 342F • HAR Title 11, Chapter 46	DOH-Indoor and Radiological Health Branch

Table 2-3. Permits and Approvals That May Be Required for the Proposed Action (Cont.)

Permit or Approval	Description	Regulation(s)	Administrative Authority
Conservation District Use Permit and Management Plan	Required for projects located within the Conservation District	• HRS Chapter 183C • HAR Title 13, Chapter 5	Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands
Historic Preservation Review	Required for projects that may affect historic property or a burial site. Required for projects that require a federal permit.	• HRS Chapter 6E • Section 106, National Historic Preservation Act	DLNR, State Historic Preservation Division (SHPD)
Section 404 Individual Permit	Required for any project that will discharge dredged or fill material into waters of the United States.	• Clean Water Act, Section 404	U.S. Army Corps of Engineers
Coastal Zone Management Federal Consistency Determination	Required for all projects that require a federal permit and are located within the Coastal Zone Management Area.	• Coastal Zone Management Act of 1972	State of Hawai'i Office of Planning and Sustainable Development
Section 401 Water Quality Certification	Required for all projects that require a federal permit or may result in discharge into State waters.	• Clean Water Act, Section 401 • Hawai'i Administrative Rules, Section 11-54	DOH-CWB
Endangered Species Review	Required for projects that require a federal permit.	• Section 7, Endangered Species Act	USFWS
Stream Channel Alteration Permit	Required for any project that would alter a stream channel	• HAR Title 13, Chapter 169	DLNR, Commission on Water Resource Management (CWRM)
Stream Diversion Works Permit	Required for the construction of a new stream diversion structure or alteration of an existing structure require an SDWP.	• HAR Title 13, Chapter 168	DLNR-CWRM
Dam Safety Permit	Required for the construction, enlargement, repair, or alteration of dams, Applies to Pu'u Lua, Pu'u 'Ōpae and Mānā Reservoirs	• HAR 179D • Title 13, Sub-title 7 Chapter 190.1	DLNR Engineering Division
Certificate of Approval to Impound	Required for the impoundment of water at a dam or reservoir. Applies to Pu'u Lua, Pu'u 'Ōpae and Mānā Reservoirs	• HAR Title 13, Chapter 190.1	DLNR, Engineering Division

Table 2-3. Permits and Approvals That May Be Required for the Proposed Action (Cont.)

Permit or Approval	Description	Regulation(s)	Administrative Authority
Use Permit/Zoning Permit	Required for projects that are not a designated "permitted" use as per the County Zoning Ordinance.	• County of Kauaʻi Ordinance No. 935	County of Kauaʻi Planning Department
Grading, Grubbing, and Stockpiling Permit	Required for all projects proposing to grade, grub, and/or stockpile in the County of Kauaʻi.	• County of Kauaʻi Ordinance No. 808	County of Kauaʻi Department of Public Works, Engineering Division
Building Permit	Required for construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal, and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures within the County inland of the shoreline in the County of Kauaʻi.	• County of Kauaʻi Ordinance No. 929	County of Kauaʻi Department of Public Works, Building Division
Permit to Perform Work Upon State Highways	Required for any work within the State highway right-of-way	• HRS Chapter 264	Hawaiʻi Department of Transportation, Highways Division (DOT-HWYS)
Permit to Operate or Transport Oversize and/or Overweight Vehicles and Loads Over State Highways	Required to operate or transport oversize and/or overweight vehicles and loads on State highways	• HRS Chapter 291, Section 36	DOT-HWYS
Permit for the Occupancy and Use of State Highway Right-of-Way	Required for underground and overhead power lines and stormwater management structures with the State highway right-of-way	• HRS Chapter 264	DOT-HWYS

2.8 Anticipated Findings and Determination

Based on the significance criteria set forth in HAR 11-200.1 and discussed in **Section 7.1**, the Proposed Action would not have a significant adverse impact on the environment. Minimal impacts to the surrounding environment are anticipated with implementation of the Proposed Action. The overall impact of the proposed action on the surrounding environment and native stream habitat are minimal and will be addressed through avoidance and/or minimization measures, as summarized in the following table. Impacts during the construction phase which would be short-term, temporary, and minimized to the extent practicable through the implementation of Best Management Practices (BMPs) and other minimization and avoidance measures. The Proposed Action would result long-term beneficial effects, some of which include the following:

- The generation of renewable energy that would avoid the need to import, store, transport, and consume 8.5 million gallons of fossil fuel each year, which would further help to achieve the State of Hawaiʻi's mandate of 100% renewable energy by 2045 and mitigate the impacts of climate change
- Creating a long-duration energy storage resource which will enhance reliability of the electrical grid
- Furthering the purposes of the HHCA
- The rehabilitation of former plantation irrigation ditches and reservoirs improving public safety and increasing the value of State-owned assets
- Providing water and infrastructure to thousands of acres of agricultural land, including Hawaiian Home Lands, which will in turn stimulate the economy and enhance food security
- Enabling first responders to have water resources for fire suppression in areas where they are not currently available
- Increasing recreational access at Puʻu Lua Reservoir.

Therefore, it is anticipated that a Finding of No Significant Impact (FONSI) will be filed by the DLNR with the State of Hawaiʻi Office of Planning and Sustainable Development's Environmental Review Program following the Draft EA public comment period that ended on October 10, 2022.

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3 Purpose and Need

3.1 Purpose of the Project

The purpose of the Project is to construct and operate an integrated renewable energy and irrigation Project, thereby providing clean, renewable energy for the island of Kauaʻi and supporting diversified agriculture adjacent to the Project site. The project has four objectives:

- Renewable energy production via hydroelectric electric generation
- Renewable energy production via solar PV generation
- Pumped hydroelectric and battery storage to shift most of the Project's solar PV energy production for use in the evening peak, nighttime, and morning peak hours (as well as during periods of rainy or cloudy weather) via the release of water to provide firm hydroelectric electric energy generation
- Irrigation delivery to support diversified agriculture on lands adjacent to the Project site including mauka lands managed by DHHL and ADC, and the agricultural fields on the Mānā Plain that are managed by KAA

The Project would involve utilizing the existing Kōkeʻe Ditch Irrigation System and the Puʻu Lua, Puʻu ʻŌpae, and Mānā Reservoirs, and would include both rehabilitation of existing State infrastructure and new construction.

The Project would enable the State to ensure proper stewardship for the Waimea River and existing State infrastructure, while expanding agriculture and renewable energy production and furthering the purposes of the HHCA by providing resources that support DHHL's development of the Puʻu ʻŌpae lands on the west side of Kauaʻi, including the Kuleana Subsistence Agricultural Lots. Additional long-term beneficial effects include: the generation of firm renewable energy that would avoid the need to import, store, transport, and consume 8.5 million gallons of fossil fuel each year, which would further help to achieve the State of Hawaiʻi's mandate of 100% renewable energy by 2045 and lessening the impacts of climate change; improve grid reliability and resilience with the addition of long-duration energy storage; rehabilitation of former plantation irrigation ditches and reservoirs improving public safety and increasing the value of State-owned assets; providing water and water delivery infrastructure to thousands of acres of State-owned agricultural land; providing additional water resources for fire suppression in areas where they are not currently available; increasing recreational access and enhancing resources at Puʻu Lua Reservoir; and creating jobs through construction and operation of the Project.

3.2 Need for the Project

The Project is needed to assist KIUC in meeting the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045 (HRS Section 269-92). For 2021, Kauaʻi generated 69% of its energy needs from renewable sources and since 2019 has achieved thousands of hours of grid operation with 100% renewable energy (primarily solar, but also hydroelectric and biomass) on sunny days, but still primarily relies on the burning of fossil-fuel for night-time electricity. The Project would significantly reduce the amount of fossil fuel burned for electricity and produce up to 25% of the total electrical energy requirements for Kauaʻi's grid, thereby allowing KIUC to make significant progress toward 100% renewable energy.

Due to the large amount of intermittent daytime solar energy and the fact that 100% renewable generation has been routinely achieved during sunny periods, bulk storage is needed in order to shift any additional solar production from daytime to nighttime, and the pumped storage capability of the Project provides that. In addition, the Project is designed to provide storage and release hydroelectric generation which also complements KIUC's dispatch needs by storing ditch water during the day and releasing it at night though the hydroelectric turbines.

Generally, solar energy generation is intermittent and is dependent upon favorable weather and natural conditions to match the electrical needs of the grid. The bulk storage provided by the pumped storage portion of the Project helps address intermittency issues. Pumped storage is fundamentally different than the battery storage currently used by KIUC and other Hawaiʻi solar installations. The reservoirs can hold a combined total of 1,500 megawatt-hours (MWh) of recoverable energy, versus only 100 MWh of the recent Lāwaʻi PV Project. This extra storage capability, plus the store and release hydroelectric generation, provides Kauaʻi with a long-duration renewable solution during cloudy and rainy periods that deplete short duration batteries. The additional storage also provides support in the event of oil-fired generation outages, allowing repair time. The Project's capabilities provide Kauaʻi with an important reliability component as the island moves towards 100% renewable generation.

The Project is also needed to provide reliable delivery of water for DHHL's water reservation and other irrigation through modifications of the Kōkeʻe stream diversions, upgrades to the reservoirs, and the assumption of long-term operations and maintenance by the Applicant. This would support diversified agriculture on the mauka lands managed by DHHL and ADC, where the only source of water for irrigation is the Kōkeʻe Ditch Irrigation System. Also, because the Project includes infrastructure linking the Kōkeʻe Ditch Irrigation System to Mānā Plain, the Project would provide an efficient reliable source of irrigation for the ADC agricultural fields on the Mānā Plain for much of the year. However, it would be necessary for Kekaha Ditch System to provide water for agriculture on Mānā Plain during drier times when water availability from Kōkeʻe streams is limited. In combination, Project benefits would increase food security and generate employment opportunities for the local community. In addition, the Project would provide lease revenue to DHHL and ADC and improve access to DHHL lands through road repairs and maintenance.

Additionally, the Project includes the complete rehabilitation of three State-owned reservoirs in accordance with current Hawaiʻi State Dam Safety Standards, which is required for the reservoirs to be brought into active use at their full capacity for energy and irrigation storage. The Project would provide DHHL with the irrigation water necessary to achieve some of the agricultural goals included in its *West Kauaʻi Regional Plan* and would further the purposes of the HHCA by providing resources that support DHHL's development of the Puʻu ʻŌpae lands on the west side of Kauaʻi, including the Kuleana Subsistence Agricultural Lots as discussed in **Section 1.4**.

4 Proposed Action and Alternatives

4.1 Proposed Action

The Proposed Action is to construct and operate an integrated renewable energy and irrigation Project. The West Kauaʻi Energy Project would utilize existing infrastructure, specifically the Kōkeʻe Ditch Irrigation System and the Puʻu Lua, Puʻu ʻŌpae, and Mānā Reservoirs, for hydroelectric generation and irrigation delivery, and would include both rehabilitation of existing State infrastructure and new construction.

4.1.1 Long-Term Water Lease

The Proposed Action is an integrated renewable energy and irrigation Project that would divert water for energy production and irrigation. Water diversion is an integral part of the Project and will require a water lease from the Board of Land and Natural Resources (BLNR). The Applicant will request a long-term (65-year) lease to divert a multi-year rolling average of 11 MGD of water into the Kōkeʻe Ditch Irrigation System from the Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe Streams combined. The 11 MGD rolling average would be diverted after the Phase Two IIFS is met utilizing the modified existing diversions at each stream, and is the amount provided for the Project in the Waimea Mediation Agreement that was approved by CWRM as discussed in **Section 4.1.1.1**. Water diverted into the Kōkeʻe Ditch Irrigation System would be delivered to Puʻu Lua Reservoir, where it would be stored until released for energy generation and irrigation.

The utilization of the existing Kōkeʻe Ditch Irrigation System with modified diversions and the rehabilitation and use of Puʻu Lua, Puʻu ʻŌpae, and Mānā Reservoirs would allow the Proposed Action to provide the following:

- Renewable energy production via store and release hydroelectric electric generation
- Renewable energy production via solar PV generation
- Pumped hydroelectric and battery storage to shift most of the Project's solar PV energy production for use during the evening peak, nighttime, and morning peak hours (as well as during periods of rainy or cloudy weather) via the release of water and firm hydroelectric electric energy generation
- Irrigation delivery, including DHHL's water reservation of 6.903 MGD, to support diversified agriculture on lands adjacent to the Puʻu ʻŌpae Reservoir, including mauka lands managed by DHHL and ADC, and the agricultural fields on the Mānā Plain that are owned by ADC and managed by KAA
- Maintenance of three state-owned reservoirs in accordance with Hawaiʻi State Dam Safety Standards
- Compliance with IIFS for Kōkeʻe, Kauaʻikinanā, Kawaikōī, and Waiakōali streams

As part of the water lease process, the Applicant would work collaboratively with DOFAW to develop a watershed management plan.

4.1.1.1 Waimea Mediation Agreement

As discussed in **Section 1.2**, the Waimea Mediation Agreement between Pōʻai Ola/West Kauaʻi Watershed Alliance, ADC, KAA, DHHL, and KIUC was approved by CWRM on April 18, 2017, and establishes the IIFS for the Proposed Action. The instream flow standards established in the Mediation Agreement are prescribed in two phases, which are discussed in more detail in **Section 1.2.2**. The Phase One IIFS became effective upon CWRM approval of the Waimea Mediation Agreement and is currently in effect. The Phase Two IIFS goes into effect if the Proposed Action goes into service. The Waimea Mediation Agreement is included as **Appendix A** in this Final EA.

The Phase Two IIFS values during operation of the Proposed Action are provided in **Table 4-1.** All the values were informed by the analysis and report commissioned by CWRM (Element Environmental, LLC, 2016) and CWRM's independent instream flow assessment for Waimea River and its tributaries (CWRM, 2018), and evaluated and agreed upon through the mediation process led by CWRM. As outlined in the Waimea Mediation Agreement, all flows above the Phase Two IIFS flow values may be used by the Proposed Action, but diversion volumes are also limited by ditch and reservoir capacity.

Table 4-1. Phase Two IIFS Rules for the Proposed Action

Stream	Established Value (MGD)	IIFS	IIFS if stream flow is below or equal to established value	IIFS if streamflow is above the established value (MGD)
Kōkeʻe	0.2	Natural flow up to 1.2 MGD	n/a	n/a
Kauaʻikinanā	1.2	--	2/3 of stream flow	0.6
Kawaikōī	6.4	--	2/3 of stream flow	4.0
Waiakōali	1.3	--	2/3 of stream flow	0.8

The Established Value in the second column of **Table 4-1** is roughly equal to a Q70 value on the flow duration curve for each stream, which is the flow that is met or exceeded 70% of the time. The IIFS for Kōkeʻe Stream is a set value of 1.2 MGD, which would generally be all stream flow except during high rain events. The IIFS for Waiakōali, Kawaikōī, and Kauaʻikinanā Streams is comprised of two different flows: one for low-flow periods and one for higher flow periods. For Waiakōali, Kawaikōī, and Kauaʻikinanā Streams, the low-flow period Phase Two IIFS values were set as a variable flow equal to two-thirds of the natural streamflow, which gives the stream and aquatic habitat more than half the natural stream flow during high stress dry periods when stream flows are below the Established Value. For times when stream flow is higher than the Established Value, the Phase Two IIFS for Waiakōali, Kawaikōī, and Kauaʻikinanā Streams are set values as shown in the right-hand column of **Table 4-1**. These set volumes would be maintained in the stream at all times when stream flows are above the Established Value at Waiakōali, Kawaikōī, and Kauaʻikinanā Streams. For example, if the natural streamflow in Kawaikōī Stream were to be 8.0 MGD (above the Established Value), the Phase Two IIFS would be 4.0 MGD (the set value) and the diverted volume would be 4.0 MGD. As another example, if the natural streamflow in Kawaikōī Stream were to be 3.0 MGD (below the Established Value), the Phase Two IIFS would be 2.0 MGD and the diverted volume would be 1.0 MGD.

4.1.1.2 Water Availability for the Proposed Action

Both Waiakōali and Kawaikōī Streams are largely derived from run off from the Alakaʻi Swamp, run through the Nā Pali-Kona Forest Reserve, and are tributaries to the Poʻomau Stream which ultimately feeds the Waimea River. Both Kauaʻikinanā and Kōkeʻe Stream are primarily driven by spring-fed groundwater, and also run through the Nā Pali-Kona Forest Reserve. Kauaʻikinanā Stream is also a tributary to Poʻomau Stream and Kōkeʻe Stream is a tributary to Waiahulu Stream. Poʻomau and Waiahulu Streams ultimately intersect and at their confluence form the Waimea River. There is no active U.S. Geological Survey (USGS) gaging station on Waiakōali or Kauaʻikinanā Streams. However, historic records from USGS Station #316011000 at Waiakōali and USGS Station #16012000 are available for the dates of July 1, 1919, to December 31, 1925. USGS Station #16010000 is located on Kawaikōī Stream upstream of the Kawaikōī Stream Diversion and has been active since 1919 and provides a continuous monitoring record. There are no historic or current flow records for Kōkeʻe Stream. **Figure 4.1** shows the locations of USGS stream and ditch monitoring locations.

To understand the expected volumes of water at each of the four diversion sites, hydrology work was completed to extend and expand the USGS records for the four subject streams. The hydrology and detailed modeling were performed using the period of record of 1920 to 2020 for Kawaikōī USGS Station #16010000. Because of the incomplete or absent USGS records at Waiakōali, Kauaʻikinanā, and Kōkeʻe Streams, a historically based data relationship has been created for modeling flows in Waiakōali and Kauaʻikinanā Streams based on the active USGS Station #16010000 on the Kawaikōī Stream. A correlation percentage with USGS Station #16010000 on Kawaikōī Stream has been determined to predict flows in Kōkeʻe Stream. Based on modeled flows, streamflow characteristics representing the 80th to 20th percentile on the exceedance curves for Waiakōali, Kauaʻikinanā, and Kōkeʻe Streams are listed below.

1. Waiakōali Stream typically runs between 1.1 MGD (80th percentile) and 4.9 MGD (20th percentile) with flood events up to 443 MGD
2. Kauaʻikinanā Stream typically runs between 0.9 MGD (80th percentile) and 2.9 MGD (20th percentile) with flood events up to 521 MGD
3. Kōkeʻe Stream typically runs between 0.7 MGD (80th percentile) and 4.5 MGD (20th percentile) with flood events up to 984 MGD
4. Kawaikōī Stream typically runs between 3.7 (80th percentile) and 23.3 MGD (20th percentile) with flood events that can exceed 5,139 MGD.

The actual flow for Kawaikōī and modeled flows for Waiakōali, Kauaʻikinanā, and Kōkeʻe Streams for dry, normal, and wet years are shown in the exceedance curves below in **Figure 4.2**, **Figure 4.3**, **Figure 4.4** and **Figure 4.5**. Exceedance curves are shown in cubic feet per second (cfs) and can be converted to MGD by dividing the cfs number by 1.55 (10cfs/1.55 = 6.5 MGD). **Figure 4.6** shows an exceedance curve for the combined Kōkeʻe Ditch flow entering Puʻu Lua Reservoir.

Figure 4.1. USGS Stream and Ditch Monitoring Stations

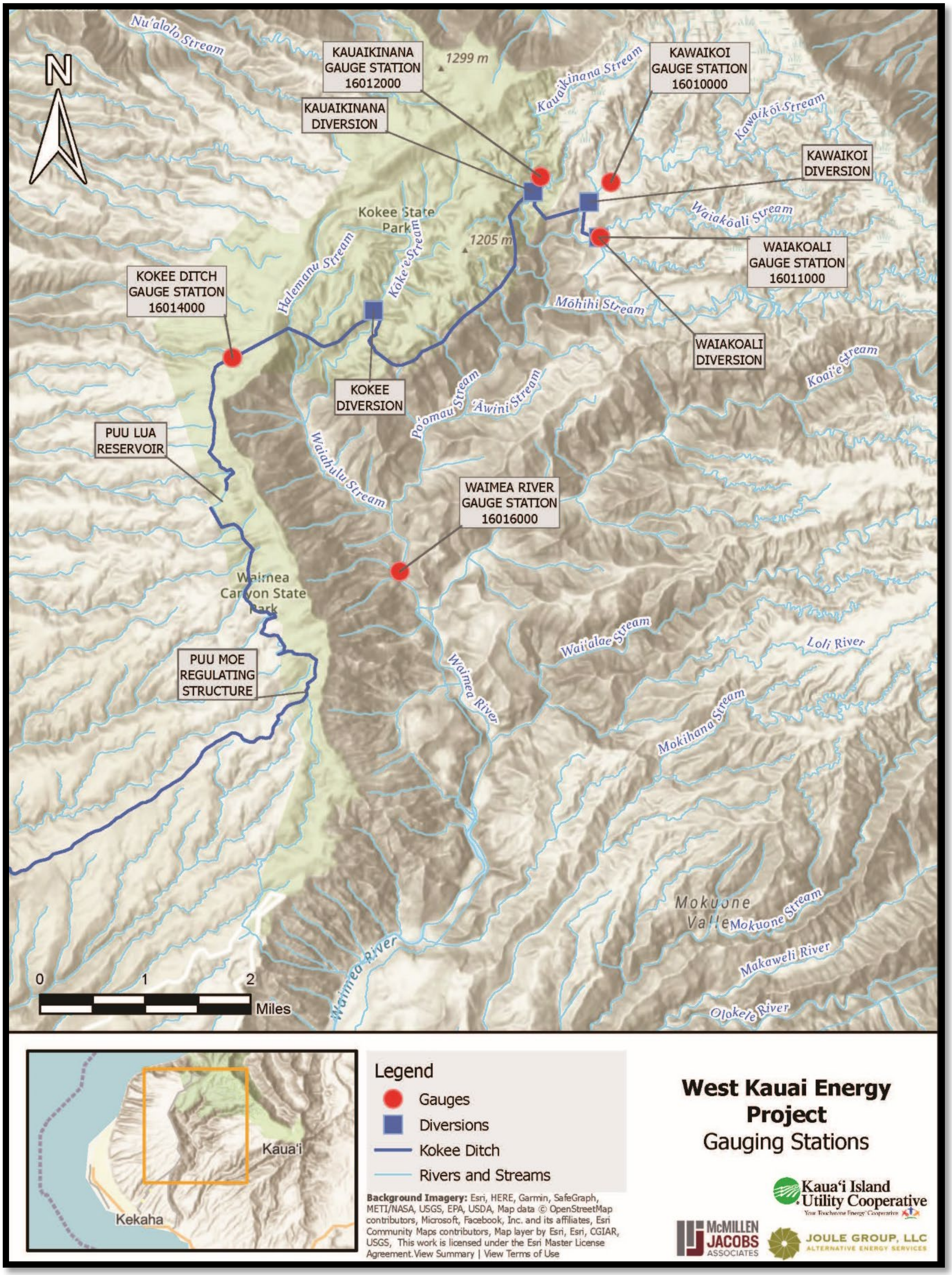


Figure 4.2. Actual Flow for Kawaikōī Stream

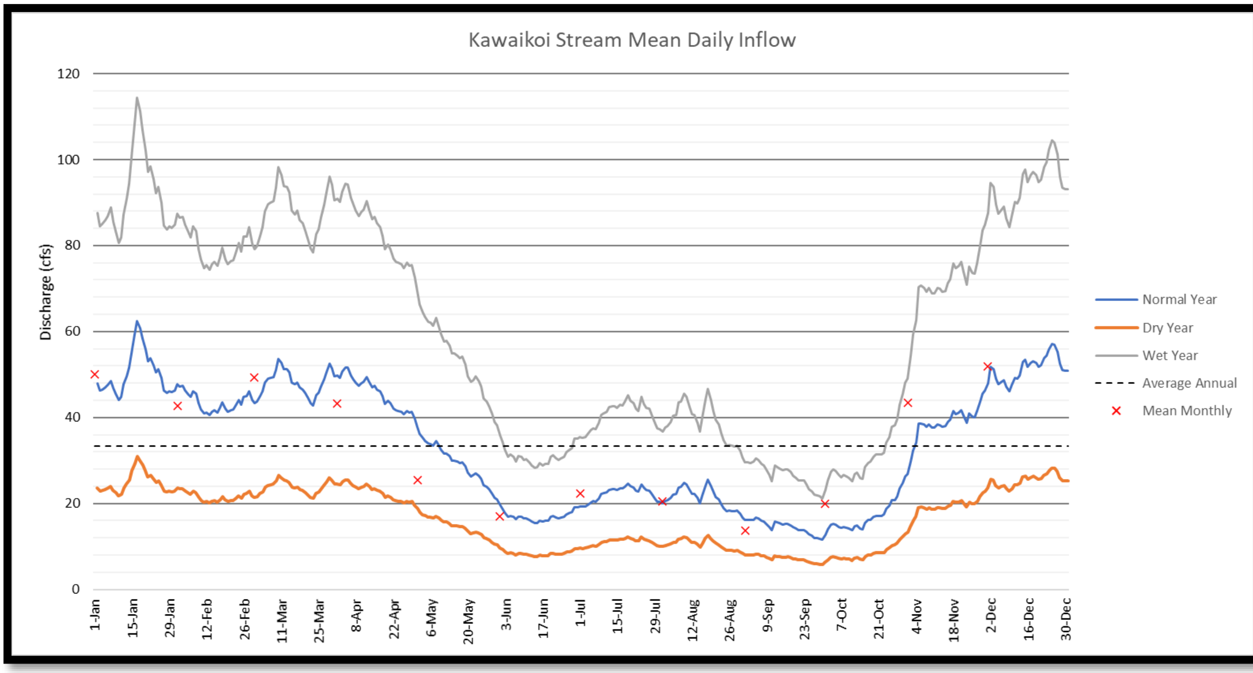


Figure 4.3. Modeled Flow for Waiakōali Stream

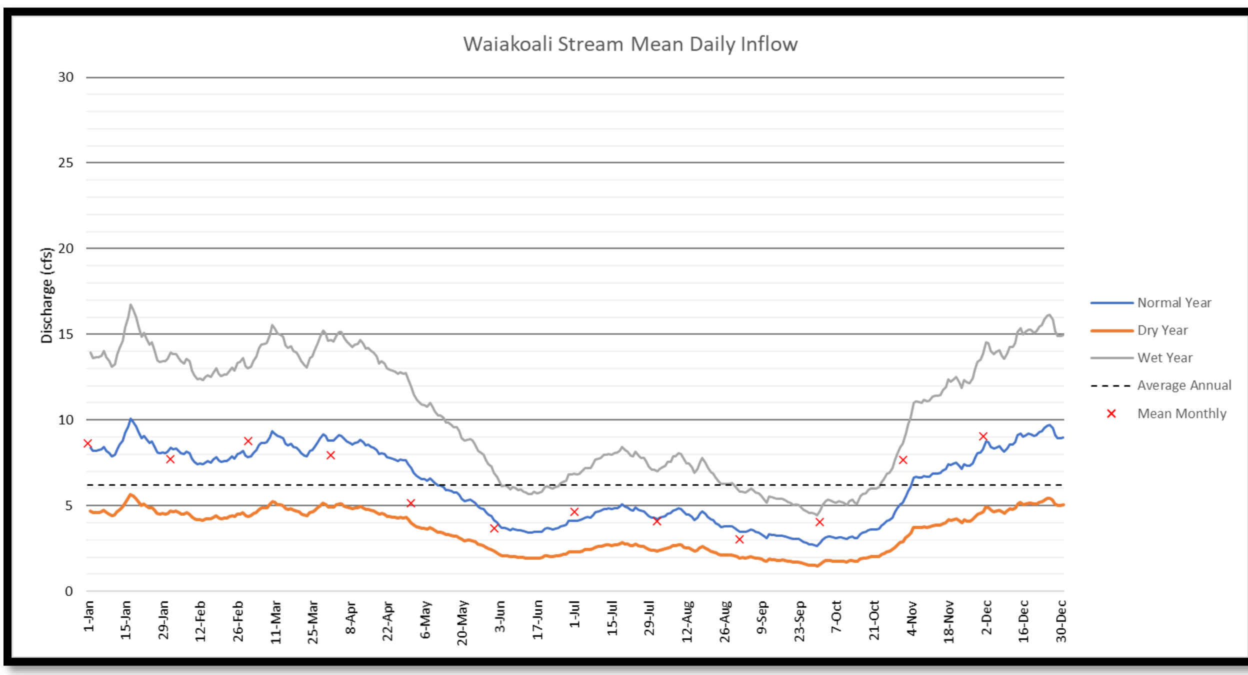


Figure 4.4. Modeled Flow for Kauaʻikinanā Stream

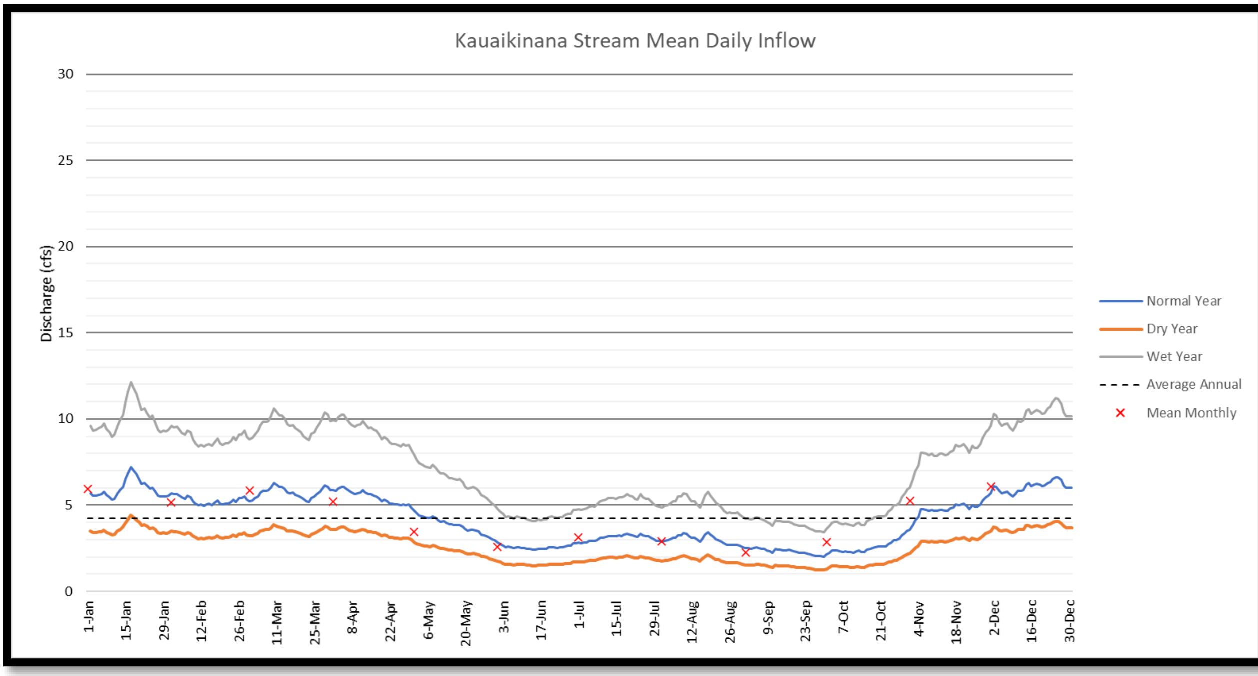


Figure 4.5. Modeled Flow for Kōkeʻe Stream

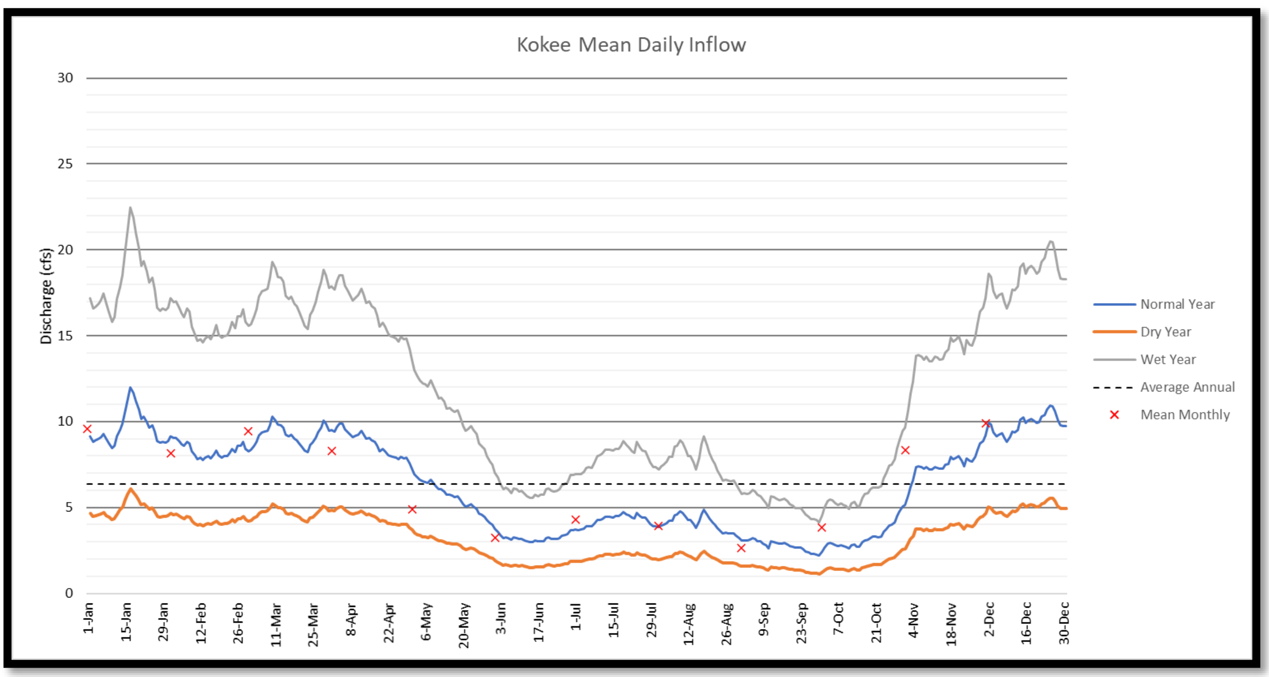
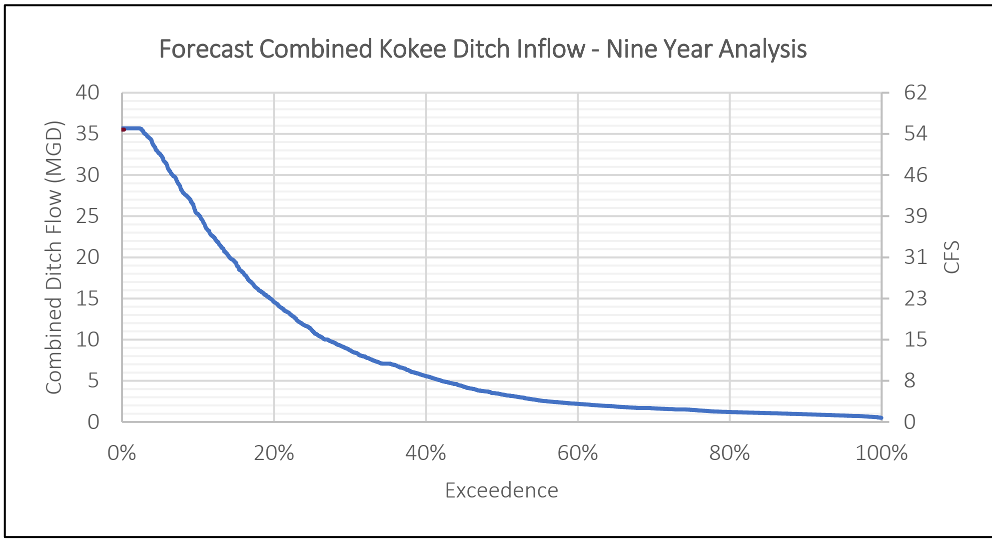


Figure 4.6. Combined Kōkeʻe Ditch Inflow to Puʻu Lua Reservoir



year	15-min mean
1991	11.24
1996	10.39
1997	12.92
2004	15.89
2005	10.08
2007	8.59
2010	8.76
2012	7.74
2013	7.95
9yr Mean	10.40

4.1.1.3 Stream Diversion and Stream Flow Data

The pre- and post-diversion stream flows were analyzed for each of the four streams based on the measured Kawaikōī Stream data and synthesized flow for Waiakōali, Kauaʻikinanā, and Kōkeʻe Streams from 1920 to 2021. Kōkeʻe Ditch capacity assumptions at each diversion location are as follows:

- Ditch at Waiakōali: 15 MGD
- Ditch at Kawaikōī (combined with Waiakōali): 50 MGD
- Ditch at Kauaʻikinanā (combined with Waiakōali and Kawaikōī): 55 MGD
- Ditch at Kōkeʻe (all flow combined): 55 MGD

The fraction of total flow remaining in each stream over the period of record is provided in **Table 4-2**. Exceedance curves for pre- and post-diversion stream flows using actual flow for Kawaikōī Stream and modeled flow for Waiakōali, Kauaʻikinanā, and Kōkeʻe Streams are shown in

Figure 4.7, **Figure 4.8**, **Figure 4.9** and **Figure 4.10**.

Table 4-2. Total Flow Remaining in Streams on the Kōkeʻe Ditch Irrigation System

Stream	Volume Remaining in Stream after Diversion, Avg (%)	Maximum Diversion Amount (MGD)
Waiakōali	32%	15
Kawaikōī	53%	50
Kauaʻikinanā	49%	55
Kōkeʻe	79%	55

Figure 4.7. Kawaikōī Streamflow Pre- and Post-Diversion

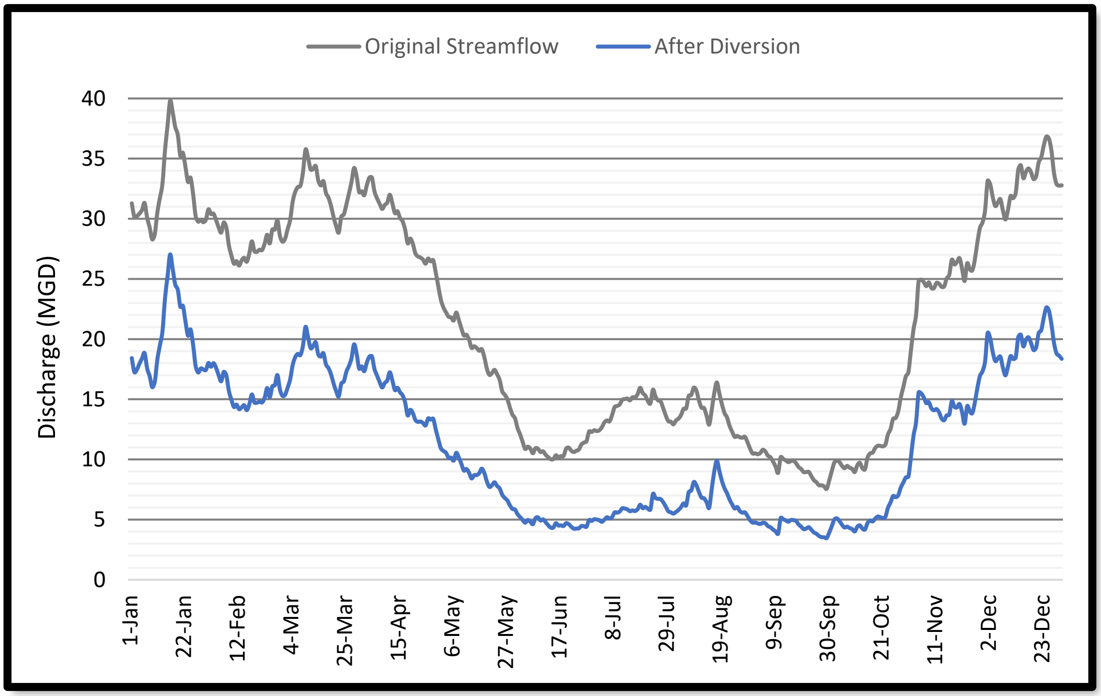


Figure 4.8. Waiakōali Streamflow Pre- and Post-Diversion

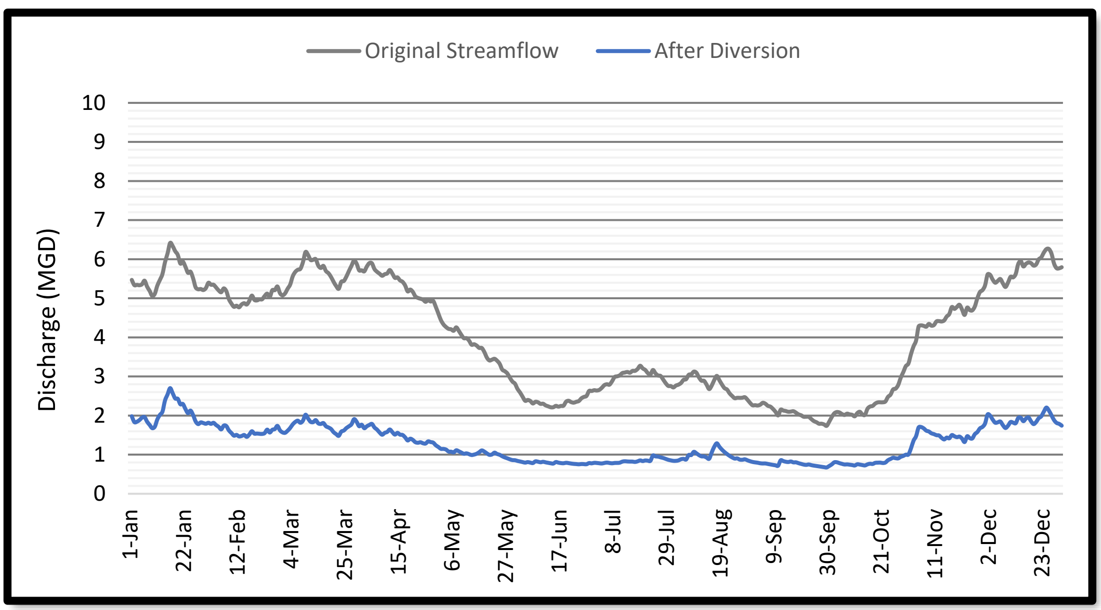


Figure 4.9. Kauaʻikinanā Streamflow Pre- and Post-Diversion

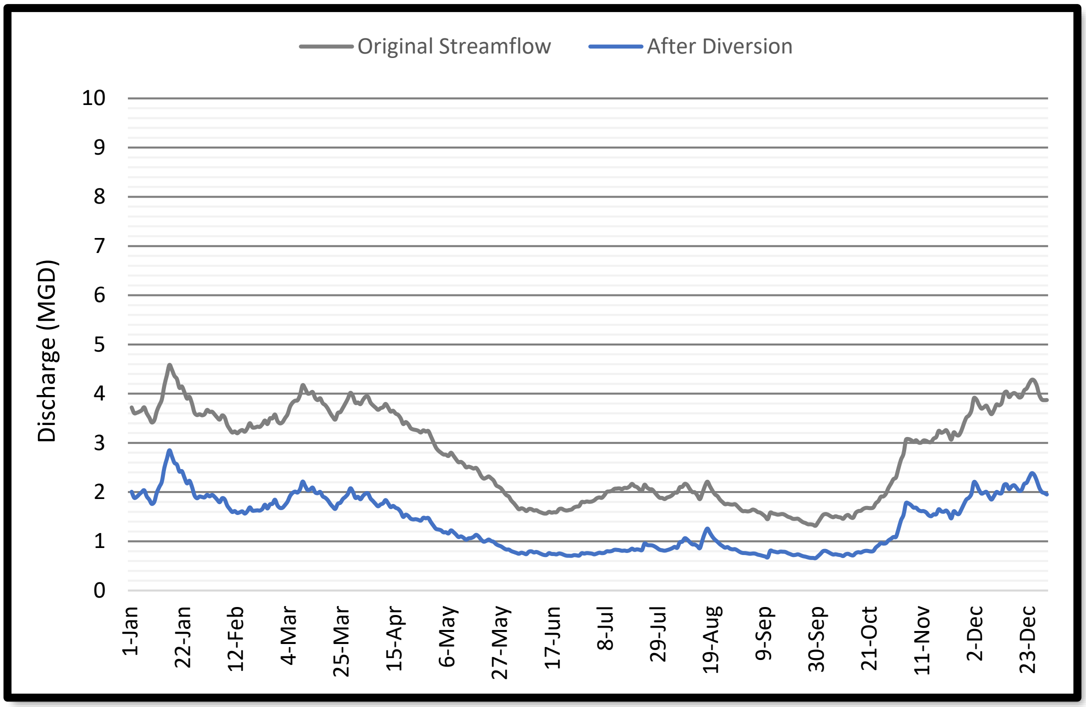
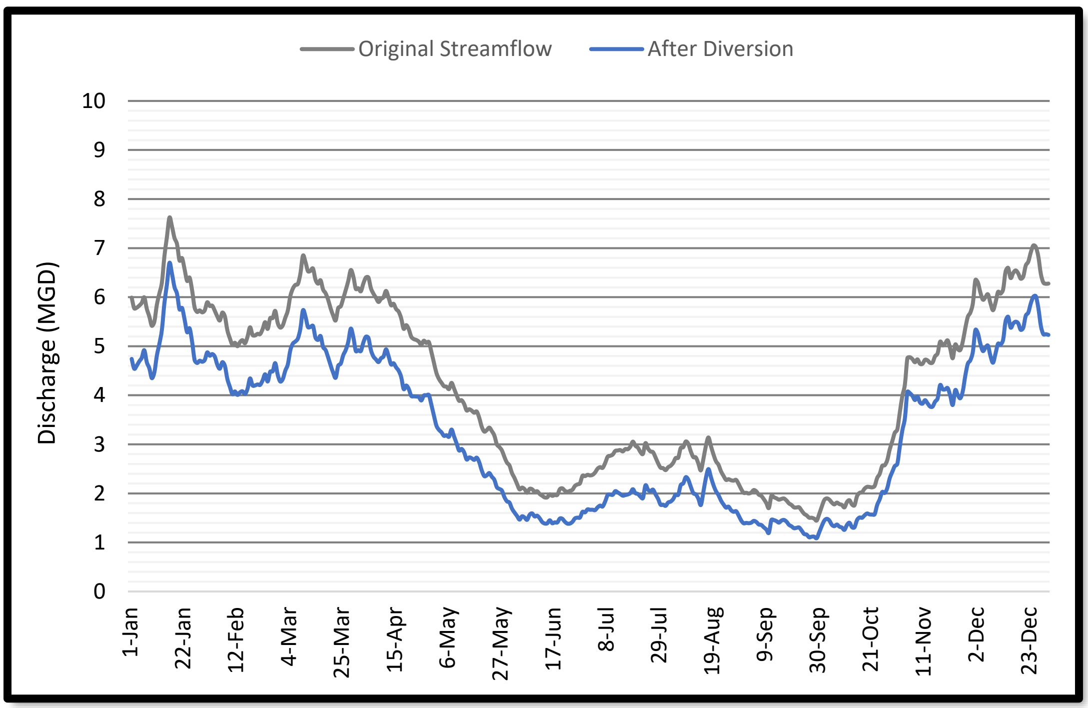


Figure 4.10. Kōkeʻe Streamflow Pre- and Post-Diversion



4.1.1.4 Fraction Diverted from the Waimea River

Historical daily flow rates for the Waimea River are available for a period of record from 2017 to 2021 from USGS Station #16031000, Waimea River near Waimea, Kaua'i. USGS Station #16031000 is located below the diversions on the Kōke'e and Kekaha Ditches and above the confluence with Makaweli Stream, which is a tributary to the Waimea River. The flow values from USGS Station #16031000 were used to simulate the reduction of water flowing in Waimea River at that gage location if the Proposed Action were to be occurring with a combined diversion of 11 MGD rolling average into Kōke'e Ditch and with the implementation of the Phase Two IIFS. These simulated values are shown in **Table 4-3**.

Table 4-3. Waimea River Diversion Amount

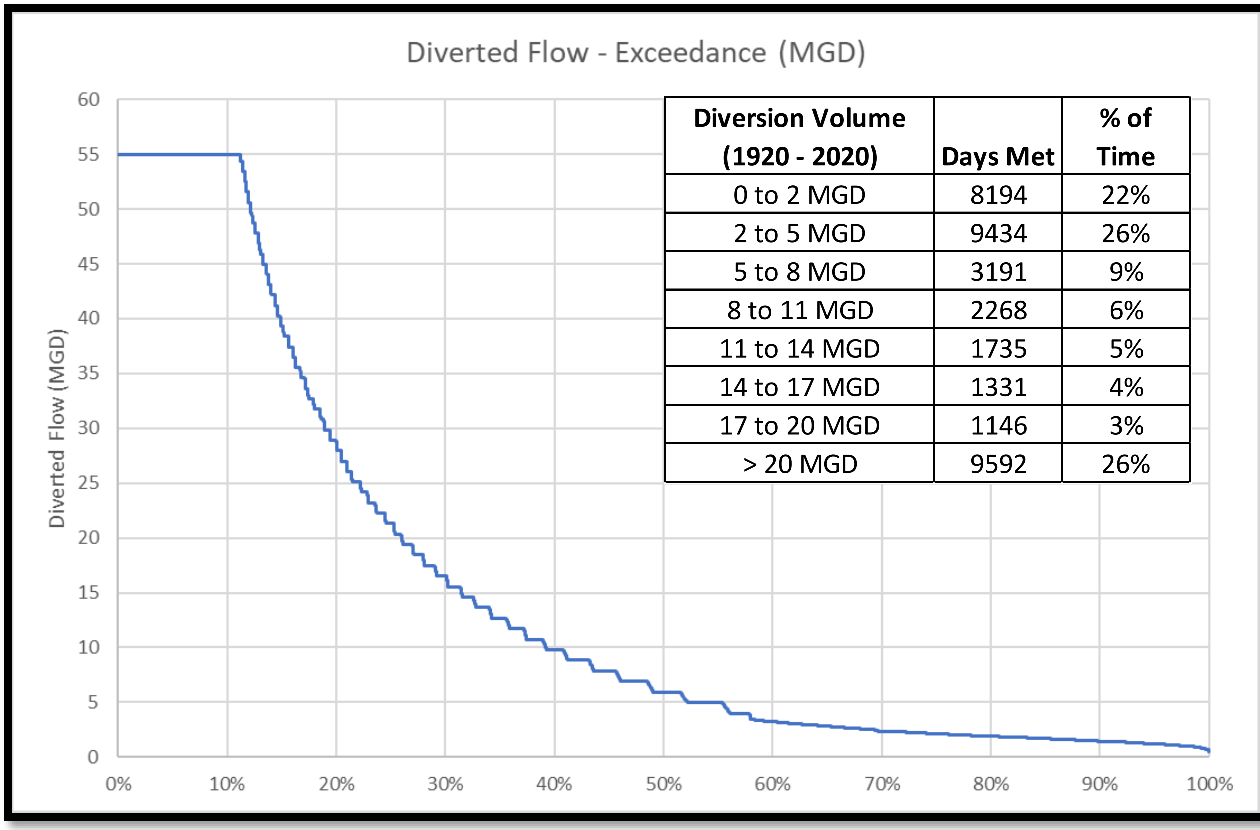
Year	USGS Station #16031000 Waimea River Flow Volume (MGD)	Total Combined Kōke'e Streamflow (MGD)	Diverted Flow Volume (MGD)	Diversion Fraction (%)
2017	26,727	7,560	3,996	15%
2018	44,367	13,648	6,292	14%
2019	36,192	11,699	5,290	15%
2020	44,768	11,855	5,417	12%
2021	42,908	15,690	6,242	15%
			Average for all Five Years	**14.2%**

Based on this simulation, an estimated average of 14.2 % of Waimea River water remaining after diversion into Kekaha Ditch and before consideration of the water contributed from the Makaweli Stream would have been diverted from the Waimea River for the period of 2017 to 2021.

4.1.1.5 Kōke'e Ditch Flow Entering Pu'u Lua Reservoir

Based on actual flow records for Kawaikōī Stream from 1920 to 2020 and modeled flows for Waiakōali, Kaua'ikinanā, and Kōke'e Streams for that same period, the estimated combined Kōke'e Ditch flow from all four diversions entering Pu'u Lua Reservoir is shown in **Figure 4.11**. The exceedance curve shows variable flow rates entering Pu'u Lua Reservoir from Kōke'e Ditch and the table provides an estimated percentage of time when flow volumes are available in Kōke'e Ditch based on stream flow variability and implementation of the IIFS.

Figure 4.11. Combined Kōkeʻe Ditch Flow Entering Puʻu Lua Reservoir



Diversion Volume (1920 - 2020)	Days Met	% of Time
0 to 2 MGD	8194	22%
2 to 5 MGD	9434	26%
5 to 8 MGD	3191	9%
8 to 11 MGD	2268	6%
11 to 14 MGD	1735	5%
14 to 17 MGD	1331	4%
17 to 20 MGD	1146	3%
> 20 MGD	9592	26%

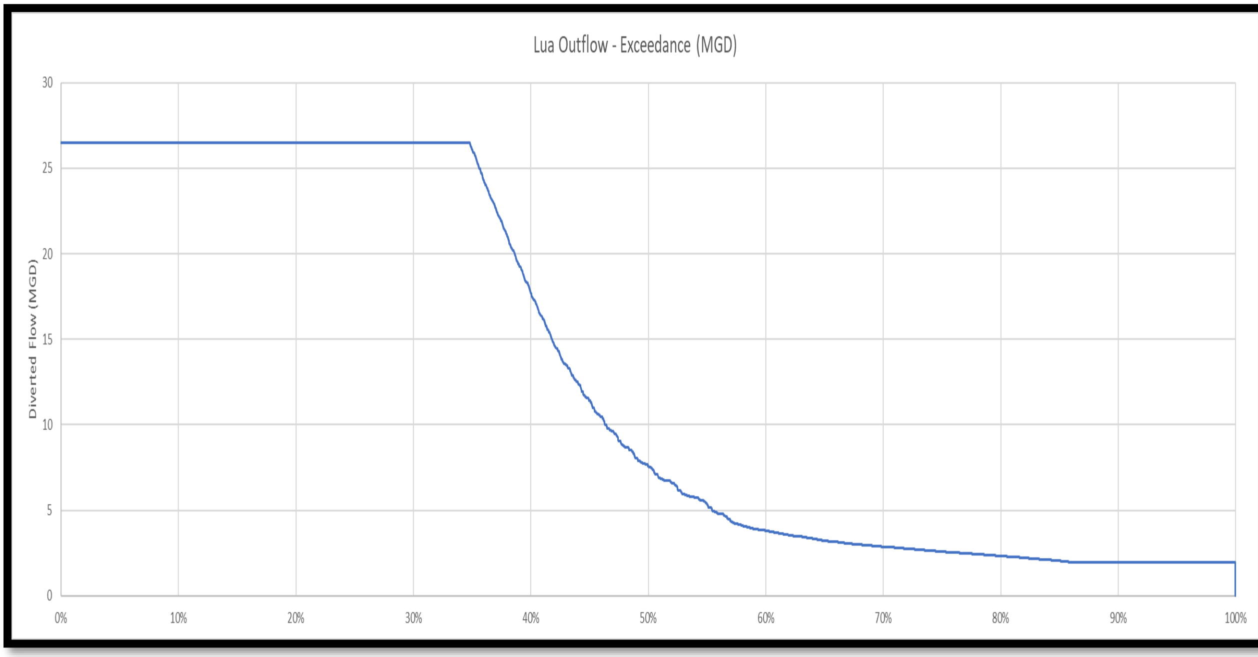
4.1.1.6 Puʻu Lua Outflow

Water delivered through the Kōkeʻe Ditch System to Puʻu Lua Reservoir would be stored until released for energy generation and irrigation. Availability of water that would be released from Puʻu Lua Reservoir at a rate of 26 MGD is shown in **Figure 4.12**.

Assumptions used for modeling the available outflow from Puʻu Lua Reservoir:

- Inflow of 55 MGD availability as shown in **Figure 4.11**
- 200 MG total storage capacity in Puʻu Lua Reservoir
- 176.6 MG active storage volume
- 20 MG irrigation storage (buffer during dry times)
- 20 MG fish habitat storage (buffer during dry times)
- 26 MGD volume available for release into Kōkeʻe Ditch at Puʻu Lua Reservoir outlet

Figure 4.12. Modeled Outflow from Puʻu Lua Reservoir



4.1.1.7 Water Availability for Irrigation

Table 4-4 below shows the percent of time irrigation withdrawals are available based on streamflow availability, Kōkeʻe Ditch capacity, and Puʻu Lua Reservoir capacity.

Table 4-4. Irrigation Withdrawal Availability

Owner	Description	Location	Amount (Max)	Amount of Time Maximum Irrigation Withdrawal Can be Met (Individual – no upstream withdrawals)	Amount of Time Maximum Irrigation Withdrawal Can be Met (If All Upstream Users Took Their Maximum Withdrawal)
Hawaiʻi State Parks	Washrooms	Kōkeʻe Ditch	.02 MGD	100%	100%
ADC	ADC Mauka Ag Tenants	Puʻu Moe Divide	0.5 MGD	100%	100%
DHHL	DHHL Mauka Village	Puʻu Moe Divide	0.8 MGD	100%	100%
DHHL	DHHL Mauka Pastoral	Upper Penstock	0.5 MGD	100%	100%
DHHL	DHHL Puʻu ʻŌpae Tenants	Puʻu ʻŌpae Reservoir	5.63 MGD	54%	50%
ADC/KAA	ADC Makai / Mānā Plain Tenants and KAA	Mānā Reservoir	3.55 MGD	62%	45%

4.1.2 Site-Specific Repairs and Construction for the West Kauaʻi Energy Project

The following subsections discuss the existing infrastructure, current conditions, current operations, proposed construction and access, and proposed operation at each of the Project sites.

The construction activities were designed, planned, and quantified as part of the 60% design engineering effort completed in 2022 and the 30% design engineering effort for the PV Solar Array completed in 2022 (**Appendix D**). These plans are being used to identify and evaluate potential impacts of the Proposed Action. Below is an overall description of the construction activities for each component of the West Kauaʻi Energy Project along with figures that depict the type and location of potential impacts.

In summary, the Project would result in approximately 567.97 acres of potential impacts during construction. The Project would include approximately 422.58 acres during operations. The potential impacts for each component of the Project are presented in **Table 4-5**.

Table 4-5. Potential Impacts from Implementation of the Proposed Action

Project Component	Construction Impacts (acres)	Operation Impacts (acres)
Waiakōali Diversion	0.09	0.01
Kawaikōī Diversion	0.15	0.01
Kauaʻikinanā Diversion	0.11	0.01
Kōkeʻe Diversion	0.03	0.01
Puʻu Lua Reservoir	21.66	17.68
Puʻu Moe Divide	0.25	0.09
Puʻu ʻŌpae Reservoir, Powerhouse and Facility Substation	40.85	22.59
Upper and Lower Penstock	77.54	47.13
Mānā Reservoir, Powerhouse, Pump Station, Facility Substation and Interconnection Line	44.16	29.45
PV Solar Array*	375	303.2
West Kauaʻi Energy Project Substation	7.47	2.4
Total	**567.97**	**422.58**

**Solar PV array operations acreage will include an agricultural component.*

There would be common construction activities that would be implemented in all construction sites to reduce potential impacts. These activities include the following:

- All existing roads utilized for access to construction sites would be left in similar current conditions or improved.

- All temporary staging and construction areas would be staked and fenced. Any clearing or grubbing that may be required would occur within the fenced area. The construction contractor would develop a Storm Water Pollution Prevention Plan to identify measures to reduce potential soil erosion and sediment transport during construction activities. Upon completion of construction activities, the contractor would remove all temporary erosion and sediment control measures, fencing and staging area materials. The contractor would regrade disturbed slopes to near existing conditions and establish a temporary cover on disturbed area and reseed with native vegetation as required.
- All vehicles would travel along the identified access roads and within the areas identified for construction use. No unauthorized off-road travel would occur at any work site.
- Land disturbance would be limited to the areas defined in construction plans.
- The contractor would ensure all equipment would be free of oil/fuel leaks, dirt, plant and animal or fragments of plants, animals, aquatic invasive species, and other vegetative matter prior to entering the work site.
- Bulk storage of hazardous materials would not occur in the immediate vicinity of the stream or ditches and only minimum quantities necessary for current work shall be kept at work sites.

Specific minimization and avoidance measures that would be included with the construction workplan are provided in **Table 4-6**, and further described in the applicable resource section.

Table 4-6. Minimization and Avoidance Measures to be Implemented During Construction Activities

Resource	Minimization and Avoidance Measure
Water Resources, Soils, Biological Resources (Section 5.1.3, 5.2.3)	Contractor would comply with all permit conditions (see **Section 2.7** for list of permits and approvals that may be required)
	Sediment containment devices would be installed and maintained for the term of the construction period
	No work would occur during extreme adverse weather conditions or flooding
	All Project construction-related debris would be removed and disposed of at an approved site
	All construction-related materials and equipment to be placed in an aquatic environment would be inspected for pollutants
	All vehicle and equipment fueling would occur away from the aquatic environment
	A contingency plan and materials for accidental spills of petroleum products would be developed and retained on-site
	Stockpiling would occur away from the aquatic environment
	All deliberately exposed soil near water would be protected from erosion and stabilized as soon as possible
	Temporary erosion control measures would be used during construction to prevent soil loss and to minimize surface runoff into adjacent wetlands and streams

Table 4-6. Minimization and Avoidance Measures to be Implemented During Construction Activities (Cont.)

Resource	Minimization and Avoidance Measure
Biological Resources (Section 5.3.3)	On-site staff would be trained to identify special-status species as well as the appropriate measures to be taken if a special-status species is identified
	A vegetation survey would be conducted for rare and special status species prior to vegetation clearing required for construction in the upper watershed areas including all four diversions, Puʻu Lua Reservoir, Puʻu Moe Divide, and the length of the Upper Penstock. Appropriate measures as recommended by USFWS and DOFAW will be employed if these species are identified within the Project vicinity
	Pre-construction surveys would be conducted in the critical habitat areas for the picture-wing fly and host plant. Appropriate measures as recommended by USFWS and DOFAW will be employed if these species are identified within the Project vicinity
	Pre-construction surveys would be conducted to identify the presence of forest birds in the upper watershed areas including all four diversions, Puʻu Lua Reservoir, Puʻu Moe Divide and the length of the Upper Penstock. Appropriate measures as recommended by USFWS and DOFAW will be employed if these species are identified within the Project vicinity
	Pre-construction surveys and biological monitoring during construction to identify the presence of Hawaiian waterbirds and the Hawaiian goose would be conducted. Appropriate measures as recommended by USFWS and DOFAW will be employed if these species are identified within the Project vicinity
	Nighttime construction would be avoided between September 15 and December 15
	Nighttime construction, if required, would utilize fully shielded and downward facing construction lights
	There would be no disturbance, removal, or trimming of woody plants greater than 15-feet-tall between June 1 and September 15 during the bat birthing and pup rearing season in the upper watershed and other forested areas where bats are known/expected to occur.
	Avoidance of removal of tree cover during peak Hawaiian forest bird breeding season of January 1 – June 30 in the upper watershed areas where Hawaiian forest birds are known/expected to occur. Work at the diversion sites will be during the dry season (typically mid-late summer or early fall) to take into account bat pupping season
	A survey for infected ʻōhiʻa trees would be conducted two weeks prior to tree cutting and the proper protocols would be followed if infected trees are identified
	Pre-construction surveys for federally and/or listed plants during the optimal period of October to April (per USFWS guidance) in the upper watershed areas and biological monitoring during construction.
	Should federally listed plants be identified during pre-construction surveys, USFWS recommendations for designated critical habitat areas and areas outside of designated critical habitat will be followed to avoid potential adverse effects to listed plants
	Kōkeʻe Diversion site is within a designated critical habitat. During construction, access to the site will be via helicopter to avoid vegetation clearing. During operation, access would be through existing roads and trails, which would not involve vegetation clearing

Table 4-6. Minimization and Avoidance Measures to be Implemented During Construction Activities (Cont.)

Resource	Minimization and Avoidance Measure
	Kauaʻikinanā Diversion site is within a designated critical habitat. Vegetation clearing will be limited to a narrow corridor of electrical conduit from the existing parking area to the diversion (approximately 75 feet). If possible, conduit will be placed above ground to limit vegetation and ground disturbance, but trenching for shallow bury may occur
	Installation of Interconnection Line will occur within cleared edges of existing dirt roads; no vegetation clearing or grading would occur. No special-status native plant species will be impacted by the installation of the Interconnection Line
	All equipment and vehicles arriving from outside all portions of the Project area located near designated critical habitat would be washed and inspected prior to any maintenance or construction activities to avoid the unintentional introduction or transport of new invasive plant species
	Minimization measures for the installation of the Interconnection Line include removing approximately two miles of existing overhead powerlines between PMRF and Polihale; limiting height of lines and number of layers on poles to the extent possible while still complying with applicable safety codes, federal and PUC guidelines; and installing reflective or LED diverters.
Traditional Cultural Practices (Section 5.4.3)	All staff would be provided cultural sensitivity training
	The Applicant would work directly with potential affected community members including cultural practitioners prior to and during construction in an effort to minimize or avoid potential disruption of their activities
	All equipment and vehicles arriving from outside all portions of the Project area located near designated critical habitat would be washed and inspected prior to any maintenance or construction activities to avoid the unintentional introduction or transport of new invasive plant species
	If human remains or burials are identified, all earth-moving activities in the area would stop and the SHPD, DHHL, and the Police Department would be notified
	If any previously unidentified potential historic properties are identified all activities in the area would stop and SHPD would be notified
Archaeological and Historic Resources (Section 5.5.3)	If human remains or burials are identified, all earth-moving activities in the area would stop and the SHPD, DHHL, and the Police Department would be notified
	If any previously unidentified potential historic properties are identified all activities in the area would stop and SHPD would be notified
	It is recommended that archaeological monitoring be conducted during construction of the Upper Penstock as well as along the Lower Penstock between the crest of Niu Ridge and Kekaha Ditch
	The four hearths (CSH 3) and basalt wall (CSH 5) would be avoided (i.e., Preservation). If avoidance is not possible, then data recovery would be performed.
	Sufficient information on CSH 4 was collected during the AIS to mitigate the effect on the historic property

Table 4-6. Minimization and Avoidance Measures to be Implemented During Construction Activities (Cont.)

Resource	Minimization and Avoidance Measure
Traffic and Transportation (Section 5.8.3)	Construction-related deliveries and vehicular ingress/egress would be avoided during the morning and afternoon peak hours (6:30 AM to 7:30 AM and 4:00 PM to 5:00 PM) would be avoided to the extent possible
	If night work occurs, appropriate permitting and monitoring would be employed
	Workers would be encouraged to carpool from an off-site location
	All loading and unloading activities would be coordinated to ensure all construction vehicles can be accommodated on-site
	Heavy equipment transportation and truck traffic would be limited as much as possible to weekdays and during daytime hours. If heavy equipment and truck traffic occur after normal working hours, appropriate permitting would be employed.
Air Quality and Greenhouse Gases (Section 5.12.3)	A dust control plan would be developed and implemented to minimize fugitive dust during construction
	Contractors would be required to maintain equipment with emissions controls
Natural Hazards (Section 5.13.3)	Personnel would respond to any emergency messages or alerts, as appropriate, to ensure their safety.

The Proposed Action would be operated automatically and monitored remotely around the clock by means of a Supervisory Control and Data Acquisition (SCADA) system and a combination of West Kauaʻi Energy Project employees and KIUC dispatchers. Integrated adjustment of the West Kauaʻi Energy Project from the diversion intake gates, the reservoirs, and both hydroelectric powerhouses, along with the PV Solar Array, battery energy storage system, and substation, would be performed automatically according to predefined operating parameters and commands from KIUC's dispatch. These operating parameters would consider the following:

- Precipitation
- Flow prioritization
- Environmental flow releases
- Stream and ditch flows
- Regulatory requirements
- Reservoir levels
- Gate settings
- Turbine settings
- Pump settings
- Sunlight and PV energy production
- Battery State of charge

- KIUC system load and dispatch requirements
- Seasonal and time-of-day scheduling need

4.1.2.1 Kōkeʻe Ditch Irrigation System

The Kōkeʻe Ditch Irrigation System was built by the Kekaha Sugar Plantation in the 1920s to provide an irrigation source for the production of sugar on the mauka (landward) lands above Waimea. The primary source of water for the system is derived from the Alakaʻi Swamp located approximately one mile northeast of the Waiakōali Intake (see **Section 5.1.1.2**). The Kōkeʻe Ditch Irrigation System historically included the following:

- Five main diversions
- 48 tunnels totaling approximately 8 miles
- Approximately 18 miles of open ditches
- Three reservoirs – Puʻu Lua, Puʻu ʻŌpae, and Mānā

At one time the system was fed by as many as 15 diversions that started with the Mōhihi Intake located at 3,497 feet msl on the Mōhihi Stream and was followed by main diversions on the Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe Streams. The diversions were designed and constructed to divert all water in the streams during low and median flow periods. The Mōhihi Diversion and Ditch are both now abandoned and the highest point on the system is the Waiakōali Stream Intake. All the streams diverted to the Kōkeʻe Ditch are tributaries to the Waimea River.

Current Site Conditions and Use

There are three existing unlined earthen reservoirs associated with the Proposed Action: the Puʻu Lua Reservoir and Puʻu ʻŌpae Reservoir, which are part of the Kōkeʻe Ditch Irrigation System; and Mānā Reservoir, which is part of the Kekaha Ditch Irrigation System, as discussed in **Section 1.1.3.2** and shown in **Figure 1.3**. These three legacy reservoirs were built almost 100 years ago to serve as irrigation sources for sugar cultivation. While properly designed and constructed according to the standards of that era, they are currently not in compliance with the Hawaiʻi State Dam Safety Standards and need to be rebuilt to reduce the risks to life and property that could result from dam failures. Puʻu Lua Reservoir is operated at partial capacity and both Puʻu ʻŌpae and Mānā Reservoirs have been drained and are not currently in service.

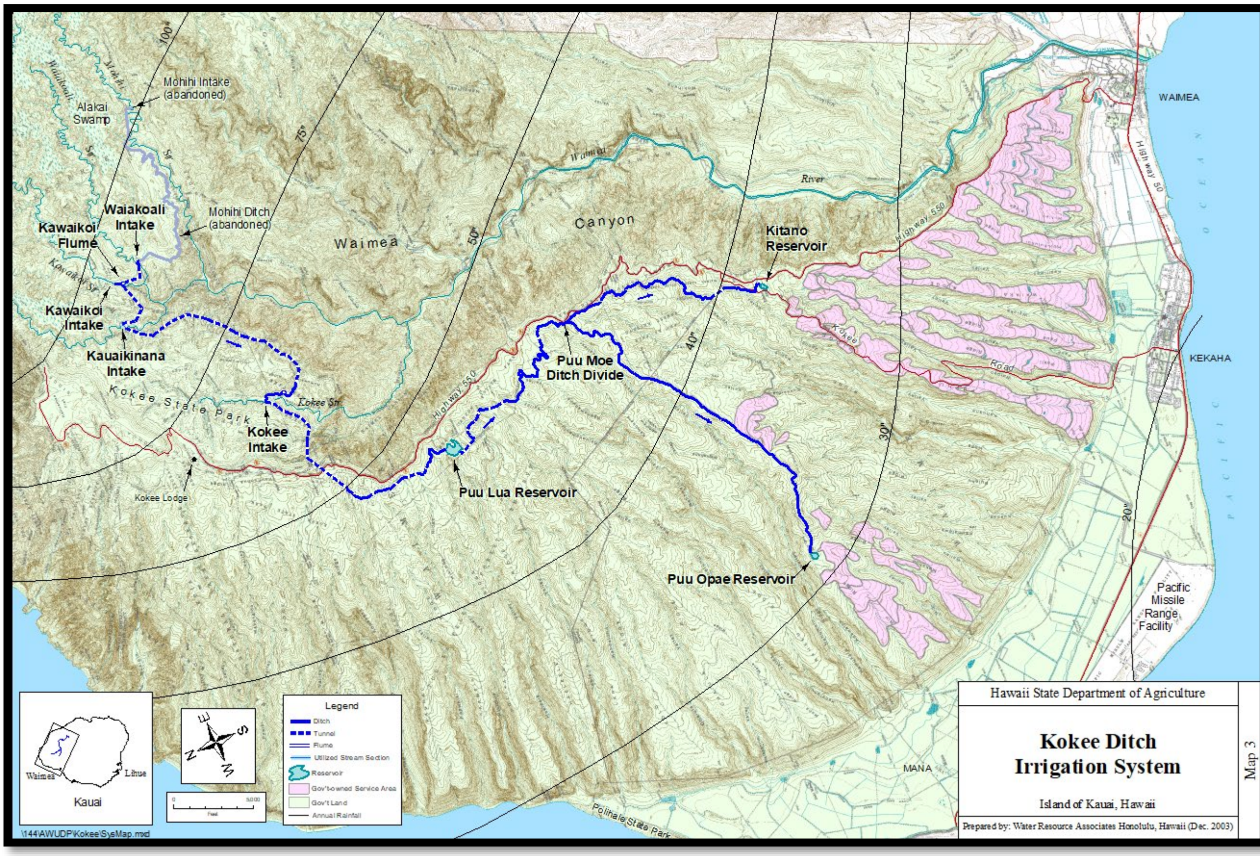
The existing facilities are shown in **Figure 4.13**.

As shown in **Figure 4.14**, the Kōkeʻe Ditch Irrigation System currently receives water from four main tributaries to the Waimea River: Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe Streams. The system was originally designed and built to remove water from the Waimea River and deliver it to agricultural fields located outside of the watershed, and it continues to operate in this way today.

The Kōkeʻe Ditch Irrigation System has been in operation since the early 1920s with a historic average diversion volume of 15.94 MGD as measured by the USGS at the Puʻu Lua Reservoir inlet (USGS gage 16014000) over the 56-year period of record (1926 – 1982). The median flow in Kōkeʻe Ditch as reported by KAA between January 2010 and June 2013 was 8.0 MGD (Spengler 2016).

Figure 4.13. Existing Facilities

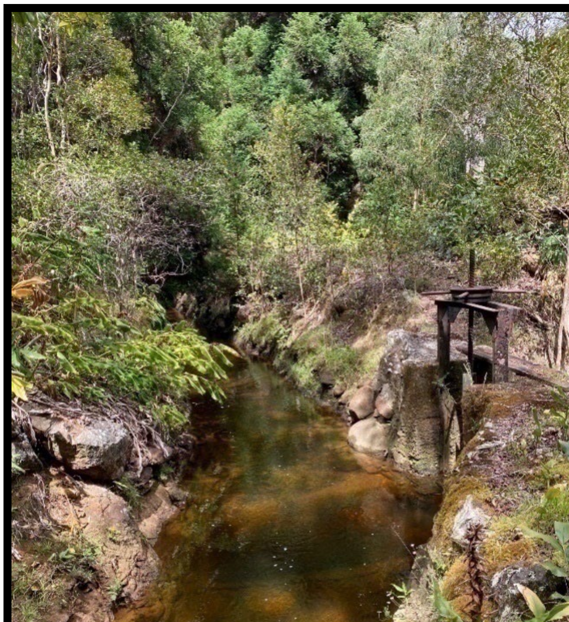
Figure 4.14. Kōkeʻe Ditch Irrigation System



As noted in CWRM staff's Waimea IFSAR (CWRM 2016), currently there is limited demand on the Kōkeʻe system with estimates as listed below:

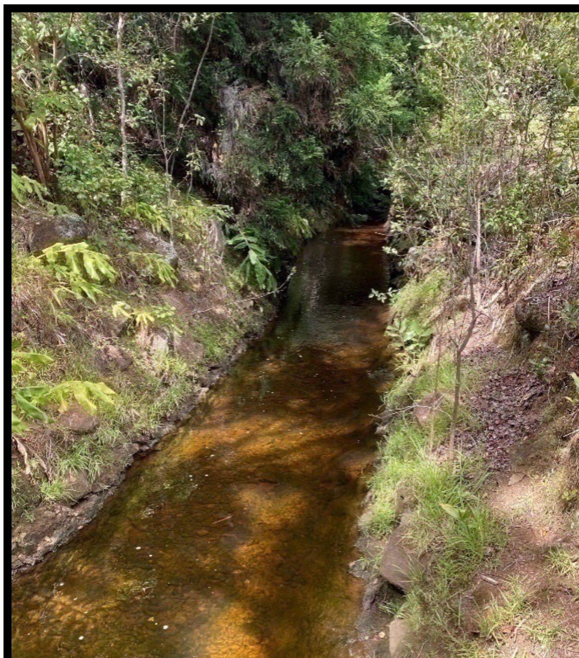
- DHHL: 0.29 MGD
- Wine of Kauaʻi (ADC mauka): 0.29 MGD
- Puʻu Lua Reservoir: volume not estimated but reservoir water height limited to 60 ft
- Kauhao sluice gate release into Kauhao Gulch to prevent silt buildup: 0.3 MGD
- Ditch maintenance flow maintained in ditch up to Puʻu Moe Divide: 1.5 MGD
- Approximate ditch discharge of 1.0 MGD at the end of the Kōkeʻe Ditch Irrigation System
- Water going south past Puʻu Moe Divide can provide back up to Menehune Ditch and Mānā Plain water users when Kekaha Ditch is shut down for repairs

After approval of the Waimea Mediation Agreement, KAA removed all pani boards at the four Kōkeʻe Ditch diversions to allow as much water as possible to remain in the stream channel and limit diversion quantities to the extent possible without construction of modifications that required permits. Under the Phase One IIFS, which is now in effect, approximately 1.5 to 2 MGD is delivered to Puʻu Lua Reservoir through the Kōkeʻe Ditch Irrigation System based on current needs. Until the Phase One IIFS modifications can be fully implemented as noted in **Section 1.2.2.1**, during low and median flows all water is diverted into the Kōkeʻe system but some is returned to streams through sluice gates downstream of the diversion point. In most cases, water is returned within a few hundred feet of the diversion point through sluice gates. However, some combined diverted flow is still returned to the watershed at Kōkeʻe Stream.



Sluice gate downstream of Kawaikōī Diversion with ditch flow from Waiakōali and Kawaikōī Diversions

Sluice gate in disrepair returning ditch water to Kawaikōī Stream



Combined Waiakōali and Kawaikōī ditch flow exiting tunnel downstream of Kawaikōī Diversion

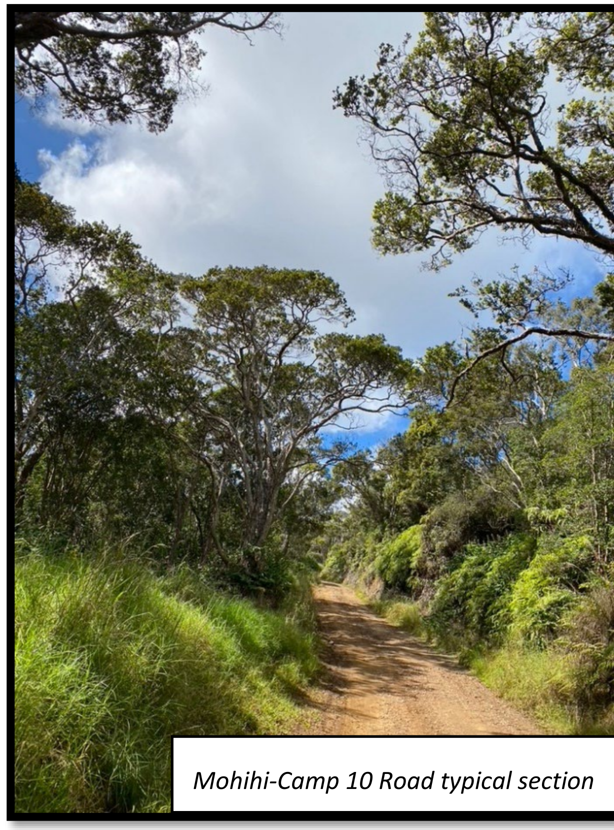
Site Access

The majority of the Kōkeʻe Ditch Irrigation System upstream of Puʻu Lua Reservoir is accessed via Mōhihi-Camp 10 Road. All along the ditch length is a combination of ditch maintenance roads suitable for ATV use or foot trails that provide access for maintenance purposes.

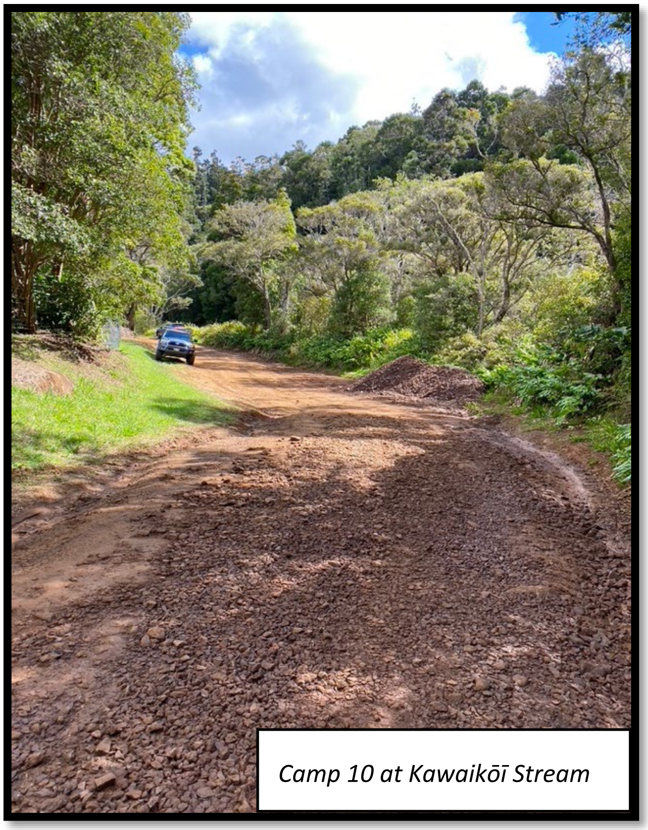
Proposed Construction

The entire length of the Kōkeʻe Ditch Irrigation System between the diversions and the Puʻu Moe Divide would be inspected, cleaned, repaired, and improved as appropriate to ensure efficient water delivery and longevity. Modifications would be made to the diversion structures as described in **Sections 4.1.2.2**, **4.1.2.3**, **4.1.2.4**, and **4.1.2.5**.

Mohihi-Camp 10 Road near entrance from Waimea Canyon Drive/Hwy 550



Mohihi-Camp 10 Road typical section



Camp 10 at Kawaikōī Stream

Camp 10 near Mohihi

Typical ditch maintenance road

Typical ditch maintenance trail

Proposed Operations for Kōkeʻe Ditch System and Gaging

The operational goals for the stream diversions are:

- Responsive and efficient operation
- Reliably maintaining IIFS volumes in streams at all times
- Capturing high flows to the greatest extent possible to recharge reservoirs
- Accumulating comprehensive flow records to inform operations and management decisions

The Phase Two IIFS values set by CWRM would be maintained at each of the four diversions at all times prior to diversion of water into the Kōkeʻe Ditch Irrigation System for irrigation and hydroelectric generation. Through the Proposed Action, diversion modifications would be completed for the implementation of the Phase Two IIFS, which would include installation of flow monitoring equipment and automation of the diversion control gates. The modifications associated with the Proposed Action would increase the reliability and consistency of IIFS implementation. All water diverted by the Project would be used for energy generation and/or agriculture, both of which are identified as beneficial uses in the Waimea Mediation Agreement. Water that cannot be used by the Project would not be diverted and would remain in the streams.

The Proposed Action would involve diverting a variable flow equivalent for a multi-year rolling average of 11 MGD into the Puʻu Lua Reservoir after the CWRM established Phase Two IIFS is met. The 11 MGD variable flow would be comprised of the combined volumes diverted into the Kōkeʻe Ditch Irrigation System from Kōkeʻe, Kauaʻikinanā, Kawaikōī, and Waiakōali Streams. The rolling average would be maintained by diverting more water than the average 11 MGD during the wetter periods when stream flows are higher than average, and by diverting less water than the average 11 MGD during the drier periods when stream flows are lower than average. The variable diversion volumes would be driven by streamflow availability provided that the Phase Two IIFS is met or exceeded at all times when water is being diverted and the multi-year rolling average is 11 MGD or less. When stream flows are equal to or less than the Phase Two IIFS, no water would be diverted.

The diverted water would be used for DHHL's water reservation of 6.903 MGD, store and release hydroelectric generation, and other irrigation and consumptive uses along the Project flowline. Details of consumptive use and irrigation delivery through the Project are shown below in **Table 4-7**.

Table 4-7. Water Use Throughout the Project Flow Path

User	Purpose	Point on System	Usage Amount (gpd)
Hawaiʻi Department of Aquatic Resources (DAR)	Public recreational trout fishing program	Puʻu Lua Reservoir	Non-consumptive; dependent upon flow through water for water quality
Hawaiʻi State Parks	Non-potable water for public viewpoint washrooms	Open ditch between Puʻu Lua and Puʻu Moe Divide	Consumptive; <20,000 GPD
DLNR / County of Kauaʻi	Water source for mauka lands fire fighting	Puʻu Lua Reservoir and Puʻu ʻŌpae Reservoir	n/a – emergency use/consumptive
ADC Mauka Ag Tenants	Diversified agriculture	Open Ditch to south of Puʻu Moe Divide	Consumptive; =< 500,000 GPD per Waimea Mediation Agreement ("WMA")
DHHL Mauka Village	Mauka Village consumptive use	Open Ditch to south of Puʻu Moe Divide	Consumptive; =<800,000 GPD
DHHL Mauka Pastoral Tenants	Pastoral agriculture / stock watering	Along western ditch/penstock route at upper DHHL border	Consumptive; =< 500,000 GPD per WMA and within DHHL Water Reservation
DHHL Puʻu ʻŌpae Tenants	Pastoral agriculture, diversified agriculture, stock watering, potential aquaculture and pastoral homesteading water supply	Pumped supply point from Puʻu ʻŌpae Powerhouse	Consumptive; =< 1,000,000 GPD - per WMA and within DHHL Water Reservation
		Gravity supply point from Puʻu ʻŌpae Reservoir	Consumptive; =< 4,630,000 GPD - per WMA and within DHHL Water Reservation
ADC Makai / Mānā Plain Tenants and KAA	Diversified Agriculture	Gravity feed to filters and drip irrigation from Mānā Reservoir	Consumptive; =< 3,500,000 GPD as available to supplement existing Kekaha system for Mānā Plain between Waiawa and Polihale
		Pumped feed to new ADC Kekaha Ditch pressurized main	

Note: Water use numbers do not include the non-consumptive pass-through flow used for renewable energy generation associated with the Proposed Action.

The natural flow in the streams providing water to the Kōkeʻe Ditch Irrigation System is highly variable and is subject to rapid changes in flow depending upon precipitation. For this reason, the diversions would operate on a fully automatic basis. The automatic operation would allow diversion flow management, and implementation of the Phase Two IIFS can happen in response to changes in streamflow. This eliminates the dependency on timely site access by ditch operators, which is often limited or not possible in the more remote areas. Automation of the diversion operations would reliably ensure compliance with IIFS requirements, limit water diversion to only what would be needed for beneficial uses, improve energy production, and decrease demands on operation personnel.

During periods of average or typical streamflow patterns, the gates would adjust repeatedly throughout the day to manage the diversion volumes according to the requirements of the Phase Two IIFS and limits of ditch capacities. During high stream flow periods or extended heavy precipitation events when the available flows exceed the capacity of the ditches, or when the Puʻu Lua Reservoir is already at full capacity, the gates would automatically restrict flow into the ditch so that excess flows would remain in the streams and be discharged at the diversion spillways. During extreme high flow events, the diversion intake gates would be partially or fully closed to isolate the Kōkeʻe Ditch Irrigation System from excess inflow.

Flow gages in the streams and ditches would provide data to the control system resulting in inlet gate position adjustments day and night in response to stream flow changes. These automatic adjustments would keep the proper amount of water in the streams by regulating the amount of water admitted to the ditch. The automation system would be capable of independent local control but would communicate flow conditions, gate setting, and any alarm conditions to the Proposed Action's Supervisory Control and Data Acquisition (SCADA) main control system. Like many remote installations, the diversion control systems would use energy efficient equipment powered by solar power and a tiny backup generator. The data gathered regarding stream flows would be made available to the State and would be used to inform decisions regarding reservoir management and energy generation.

Routine Project maintenance would include periodically checking the automated system, gates and trash racks, overflow weirs, gaging sensors, and diversions to ensure everything is operating properly and to implement any repairs or maintenance actions as needed.

4.1.2.2 Waiakōali Diversion

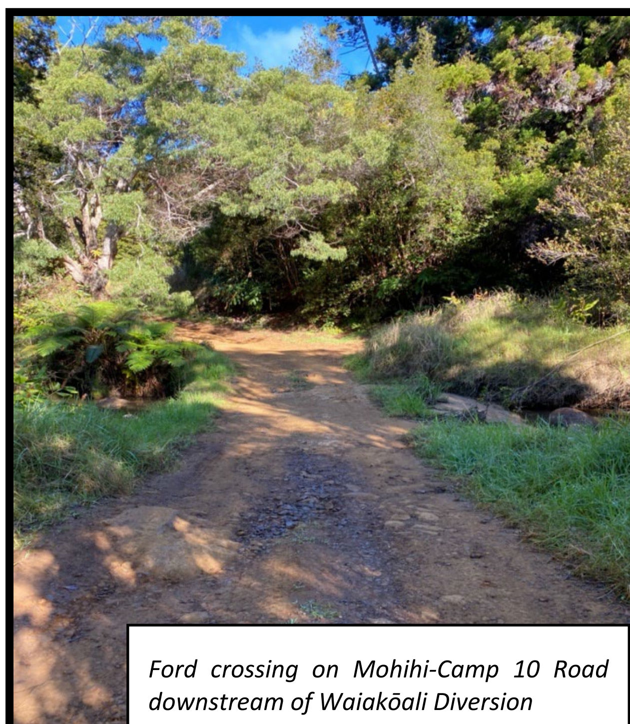
Current Site Conditions and Use

Waiakōali Diversion is located along Mōhihi-Camp 10 Road approximately 4.5 miles from the entrance to Camp 10 from Waimea Canyon Drive. The diversion has been in operation since original construction in the 1920s. Across the road from Waiakōali Diversion is Waiakōali Campground, which is frequently used by locals and tourist for recreational camping and has a shelter and a composting toilet. A photo of the campground is below. Camping at Waiakōali Diversion occasionally happens as demonstrated by the fire ring in the parking area of the diversion in one of the photos below.

Aerial View of Existing Waiakōali Diversion

Waiakōali Campground

Parking area at Waiakōali Diversion with fire pit and cleared area near ditch bank



Ford crossing on Mohihi-Camp 10 Road downstream of Waiakōali Diversion

Site Access

The diversion can be accessed from Mōhihi-Camp 10 Road through two existing spur roads: one (approximately 90 feet in length) provides access to the intake ditch and right abutment and the second (approximately 1.3 miles) provides access to the left abutment. Entrance between the two spur roads from Camp 10 is approximately 1/5 of a mile and spans the existing ford crossing downstream of the diversion.

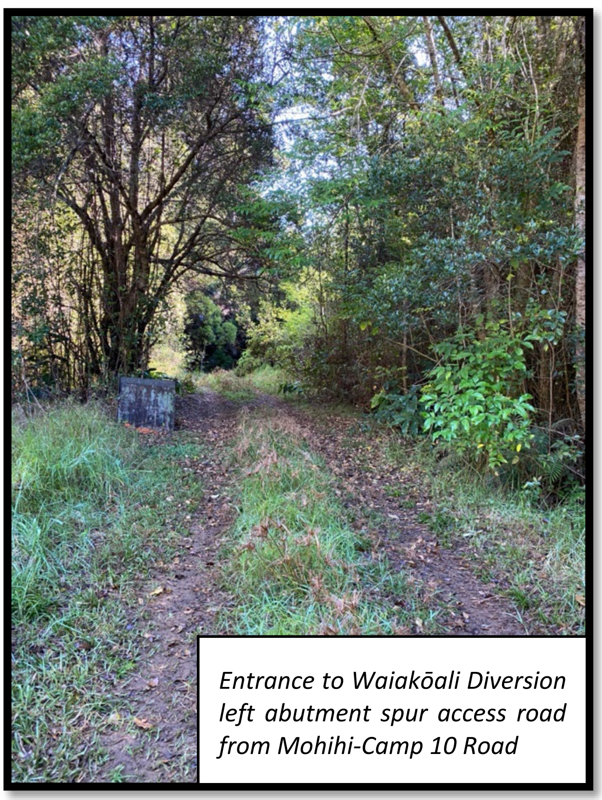
Existing Infrastructure and Current Operations

The Waiakōali Diversion is the first operating diversion on the Kōke‘e Ditch Irrigation System since the Mōhihi Diversion was abandoned in the 1980s. A concrete dam spans the width of Waiakōali Stream just upstream of Mōhihi-Camp 10 Road. The diversion was designed to capture all stream flow except during high flow events when the stream rises to a sufficient height to overtop the concrete wall structure. Waiakōali Stream is the second largest contributor to the Kōke‘e Ditch

Irrigation System with a drainage area of 1.99 square miles and 133 inches of precipitation annually (Element Environmental, 2016). The Waiakōali Diversion consists of a series of man-made tunnels, basalt and mortar constructed wall, and concrete masonry walls. The concrete structure diverts water from Waiakōali Stream to a short segment of open ditch, which transitions to a series of tunnels that delivers water through the Kōkeʻe Ditch to Kawaikōī. The diversion also contains a concrete overflow structure to allow flow to return to the Waiakōali Stream in the event ditch capacity is exceeded. The diversion spillway and right-side abutment currently have surficial structural issues that require repair. The left-side abutment was damaged at some point in past years and requires reinforcement.

The Waiakōali Diversion diverts water at 3,424 feet msl into an open six-foot-wide ditch and then a 0.4-mile-long tunnel before entering a 200-foot-long, 30-inch diameter high density polyethylene (HDPE) pipe that crosses Kawaikōī Stream.

Without modifications, low and median flows continue to be diverted at Waiakōali. During low-flow conditions, the segment of Waiakōali Stream below the dam receives minimal amounts of flow from small amounts of seepage through the dam. However, since the Waimea Mediation Agreement, current operations involve returning the majority of diverted flow back to Waiakōali Stream a few hundred feet downstream of the diversion location and only a small portion of flow remains in the ditch.

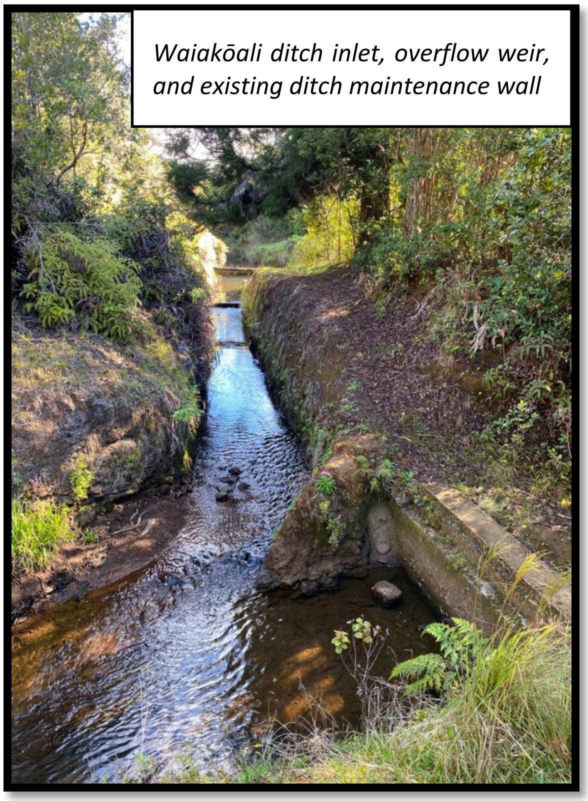


Entrance to Waiakōali Diversion left abutment spur access road from Mohihi-Camp 10 Road

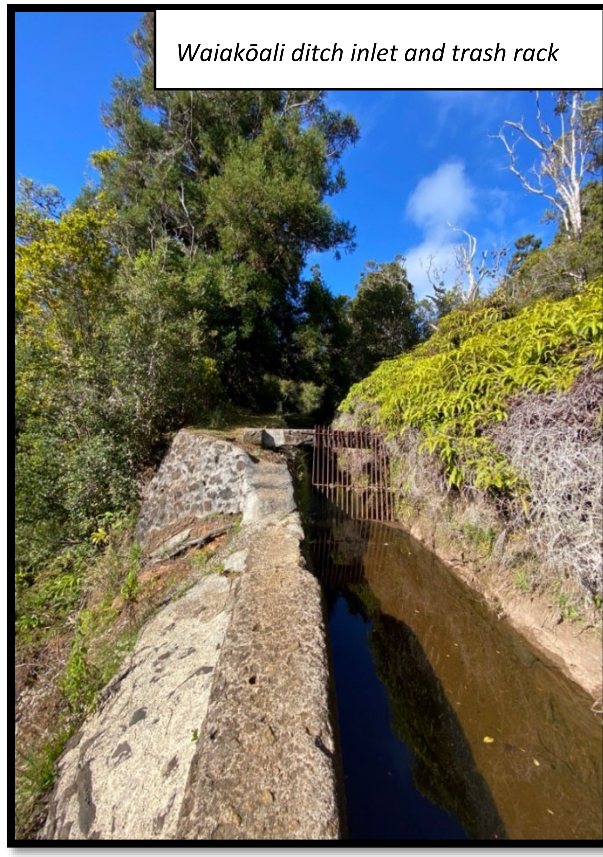
Entrance spur access to Waiakōali Diversion from Mohihi-Camp 10 Road

Waiakōali Diversion from ditch inlet

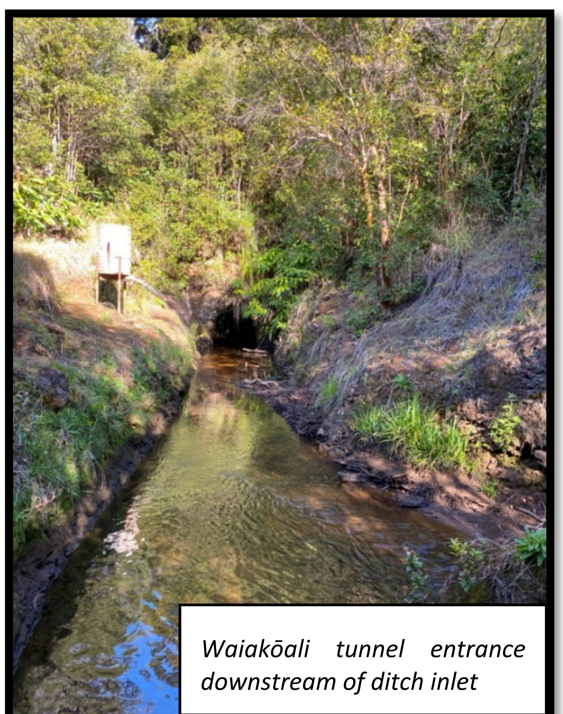
Waiakōali Diversion from left abutment



Waiakōali ditch inlet, overflow weir, and existing ditch maintenance wall



Waiakōali ditch inlet and trash rack



Waiakōali tunnel entrance downstream of ditch inlet

Waiakōali ditch, overflow weir, old fish feeding station, and cleared area near ditch bank

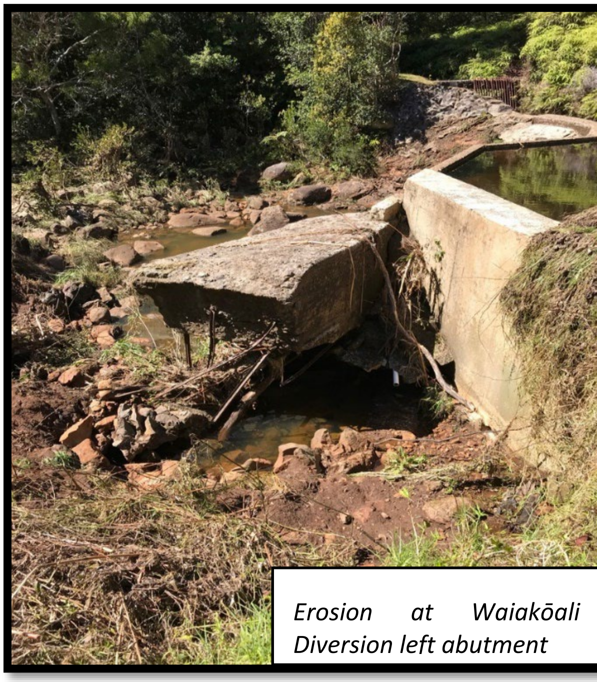
Proposed Construction

Construction Activities

Construction at this site primarily involves repairs or small modifications to the existing infrastructure that are within the footprint of the existing structure or within existing cleared areas along the ditch bank.

Currently there is no gate to regulate flow being diverted into the ditch at Waiakōali Diversion. To regulate diverted flows and ensure implementation of the Phase Two IIFS, a new slide gate and level sensors to regulate both ditch flows and instream flows would be installed within the existing ditch downstream of the ditch inlet. Along the ditch bank near the parking area, a new solar panel and control and power equipment box to operate the new slide gate would be placed on a new concrete pad. The equipment box would house all the electrical equipment necessary for gate sensors and automation, and the solar panel would provide a local source of power. A thermoelectric generator would also be installed in the equipment box to provide a backup source of power. A new utility cable extending from the equipment box to the new slide gate would be buried alongside the walking path located on the ditch bank and running parallel to the open ditch. All this work would occur either within the ditch or on the cleared ditch bank, and no vegetation clearing is required.

Modifications would be made to the existing ditch overflow structure by adding a slot and stoplogs to allow for flushing of the ditch from the diversion dam to the tunnel portal. Due to the buildup of sediment outside of the diversion at the overflow structure, a small area (approximately 10 feet by 20 feet) would need to be excavated and cleared of vegetation to allow any overflow water to travel back to Waiakōali Stream. This work would occur within the footprint of the existing overflow channel. The overflow weir would be used on occasion during operations to flush ditch sediment from the ditch inlet, returning water used for flushing back to the stream channel. The gate sensors and automation would significantly limit water volumes above ditch capacity from entering the ditch inlet. However, there would be the potential for extreme high flow events to overtop the gate structure or brief lags in gate adjustments to occur during rapidly changing high streamflow events. If these rare types of incidences were to occur, water entering the ditch inlet that exceeded ditch capacity would be returned to the stream through the overflow weir.



Erosion at Waiakōali Diversion left abutment

Repairs at Waiakōali Diversion would address the erosion of the left abutment, seepage in the dam face, and disrepair of the existing trash rack. The existing dam face shows signs of leakage through minor cracks in the structure. Leaks would be sealed by drilling and injecting pressurized grout within the structure. The existing left abutment of Waiakōali Diversion has experienced erosion and undercutting during high flow events through the many years of operation. Compacted fill would be placed downstream of the left abutment in an approximate area of 35 feet by 35 feet. Once compacted and filled, the area would be protected from future erosion by the application of grouted rip rap. A mix of mortar, grout, and concrete would be used to repair the existing left abutment and to raise the height by approximately two feet to prevent overtopping of the left abutment at flows of up to approximately 685 cfs, which is consistent with historic and modeled peak flows. The additional height would add increased scour protection around the left abutment. Due to the possibility of future storm events exceeding 685 cfs, the downstream face of the left abutment would be regraded and protected with grouted rip rap cover to prevent erosion during overtopping events. This work would involve some minor vegetation clearing (approximately 2 feet by 2 feet) downstream of the left abutment.

The existing trash rack at the ditch inlet would be replaced with a new trash rack. The existing trash rack and concrete beam that extends across the ditch would be removed. Installation of the new trash rack would require pouring a small amount of concrete in the ditch at the foot of the new trash rack (approximately 3.5 feet by 1 foot) and on both sides of the ditch wall (approximately 3-feet-deep and two-feet-wide).

Dry conditions would be necessary during repairs that require concrete. Sandbags would be used to temporarily block the ditch entrance to maintain dry conditions within the ditch channel during construction. Additionally, sandbags would be used to temporarily channel stream water around work areas involving repairs to the dam resulting in localized dry areas, but continuous streamflow would be maintained within the stream channel throughout construction. After construction is completed, all sandbags would be removed.

Construction Access and Construction Disturbance Areas

Construction equipment and personnel would gain access to the site through two existing roads. For most construction activities, access would be gained from Mōhihi-Camp 10 Road to an existing clearing in the parking area at Waiakōali Diversion. This area would be used for parking vehicles and as a staging area for equipment.

For repairs to the left abutment, vehicles would access the site using an existing road that extends from Mōhihi-Camp 10 Road. This access road would require some improvements to allow the equipment to travel to the construction area. All improvement activity would occur within the existing footprint of the road and consist of possible light scraping, resurfacing, and trimming of overhanging branches to provide adequate height clearance. The access road ends in an open area that would be used for a staging area and construction operations.

The proposed construction work at Waiakōali Diversion is estimated to take up to four weeks and is expected to occur during the dry season when streamflows are low. The dewatering of localized work areas associated with construction is expected to occur for a period of three weeks. Work at this site would not impact public access to Mōhihi-Camp 10 Road or Waiakōali Campground. Public access would be restricted from designated staging areas and active work sites at Waiakōali Diversion during construction.

Figure 4.15 and **Figure 4.16** show the disturbance areas during construction at the Waiakōali Diversion.

Construction Equipment

Table 4-8 lists the equipment needed for construction.

Table 4-8. Equipment Needed to Modify the Waiakōali Diversion

Equipment Type	Quantity	Purpose
Track Backhoe (Cat 230 size) and Small Skid Steer Loader	1	• Removal of selective demolition materials • Excavation of sediment and debris from the existing intake ditch • Handling of construction materials • Placement and grading of earth fill at left abutment • Final rock placement and grading
Concrete Drum Mixer and Hand Pump	1	• Pump grout into existing diversion structure. Mix concrete for forming control structure.
Enclosed Utility Trailer	1	• House small tools and equipment onsite
Construction Pickup	2	• Transport crew and equipment to the site
Transport Truck and Low Boy Trailer	1	• Transport equipment to the Project site
Chain Trencher	1	• Trench buried conduit
Small Generator and Air Compressor	1	• Supply power to tools.

Figure 4.15. Waiakōali Diversion Proposed Construction and Disturbance Area (1 of 2)

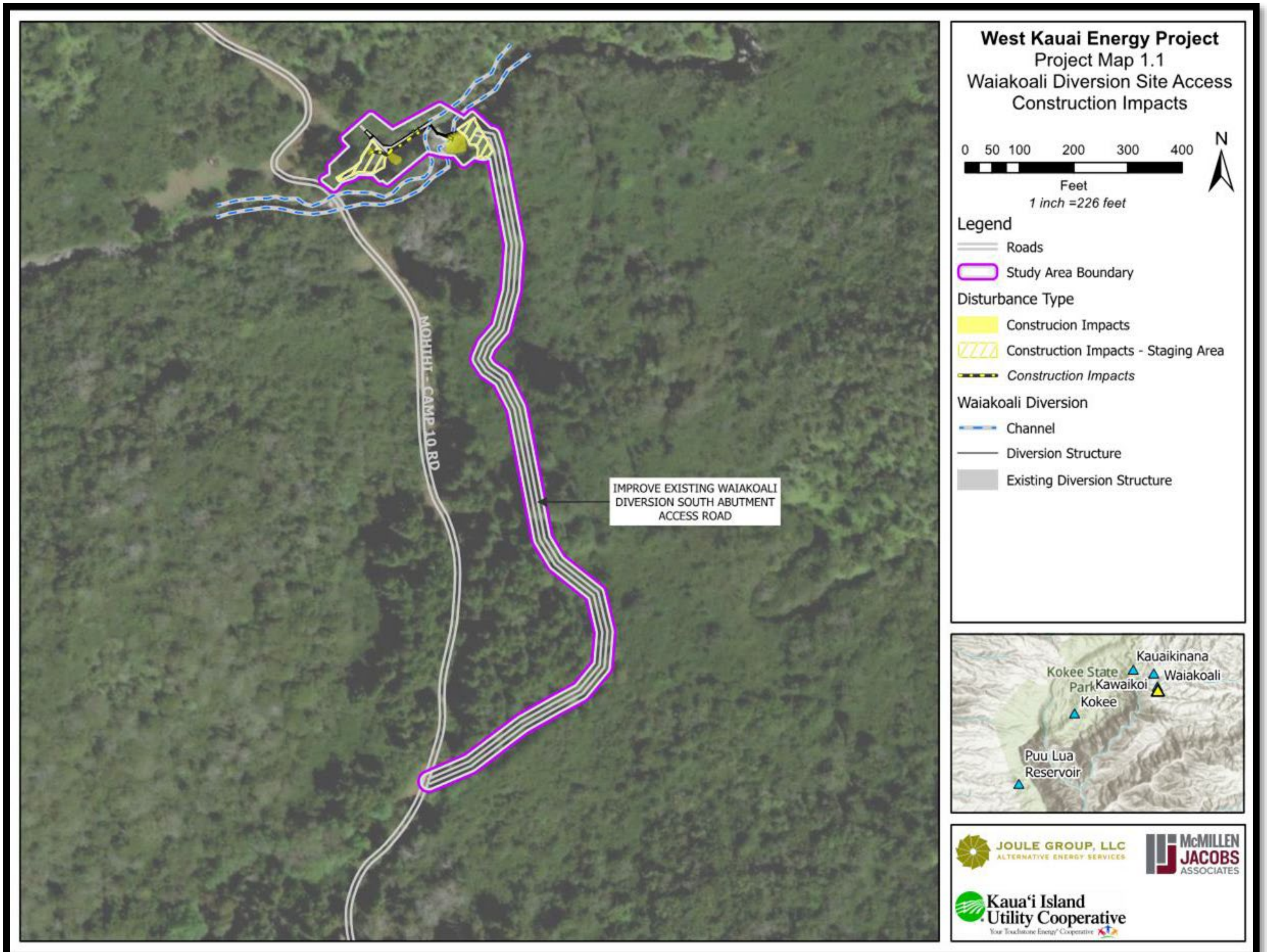
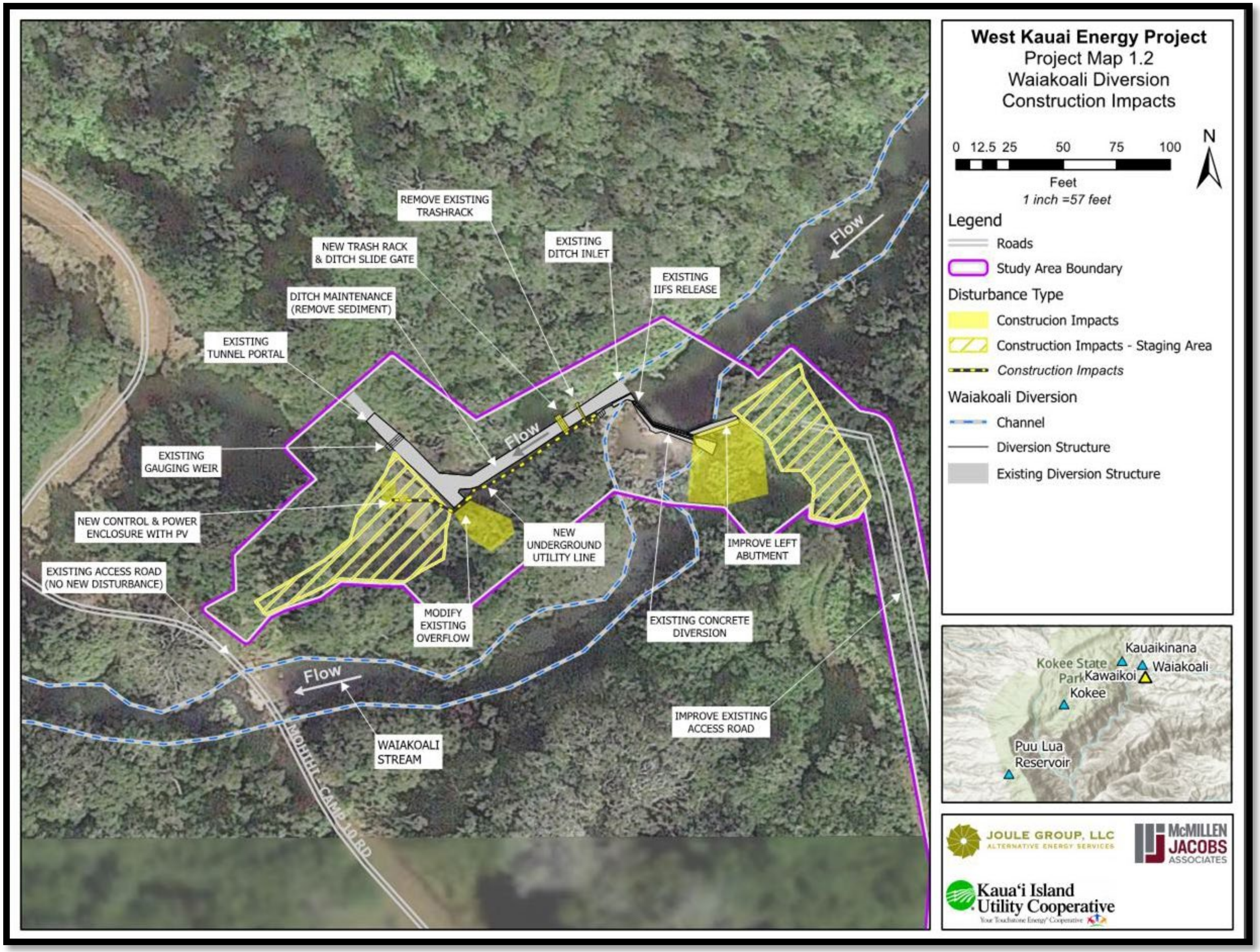


Figure 4.16. Waiakōali Diversion Proposed Construction and Disturbance Area (2 of 2)



Proposed Operations

A notch in the crest of the concrete diversion would be used as the mechanism for maintaining the IIFS in Waiakōali Stream. Natural flow remaining in the stream would pass through this area of the diversion during low to median flow conditions. Extreme high flow events with flows exceeding ditch capacity would overtop the concrete diversion crest.

After the proposed modifications are completed, the Waiakōali Diversion would be equipped with automatic gate operations. Level sensors would measure the amount of water remaining in the stream and the amount of water in the ditch, and these readings would be monitored within the new equipment box. The control panel would send signals through the buried utility cables to the new slide gate instructing it to open or close based on the level sensor readings. This automated system would ensure the required instream flow standard remains in the stream channel and would regulate the volume of flow entering the ditch. All solar panel and control and power equipment boxes at the diversions would have a backup energy source provided by a thermoelectric generator.

During operations, the overflow weir would be used occasionally during operations to flush ditch sediment from the ditch inlet, returning water used for flushing back to the stream channel. The gate sensors and automation would significantly limit water volumes above ditch capacity from entering the ditch inlet. However, there would be the potential for extreme high flow events to overtop the gate structure or brief lags in gate adjustments to occur during rapidly changing high streamflow events. If these rare types of incidences were to occur, water entering the ditch inlet that exceeded ditch capacity would be returned to the stream through the overflow weir.

Routine Project maintenance would include periodically checking the automated system, gates and trash racks, overflow weirs, gaging sensors, and diversion structure to ensure everything is operating properly and to implement any repairs or maintenance actions as needed.

Figure 4.17 and **Figure 4.18** show the Project footprint during operation at Waiakōali Diversion.

Figure 4.17. Waiakōali Diversion Site Access Operations Impacts

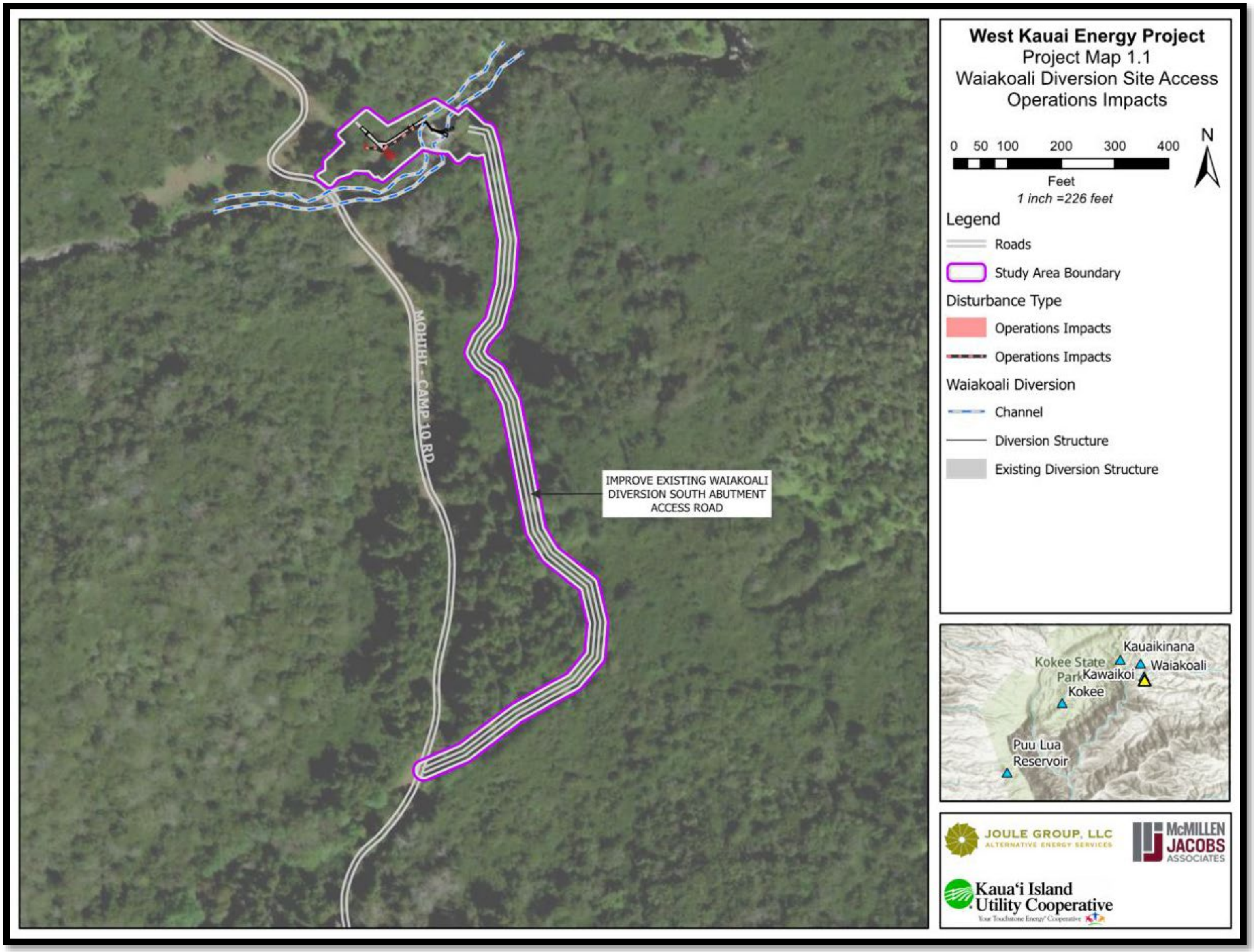
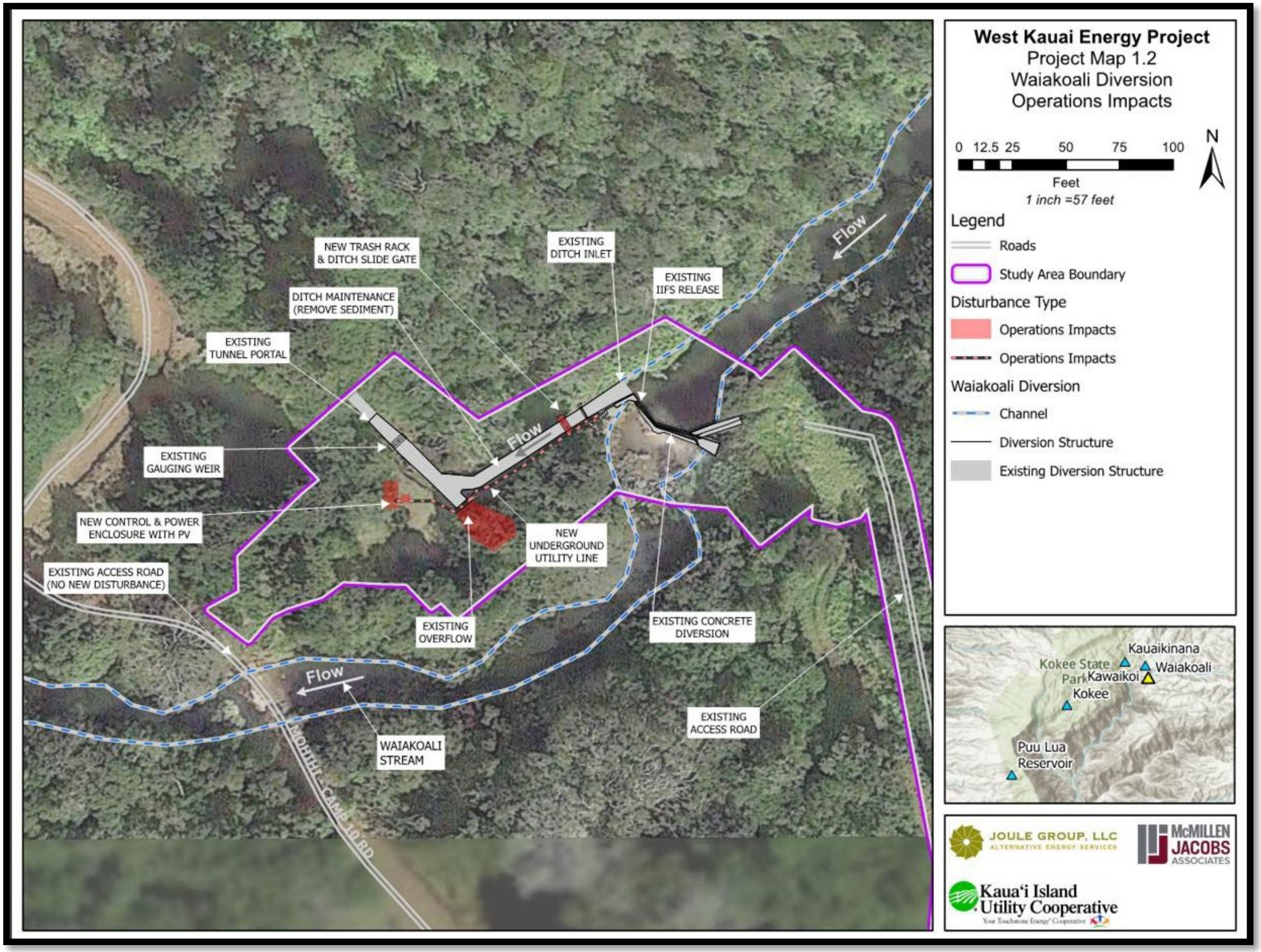


Figure 4.18. Waiakōali Diversion Operations Impacts



4.1.2.3 Kawaikōī Diversion

Current Site Conditions and Use

The Kawaikōī Diversion is located on Mōhihi-Camp 10 Road approximately 3.5 miles from the entrance to Camp 10 from Waimea Canyon Drive. The diversion has been in operation since its original construction. There are two campgrounds adjacent to the diversion site. Kawaikōī Campground is located across the road and upstream of the diversion, and Sugi Grove Campground is located directly across the stream from the diversion structure. An aerial view of the Kawaikōī Diversion is shown on the following page, and a shelter in the Sugi Grove Campground can be seen overlooking the diversion site.

Kawaikōī Campground has a cleared area for camping, a rustic shelter, a table, non-potable water, trash can, and a composting toilet. Sugi Grove Campground is equipped with a picnic shelter and a composting toilet. The existing USGS Kawaikōī gaging station is accessed via the Pihea Trail extending from the back of Kawaikōī campground. Sugi Grove Campground is equipped with a picnic shelter and a composting toilet.

There are a number of recreational trails accessible at Kawaikōī including the Kawaikōī Stream Trail that starts across the road from Sugi Grove Campground and the Pihea Trail.

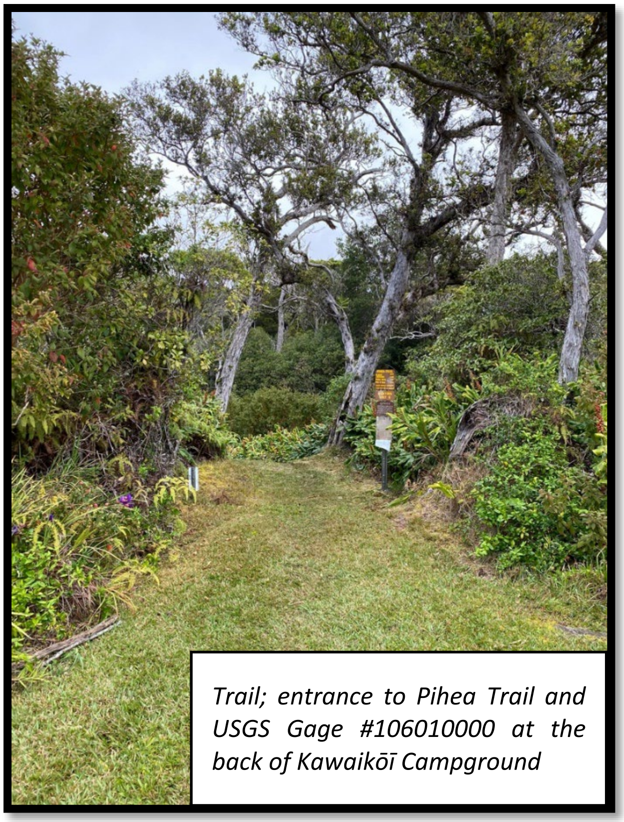
Aerial view of Kawaikōī Diversion

Aerial view of siphon crossing Kawaikōī Diversion carrying flow diverted at Waiakōali Diversion

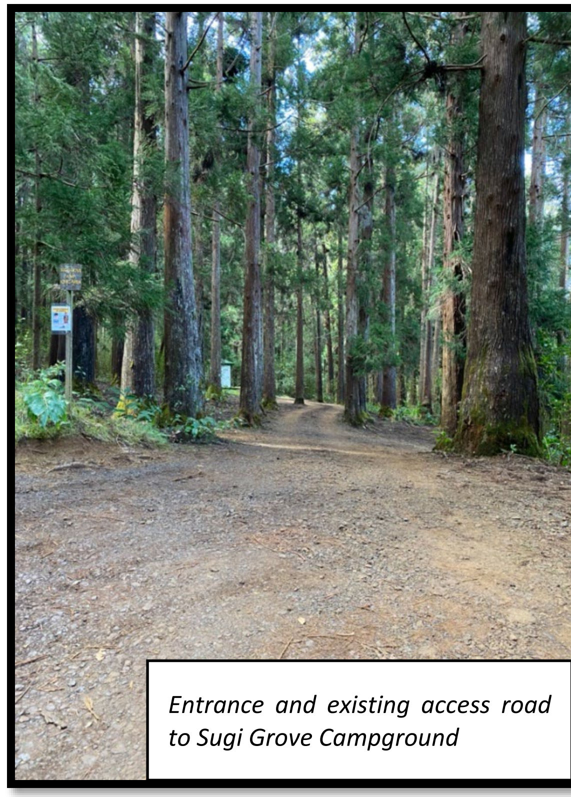
Kawaikōī Campground

Kawaikōī Campground, picnic shelter, and composting toilet

Existing USGS Gage #106010000 located on Kawaikōī Stream upstream of Kawaikōī Diversion



Trail; entrance to Pihea Trail and USGS Gage #106010000 at the back of Kawaikōī Campground



Entrance and existing access road to Sugi Grove Campground

Sugi Grove Campground picnic shelter

Site Access

Kawaikōī Diversion site is accessed by an existing spur road extending approximately 740 feet from Mōhihi-Camp 10 Road. The spur road runs parallel to the stream, extends beyond the diversion, and terminates at a cleared parking area near the siphon that crosses Kawaikōī Stream. The diversion can be accessed by two existing footpaths: one extending approximately 70 feet in length from the spur road approximately 370 feet from Mōhihi-Camp 10 Road, and the other extending between the diversion and the siphon, which is shown running along the ditch bank below. The existing Kawaikōī ford on Mōhihi-Camp 10 Road is located upstream of the diversion, approximately 350 feet from the diversion access spur road and approximately 215 feet from the Sugi Grove Campground.

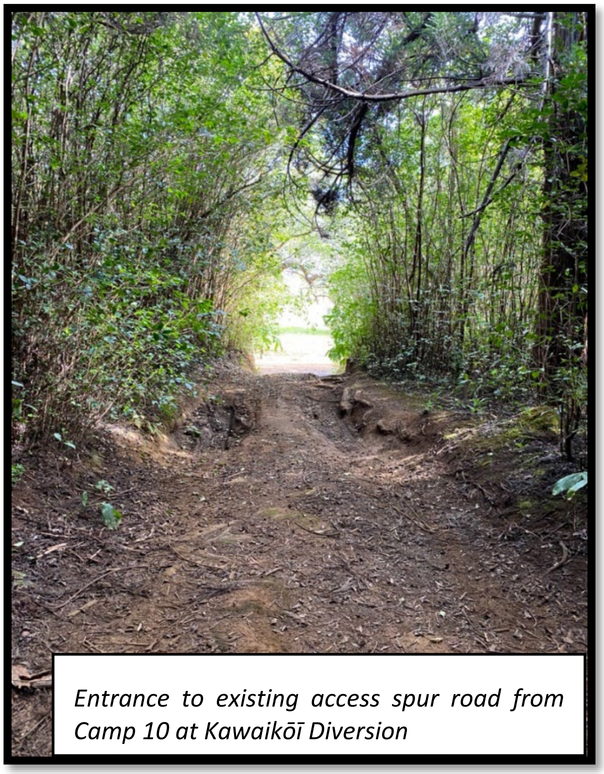
Existing access spur road at Kawaikōī Diversion

Existing Infrastructure and Current Operations

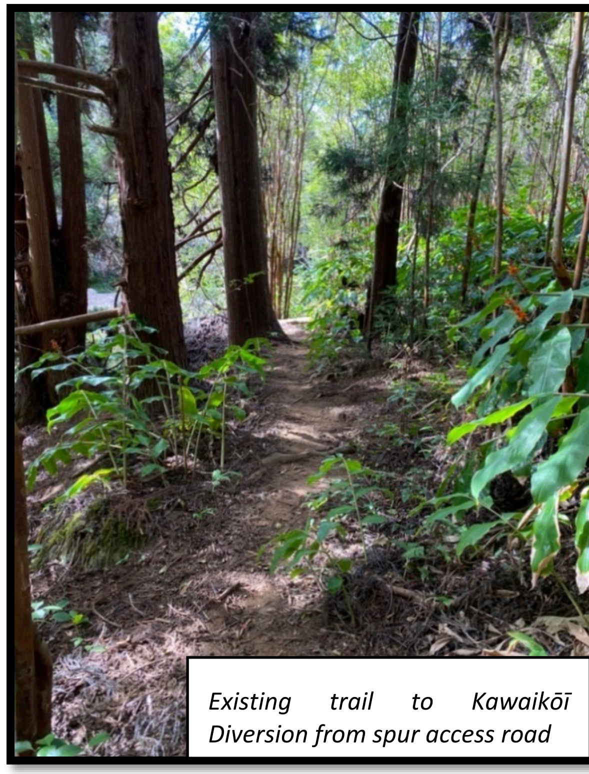
The Kawaikōī Diversion is the largest contributor of water to the Kōke‘e Ditch Irrigation System with a drainage area of 4.1 square miles and 152 inches of precipitation annually (Element Environmental, 2016). Water diverted at Kawaikōī joins water delivered from Waiakōali downstream of the Kawaikōī ditch inlet. From Kawaikōī, the combined flow from Waiakōali and Kawaikōī is transported through the Kōke‘e Ditch to Kaua‘ikinanā Stream.

The Kawaikōī Diversion consists of concrete and rubble masonry walls constructed in landscape surrounded by water-rounded basalt boulders and a man-made tunnel. An existing concrete overflow weir is located just before the tunnel entrance downstream of the ditch inlet and is designed to return excess flow back to the stream during high flow events or if the ditch system becomes plugged somewhere beyond this point. The existing diversion structure has structural integrity issues and currently leaks.

The Kawaikōī Diversion diverts water at 3,400 feet msl into a short unlined segment of open ditch that follows the western valley wall. It then enters a short tunnel before joining with the flow from Waiakōali Stream just downstream from where the siphon crosses Kawaikōī Stream. The size of the intake at the base of the dam and the height of the overflow weir along the ditch are designed to regulate the maximum flow within the ditch to around 55 MGD. Without modifications, the structure diverts all low and median flows. However, after the Waimea Mediation Agreement, current operations involve returning most of the diverted flow through a sluice gate back to Kawaikōī Stream a few hundred feet downstream of the diversion location and only a small portion of flow remains in the ditch. Due to the dam’s location within a boulder field, there appears to be a persistent small quantity of flow remaining in the stream during all flow conditions below the dam due to leaks within the dam structure.



Entrance to existing access spur road from Camp 10 at Kawaikōī Diversion



Existing trail to Kawaikōī Diversion from spur access road

Ford crossing on Mohihi-Camp 10 Road at Kawaikōī Stream

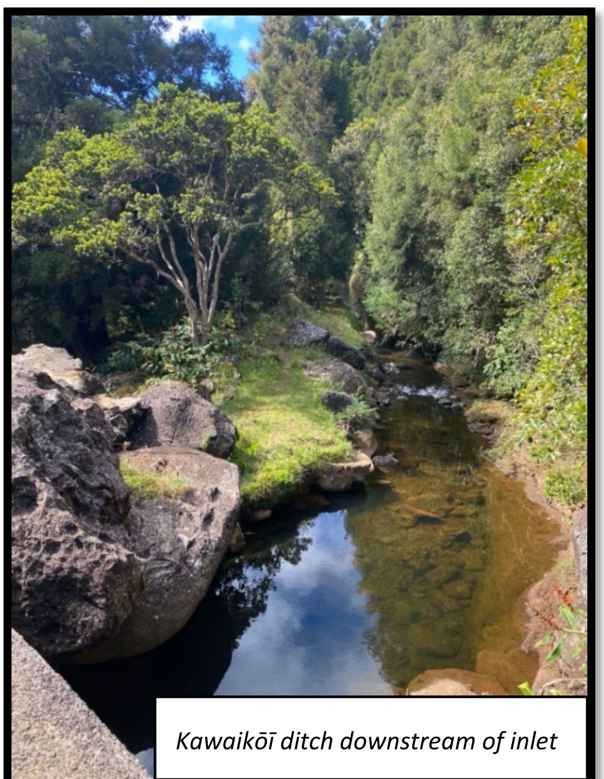
Termination of Kawaikōī Diversion existing access spur road and parking at siphon

Kawaikōī Diversion, headwall, and ditch inlet viewed from Sugi Grove Campground

Kawaikōī Diversion and headwall at ditch inlet

Kawaikōī headwall, ditch inlet, and existing ditch maintenance trail

Existing overflow weir and tunnel entrance downstream of Kawaikōī ditch inlet



Kawaikōī ditch downstream of inlet

Existing siphon that delivers flow from Waiakōali Stream entering tunnel where Waiakōali diverted flow joins with Kawaikōī diverted flow

Proposed Construction

Construction Activities

Construction at this site primarily involves repairs or small modifications to the existing infrastructure that are within the footprint of the existing structure or within existing cleared areas along the ditch bank.

Currently, there is no gate at the ditch inlet to regulate the volume of water diverted at the Kawaikōī Diversion. To address this, a new ditch regulating gate would be installed at the existing ditch entrance headwall on the diversion's right abutment. Concrete would be used to secure the new regulating gate in the existing opening of the headwall and along the floor and banks of the ditch, and the new gate would be sealed in place with grout and sealant. A trash rack would also be installed in front of the new slide gate to minimize debris entering the ditch system

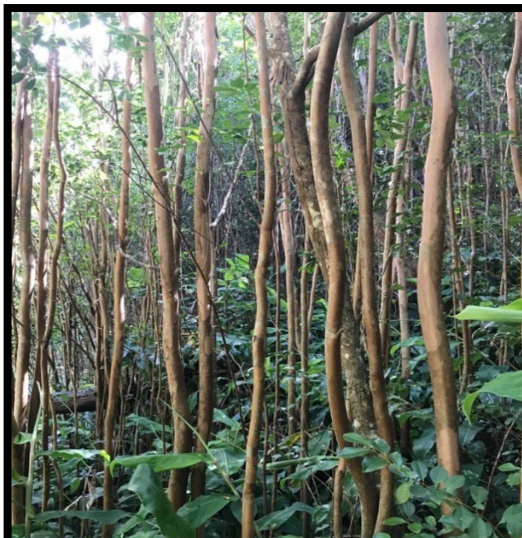
A new concrete weir designed to allow for passage of native, migratory aquatic species would be installed within the existing concrete section of the dam, which would provide a control point for measuring the Phase Two IIFS. A level sensor would be mounted on the existing headwall to measure IIFS levels. A new stilling well and level sensor would be located on the ditch bank near the overflow weir to measure the ditch flow levels to provide accurate monitoring of diverted flows. A solar panel and control and power equipment box would be located on the right abutment. An existing flow transducer would be coupled with a new stilling well and level transducer, both of which would be installed in the ditch near the existing overflow weir to provide accurate monitoring of diverted flows. Utility cables would be buried along the ditch bank between the power equipment box and the new stilling well near the concrete overflow weir.

Repairs at this diversion would address the leakage at the dam and disrepair of the trash rack at the tunnel entrance. To control leakage through the boulders that make up the existing dam, grout would be pumped in and around the fissures and cracks to provide a more watertight seal. To allow for flushing of the sediment buildup in the ditch inlet, a new stoplog structure would be built within the entrance of the existing tunnel. Access to the tunnel for repairs and stoplog adjustments would be through an existing adit approximately 20 feet downstream of the tunnel entrance.

It is assumed that the Phase One IIFS modifications being implemented by KIUC in a separate project (The Kōkeʻe Diversion Modification Project and Flow Monitoring Plan), would be completed prior to construction of West Kauaʻi Energy Project. If that is the case, the cofferdam and associated structures installed within the ditch channel as part of the Phase One IIFS modifications would be removed during West Kauaʻi Energy Project construction.

All-natural stream flow would be routed around the construction area using bypass pumps and a pipe to provide a dry working area during repairs to the diversion and to implement ditch modifications. Temporary cofferdams consisting of sandbags with plastic liners would be situated upstream of the diversion between rocks acting as a temporary dam. Three bypass pumps (similar to a sump pump) would be installed upstream of the temporary cofferdams. These pumps would pump water from Kawaikōī Stream into a pipe located along the streambank and extending below the construction area. Water would be conveyed through this pipe and released back into Kawaikōī Stream downstream of the diversion. Once construction is completed the sandbags, bypass pumps, and pipe would be removed, and stream flow would return to its natural course.

Construction Access and Construction Disturbance Areas



Vegetation at proposed staging area on west side of Kawaikōī Stream

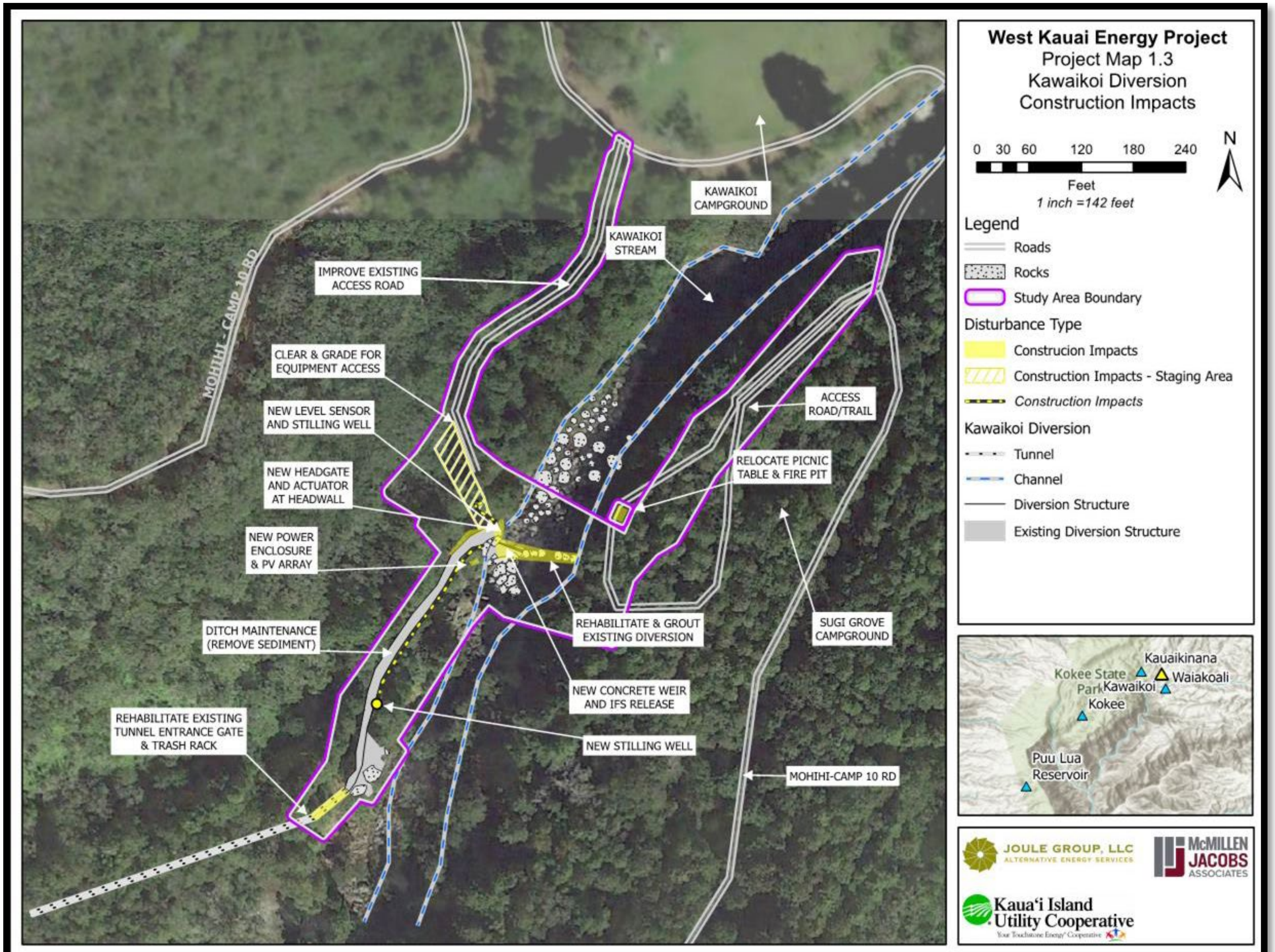
Construction equipment and personnel would gain access to the site through two existing roads. Access for most construction activities would be gained from Mōhihi-Camp 10 Road, and an existing spur road that extends from Mōhihi-Camp 10 Road to the diversion structure on the west side of Kawaikōī Stream as shown in **Figure 4.19**. This spur road would require improvements to allow construction equipment to travel to the construction area. Road improvements would occur within the existing footprint of the road and may include scraping to level rutted areas, application of gravel, and trimming of overhanging branches to provide adequate height clearance. A temporary staging area, approximately 2,614 square feet, would be established on the west side of the stream and ditch embankment through clearing and grubbing an area between the ditch bank and the existing spur road, but avoiding the removal of any mature trees. There would be some vegetation removal required as this area is predominantly filled with small guava and ginger. This area would be used for personnel parking, staging equipment, and construction operations.

For grout work on the existing diversion, vehicles would access the site using an existing road that extends from Mōhihi-Camp 10 Road into the Sugi Grove Campground. No improvements or modifications to the access road are anticipated. A staging area within Sugi Grove Campground would be created by temporarily relocating a shelter, picnic table, and fire pit to allow a trailer mounted concrete line pump to position in a manner to pump the grout into place. The concrete line pump would descend over the stream bank to the dam structure. Once the grout work is completed the picnic table and fire pit would be relocated back into their original location. No vegetation clearing or grubbing of the staging area, or the stream bank would be necessary for this work.

Construction at this site is anticipated to require five weeks and is expected to happen in the dry season when stream flows are low. The dewatering associated with construction is expected to occur for a period of four weeks. During construction, public access to the staging areas and active work sites would be restricted. This includes the Kawaikōī Diversion, the existing spur access road, and the existing footpath to the diversion. The Sugi Grove Campground (including the picnic area) would remain open throughout construction. However, the shelter, picnic table, and fire pit would be out of commission for approximately one week during the construction period. Work at this site would not impact public access along Mōhihi-Camp 10 Road or Kawaikōī Campground and trailheads within the vicinity.

Figure 4.19 shows the construction impact area at Kawaikōī Diversion.

Figure 4.19. Kawaikōī Diversion Construction Impacts



Construction Equipment

Table 4-9 lists the equipment needed for construction at Kawaikōī Diversion.

Table 4-9. Equipment Needed for Construction Activities at Kawaikōī Diversion

Equipment Type	Quantity	Purpose
Track Backhoe (Cat 230 size) and Small Skid Steer Loader	1	• Removal of selective demolition materials • Excavation of sediment and debris from the existing intake ditch • Handling of construction materials
Trailer Mounted Concrete Line Pump/Drum Mixer	1	• Pump grout into existing diversion structure. Mix concrete for forming control structure/headwall
Enclosed Utility Trailer	1	• House small tools and equipment onsite
Construction Pickup	2	• Transport crew and equipment to the site
Transport Truck and Low Boy Trailer	1	• Transport equipment to the Project site
Chain Trencher	1	• Trench buried conduit
Small Generator and Air Compressor	1	• Supply power to tools.
Dewatering Pumps	2	• Collect and pump flow out of the dewatered area into the ditch during construction

Proposed Operations

The new concrete weir at the diversion would be used as the mechanism for maintaining the IIFS in Kawaikōī Stream. Natural flow remaining in the stream would pass through this area of the diversion during low to median flow conditions. During extreme high flow events, flows exceeding ditch capacity would overtop boulders on either side of the new weir and remain in the stream channel.

After the proposed modifications, the Kawaikōī Diversion would be equipped with automatic gate operations. Level sensors would measure the amount of water remaining in the stream and the amount of water in the ditch, and these readings would be monitored within the new equipment box. The control panel would send signals through the buried utility cables to the new slide gate instructing it to open or close based on the level sensor readings. This automated system would ensure the required instream flow standard remains in the stream channel and regulate flow diverted into the ditch system. All solar panel and control and power equipment boxes at the diversions would have a backup energy source provided by a thermoelectric generator.

During operations, water used for flushing of ditch sediment would be returned to Kawaikōī Stream at the existing concrete overflow weir. The new gate sensors and automation would significantly limit water volumes above ditch capacity from entering the ditch inlet. However, there would be the potential for extreme high flow events to overtop the existing headwall or for brief lags in gate adjustments to occur during rapidly changing high streamflow events. If these rare types of incidences were to occur, water entering the ditch inlet that exceeded ditch capacity would be returned to the stream through the overflow weir.

Routine Project maintenance would include periodically checking the automated system, gates and trash racks, overflow weirs, gaging sensors, and diversions to ensure everything is operating properly and to implement any repairs or maintenance actions as needed.

Figure 4.20 shows the Project footprint during operation at Kawaikōī Diversion.

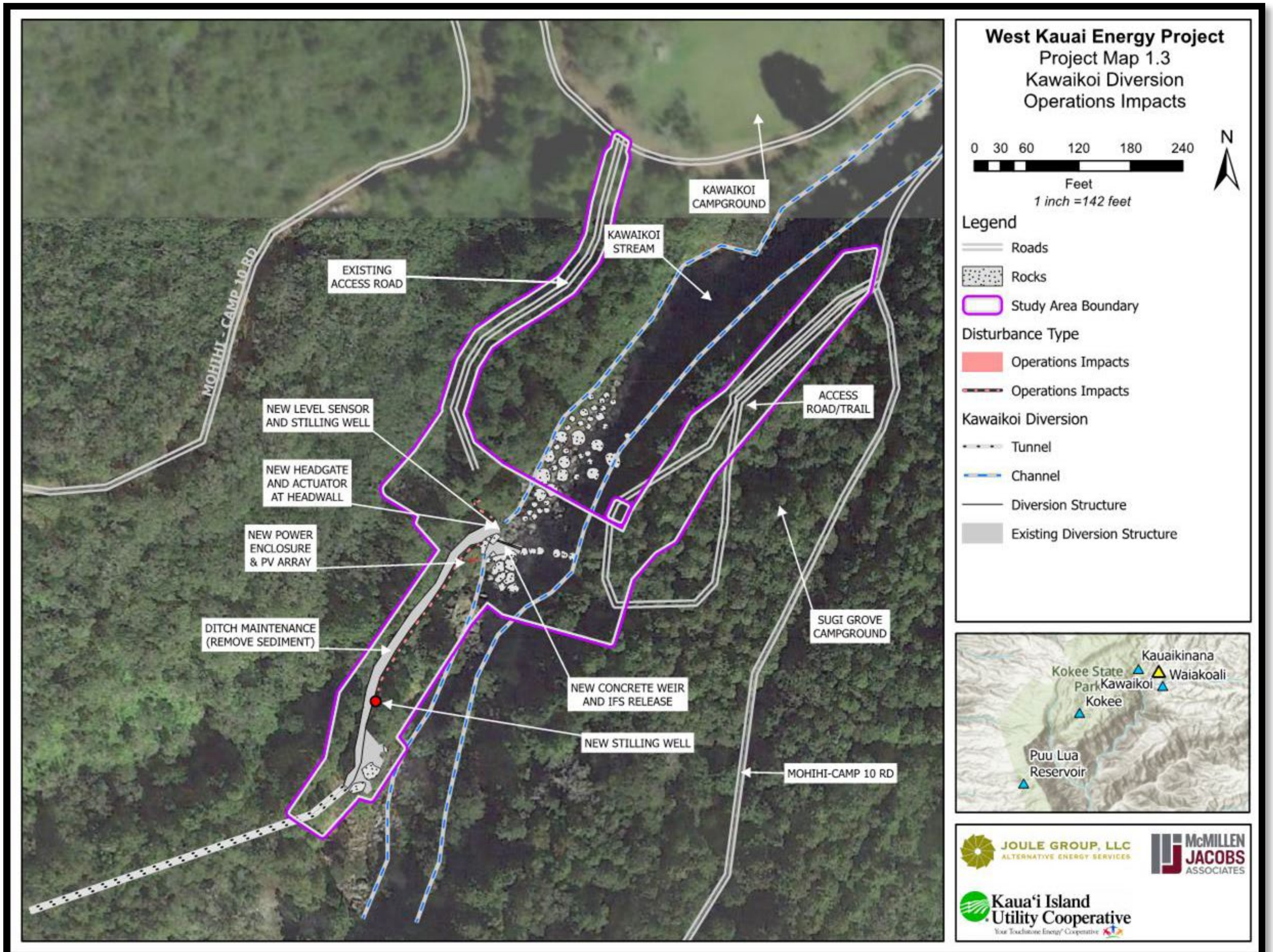
4.1.2.4 Kauaʻikinanā Diversion

Current Site Conditions and Use

The Kauaʻikinanā Diversion is located on Mōhihi-Camp 10 Road approximately 2.26 miles from the entrance off Waimea Canyon Drive. The Poʻomau Canyon Ditch trailhead is located approximately 275 feet from the diversion access spur road. Near the diversion site there is a bridge on Mōhihi-Camp 10 Road approximately 285 from the diversion spur access road that was recently rebuilt by the State. Frequently people park at Kauaʻikinanā Diversion to hike the trail or hunt in the area.

Aerial view of Kauaʻikinanā Diversion, parking area, and trail to diversion

Figure 4.20. Kawaikōī Diversion Operations Impacts



Aerial view of Kauaʻikinanā existing access spur, parking area, entrance to trail to diversion, and Kauaʻikinanā Stream flow after discharge from Kōkeʻe Ditch (combined flow from Kawaikōī and Waiakōali Diversions)

Aerial view of Mohihi-Camp 10 Road and existing bridge across Kauaʻikinanā Stream

Site Access

The diversion site is accessed by an existing spur road approximately 106 feet in length and extending from Mōhihi-Camp 10 Road and terminating in an open parking area. The diversion is accessed by a foot trail, approximately 200 feet in length, then a catwalk that crosses a small, unnamed tributary feeding into Kauaʻikinanā Stream immediately adjacent to the diversion.

Entrance to Kauaʻikinanā access spur from Mohihi-Camp 10 Road

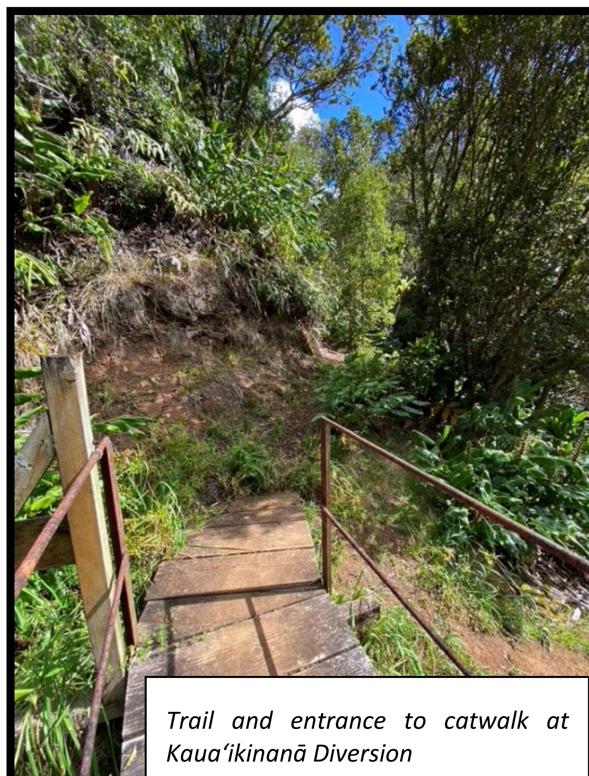
Existing Infrastructure and Current Operations

The Kauaʻikinanā Diversion is comprised of a concrete spillway, a ditch inlet gate, basalt and mortar constructed walls, and concrete masonry walls. Other existing man-made features include a catwalk spanning the stream channel adjacent to the diversion. There is slot within the center of the concrete dam where wooden pani boards are placed to regulate stream and ditch flow. This intake consists of a 15-foot-high concrete gravity structure that diverts flows at elevation 3,360 feet msl into a 3.1-mile-long series of tunnels and open ditches running along the rim of Waimea Canyon and discharging into Kōkeʻe Stream above the Kōkeʻe Intake. The diversion structure is in good condition and does not require repairs; however, the left ditch inlet wall is in disrepair. The gate is in relatively good condition but requires manual operation. The catwalk was recently repaired and is in serviceable condition. Kauaʻikinanā is the smallest stream on the system with a drainage area of 1.34 square miles, but the third largest contributor due to its 117 inches of precipitation annually (Element Environmental, 2016).

Kōkeʻe Ditch flow from Waiakōali and Kawaikōī Diversions discharges into Kauaʻikinanā Stream just upstream of the Kauaʻikinanā Diversion. The dam and intake gate are accessed by the metal framed catwalk. Diversion flow is manually regulated using pani boards in the existing slot in the Kauaʻikinanā Diversion in combination with manual adjustments to the gate located at the ditch inlet. After the Waimea Mediation Agreement, the pani boards are set low within the slot or removed entirely and the gate is set low to minimize the volume of flow being diverted into Kōkeʻe Ditch at Kauaʻikinanā Stream.

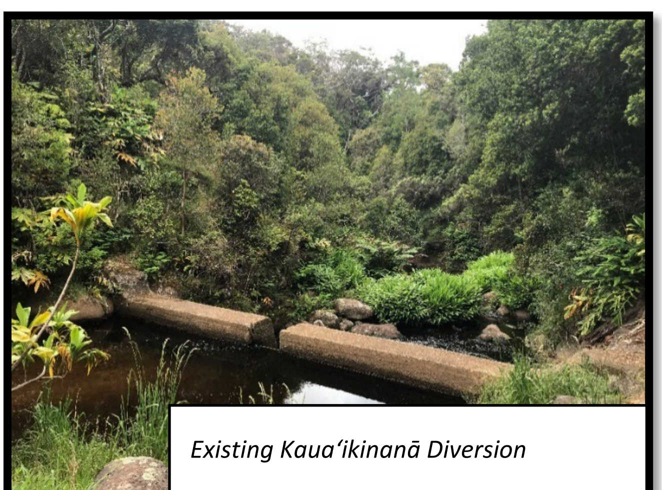
Existing Kauaʻikinanā Diversion parking area

Trail to Kauaʻikinanā Diversion



Trail and entrance to catwalk at Kauaʻikinanā Diversion

Catwalk at Kauaʻikinanā Diversion and Kauaʻikinanā streamflow before ditch inlet



Existing Kauaʻikinanā Diversion

Existing Kauaʻikinanā ditch inlet, control gate, and trash rack

Proposed Construction

Construction Activities

Construction at the Kauaʻikinanā Diversion involves repairs or small modifications to the existing infrastructure that are within the footprint of the existing structure or within existing cleared areas along the ditch bank, and construction of new features outside the existing diversion structure footprint.

The existing gate at the ditch inlet and tunnel entrance would be replaced with a new, automated slide gate that would regulate flows diverted into Kōkeʻe Ditch. A new stilling well would be bolted to the upstream face of the dam to monitor flow volume remaining in Kauaʻikinanā Stream, and a flow sensor (acoustic doppler) would be installed within the tunnel to measure ditch flow just downstream of the ditch inlet. The new automated gate would adjust (open or close) based on the sensor level readings.

To measure the natural flow of Kauaʻikinanā Stream that would be unaffected by inflows from Kōkeʻe Ditch, a new concrete gauging weir would be constructed within the stream channel approximately 650 feet upstream of the diversion and under the existing bridge crossing Kauaʻikinanā Stream. The new concrete weir would be designed to support passage of native, migratory aquatic species. At this same location and adjacent to the new gaging weir, a new level sensor and stilling well would be installed on the bank of the stream. Utility cables extending from this new gage would be buried within the right-of-way of Mōhihi-Camp 10 Road to a new solar panel and control and power equipment box located on one side of the cleared parking area. A second set of utility cables extending from the power equipment box to the new automated slide gate would be buried by hand as it descends the hillside or be placed above ground in conduit. There is no vegetation clearing anticipated for this work, and placement of the cables would be determined onsite to minimize vegetation and ground disturbance.

There is significant erosion and undercutting of the existing masonry wall on the downstream side of the ditch inlet and under the existing catwalk. Repairs to this area would involve clearing loose rubble, debris, and shotcrete and then rehabilitating this wall with grouted boulders and riprap to prevent further erosion.

Repairs to the masonry wall near the ditch inlet would need to be conducted in dry conditions. Temporary rerouting of the unnamed stream would occur as well as blocking Kauaʻikinanā Stream flow from entering the area at the ditch inlet. A temporary cofferdam consisting of sandbags with plastic liners would be located where the unnamed stream enters the section of ditch just upstream of the Kauaʻikinanā Ditch inlet. Pumps would be positioned in a shallow trench in the ditch near the tunnel and would pump water from the unnamed stream into a pipe. The pipe would extend along the ditch bank to Kauaʻikinanā Stream just upstream of the diversion. Water would be released from the pipe into the Kauaʻikinanā Stream where it would flow through the slot on the existing Kauaʻikinanā Diversion. Kauaʻikinanā Stream flow would be temporarily blocked from entering the area around the ditch inlet using temporary cofferdams consisting of sandbags with plastic liners. The cofferdams would restrict streamflow from entering the ditch inlet and push all Kauaʻikinanā Stream flow through the slot or over the dam crest. Once construction is complete the sandbags, bypass pumps, and pipe would be removed, and stream flow would return to its natural course and ditch inlet flow would resume.

Construction Site Access and Construction Disturbance Area

Construction equipment and personnel would gain access to the Kauaʻikinanā Diversion using an existing spur road that extends approximately 100 feet off Mōhihi-Camp 10 Road to an existing cleared parking area. This area would be used for personnel parking, staging equipment, and construction operations. The construction personnel would use the existing trail from the temporary staging area to the Kauaʻikinanā Diversion. The upstream construction area for installing the new gaging weir would be accessed by an existing footpath. Vehicles at the new gaging weir location would be parked alongside the road in the existing pull off area. Work at this site does not involve any vegetation clearing.

Construction and dewatering associated with construction at this site is estimated to require 4 weeks and is expected to occur during the dry season when stream flows are low. Public access would be restricted from staging areas and active work sites during construction which would include the cleared parking area, the existing foot path, and the diversion site. Construction at this site would not restrict public access to Mōhihi-Camp 10 Road.

Figure 4.21 shows the Kauaʻikinanā Diversion modifications and areas of disturbance.

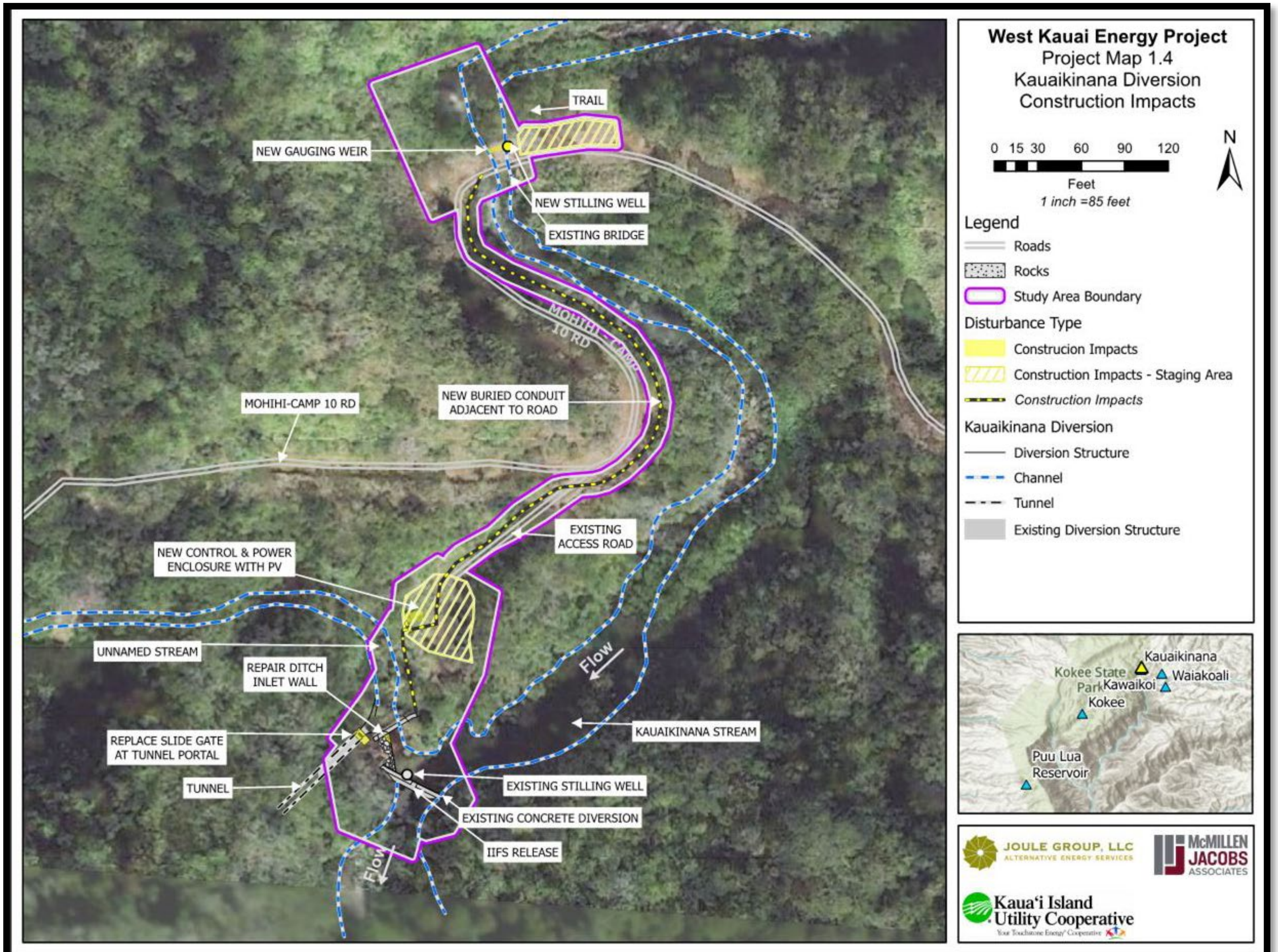
Construction Equipment

Table 4-10 lists the equipment needed for construction.

Table 4-10. Equipment Needed for Construction Activities at Kauaʻikinanā Diversion

Equipment Type	Quantity	Purpose
Concrete Drum Mixer and Hand Pump	1	• Mix concrete for forming gauging weir
Enclosed Utility Trailer	1	• House small tools and equipment onsite
Construction Pickup	2	• Transport crew and equipment to the site
Transport Truck and Low Boy Trailer	1	• Transport equipment to the Project site
Chain Trencher	1	• Trench buried conduit
Small Generator and Air Compressor	1	• Supply power to tools.
Dewatering Pumps	2	• Collect and pump flow out of the dewatered area into the ditch during construction

Figure 4.21. Kaua'ikinanā Diversion Construction Impacts



Proposed Operations

The existing slot in the Kauaʻikinanā Diversion would be used as the mechanism for maintaining the IIFS in Kauaʻikinanā Stream. Pani boards would be used in the slot to control the upstream diversion pool level and a permanent opening in the bottom pani board would be sized to ensure the implementation of the IIFS. There is no overflow weir located at Kauaʻikinanā Diversion and flows exceeding ditch capacity would spill over the diversion structure and remain in the stream channel.

After the proposed modifications are completed, the Kauaʻikinanā Diversion would be equipped with automatic gate operations. Level sensors would measure the amount of water remaining in the stream and the amount of water in the ditch, and these readings would be monitored within the new equipment box. The control panel would send signals through the buried utility cables to the new slide gate instructing it to open or close based on the level sensor readings. This new automated system would ensure the required instream flow standard remains in the stream channel and regulate flow diverted into the ditch system. All solar panel and control and power equipment boxes at the diversions would have a backup energy source provided by a thermoelectric generator.

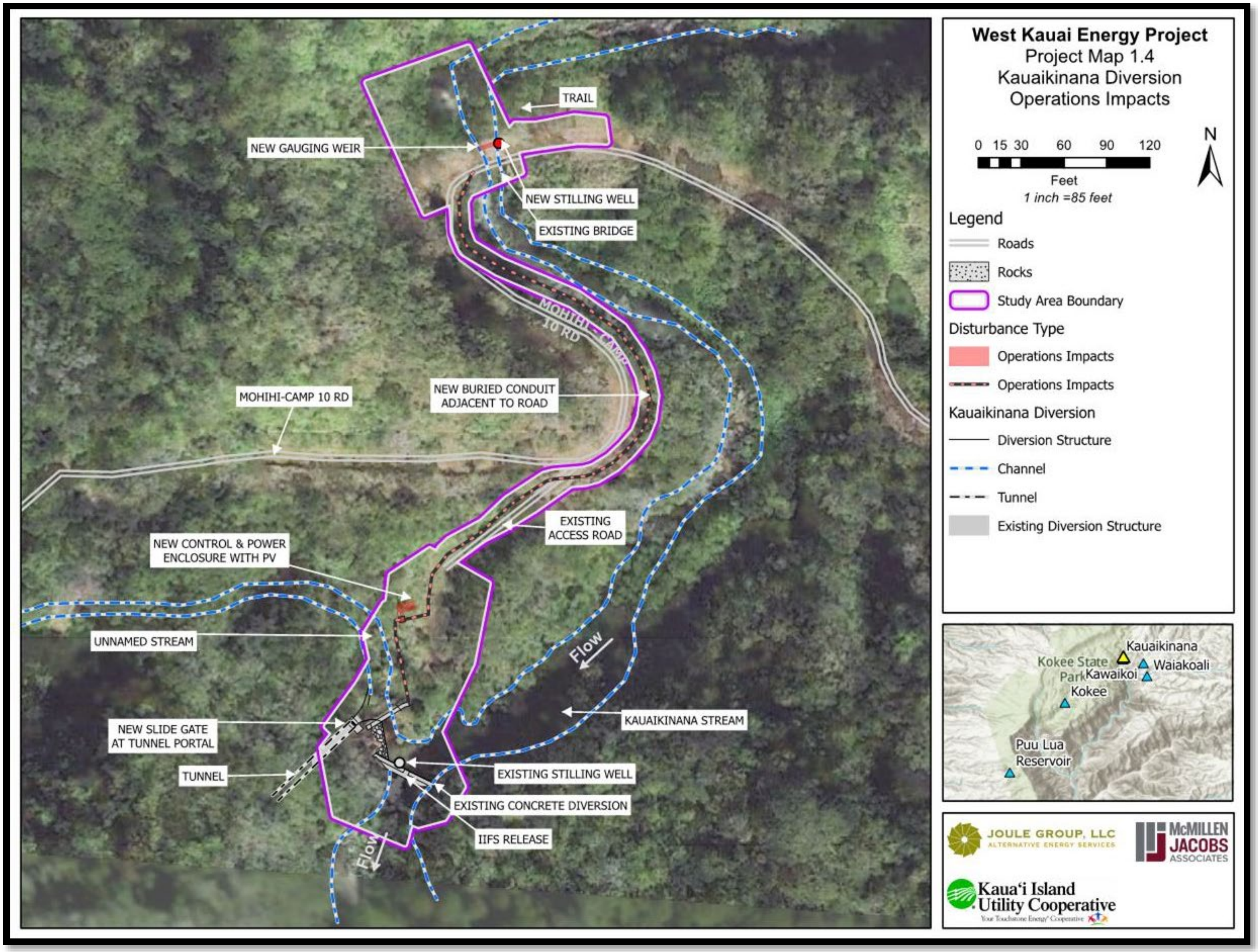
Routine Project maintenance would include periodically checking the automated system, gates and trash racks, overflow weirs, gaging sensors, and diversions to ensure everything is operating properly and to implement any repairs or maintenance actions as needed. **Figure 4.22** shows the Project footprint during operation at Kauaʻikinanā Diversion.

4.1.2.5 Kōkeʻe Diversion

Current Site Conditions and Use

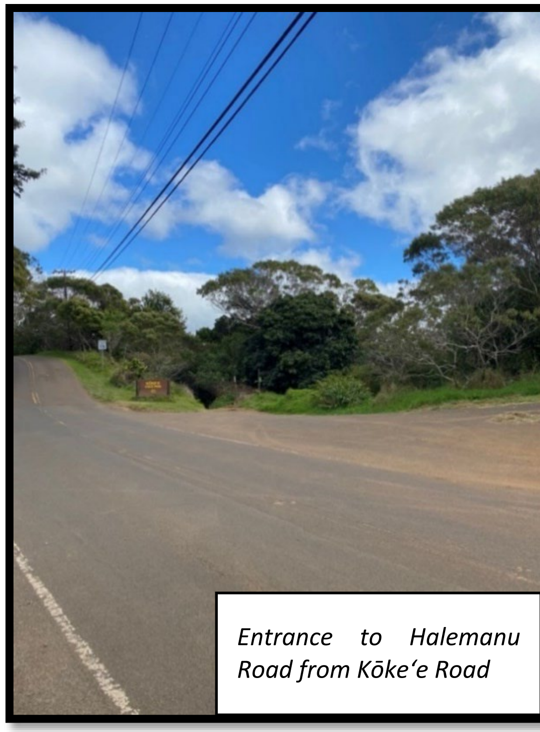
Kōkeʻe Diversion is located off a series of dirt roads and is used by tourists and locals for recreational purposes, although less so than the other three diversions. Kōkeʻe Diversion is accessed by the existing Halemanu Road, the entrance to which is near mile marker 14 on Waimea Canyon Drive (Hwy 550). Halemanu Road provides access to a number of recreational trails as well as cabins and hunting spots including the popular Waipoʻo Falls trail, Black Pipe Trail Loop, and Waimea Canyon Trail. Also, near the entrance to Halemanu there are two popular overlooks on either side of Kōkeʻe Road (Hwy 550).

Figure 4.22. Kaua'ikinanā Diversion Operations Impacts



Site Access

The existing access road to the existing parking area near Kōke‘e Diversion is approximately 1.5 miles in length. From the existing parking area, the diversion is accessible via a foot trail approximately 1/5 miles in length. Halemanu Road receives less maintenance than Mōhihi-Camp 10 Road but is in serviceable condition with a sturdy four-wheel drive vehicle. Occasionally downed limbs block the roadway but are usually removed within a day or two by the State.

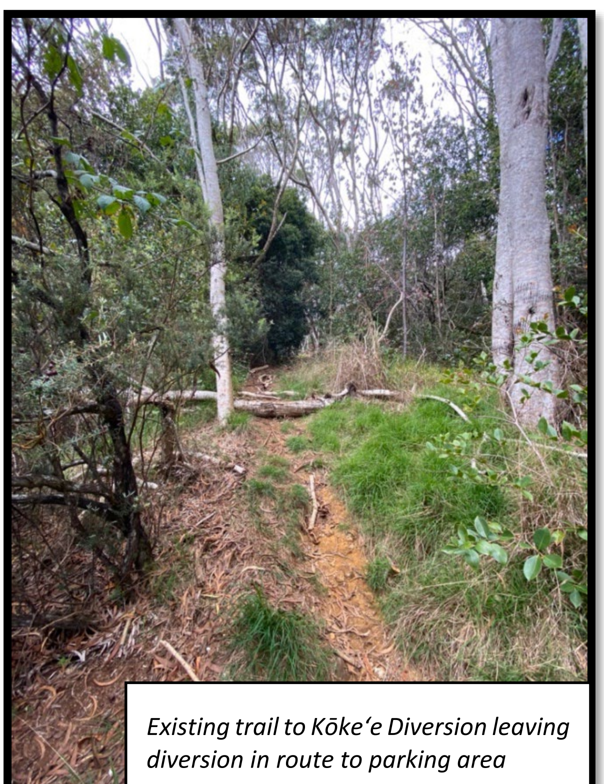


Entrance to Halemanu Road from Kōke‘e Road

Halemanu Road enroute to Kōke‘e Diversion

Halemanu Road enroute to Kōke‘e Diversion

Existing parking area at Kōkeʻe Diversion after recent windstorm and treefall clearing



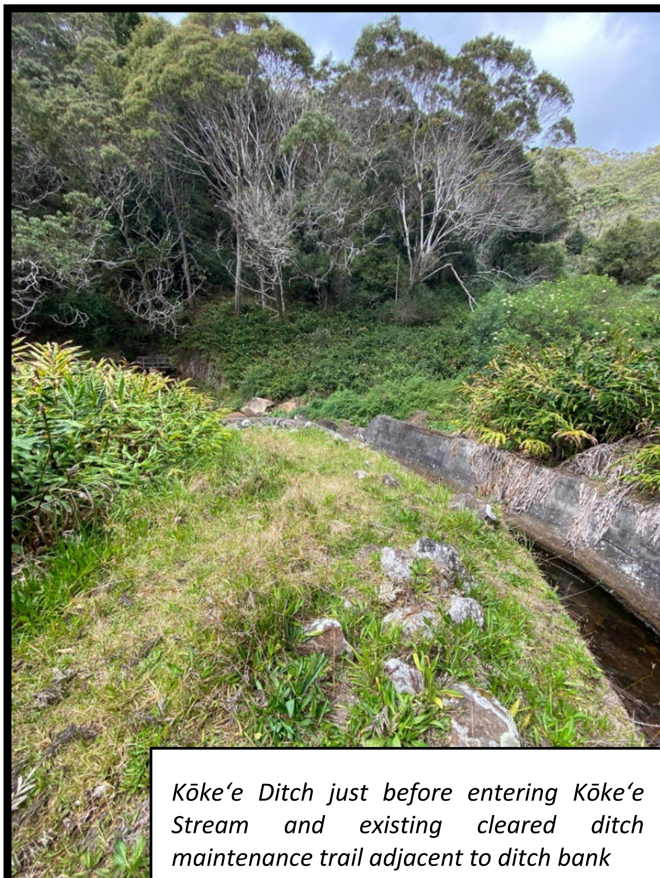
Existing trail to Kōkeʻe Diversion leaving diversion in route to parking area

Existing trail to Kōkeʻe Diversion leaving diversion in route to parking area

Existing Infrastructure and Current Operations

The Kōkeʻe Diversion consists of basalt and mortar constructed walls and ditches, and concrete masonry walls constructed in landscape surrounded by water-rounded basalt boulders. The diversion is a concrete structure at an elevation of 3,353 feet msl. Kōkeʻe Ditch combined flows from Waiakōali Stream, Kawaikōī Stream, and Kauaʻikinanā Stream enter Kōkeʻe Stream upstream of the diversion. Water diverted at Kōkeʻe enters into a 3.2-mile-long series of tunnels and open ditches that carry the water from the Waimea basin onto the western slope of the Waimea Ridge and to Puʻu Lua Reservoir. The diversion structure is in good condition. Kōkeʻe Stream is the smallest contributor to the Kōkeʻe Ditch with 1.48 square miles of drainage area but only 79 inches of precipitation annually (Element Environmental, 2016).

Kōkeʻe Diversion has been in operation since its original construction in the 1920s. Currently diverted flows from Waiakōali, Kawaikōī, and Kauaʻikinanā are discharged into Kōkeʻe Stream immediately upstream of the diversion. Diversion flow is manually regulated using pani boards in the existing slot in center of the dam in combination with manual adjustments to the gate located at the ditch inlet. Without modifications, the diversion structure is designed to divert all streamflow in low or median flows. However, since the Waimea Mediation Agreement, all pani boards have been removed from the slot in the dam and the control gate at the tunnel inlet is significantly lowered to reduce the amount of flow being diverted into Kōkeʻe Ditch at Kōkeʻe Stream. Without modifications to the structure, there is no way to separate ditch flow from natural stream flow or to measure natural stream flow entering the diversion pool.



Kōkeʻe Ditch just before entering Kōkeʻe Stream and existing cleared ditch maintenance trail adjacent to ditch bank

Existing Kōkeʻe Diversion, Kōkeʻe Ditch entering Kōkeʻe Stream and Kōkeʻe Stream entering diversion pool

Kōkeʻe Dam with pani boards removed

Proposed Construction and Access to the Site

Construction Activities

Construction at the Kōkeʻe Diversion involves repairs or small modifications to the existing infrastructure that are within the footprint of the existing structure or within existing cleared areas along the ditch bank.

To measure natural stream flow on Kōkeʻe Stream, a new compound overflow weir would be constructed across the Kōkeʻe Stream channel upstream of the Kōkeʻe Diversion. The new overflow weir would be designed to allow for the passage of native, migratory aquatic species. A new level sensor would be bolted to the upstream side of the constructed weir to accurately measure natural flow of Kōkeʻe Stream in a location not affected by inflows from Kōkeʻe Ditch.

The existing gate and trash rack at the ditch inlet and tunnel entrance would be replaced with a new, automated slide gate and trash rack to regulate flow being diverted into Kōkeʻe Ditch and delivered to Puʻu Lua Reservoir. A new flow sensor would be installed inside of the tunnel at the ditch inlet to accurately measure the flow diverted into Kōkeʻe Ditch. A new stilling well would be installed on the upstream face of the existing concrete diversion to accurately measure flows spilling over the existing diversion and remaining in the Kōkeʻe Stream. A new solar panel and control and power equipment box would be located on the cleared ditch bank upstream of the diversion. Utility cable would extend to the new slide gate and would either be buried on the ditch bank or anchored to the concrete diversion structure. When spanning the slot in the diversion structure, the utility cable would be placed in a rigid metal conduit.

It is assumed that the Phase One IIFS modifications being implemented by KIUC in a separate project (The Kōkeʻe Diversion Modification Project and Flow Monitoring Plan) would be completed prior to construction of West Kauaʻi Energy Project. If that is the case, the 24-inch existing pipe and associated structures installed as part of the Phase One IIFS modifications would be removed during West Kauaʻi Energy Project construction.

Temporary dewatering of Kōkeʻe Stream would occur during construction of the new concrete weir and other modifications. A temporary cofferdam consisting of sandbags with plastic liners would be located within Kōkeʻe Stream upstream of the diversion, Kōkeʻe Ditch, and proposed location of the new concrete weir. A dewatering pump would be positioned in a shallow trench upstream of the sandbags and would reroute Kōkeʻe Stream flow into a pipe. The pipe would extend around the diversion area to the downstream side of the diversion. Water would be released from the pipe into the Kōkeʻe Stream downstream of the diversion structure. Gates on the Kōkeʻe Ditch System upstream of where Kōkeʻe Ditch flow enters the diversion pool upstream of the diversion and Kōkeʻe Stream would be closed, stopping all ditch flow from entering the diversion pool. Once construction is complete the sandbags, bypass pumps, and pipe would be removed, and stream flow would return to its natural course and Kōkeʻe Ditch flow would resume.

No vegetation clearing or grubbing is required for the proposed work at Kōkeʻe Stream or for access to the site.

Construction Site Access and Construction Disturbance Areas

Some limited construction equipment and personnel would gain access to the site using the existing Halemanu Road from Highway 550 and existing side roads off Halemanu. In the existing cleared parking area at the diversion site, a temporary staging area would be established and used for personnel parking, staging equipment, and construction operations. Personnel would access the diversion area using an existing footpath. No vegetation clearing is needed at the parking area or along the trail. Larger equipment including a mini-excavator (CAT 300), slide gate, and trash rack would be delivered to the site via helicopter.

The proposed construction and associated dewatering at Kōke‘e Diversion is expected to require five weeks to complete and would be conducted during the dry season when stream flows are low. Public access would be restricted from staging areas and active work sites including the existing parking area, the foot path to the diversion, and the diversion site. Public access along Halemanu Road and trail heads in the vicinity would not be impacted. **Figure 4.23** shows the area of construction impacts at Kōke‘e Diversion.

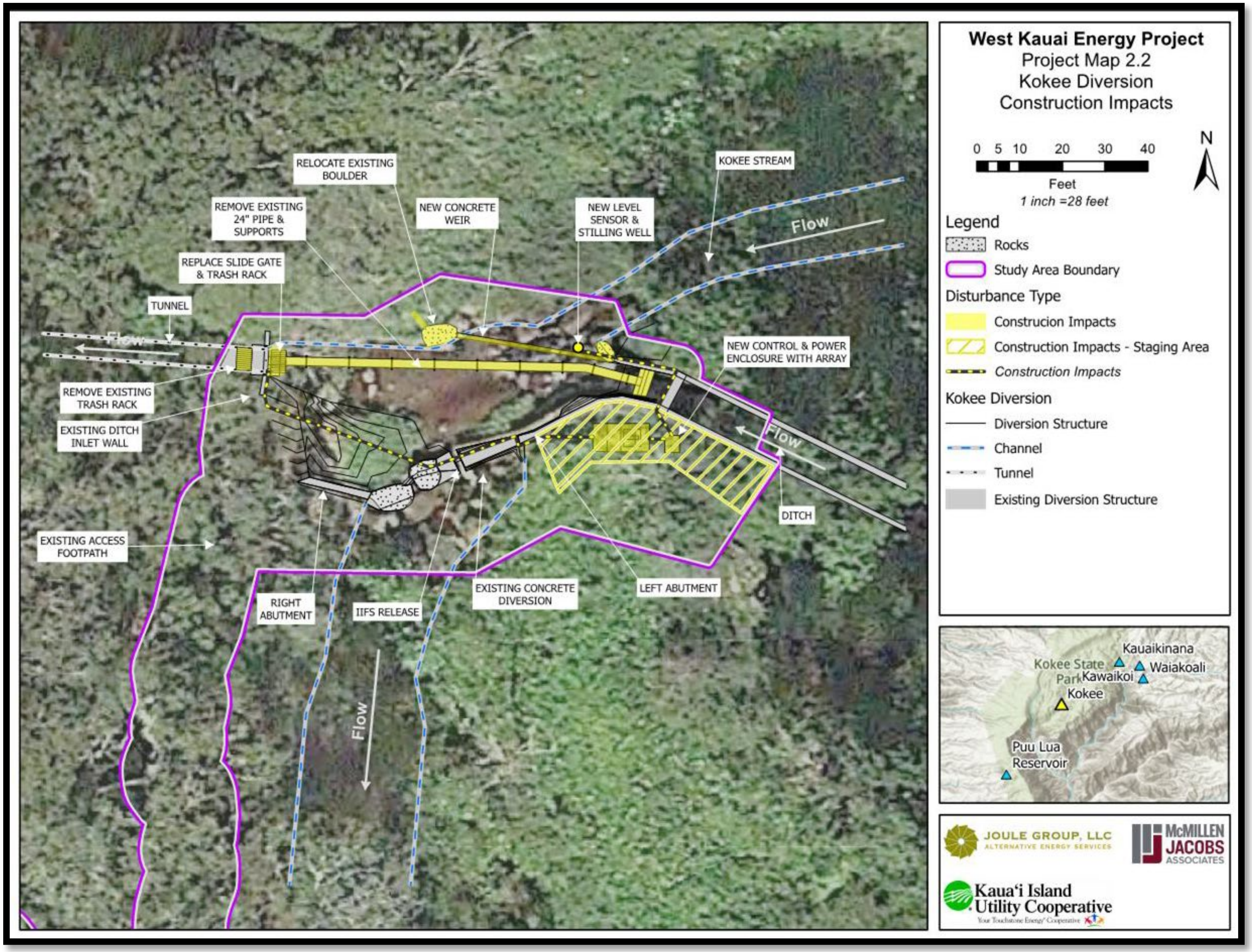
Construction Equipment

Table 4-11 lists the equipment needed for construction.

Table 4-11. Equipment Needed for Construction Activities at Kōke‘e Diversion

Equipment Type	Quantity	Purpose
Mini Excavator (CAT 300)	1 by helicopter	• Removal of selective demolition materials • Excavation for diversion structure • Excavation of sediment and debris from the existing intake ditch • Handling of construction materials
Concrete Drum Mixer	1 by helicopter	• Mix concrete for forming weir.
Enclosed Utility Trailer	1 by helicopter	• House small tools and equipment onsite
Construction Pickup	2	• Transport crew and equipment to the site
1-ton truck and trailer	1	• Transport equipment on main road only to location near the project site
Chain Trencher	1 by helicopter	• Trench buried conduit
Small Generator and Air Compressor	1 by helicopter	• Supply power to tools.
Dewatering Pumps	1 by helicopter	• Collect and pump flow out of the dewatered area into the ditch during construction

Figure 4.23. Kōkeʻe Diversion Construction Impacts



Proposed Operations

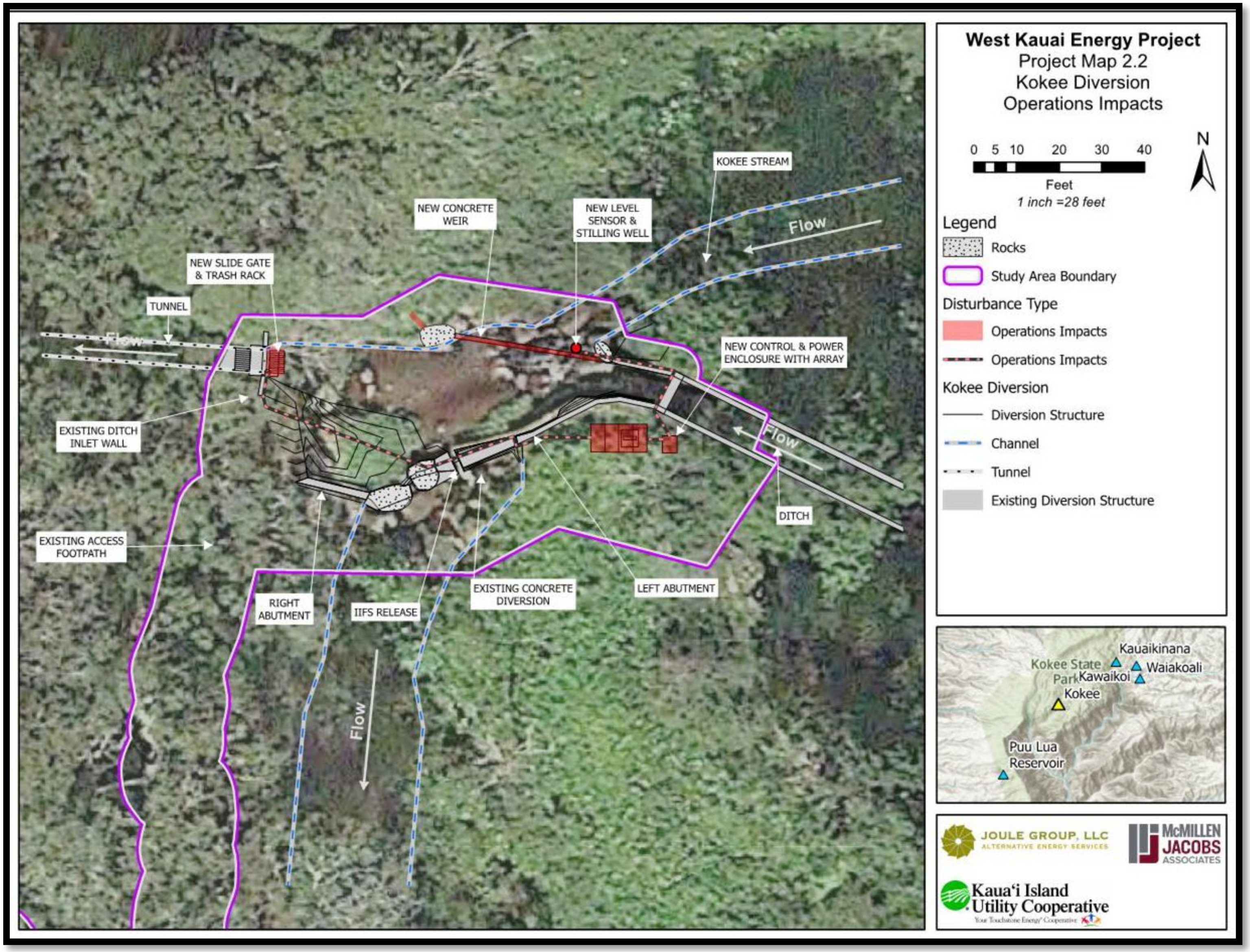
The existing slot in the Kōkeʻe Diversion in combination with the new automated control gate would be used as the mechanism for maintaining the IIFS in Kōkeʻe Stream. Pani boards would be used in the slot to control the upstream diversion pool level. There is no overflow weir located at Kōkeʻe Diversion and flows exceeding ditch capacity would spill over the diversion structure and remain in the stream channel.

After the proposed modifications are completed, the Kōkeʻe Diversion would be equipped with automatic gate operations. Level sensors would measure the amount of water remaining in the stream and the amount of water in the ditch, and these readings would be monitored within the new equipment box. The control panel would send signals through the buried utility cables to the new slide gate instructing it to open or close based on the level sensor readings. This would ensure the required instream flow standard remains in the stream channel and regulate flow diverted into the ditch system. All solar panel and control and power equipment boxes at the diversions would have a backup energy source provided by a thermoelectric generator.

Routine Project maintenance would include periodically checking the automated system, gates and trash racks, overflow weirs, gaging sensors, and diversions to ensure everything is operating properly and to implement any repairs or maintenance actions as needed.

Figure 4.24 shows the Project footprint during operation at Kōkeʻe Diversion.

Figure 4.24. Kōkeʻe Diversion Operations Impacts



4.1.2.6 Puʻu Lua Reservoir

Current Site Conditions and Use

Puʻu Lua Reservoir was constructed across a natural gulch and is impounded by an earthen dam measuring 640-feet-long and 105-feet-high. Historic maximum pool elevation of the impoundment was approximately 3,270 feet, corresponding to a storage capacity of approximately 260 million gallons and a surface area of approximately 17 acres. The seven miles of ditches and tunnels upstream of Puʻu Lua Reservoir that supply the reservoir are documented to have a historic maximum capacity of 55 million MGD (Water Resource Associates, 2004). The reservoir does not have a spillway. The reservoir inlet is a 7-foot by 3-foot trapezoidal ditch with a regulating gate. A bypass ditch branches from the reservoir inlet and travels around the northeast side of the reservoir.

The outlet works of Puʻu Lua Reservoir are comprised of a 24-inch globe valve with an access manhole, vent shaft, and manual hoisting mechanism on top of the dam crest. The outlet conduit consists of a combination of a pipe through the dam embankment and a 6-foot by 6-foot partially lined tunnel, both of which are approximately 110 feet below the top of the dam. The Puʻu Lua Reservoir outlet tunnel discharges flows into Kōkeʻe Ditch downstream of the reservoir. This section of Kōkeʻe Ditch has a historic capacity of 26 MGD and extends 3.1 miles from Puʻu Lua Reservoir to the Puʻu Moe Divide.

Aerial view of Puʻu Lua Reservoir

Site Access

The existing access to Puʻu Lua Reservoir is through approximately 0.8 miles of existing road from Waimea Canyon Drive/Highway 550.

Existing Infrastructure and Current Operations

Puʻu Lua Reservoir was built with a historic capacity of 260 million gallons for the purpose of irrigation and water storage. Puʻu Lua Reservoir is currently managed by DLNR as a recreational and sport fishing (trout) site, but also still provides some limited storage for irrigation. The Division of Aquatic Resources (DAR), a division of DLNR, manages the trout population in the reservoir and maintains a fingerling holding pen.

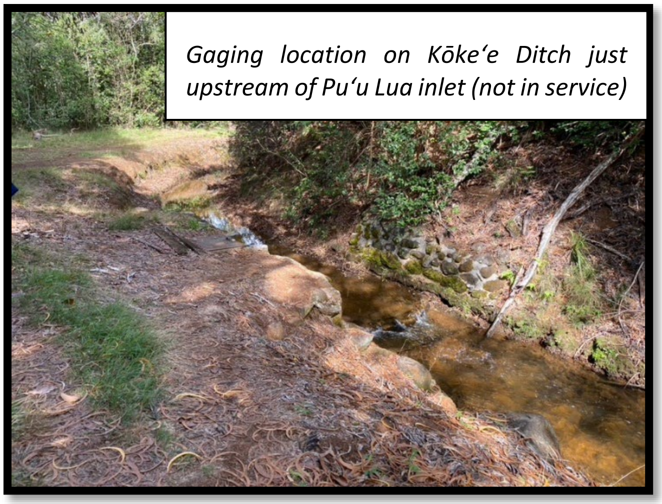
Since July 2013, the flow of water from the Kōkeʻe Ditch Irrigation System into Puʻu Lua Reservoir has been controlled to prevent the water level from rising above a level of 60 feet (approximately 50 to 60 million gallons) within the reservoir due to the observation of seepage from the dam embankment and the need to upgrade the reservoir to meet Hawaiʻi State Dam Safety Standards. This new regulated reservoir height was based on geotechnical borings drilled in the embankment that encountered bedrock somewhere below 75 feet below the top of the embankment.

It is estimated that the reservoir currently loses around 1 MGD from seepage through the dam embankment (Element Environmental, 2016). The amount of seepage loss increases as the water level in the reservoir rises. On average, approximately 1.5 and 2 MGD of water currently enters the reservoir to preserve this water level in the reservoir and to provide water to the water users along sections of the Kōkeʻe Ditch Irrigation System below Puʻu Lua Reservoir.

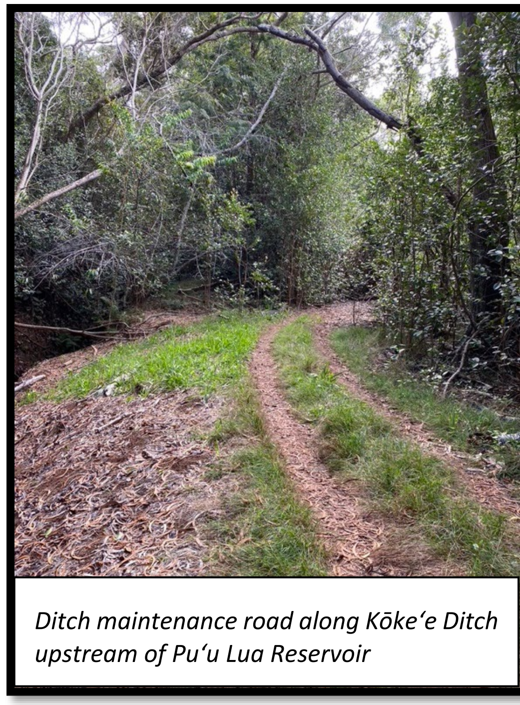
The outflow from the reservoir is controlled by a valve and discharge piping buried in the dam embankment. The valve is accessed via a vertical concrete shaft with manhole located near the middle of the dam embankment. The globe-type valve is adjusted by turning a large metal steering wheel mounted on the side of the manhole. The bypass ditch was historically used to route Kōkeʻe Ditch flow around the reservoir for downstream uses when it was closed for repair or silt removal; however, it is no longer operational.

Existing Puʻu Lua parking area and dam embankment road

Dam embankment road that continues around the reservoir



Gaging location on Kōkeʻe Ditch just upstream of Puʻu Lua inlet (not in service)



Ditch maintenance road along Kōkeʻe Ditch upstream of Puʻu Lua Reservoir

Puʻu Lua Reservoir inlet gate and entrance to bypass ditch

Bypass ditch

Puʻu Lua Reservoir outlet works

Flow entering Kōkeʻe Ditch downstream of Puʻu Lua Reservoir outlet

Proposed Construction and Access to the Site

Construction Activities

Repairs and modifications to Puʻu Lua Reservoir are intended to bring the dam into compliance with Hawaiʻi State dam safety standards and restore operational storage capacity. The existing embankment dam would be left largely in place with the major work consisting of clearing and removing of existing vegetation, compacting the soil, and installing new dam buttress material. A conventional drain filter would be constructed on the downstream face of the existing embankment. The downstream embankment and buttress slopes would be reseeded with native grasses to protect from erosion.

Existing infrastructure associated with the dam would be repaired or replaced. The entire outlet works would be replaced. The existing intake box and trash rack located within the reservoir would be removed and replaced. The existing pipe that conveys the water from the intake box to the valve vault would be cleaned and a liner installed within the pipe. The existing valve vault would be rehabilitated by applying a water sealant to address water seepage and installing a new outlet control gate, new cover, and vent pipe. The existing outlet tunnel would be inspected and repaired to provide a long-term stable structure. A fabricated steel walkway that would extend into the reservoir would be installed to provide access to the new outlet control gate.

A spillway feature is necessary for the dam and reservoir to prevent overtopping of the dam embankment and potential subsequent failure. A new spillway would be installed on the northwestern side of the dam embankment, which would consist of a concrete overflow weir and receiving channel on the upstream face of the dam. A steel pipe would exit from this structure through the embankment and extend along the new buttress eventually releasing any water downstream of the energy dissipation structure. An energy dissipation structure is a device designed to protect downstream areas from erosion by reducing the velocity of the water being released.

To increase storage capacity, the peninsula on the southeast edge would be excavated. After modifications at Pu‘u Lua Reservoir are completed, the water storage capacity would be increased from the current storage level to approximately 200 MG, close to its historic capacity of 260 MG.

The existing bypass ditch that was designed to route water around the reservoir is in disrepair. The bypass ditch has brush and vegetation growing within the ditch alignment which would be removed and sections of ditch wall that have collapsed would be repaired. The existing tunnel along the bypass ditch alignment has collapsed and would be replaced with a pipe or excavated to provide an open ditch system. The existing culvert along the bypass ditch alignment under the existing access road to Pu‘u Lua Reservoir would be replaced.

The existing Pu‘u Lua Reservoir inlet gate is in disrepair and would require replacement, which would consist of removing the existing gate and concrete, constructing a new concrete floor and walls, and installing a new fabricated gate with a manual wheel operator. The Pu‘u Lua Reservoir inlet gate would be used to control Kōke‘e Ditch flows entering the reservoir. Full closure of the gate would divert Kōke‘e Ditch flow into the bypass ditch during construction to maintain dry conditions in the reservoir but allow for Kōke‘e Ditch flow to be delivered to users along Kōke‘e Ditch downstream of Pu‘u Lua Reservoir. The bypass ditch would also be used during operations during reservoir repairs or dam safety inspections.

New instrumentation would be installed to monitor the Pu‘u Lua Reservoir inlet level, reservoir water level, and to measure flow through the Pu‘u Lua Reservoir outlet. The new instrumentation would be a dedicated system consisting of four elements that would include 1) instrumentation to measure the water levels, 2) a control panel to receive input from the instruments and send out signals to the infrastructure to open or close slide gates accordingly, 3) an uninterruptible power supply, and 4) a control power distribution system. The instrumentation to measure water levels would be located at the Pu‘u Lua Reservoir inlet channel, within the reservoir, and within the outlet tunnel. The location and details of the control panel and power system are discussed in the next paragraphs.

A small concrete masonry unit block enclosure would be constructed over the existing valve vault structure. The new building would encompass the entire valve shaft and new electrical actuator, a new 10 kW standby generator, electrical and instrumentation panels, and communication panels. The roof structure would include a framed opening with a removable cover providing access for removal of the gate operator, gate stem, gate, and associated equipment. A standard double wide steel door would be provided for access and equipment removal.

A small electrical distribution system would be installed to provide electrical power for operations at Pu‘u Lua Reservoir. Power for the local electrical distribution system would be provided through new power and fiber optic lines that would be buried along the existing Pu‘u

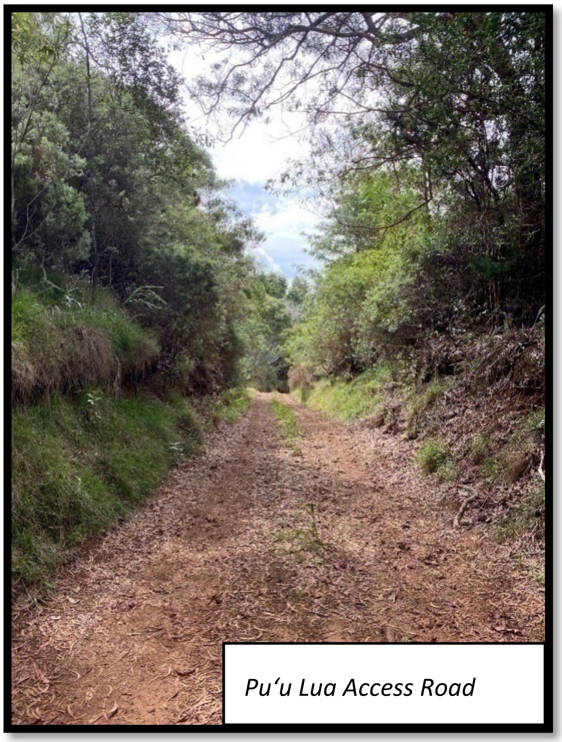
Lua Reservoir access road from the existing transmission line located at Waimea Canyon Drive/Highway 550 to the reservoir and the new flow gage at the existing Puʻu Lua Reservoir inlet.

The repairs and modifications to the bypass ditch would be conducted early during construction to allow Kōkeʻe Ditch flow to be delivered to Kōkeʻe Ditch downstream of the reservoir for irrigation use throughout construction and repairs to the reservoir and dam embankment. The reservoir would be drained for construction activities to take place. Construction would occur during the dry time of the year to minimize difficulties with erosion control and soil handling. If heavy precipitation occurs, construction may be suspended until dry conditions return. The net pens for trout would be removed for construction and reinstalled after completion of work at the reservoir.

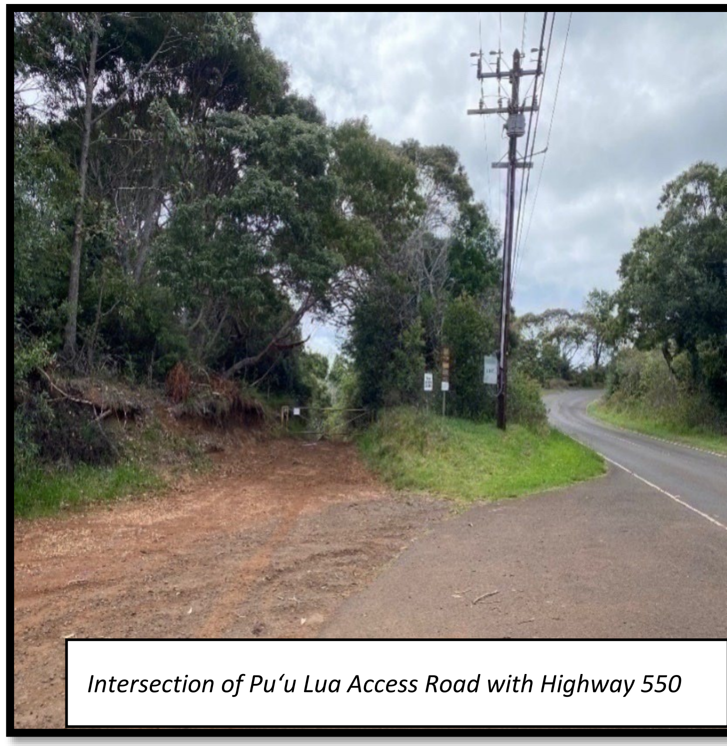
Public access to the reservoir would be restricted throughout the construction period, which is estimated to require 10 months with the goal of minimizing impacts to public access to the loss of one trout fishing season. The existing access road to Puʻu Lua Reservoir would be closed for approximately 7 months during road improvements, electrical line installation, and dam embankment construction. After completion of these items, the access road would be opened for public use and public access would only be restricted at specific work sites and staging areas around the reservoir.

Construction Site Access and Construction Disturbance Areas

Access to Puʻu Lua Reservoir would be through the approximately 0.8 mile of existing road from Waimea Canyon Drive/Highway 550. The existing access road and parking area on the south abutment of the dam would be re-graded and resurfaced with rock. The existing road that traverses the dam embankment would be regraded and resurfaced after the dam modifications were completed to provide a durable road surface. All road improvements would occur within the existing footprint of the road and would not require any vegetation removal. The existing access road and dam embankment road would be used through the life of the Project for maintenance and monitoring.



Puʻu Lua Access Road



Intersection of Puʻu Lua Access Road with Highway 550

Construction equipment would need to maneuver around the embankment to access various construction areas. An access corridor approximately 50-feet-wide downstream of the buttress would be cleared of trees to provide access. Additionally, a short (approximately 300 feet) temporary access spur extending from the existing access road would be constructed to provide access to the dam embankment construction site. This access spur would be restored once construction is complete; however, the impact is considered long term as it will require tree removal. **Figure 4.25** shows the proposed construction area at Puʻu Lua Reservoir.

Puʻu Lua Reservoir access road and parking area

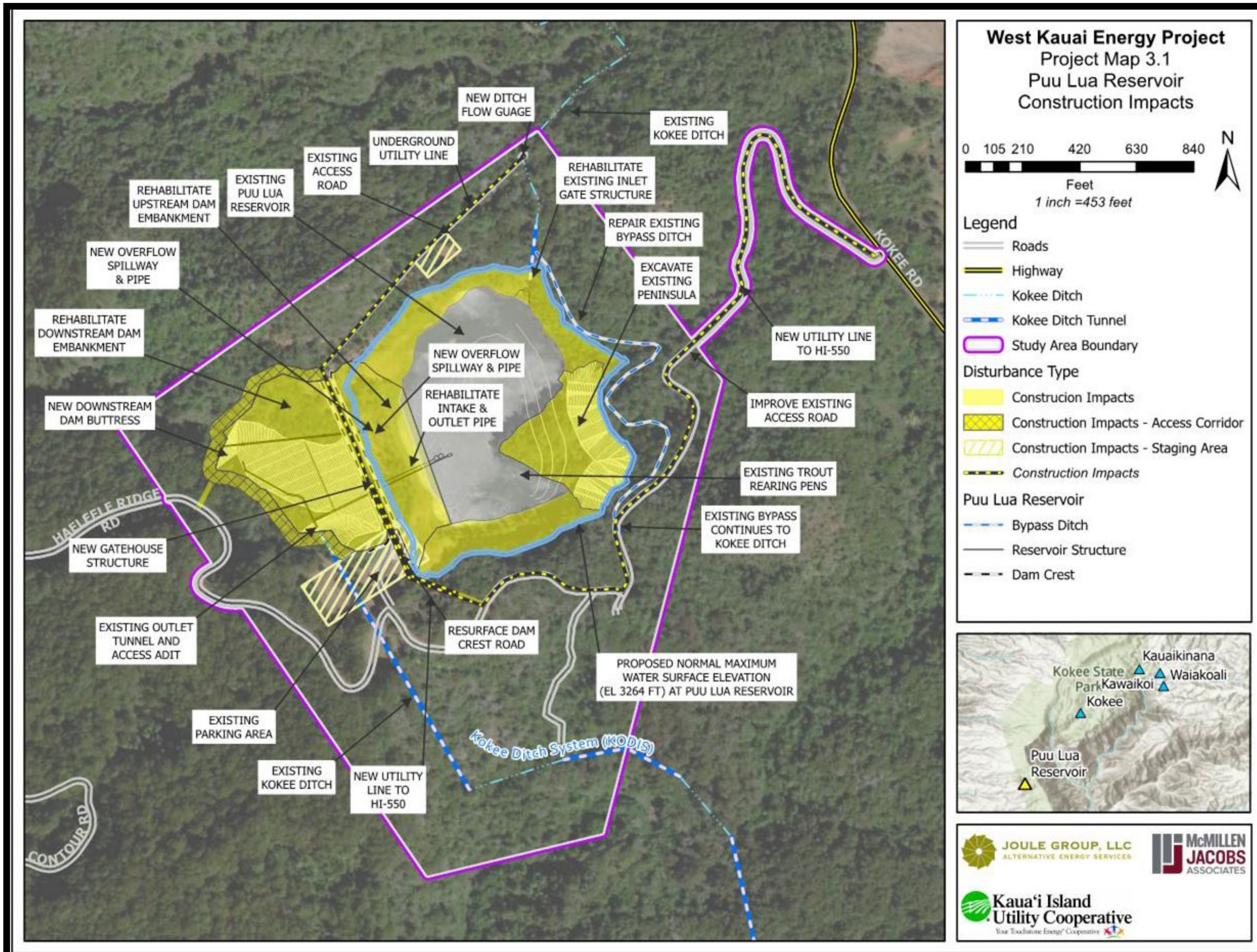
Construction Equipment

Table 4-12 lists the equipment needed for construction at Puʻu Lua Reservoir.

Table 4-12. Equipment Needed for Construction Activities at Puʻu Lua Reservoir

Equipment Type	Quantity	Purpose
Dozer (D6 size)	1	• Clear and grub • Assist with excavation and embankment of material
Excavator (349 size)	1	• Excavate and embank dam materials
84" Roller	1	• Compact dam materials in place
4000 Gallon Water Truck	1	• Dust control • Provide water for compaction and other activities
Loader (966 size)	1	• Load/Unload and relocate construction materials • Assist with earthwork activities
Motor Grader (CAT 140m size)	1	• Grade access roads
Articulated Dump Truck (35 TN)	3	• Haul excavation and embankment material
Backhoe (Cat 416 size)	1	• Install silt fence and assist with bypass ditch improvements
Skid Steer	1	• Assist with miscellaneous structure grade prep • Install fencing
Concrete Pump Truck	1	• Pump concrete from mixer truck to structure
Pickups	3	• Transport crew and equipment to Project site
Transport Truck and Trailer	1	• Transport equipment to site
Dump Trucks	5	• Haul material from offsite pit to and from dam
Small generator and Air Compressor	2	• Supply power to tools
Dewatering Pumps	2	• Pump out excavated areas after rain event
Enclosed Utility Trailer	1	• House small tools and equipment on site

Figure 4.25. Pu‘u Lua Reservoir Construction Impacts



Proposed Operations

Puʻu Lua Reservoir would serve as the West Kauaʻi Energy Project's upper storage reservoir for store and release hydroelectric generation and irrigation. Water released from Puʻu Lua Reservoir would also provide make-up water for evaporative losses at Puʻu ʻŌpae and Mānā Reservoirs as well as refilling of irrigation storage buffers after dry periods. Initially, water diverted into Kōkeʻe Ditch would fill the reservoir, and throughout operations water diverted into Kōkeʻe Ditch would be the sole source of water at Puʻu Lua Reservoir. The design storage capacity at Puʻu Lua Reservoir is approximately 200 MG with an irrigation storage buffer of 20 MG, a storage buffer for trout habitat of 20 MG, and an active operational storage of approximately 178 MG.

The Puʻu Lua Reservoir outlet releases would be controlled by the new instrumentation that would measure the reservoir levels and new instrumentation at the Puʻu Moe Regulating Structure and Puʻu ʻŌpae Powerhouse that monitor flow at those locations. Controlled releases at the Puʻu Lua Reservoir outlet would be during non-solar periods (e.g., evening hours, extended rainy periods of no solar or reduced solar generation). The maximum release from the Puʻu Lua Reservoir outlet would be limited to 26 MGD based on the capacity of the Kōkeʻe Ditch between Puʻu Lua Reservoir to the Puʻu Moe Regulating Structure, but during dry times the minimum release could be as little as 2 MGD.

During extreme rain events storm water runoff may enter the reservoir, which would result in excess water being discharged through the spillway, protecting the reservoir from overtopping.

All the infrastructure would undergo routine maintenance and remain in compliance with Hawaiʻi State Dam Safety Standards. The slopes on the new dam would be maintained in a condition free of large vegetation to reduce the potential for root structures to create seepage paths that may undermine the integrity of the dam.

After rehabilitation of Puʻu Lua Reservoir, the trout fishing program would be able to continue under DLNR-DAR management. West Kauaʻi Energy Project operations would support continuation of the trout fishing program by providing long-term maintenance of the reservoir, consistent inflow of clean water into the reservoir, and increased water storage levels. Also, West Kauaʻi Energy Project operations would maintain the Puʻu Lua Reservoir access road, which would provide improved accessibility to recreational users at Puʻu Lua Reservoir.

Figure 4.26 shows the Project footprint during operations at Puʻu Lua Reservoir. **Figure 4.27** shows a diagram of the proposed storage capacity.

Figure 4.26. Pu'u Lua Reservoir Operations Impacts

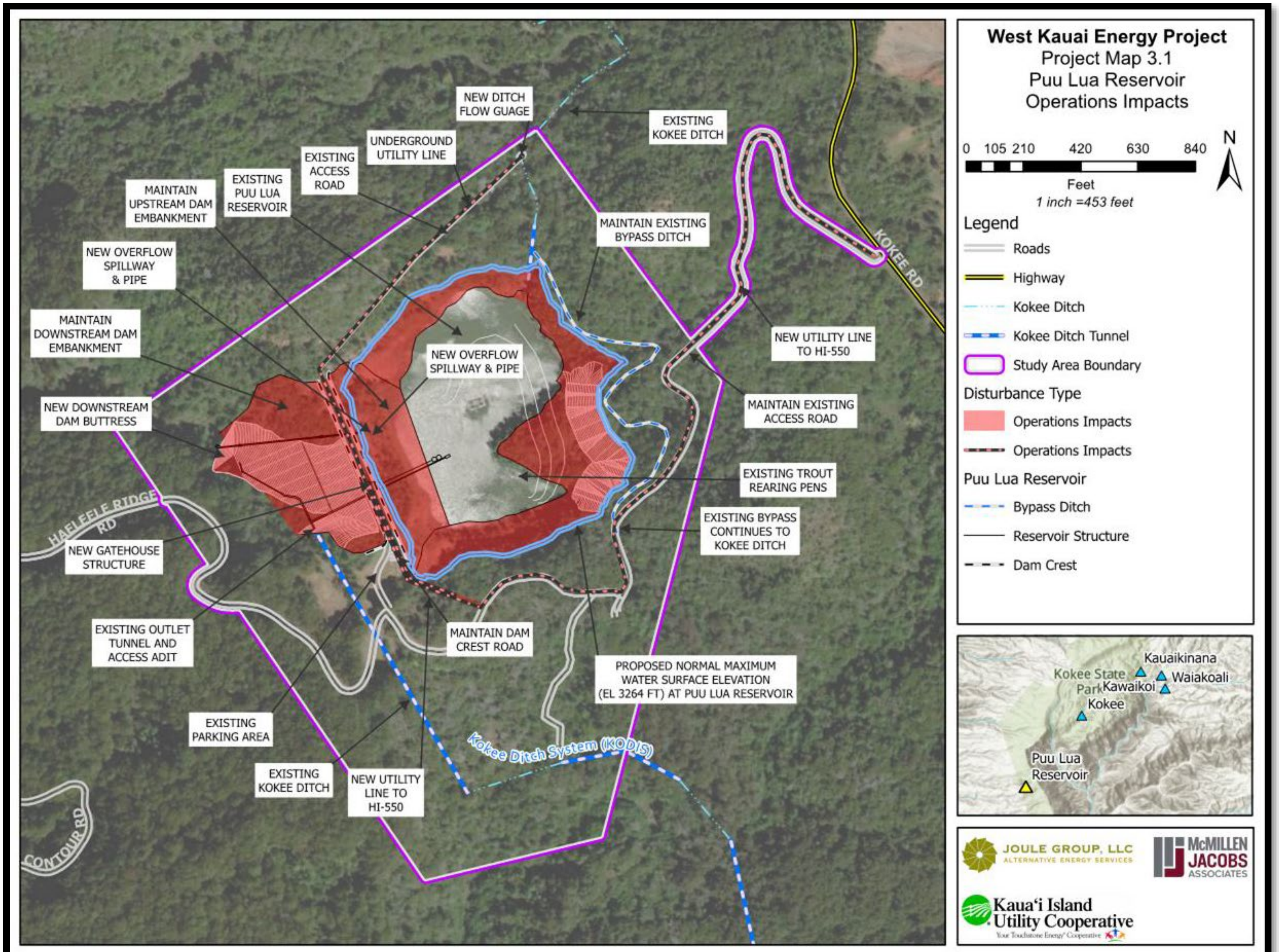
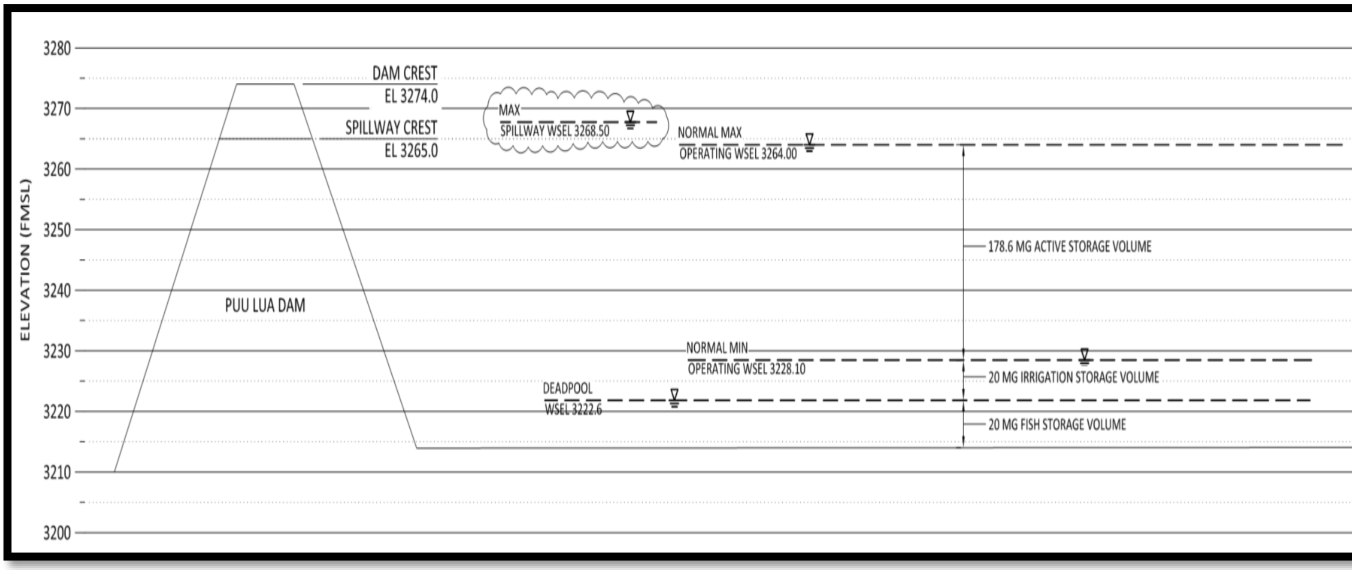


Figure 4.27. Proposed Storage Capacity at Pu'u Lua Reservoir



4.1.2.7 Pu'u Moe Divide Regulating Structure and Mauka Irrigation Deliveries

Current Site Conditions and Use

Pu'u Moe Divide is a point in the Kōke'e Ditch Irrigation System below Pu'u Lua Reservoir near mile marker 10 on Waimea Canyon Drive/Hwy 550 where the main ditch divides into two branches: one extends west 4.7 miles to the Pu'u 'Ōpae Reservoir and historically had a capacity of 7 MGD, and the other extends south approximately 2 miles to the decommissioned Kitano Reservoir and historically had a capacity of 19 MGD. The Pu'u Moe Divide is in disrepair and does not operate as intended.

Site Access

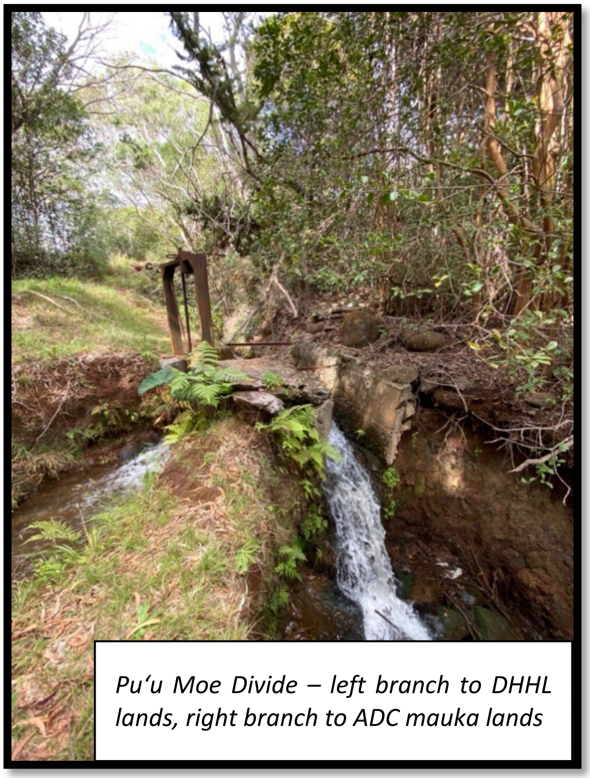
The existing access to the Pu'u Moe Divide is through the existing Trail 1 Road off of Kōke'e Road.

Aerial image of Puʻu Moe Divide and entrance to Trail 1 Road

Existing Infrastructure and Current Operations

The existing regulating structure at Puʻu Moe Divide is composed of earthen ditch sections, a stacked basalt and mortar constructed culvert beneath the access road, and a stacked basalt and mortar constructed gate structure with concrete masonry and metal sluice gates to regulate the makai-bound waters. The ditch sections at Puʻu Moe Divide are narrow and badly eroded in places, especially the section below the divide that heads toward Kitano Reservoir. KAA replaced the lumber in the control gate for DHHL in June 2015 (Element Environmental, 2016). The gate structure regulating flow to DHHL lands is inoperable. A section of PVC pipe installed with the gate is currently being used to pass ditch flow to DHHL land. On December 2, 2014, a total of 0.23 MGD of water was measured flowing towards Puʻu ʻŌpae Reservoir through DHHL lands (Element Environmental, 2016). Based on the CWRM IFSAR (CWRM 2018), DHHL is using an estimated 0.29 MGD and ADC mauka tenants are using an estimated 0.29 MGD.

Historically, most of the flow in the main ditch was routed in the direction of Kitano Reservoir, which served the upland fields of sugarcane planted above the town of Waimea. However, Kitano Reservoir was decommissioned in 2018 and is no longer in use. Currently, ditch flows that continue past Puʻu Moe Divide in the southern branch are utilized by farmers on ADC mauka lands and water remaining in the ditch downstream of these uses is estimated to be 1.0 MGD (CWRM, 2018). As shown in **Figure 4.28**, this water is piped under Waimea Canyon Road and then released into a natural drainage and ultimately enters Kekaha Ditch to supplement Kekaha Ditch flows and provide back up for Menehune Ditch users when Kekaha Ditch is offline for repairs (see **Figure 4.14**).



Pu‘u Moe Divide – left branch to DHHL lands, right branch to ADC mauka lands

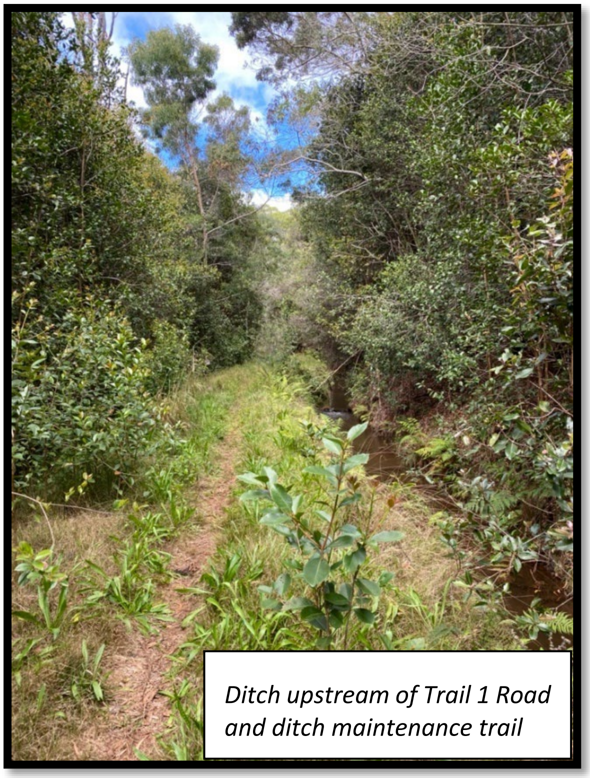
Gate to DHHL land

Figure 4.28. Kōke‘e Ditch Tailwater Drop to Kekaha Ditch

Kōkeʻe Ditch Tailwater Drop to Kekaha Ditch

West Kauaʻi Energy Project – Kauaʻi, Hawaiʻi

SSFM International



Ditch upstream of Trail 1 Road and ditch maintenance trail

Ditch upstream of Puʻu Moe Divide and existing culvert under Trail 1 Road

Proposed Construction and Access to the Site

Construction Activities

A new regulating structure would be constructed at Puʻu Moe Divide on the northwest side of Trail 1 Road that would operationally replace the existing regulating structure. However, the existing regulating structure would be left in place and not disturbed. The new regulating structure would receive Kōkeʻe Ditch flow released from Puʻu Lua Reservoir and provide regulation of flows continuing down the southern branch of Kōkeʻe Ditch and into the new Upper Penstock. The new regulating structure would be constructed of concrete and contain a settling basin, multiple debris management systems to screen and filter sediment or debris in ditch water, penstock isolation gates, an irrigation release and monitoring mechanism for flow entering the southern branch of the Kōkeʻe Ditch, and an emergency overflow channel.

The new regulating structure would be a concrete basin containing multiple debris management systems and measure approximately 50 feet by 30 feet. A single-action isolation gate would be located perpendicular to the Kōkeʻe Ditch to route Kōkeʻe Ditch flow into the regulating structure. This isolation gate would remain open unless maintenance is required on the new Upper Penstock or the regulating structure. If this gate were closed, Kōkeʻe Ditch flow would continue south in the existing southern branch of Kōkeʻe Ditch. Debris entering the regulating structure intake would be removed from water flow using an angled debris removal screen. The regulating structure would contain a settling basin with a weir wall for settling of smaller particles. The south wall of the settling basin would serve as an overflow spillway to direct Kōkeʻe Ditch flow not entering the new Upper Penstock back to the Kōkeʻe Ditch downstream of new regulating structure. The new Upper Penstock intake would be located on the southwest side of the new regulating structure and be constructed well beneath the surface elevation of water passing over the weir, thereby preventing vortexes that would introduce air into the penstock. Water entering the new Upper Penstock would be screened and filtered preventing entrainment of debris and animals from entering the penstock. New monitoring instrumentation would be installed in front of the isolation gate and within the new regulating structure to monitor water flowing through the new regulating structure.

A new flow release mechanism would be located in-line with Kōkeʻe Ditch to regulate and measure irrigation flows continuing down the southern branch of Kōkeʻe Ditch for use on ADC mauka lands and for DHHL's Mauka Village. The new release mechanism would include a flushing gate for flushing any sediment that accumulates behind the structure at intervals by opening the gate.

During construction at Puʻu Moe Divide, Kōkeʻe Ditch flow would be routed around the construction area either in a pipe or in the open ditch. This work would not restrict water availability. Some limited vegetation clearing between Trail 1 Road and Kōkeʻe Ditch would be required during construction.

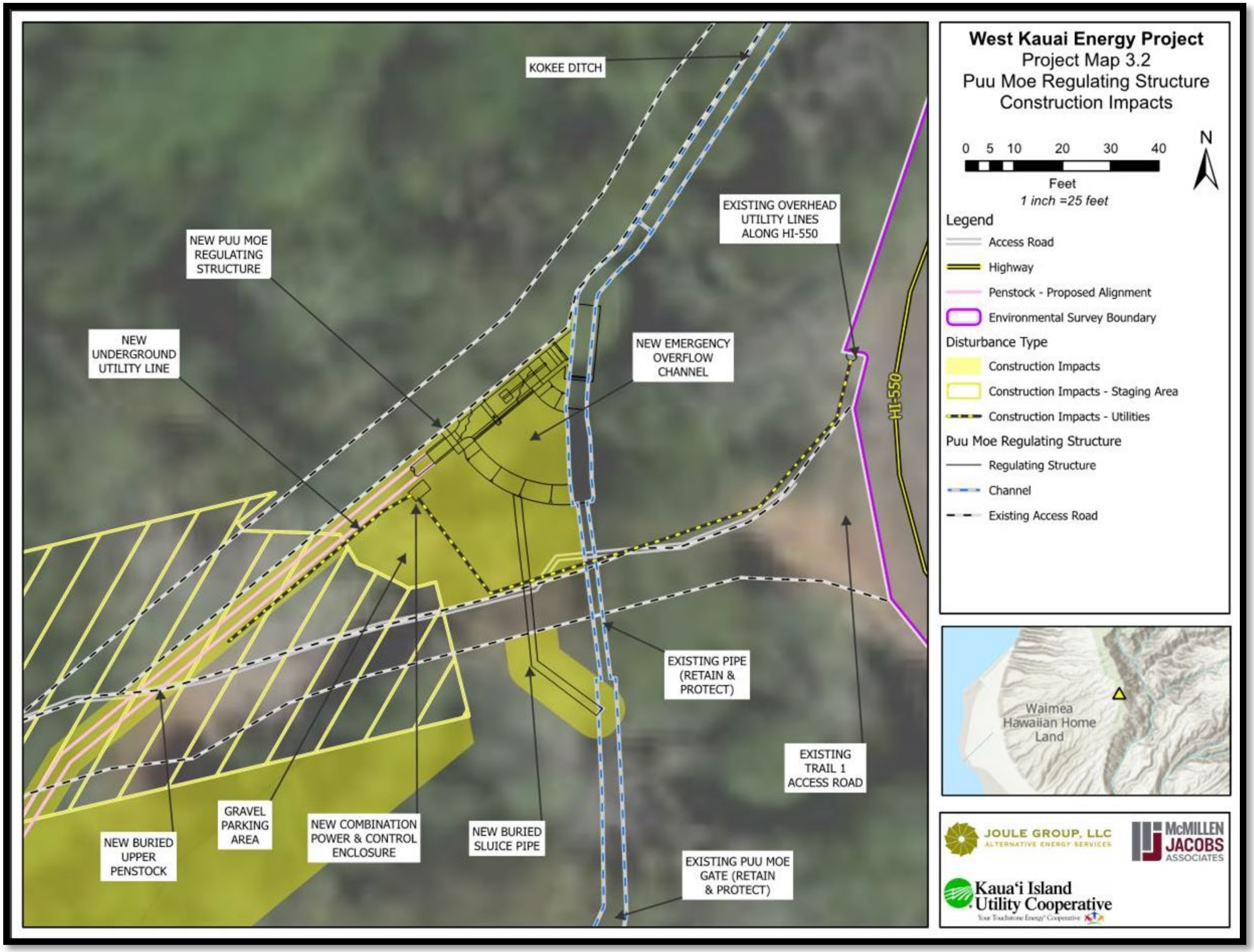
Construction at Puʻu Moe Divide is estimated to require 4 months. The construction work site and staging areas would be restricted from public access; however, DHHL access and other limited access along Trail 1 Road would be accommodated throughout the construction period.

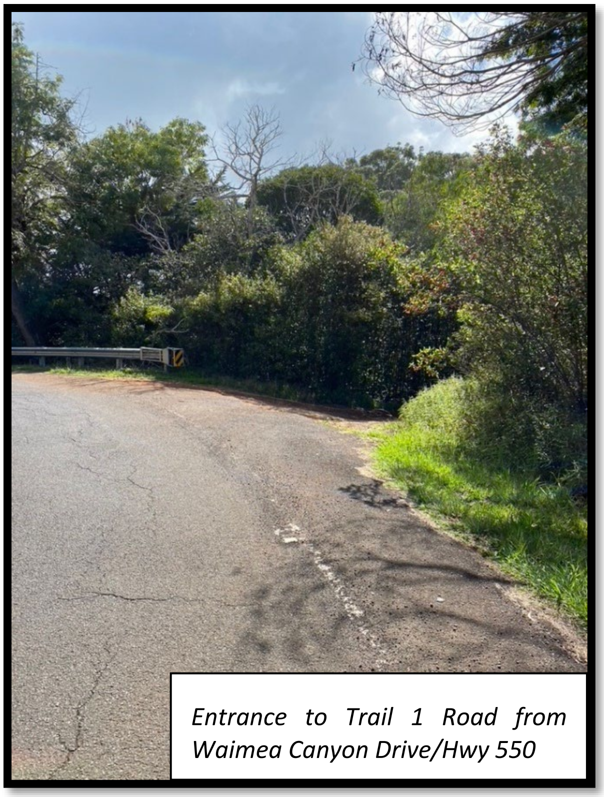
Construction Site Access and Construction Disturbance Areas

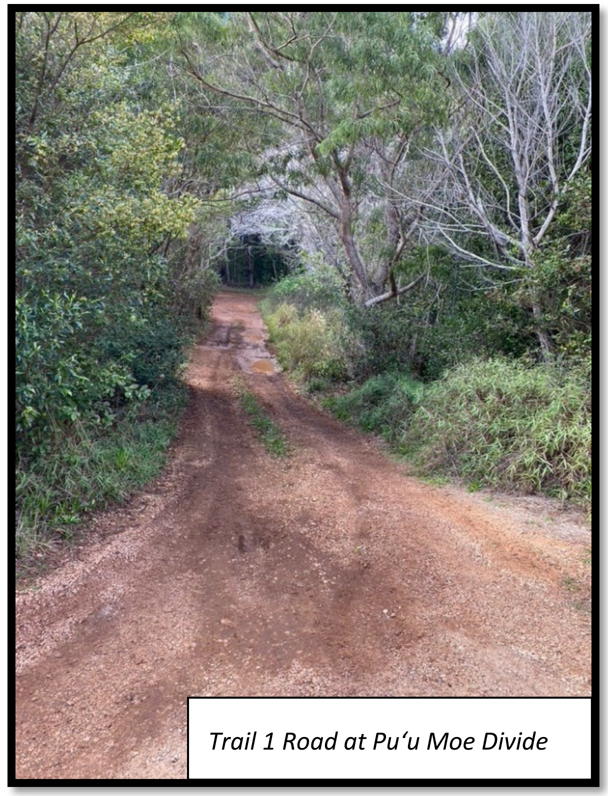
Access to the Puʻu Moe Divide would be from the existing Trail 1 Road. The road between Waimea Canyon Drive/Highway 550 and the existing gate would be resurfaced with gravel. During construction, the existing parking area at Puʻu Moe Divide would provide a staging area for equipment and materials required to complete construction of the new regulating structure. This area would also provide parking for maintenance staff during Project operations.

Figure 4.29. Puʻu Moe Regulating Structure Construction Impacts shows the proposed construction area at Puʻu Moe Divide.

Figure 4.29. Pu'u Moe Regulating Structure Construction Impacts




Entrance to Trail 1 Road from Waimea Canyon Drive/Hwy 550


Trail 1 Road at Puʻu Moe Divide

Construction Equipment

Table 4-13 lists the equipment needed for construction at Puʻu Moe Divide.

Table 4-13. Equipment Needed for Construction Activities at Puʻu Moe Divide

Equipment Type	Quantity	Purpose
Forklift	1	• Transport materials and set formwork/permanent equipment
Excavator (336 size)	1	• Excavate/Backfill for piping and structures
Loader (950 size)	1	• Transport aggregates and materials
Skidsteer	1	• Place and prep for aggregates at structures, access road, parking area, etc.
48"- 84" Roller	1	• Compact aggregates and native material
4000 Gallon Water Truck	1	• Dust control • Provide water for compaction and other activities
Concrete Pump Truck	1	• Pump concrete from mixer truck to structures
Pickups	1	• Transport crew and equipment to Project site
Transport Truck and Trailer	1	• Transport equipment to site
Dump Trucks	2	• Haul material from offsite pit to and from penstock
Small generator and Air Compressor	2	• Supply power to tools • Test penstock piping
Dewatering Pumps	1	• Pump out excavated areas after rain event
Enclosed Utility Trailer	1	• House small tools and equipment on site

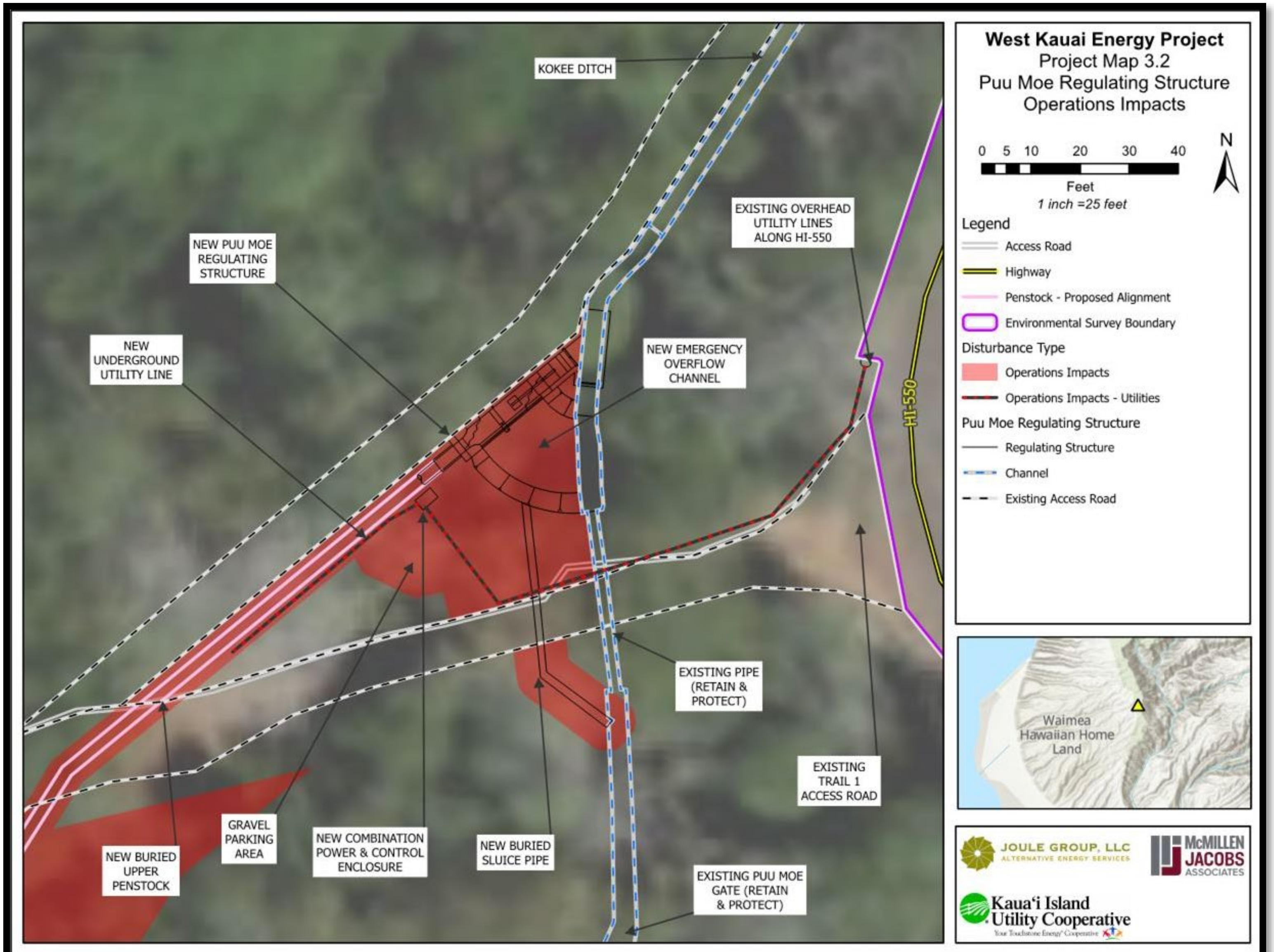
Proposed Operations

Water entering the new Puʻu Moe Regulating Structure would be released from Puʻu Lua Reservoir into Kōkeʻe Ditch on a controlled store and release basis during non-solar hours. The new Puʻu Moe Regulating Structure would regulate flow from the Kōkeʻe Ditch into the new Upper Penstock for store and release power generation at the Puʻu ʻŌpae Powerhouse and irrigation uses at the DHHL pastoral lots and Puʻu ʻŌpae Reservoir. Delivery and monitoring of water to ADC mauka lands for irrigation and the DHHL Mauka Village would be conveyed from the new Puʻu Moe Regulating Structure into the existing southern branch of Kōkeʻe Ditch by the new irrigation release mechanism. This would be implemented by a communication and control loop between the new Puʻu Moe Regulating Structure and the Puʻu ʻŌpae Powerhouse. When irrigation water would not be needed on ADC mauka land or at the DHHL Mauka village, the same communication and control loop would allow all water to enter the new Upper Penstock. The flow monitoring devices would measure flow entering the new Puʻu Moe Regulating Structure, flow entering the new Upper Penstock and flow released into the southern branch of Kōkeʻe Ditch.

During Project operations, the connection between Kōkeʻe Ditch and Kekaha Ditch would provide the mechanism for the Project to deliver water through the southern branch of the Kōkeʻe Ditch to Menehune Ditch through Kekaha Ditch as a backup irrigation source when Kekaha Ditch is undergoing repair or maintenance.

Figure 4.30 shows the Project footprint during operation at the Puʻu Moe Regulating Structure.

Figure 4.30. Pu'u Moe Regulating Structure Operations Impacts



4.1.2.8 Upper Penstock

Current Site Conditions and Use

The Upper Penstock would be a new facility included in the Proposed Action. The location of the new Upper Penstock would generally follow the alignment of Trail 1 Road and the western branch of Kōke‘e Ditch, all of which are previously disturbed areas.

Site Access

The existing access to the Upper Penstock is through the existing Trail 1 Road off of Kōke‘e Road.

Current Operations

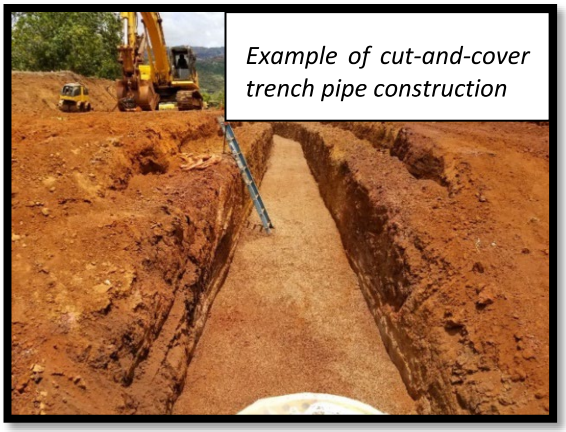
The Upper Penstock would be a new facility that would replace the existing western branch of Kōke‘e Ditch that currently transports water from Pu‘u Moe Divide to Pu‘u ‘Ōpae Reservoir. This branch of Kōke‘e Ditch is in a state of significant disrepair and functions in a limited capacity with significant water loss and erosion issues. Replacement of the ditch with a pipe is necessary for efficient water delivery to the Pu‘u ‘Ōpae area.

Proposed Construction

Construction Activities

The new Upper Penstock would be constructed of steel and buried for its entire length of approximately 23,400 feet between Pu‘u Moe Divide and Pu‘u ‘Ōpae Powerhouse and would be designed to convey a maximum flow of 26 MGD via gravity to the Pu‘u ‘Ōpae Powerhouse. The size of the Upper Penstock would range from 30 to 36 inches outer diameter. The exterior and interior Upper Penstock surfaces would be protected by a protective, high-performance industrial lining and coating system. There are several materials that would be appropriate for the coating system based on expected service conditions, temperature and humidity, and environmental and safety conditions for field applied coating and lining repair, one of which will be selected as part of the final design process. The Upper Penstock would be equipped with manholes, air release valves, a vacuum vent standpipe, and thrust blocks. Entrance to the Upper Penstock would be screened to prevent animals or debris from entering the penstock.

The installation of the Upper Penstock would occur in sections and would be installed in a cut-and-cover trench having a bottom width of a minimum of three feet wider (i.e., 18-inches each side) than the outside pipe diameter to allow access for welders to perform their work and to provide adequate space for the pipe zone material to be compacted. Each section would be constructed in an open trench with a maximum length of approximately 2,000 feet and a maximum width of 60 feet to allow construction personnel to access the work area safely. Once the work is completed for that section of the penstock, the next section would be trenched and made available for construction personnel. A minimum soil cover of two feet would be provided above the top of the pipe for the entire length of the Upper Penstock. Small staging areas would be set up along the penstock alignment at each section of construction and disassembled after construction of the section is complete.



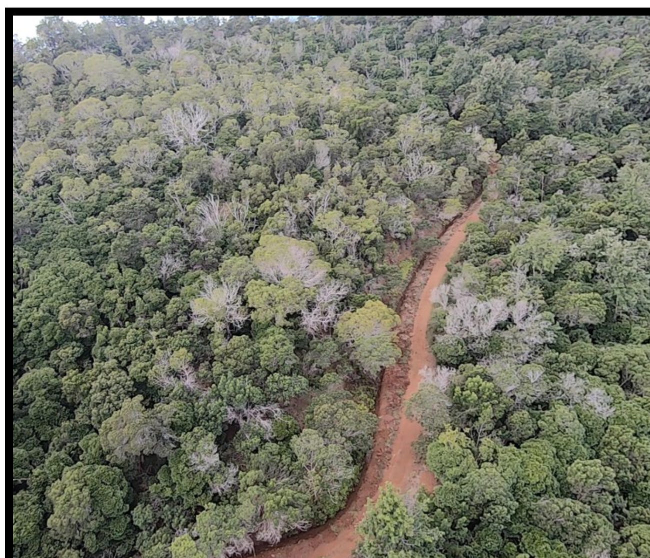
Example of cut-and-cover trench pipe construction

Example of cut-and-cover trench pipe construction

The Upper Penstock would be equipped with two flow meters, referred to as a penstock leak detection system. One flow meter would be located at the top of the penstock near the Puʻu Moe Regulating Structure and the second flow meter will be located near the bottom of the penstock just upstream of the Puʻu ʻŌpae Powerhouse. The purpose of the penstock flow monitoring or leak detection system is to monitor the volume of water flowing through the penstock and monitor any possible leakage in the penstock.

A fiber optic line and power cable would be buried along the Upper Penstock alignment to provide communication between the Puʻu ʻŌpae Powerhouse and the Puʻu Moe Regulating Structure and communication between the upper and lower flow meters. The instrumentation systems of the West Kauaʻi Energy Project would be interconnected via this fiber optic cable.

During times when the Puʻu ʻŌpae Powerhouse turbine may be offline for maintenance or not operating due to low flow conditions, the Project has been designed to allow for delivery of water for irrigation to the Puʻu ʻŌpae Reservoir through the installation of a turbine shut-off valve and an energy dissipation bypass valve on the Upper Penstock. Irrigation water availability would be subject to streamflow variability and diversion volumes available after the IIFS is implemented.



Trail 1 Road and Kōkeʻe Ditch near Puʻu ʻŌpae Reservoir

Construction Site Access and Construction Disturbance Areas

Construction access for the Upper Penstock would be by the existing unpaved Trail 1 Road. The road would be improved for construction as well as maintenance and inspection of the penstock, valve vaults, and other penstock appurtenances during West Kauaʻi Energy Project operations. Improvements to Trail 1 Road would involve scraping, leveling, and gravel placement as necessary to safely support construction traffic. Light maintenance would be performed for the life of the Project.

Approximately 1.3 miles, the upper portion, of the Upper Penstock construction would occur in forested areas and would result in tree removal. The lower sections of the Upper Penstock traverse areas generally more open, but still may require some limited tree removal.

Because the Upper Penstock is along the western branch of the Kōkeʻe Ditch, there may be brief periods during construction when it is not possible to deliver irrigation water through the open ditch. Under these circumstances, the Project would provide water through other means to existing irrigation users at Puʻu ʻŌpae who currently get water through the western ditch branch. Methods of providing would likely involve piping ditch flow around the construction area, but may also involve trucking fresh water to the site or providing storage tanks in the immediate areas of use. Specific methods of providing water during brief construction periods when delivering through the open ditch may not be possible would be determined at the time of construction depending on the season and weather, length of time water cannot be delivered through the open ditch or other specific considerations that may be occurring at the time.

Figure 4.31, **Figure 4.32**, and **Figure 4.33** show the proposed construction and disturbance area for the Upper Penstock.

Trail 1 Road and Kōkeʻe Ditch just upstream of Puʻu ʻŌpae Reservoir

Trail 1 Road at DHHL pastoral lots

Trail 1 Road – forested section in Puʻu Ka Pele Forest Reserve

Figure 4.31. Upper Penstock Construction Impacts (1 of 3)

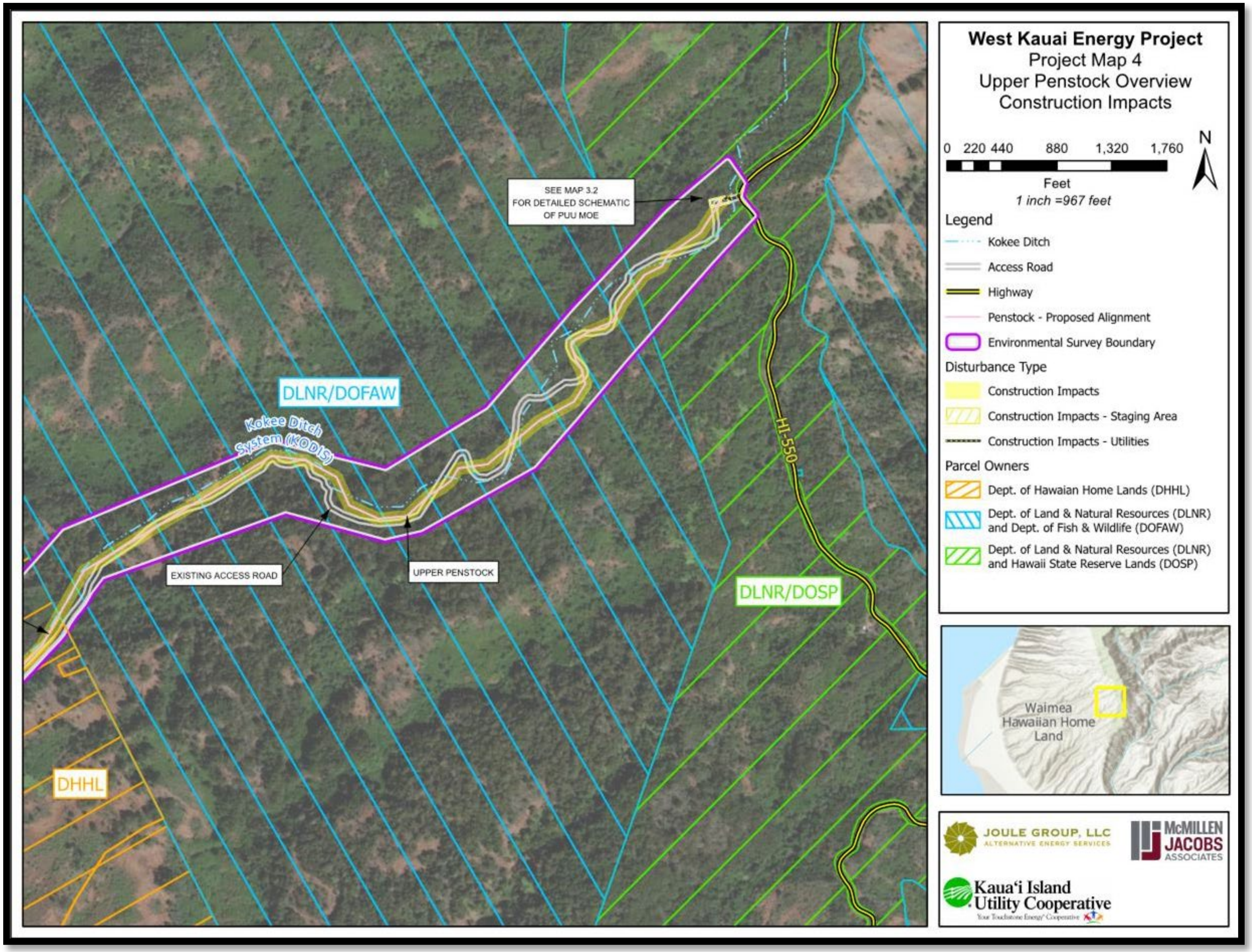


Figure 4.32. Upper Penstock Construction Impacts (2 of 3)

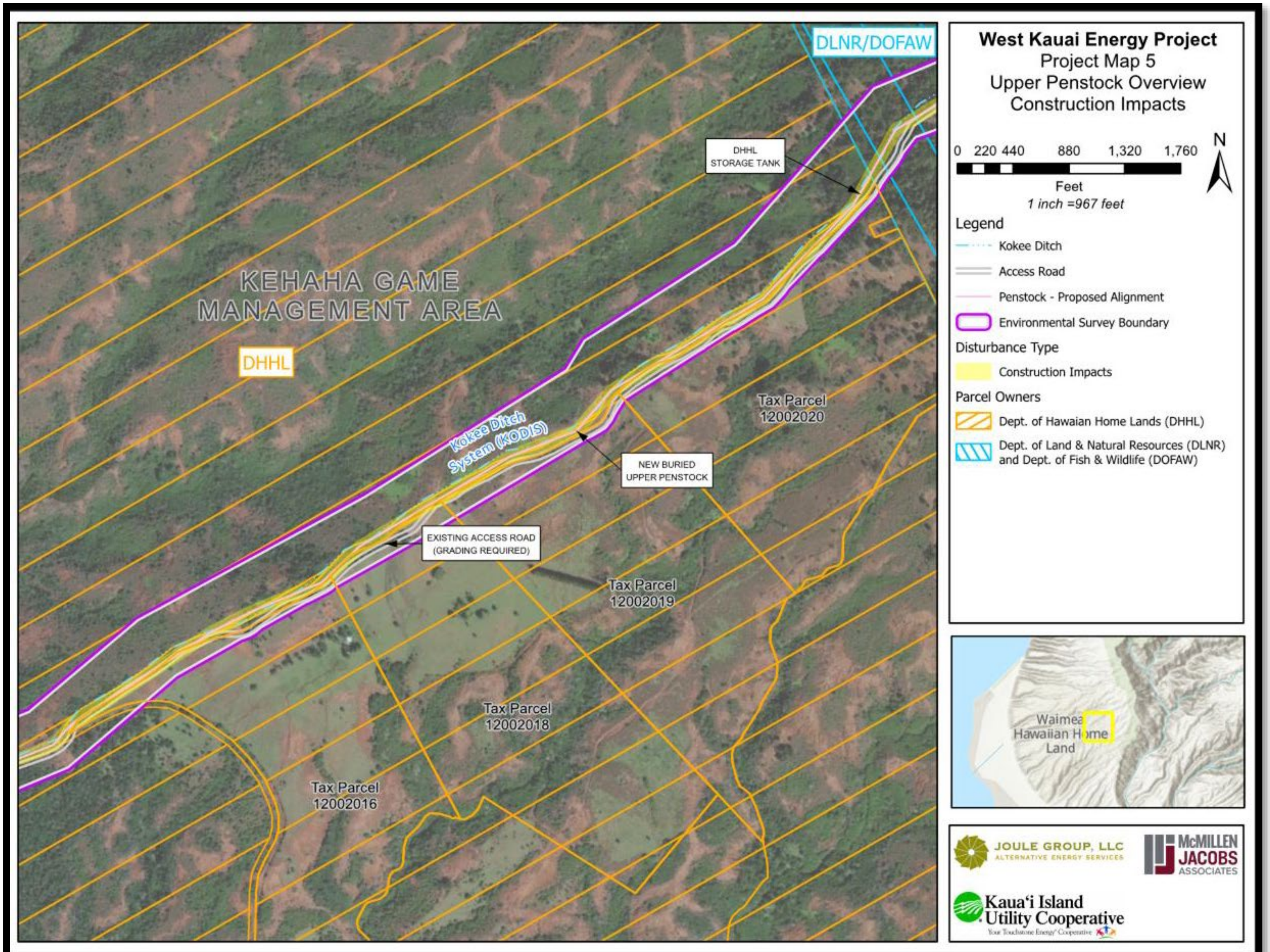
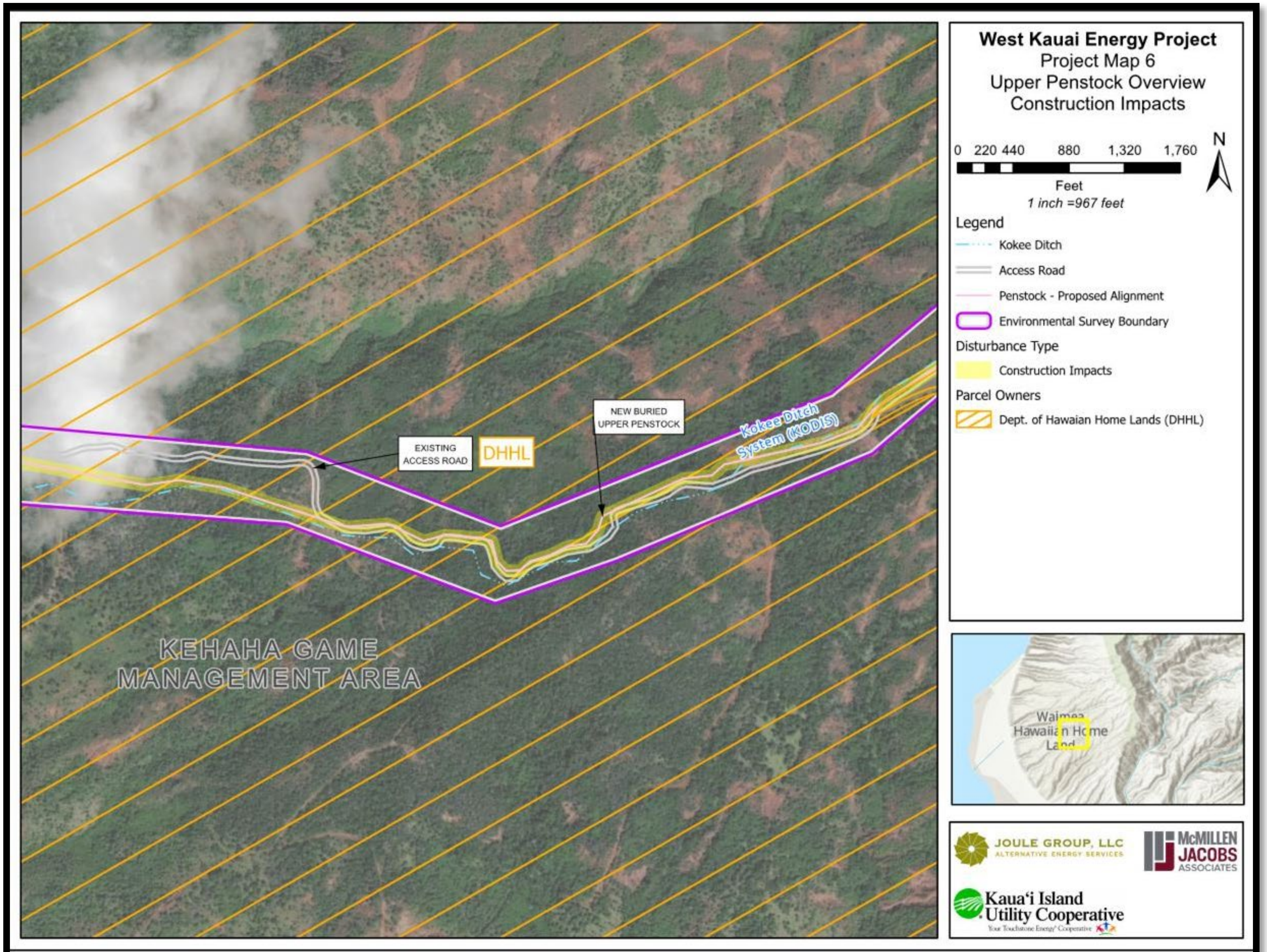


Figure 4.33. Upper Penstock Disturbance Area (3 of 3)



Construction Equipment

Table 4-14 lists the equipment needed for construction of the Upper Penstock.

Table 4-14. Equipment Needed for Construction of the Upper Penstock

Equipment Type	Quantity	Purpose
Dozer (D8 size)	2	• Clear and grub/slope grading
Excavator (349 and/or 352 size)	2	• Mass excavation/slope grading • Trench and set pipe
84" Roller	1	• Compact aggregates and native material
Loader (980 size)	2	• Relocate aggregates and excavated materials • Screen excavated materials • Load/Unload penstock piping
4000 Gallon Water Truck	1	• Dust control • Provide water for compaction and other activities
Articulated Dump Truck (35 TN)	3	• Haul excavated materials and penstock piping
400 Amp Welder	2	• Weld steel penstock
Concrete Pump Truck	1	• Pump CLSM from mixer truck to trench and to construct penstock thrust blocks.
Pickups	4	• Transport crew and equipment to Project site
Transport Truck and Trailer	1	• Transport equipment to site
Dump Trucks	3	• Haul material from offsite pit to and from penstock
Small generator and Air Compressor	2	• Supply power to tools • Test penstock piping
Dewatering Pumps	2	• Pump out excavated areas after rain event
Enclosed Utility Trailer	1	• House small tools and equipment on site

Proposed Operations

The new Upper Penstock operations would be based on the controlled releases at Puʻu Lua Reservoir during non-solar hours. Water delivered through the new Upper Penstock would be for the purpose of store and release hydroelectric generation, irrigation and/or make up water for evaporative losses at Puʻu ʻŌpae and Mānā Reservoirs. Water entering the new Upper Penstock would be filtered and screened at the new Puʻu Moe Regulating Structure to prevent animals or debris from entering the penstock. The maximum capacity of the Upper Penstock would be 26 MGD, corresponding to the capacity of the Kōkeʻe Ditch between Puʻu Lua Reservoir and Puʻu Moe Divide. The total volume of water delivered through the Upper Penstock would range from 2 to 26 MGD depending on the following considerations:

- Volume of water available in the stream

- Implementation of the Phase Two IIFS
- Kōkeʻe Ditch capacity
- Puʻu Lua Reservoir storage capacity
- Irrigation/consumptive uses along the Project flowline above Puʻu ʻŌpae Powerhouse

Regulating water flow through the Upper Penstock would be automated through new control and monitoring systems installed as part of the Project.

Vegetation maintenance over a 60-foot corridor along the penstock alignment would occur during Project operations to prevent growth of large shrubs or trees. Agricultural activities along the Lower Penstock alignment would not be impeded during Project operations.

Figure 4.34, **Figure 4.35**, and **Figure 4.36** show the Project footprint of the Upper Penstock during operations.

Figure 4.34. Upper Penstock Operations Impacts (1 of 3)

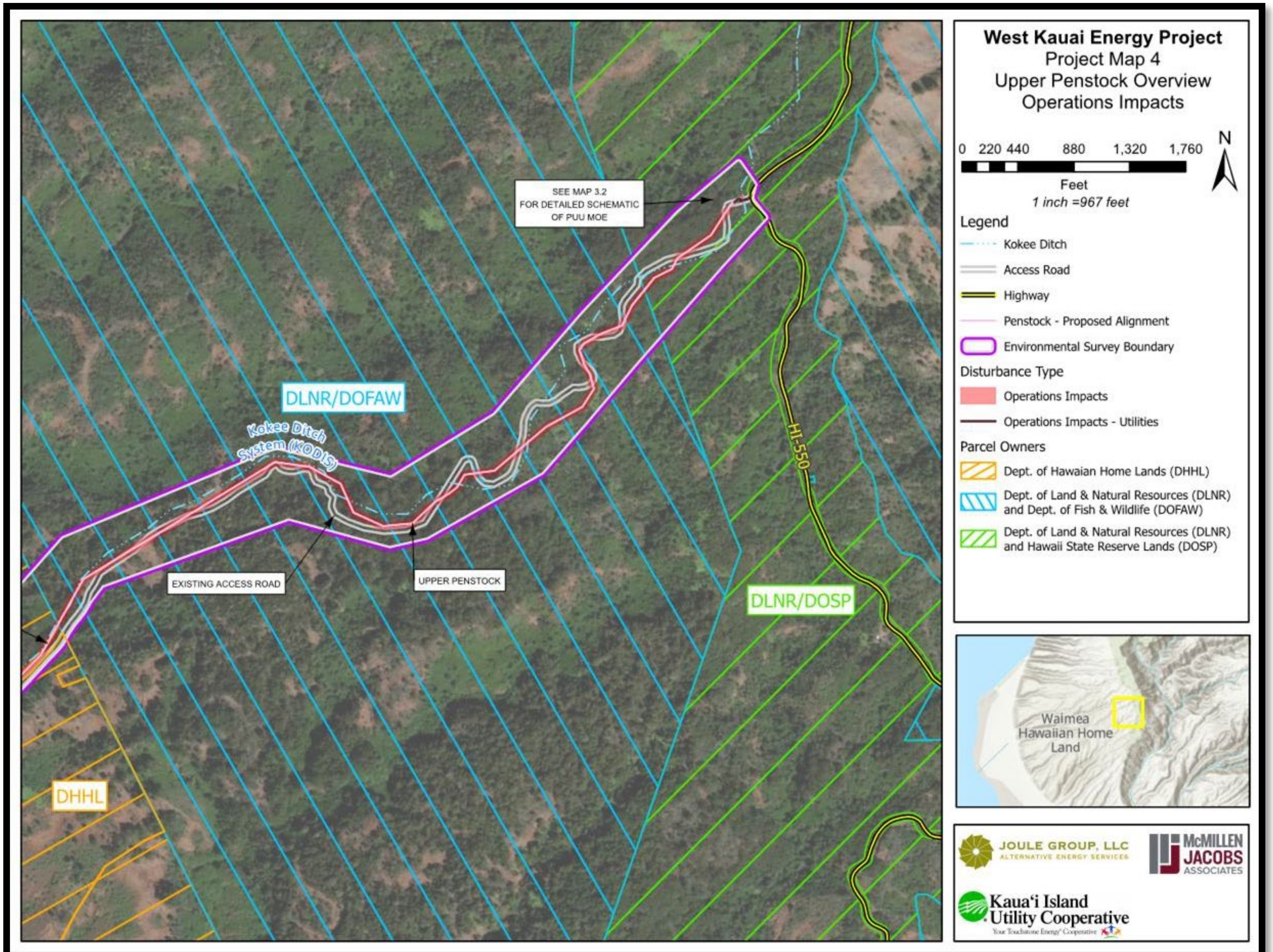


Figure 4.35. Upper Penstock Operations Impacts (2 of 3)

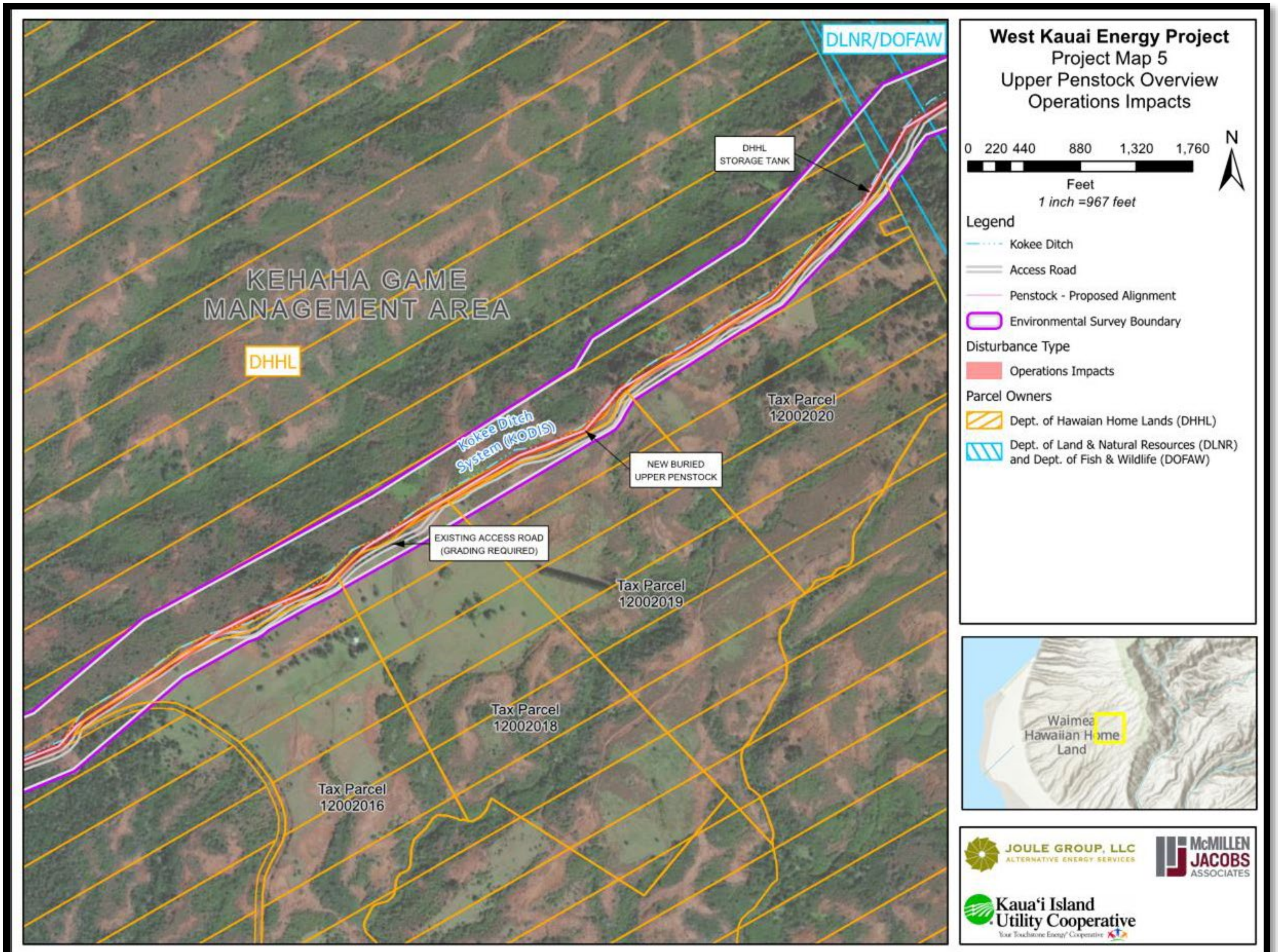
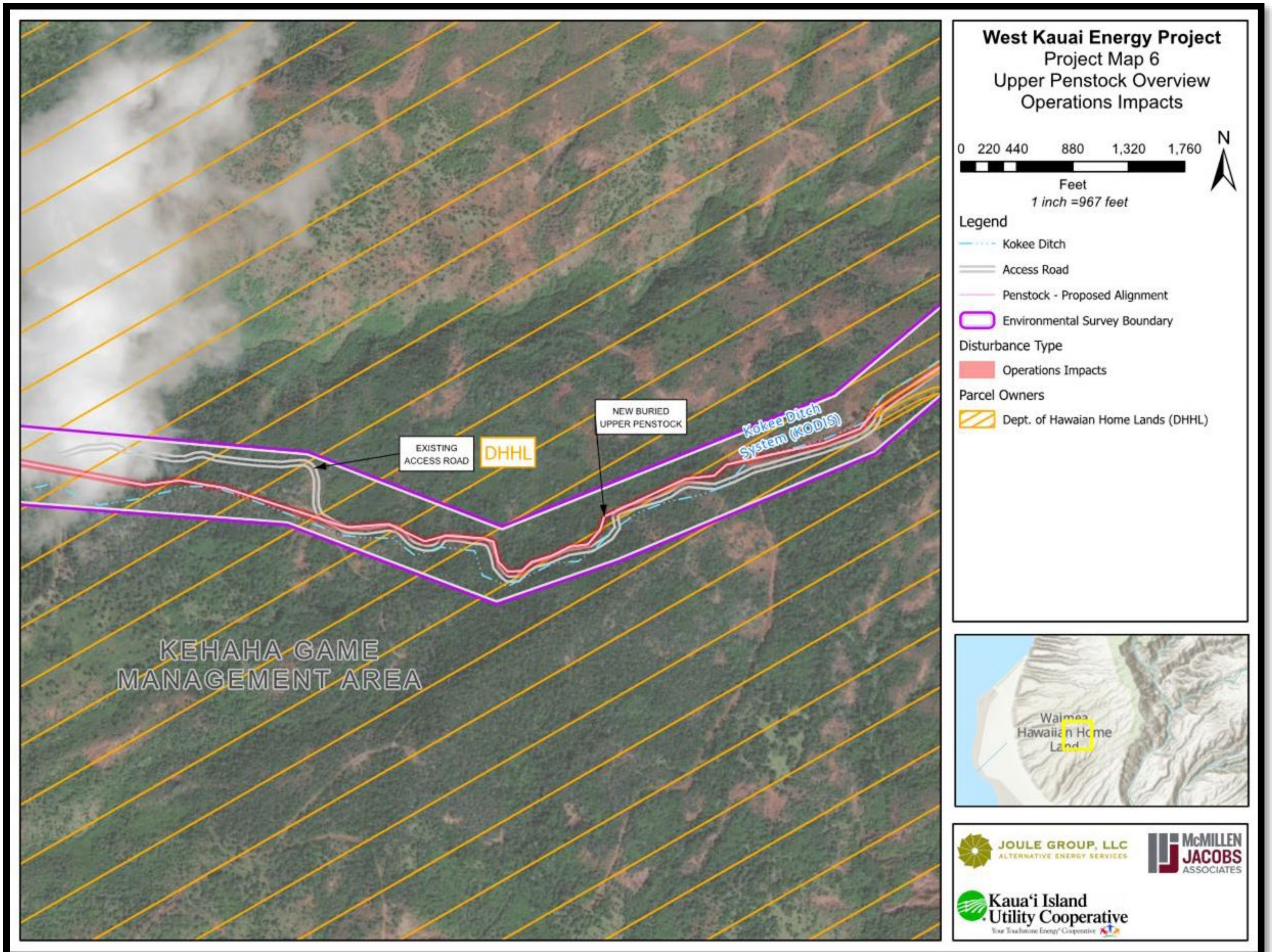


Figure 4.36. Upper Penstock Operations Impacts (3 of 3)

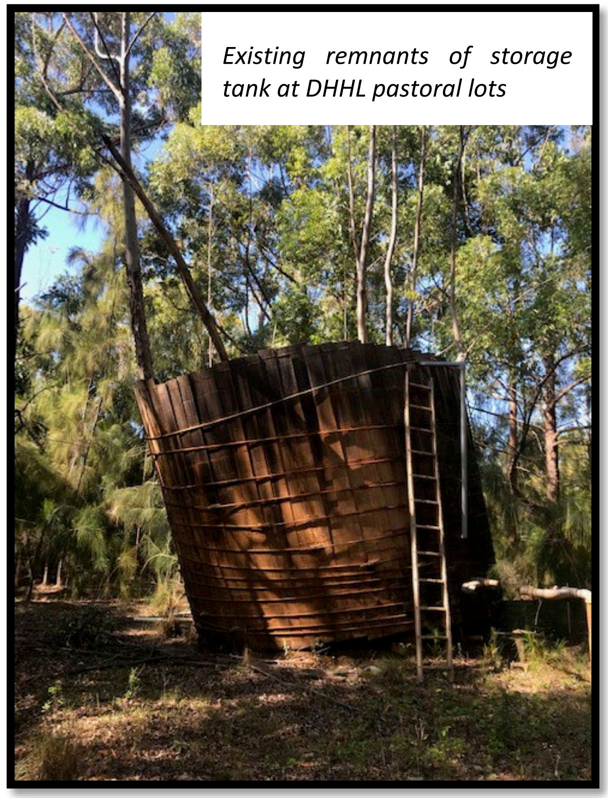


4.1.2.9 DHHL Storage Tank

Current Site Conditions and Use

The existing storage tank at the DHHL pastoral lots is in a state of disrepair and is no longer operable. Irrigation needs at the DHHL pastoral lots are currently supplied by a small PVC pipe extending from Kōkeʻe Ditch and buried along Trail 1 Road. There are repeated issues with the pipe cracking and failing or the pipe inlet getting clogged.


Outlet from existing storage tank


Existing remnants of storage tank at DHHL pastoral lots

Site Access

The existing access to the DHHL storage tank is through the existing Trail 1 Road off of Kōkeʻe Road.

Proposed Construction and Access to the Site

Construction Activities

The existing DHHL storage tank would be left in place. A new 10,000-gallon concrete storage tank would be constructed in an adjacent location. Construction of the new tank would also include the installation of a valve and meter vault and pipes to connect these structures to each other and the new Upper Penstock.

A new, buried 4-inch pipe would extend from the new Upper Penstock to the new valve vault. The new valve vault would house two 4-inch diameter gate valves, one upstream and one downstream of a pressure reducing valve, and a new flow meter. The flow meter would measure the volume of water delivered to the 10,000-gallon concrete storage tank. Downstream of the storage tank there would be a manually operated gate valve located in a valve box that would provide DHHL access and control of irrigation delivery from the new storage tank. The new flowmeter and associated equipment and instrumentation would be powered from a dedicated solar array and battery set located at the site.

Construction of the new DHHL storage tank is estimated to require one month. This site is not accessible to the general public. Access by DHHL and DHHL licensees to the work site and staging areas during construction would be restricted.

Water for irrigation at the pastoral lots would be available during construction. Water from the ditch would be delivered either through existing infrastructure (combination of ditch and pipes), routed through separate temporary pipe, or by trucking tanks into the site.

Construction Site Access and Disturbance Area

Construction site access would be via the existing Trail 1 Road. The construction area would extend approximately 40 feet from where it connects into the Upper Penstock.

The location of the new DHHL storage tank is at the mauka border of DHHL lands as shown above in **Figure 4.32**.

Construction Equipment

Table 4-15 lists the equipment needed for construction of the DHHL Storage Tank.

Table 4-15. Equipment Needed to Construct the DHHL Storage Tank

Equipment Type	Quantity	Purpose
Excavator (336 size)	1	• Structure and pipe excavation/backfill
Loader (950 size)	1	• Move pipe and materials as needed
Backhoe w/ Hoe-pack (450 size)	1	• Backfill and compact piping materials
Pickup Truck	1	• Transport crew and equipment to Project site
Dump Truck	1	• Haul material to and from off-site pit
Concrete Pump Truck	1	• Pump concrete from mixer truck to structure
Small Generator and Air Compressor	2	• Supply power to tools
Dewatering Pump	1	• Pump out excavated areas after rain event
Enclosed Utility Trailer	1	• House small tools and equipment on site

Proposed Operations

Water for the new DHHL storage tank would be delivered through the new Upper Penstock. The new DHHL storage tank would be maintained at a constant level to ensure irrigation water is available. If the water level in the storage tank drops too low the valves would automatically open allowing water to refill the tank.

DHHL would have access to the new manually operated control valve downstream of the new storage tank and would have the ability to open or close the valve based on irrigation needs at the pastoral lots.

4.1.2.10 Puʻu ʻŌpae Powerhouse and Facility Substation

Current Site Conditions and Use

The Puʻu ʻŌpae Powerhouse and Substation would be a new facility included in the Proposed Action and located on the north/mauka side of Puʻu ʻŌpae Reservoir adjacent to where the Kōkeʻe Ditch enters the reservoir.

Puʻu ʻŌpae Reservoir and proposed location for new Puʻu ʻŌpae Powerhouse and Substation

Site Access

The Puʻu ʻŌpae Powerhouse and Substation would be accessed by the existing road from the Mānā Plain, identified as the Puʻu ʻŌpae Access Road.

Current Operations

The Puʻu ʻŌpae Powerhouse and Substation does not currently exist; therefore, there are no current operations.

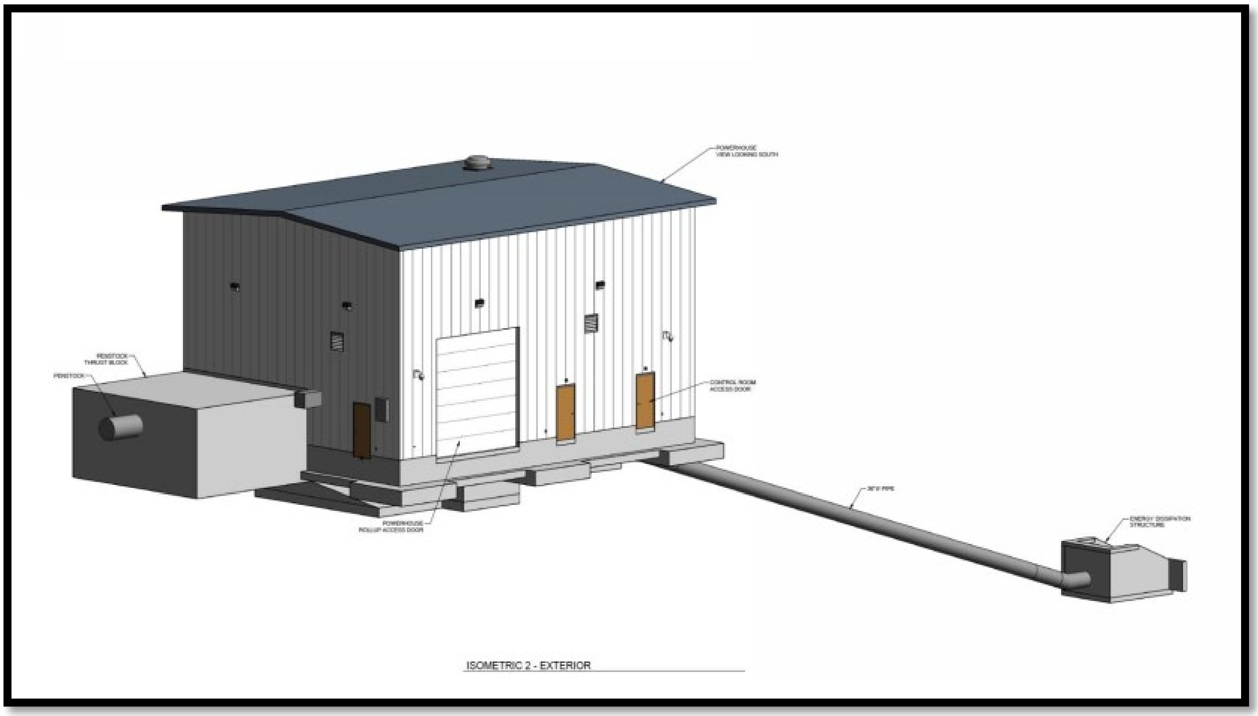
Proposed Construction

Construction Activities

The new Puʻu ʻŌpae Powerhouse would be constructed at the northeastern corner of Puʻu ʻŌpae Reservoir. The powerhouse would contain a single 4 MW turbine generator with an operating range of 2.6 MGD to 25.8 MGD and the turbine inlet valve, as well as the auxiliary equipment such as electrical and control systems, hydraulic systems, and building ventilation system. Immediately adjacent to the new powerhouse would be the new facility substation.

The new powerhouse would measure approximately 42 feet by 54 feet and 30 feet in height and would consist of a steel prefabricated building with internal steel frame to support an overhead bridge crane for equipment maintenance as shown in **Figure 4.37**.The new powerhouse would not have potable water; however, an emergency shower/eyewash station would be provided using a standalone tank disconnected from the powerhouse service water system. Additionally, lavatory facilities would be provided in the powerhouse with a buried septic tank that would be pumped as part of routine maintenance of the facility.

Figure 4.37. Rendering of Pu‘u ‘Ōpae Powerhouse



Water would be delivered through the new Upper Penstock to the new Pu‘u ‘Ōpae Powerhouse where it would spin the turbine generation and produce energy. After energy generation, water would be discharged through a new 140-foot-long tailrace channel that extends to the Pu‘u ‘Ōpae Reservoir. Water being conveyed from the powerhouse to the reservoir through the tailrace would run through an energy dissipation structure to reduce water velocity of the tailrace discharge, thereby preventing scour of the reservoir. A small concrete apron would be installed around the tailrace outlet to prevent scour at the discharge point. A turbine shut-off valve would be installed on the Upper Penstock along with an energy dissipation bypass valve to allow shut down of the turbine and continued delivery of irrigation water to Pu‘u ‘Ōpae Reservoir.

To provide water for KHHA’s fields (See **Figure 1.10**) uphill of Pu‘u ‘Ōpae Reservoir, a new submersible vertical turbine pump with a rated capacity of 1.4 MGD would be installed at the floor of the tailrace channel and adjacent to the energy dissipation structure. An 8-inch diameter steel pipe would extend from the pump to the reservoir’s surface and would be fitted with a flange for connection to piping to KHHA’s fields. The pump would be operated by DHHL to regulate irrigation needs, and flow meters would be installed to monitor daily water usage.

The new facility substation would measure approximately 50 feet by 50 feet and be entirely contained within a chain link fence. The new substation would contain both the Pu‘u ‘Ōpae

Powerhouse electrical service and the main step-up transformers. The generator step-up transformer would raise the generator voltage from 4,160 volts to 12.5 kilovolts for transmission. The new substation would also include an outdoor weatherproof switchgear equipment box that would contain the high side circuit breaker and disconnect switch. After completion of the West Kauaʻi Energy Project, DHHL licensees around Puʻu ʻŌpae would have the ability to request electrical service from KIUC that would be connected at this new substation location.

A gravel parking area would be located to the north of the powerhouse for vehicular parking and equipment access to the new Puʻu ʻŌpae Powerhouse and Substation.

Construction Site Access and Construction Disturbance Area

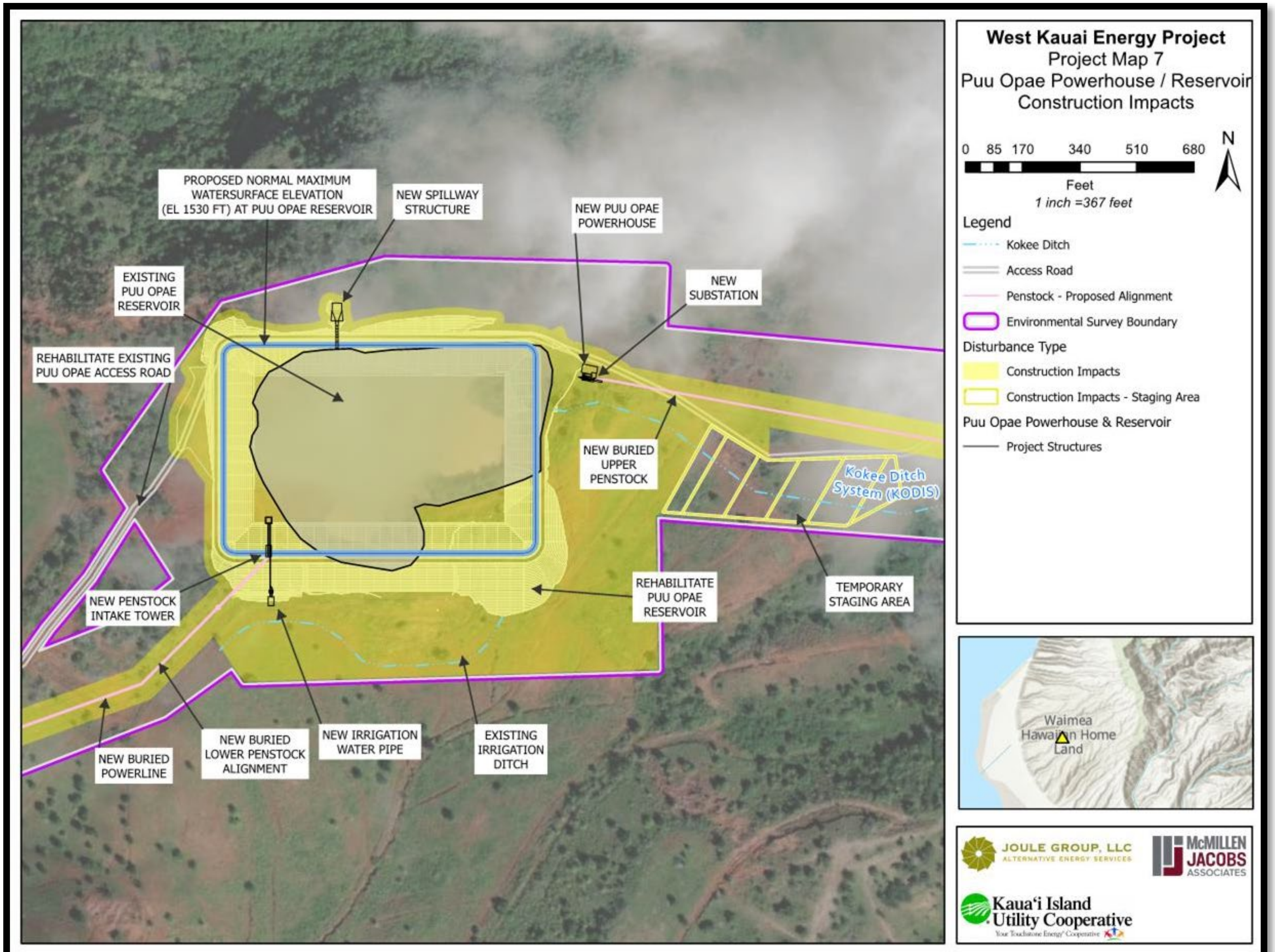
Access to the Puʻu ʻŌpae Powerhouse and Substation would be provided by the existing road from the Mānā Plain, labeled as the Puʻu ʻŌpae Access Road on **Figure 4.38**, which would be repaired and improved as part of the Proposed Action. Improvements to the lower section of the existing Puʻu ʻŌpae Access Road may include drainage improvements, culvert replacement, and paving. Improvements to the upper section of the existing road are likely to include scraping and gravel resurfacing. The Puʻu ʻŌpae Access Road would be used for daily access during construction and Project operation.

A temporary staging area would be established along the eastern edge of the reservoir to allow for parking, staging equipment, and construction preparation activities. Construction vehicles would gain access to the construction areas by traveling along the existing dam embankment road on the north side of the reservoir, which would be regraded and resurfaced with gravel. This area is open and would not require the removal of any trees.

Construction of the powerhouse is estimated to require 15 months. This work site is behind DHHL gates and is not open to the public. Access would be restricted from the construction site and staging areas. However, construction of the Puʻu ʻŌpae Powerhouse and Substation would not impact KHHA's farming operations north of the reservoir.

Limited and localized traffic on Trail 1 Road can be accommodated during construction of the Upper Penstock and Puʻu ʻŌpae Powerhouse but would be open for DHHL and DHHL licensees use after the Upper Penstock construction is completed. However, the existing access road from Mānā Plain to Puʻu ʻŌpae would remain closed until after all construction at Puʻu ʻŌpae Reservoir and Puʻu ʻŌpae Powerhouse and Substation is completed. This access road, referred to as the Puʻu ʻŌpae Access Road, is not currently drivable and its closure would not impact current use. After construction is completed the Puʻu ʻŌpae Access Road would be the primary access for Project operations and maintenance, and it would be open to DHHL, DHHL licensees, and future subsistence agriculture homesteaders for their use.

Figure 4.38. Pu'u 'Ōpae Powerhouse, Reservoir and Facility Substation Construction Impacts



Construction Equipment

Table 4-16 lists the equipment needed for construction of the Puʻu ʻŌpae Powerhouse and Substation.

Table 4-16. Equipment Needed to Construct the Puʻu ʻŌpae Powerhouse and Substation

Equipment Type	Quantity	Purpose
Excavator (336 size)	1	• Structure and piping excavation/backfill
Dozer (D6 size)	1	• Assist with excavation and access road maintenance
48”-84” Roller	1	• Compact subgrade and backfill materials
4000 Gallon Water Truck	1	• Dust control • Provide water for compaction and other activities
Loader (966 size)	1	• Load/Unload and relocate construction materials • Assist with earthwork and pipe activities
Motor Grader (CAT 140m size)	1	• Grade access roads
Articulated Dump Truck (35 TN)	1	• Haul excavated materials
Skid Steer	1	• Assist with miscellaneous structure grade prep • Install fencing
Forklift	1	• Transport materials and set formwork/permanent materials
Concrete Pump Truck	1	• Pump concrete from mixer truck to structures
Crane (150 TN and 75 TN size)	2	• Pile driving • Set equipment, forms, other misc. materials
60’ Manlift	2	• Set formwork, misc. metals and install building structure
400 Amp Welder	2	• Weld steel pipe
Pickups	4	• Transport crew and equipment to Project site
Transport Truck and Trailer	1	• Transport equipment to site
Dump Trucks	3	• Haul material from offsite pit to and from dam
Small generator and Air Compressor	3	• Supply power to tools
Dewatering Pumps	2	• Pump out excavated areas after rain event
Enclosed Utility Trailer	1	• House small tools and equipment on site

Proposed Operations

The new Puʻu ʻŌpae Powerhouse would operate during non-solar hours on water stored and released from Puʻu Lua Reservoir. Water delivered to the new Puʻu ʻŌpae Powerhouse would spin the turbine and generate an average of 14.6 GWh per year of electricity, corresponding to a greenhouse gas (GHG) emissions offset of 13,943 $MTCO_2eq$. After energy generation, water would be discharged from the powerhouse through the tailrace channel into Puʻu ʻŌpae

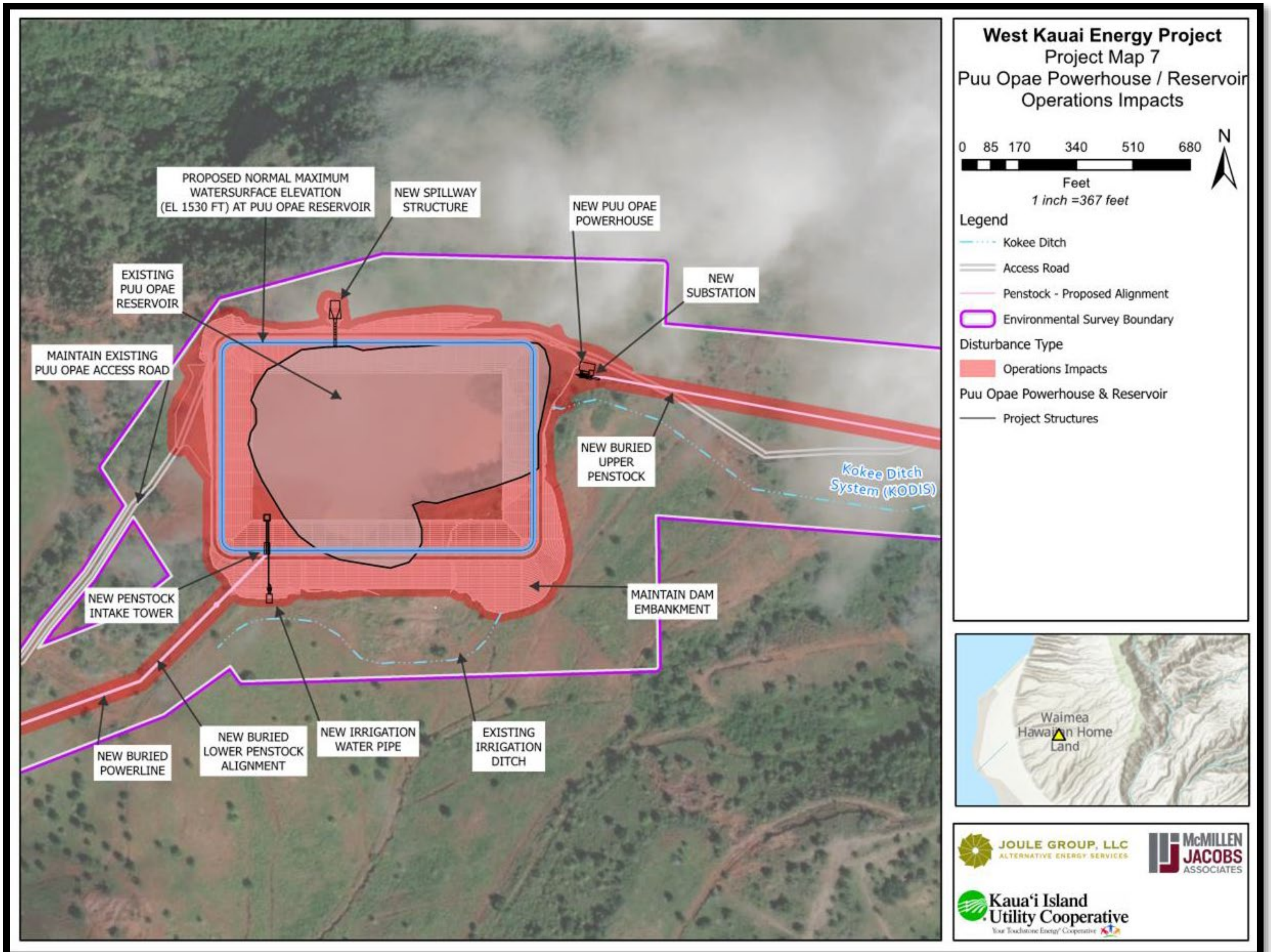
Reservoir. The inflow into Puʻu ʻŌpae Reservoir would be regulated and monitored at the Puʻu ʻŌpae Powerhouse.

Electricity generated at Puʻu Ōpae Powerhouse would be conveyed to the adjacent facility substation. From the facility substation, power would be conveyed through electrical conduit buried along the Lower Penstock alignment to the Project Substation located on Mānā Plain and then to the KIUC grid.

The facility substation located at Puʻu ʻŌpae would provide a new localized source of power connection for DHHL tenants in the Puʻu ʻŌpae area. Currently the closest source of power connection is several miles from Puʻu ʻŌpae Reservoir.

Figure 4.39 shows the Project footprint at Puʻu ʻŌpae Powerhouse, Reservoir, and Facility Substation during operations.

Figure 4.39. Puʻu ʻŌpae Powerhouse and Reservoir Operation Impacts



4.1.2.11 Puʻu ʻŌpae Reservoir

Current Site Conditions and Uses

Puʻu ʻŌpae Reservoir (State Dam ID KA-0003) is the second largest reservoir on the Kōkeʻe Ditch Irrigation System and is located approximately 4.5 miles north of Kekaha. This reservoir was built by the Kekaha Sugar Company as part of the Kōkeʻe Ditch Irrigation System for the purpose of irrigation water storage. Puʻu ʻŌpae was constructed as an unlined reservoir with three sections of man-made earthen embankments. The largest embankment measures 1,000-feet-long and up to 47-feet-tall. The reservoir has a historical design capacity of 88 million gallons at 1,530 feet elevation (Water Resource Associates, 2004) and corresponding to a surface area of approximately 9.5 acres. The reservoir intake is a 2-foot by 2-foot unlined ditch, which is the western branch of Kōkeʻe Ditch. Other features include one corrugated metal culvert with a stone masonry header that served as an overflow (spillway), remnants of a concrete structure with associated basalt and mortar walls, an abandoned ditch composed of concrete masonry unit blocks which served as an irrigation inlet, and a settling basin and filter station. Historically, Puʻu ʻŌpae was used to provide water both to open furrow irrigation and pressurized drip irrigation on the Niu and Makaha Ridges between the elevations of 800 and 1,500 feet. Outlet works consist of a low-level gate structure on the south side, which admitted water to an open ditch system and a pre-filter settling basin. A 36-inch-diameter culvert on the north side of the embankment served as an overflow spillway. The fields surrounding the reservoir consist of vast open land largely overtaken by guinea grass and scattered with polyethylene tubing remnants commonly used for agricultural purposes.

The reservoir is in a state of disrepair and does not meet Hawaiʻi State Dam Safety Standards. A relatively deep layer of siltation has built up on the reservoir floor, heavy erosion is occurring along the embankments, and vegetation is growing on the embankments. The reservoir is currently drained and unused due to dam safety considerations.

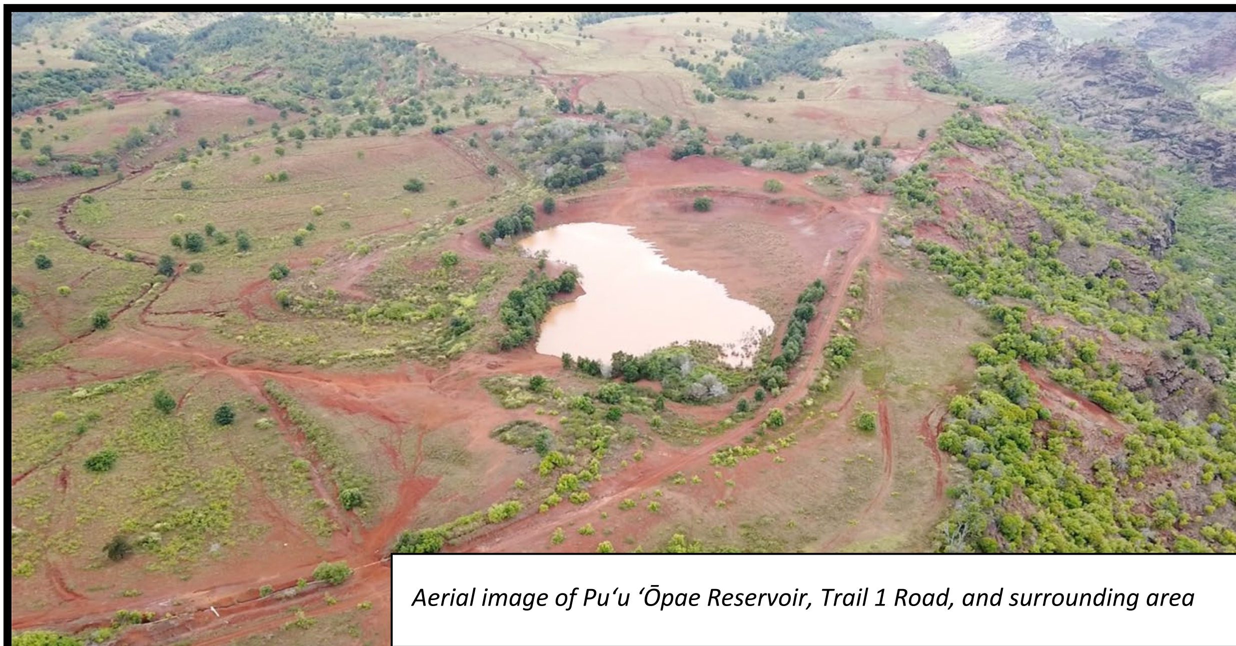
As mentioned previously in **Section 1.4**, DHHL is proposing the Puʻu ʻŌpae Kuleana Homestead Settlement Plan to offer 251 homestead lots (11 Pastoral and 240 Subsistence Agriculture) on 1,421 acres in the Waimea area of West Kauaʻi. The Puʻu ʻŌpae Kuleana Homestead Project is proposing the following DHHL land uses: Subsistence Agriculture, Pastoral, Community Use, and Special District. **Figure 1.10** shows the proposed Puʻu ʻŌpae Kuleana Homestead Settlement Plan and land uses in relation to the proposed Project. These land uses are dependent on the completion of the Proposed Action to deliver water to the area, as agreed upon through the Waimea Mediation Agreement.

Site Access

The existing access to Puʻu ʻŌpae Reservoir is through the existing road from the Mānā Plain, identified as the Puʻu ʻŌpae Access Road.

Current Operations

Puʻu ʻŌpae Reservoir has not been operational for several years. A system of pipes has been installed to route ditch flow away from Puʻu ʻŌpae Reservoir due to dam safety concerns. Upstream of the reservoir ditch flows are utilized by DHHL homesteaders for cattle grazing activities and to irrigate a series of taro fields located mauka of the reservoir and which are maintained by KHHA as part of their Puʻu ʻŌpae Farm Plan. KHHA has a license from DHHL for 231 acres to develop their Puʻu ʻŌpae Farm Plan, which includes development of a community center, loʻi, reforestation, community pastoral, uala, aquaculture, dryland kalo, orchards and a garden (see **Figure 1.10**). Any water remaining in the ditch after these uses is routed away from the reservoir into the Kaʻawaloa Stream gulch. Any pooling that occurs in Puʻu ʻŌpae Reservoir is minimal and a result of rainfall accumulation. The water outfall from the taro fields is discharged via a small diameter pipe into a shallow, unvegetated swale that flows in the general direction of Kaʻawaloa Stream gulch.

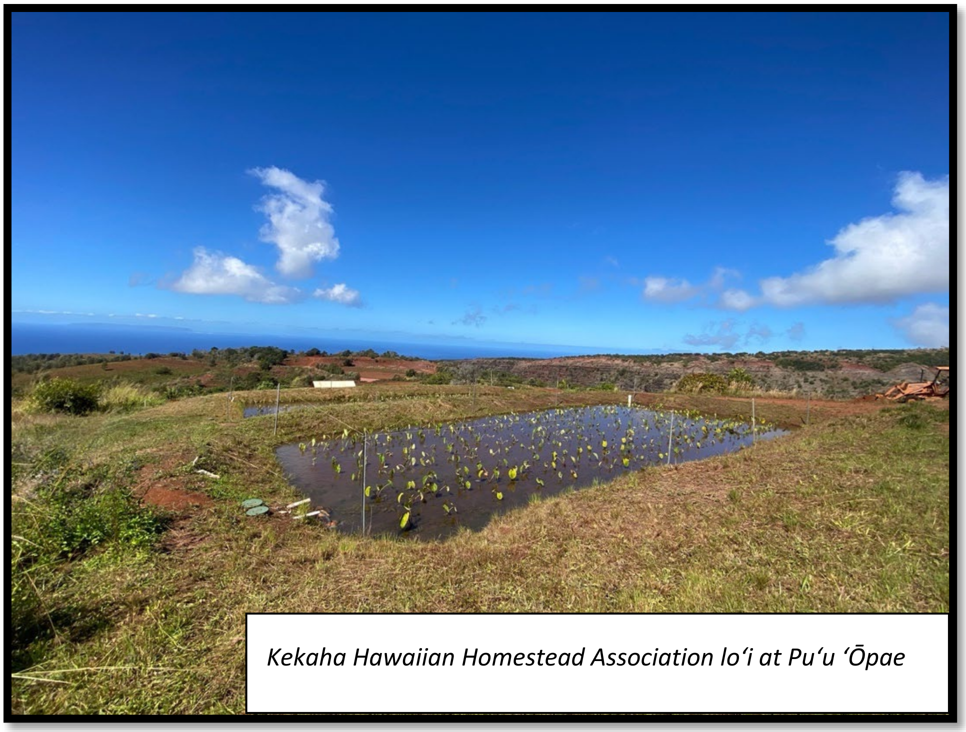


Aerial image of Puʻu ʻŌpae Reservoir, Trail 1 Road, and surrounding area

Puʻu ʻŌpae Reservoir, settling basin, and surrounding area during sugar operations

Existing settling basin and filtration system

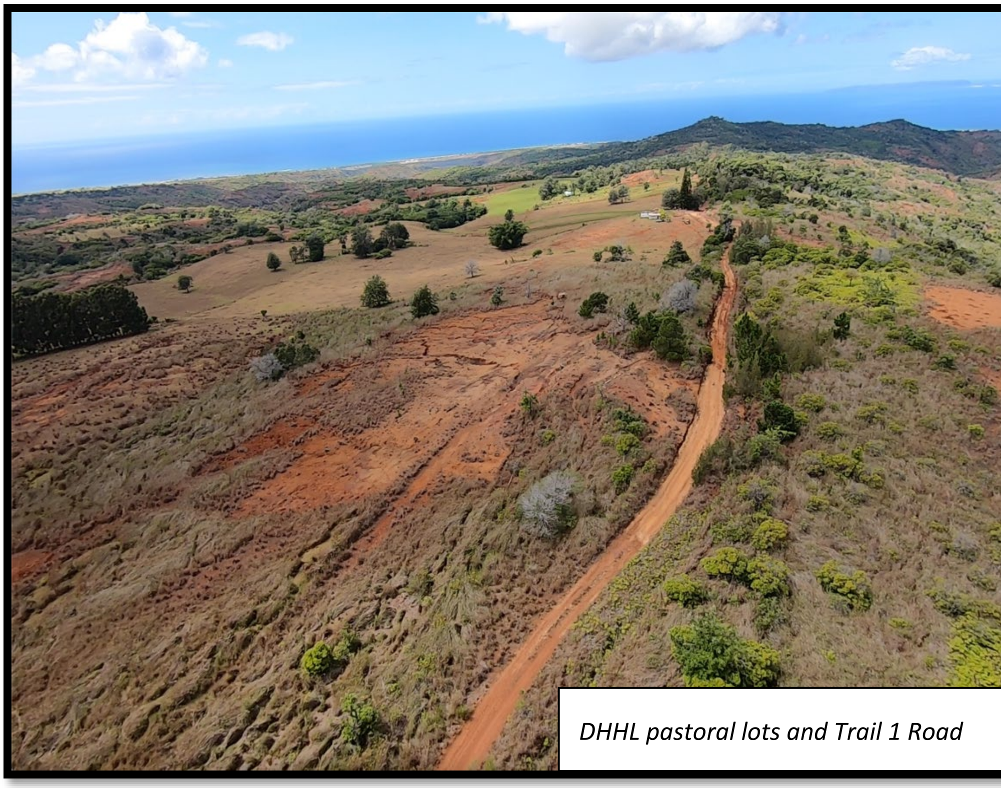
Kekaha Hawaiian Homestead Association farming activities at Puʻu ʻŌpae



Kekaha Hawaiian Homestead Association loʻi at Puʻu ʻŌpae

Existing spillway culvert at Puʻu ʻŌpae Reservoir

Existing upstream outlet at Puʻu ʻŌpae Reservoir



DHHL pastoral lots and Trail 1 Road

Pipe bypassing Kōkeʻe Ditch flow away from Puʻu ʻŌpae Reservoir to Kaʻawaloa Stream gulch

Existing downstream outlet at Puʻu ʻŌpae Reservoir and connection to downstream irrigation

Existing siltation basin downstream of Puʻu ʻŌpae Reservoir

Existing filter station downstream of Puʻu ʻŌpae Reservoir

Proposed Construction

Construction Activities

The existing Puʻu ʻŌpae Reservoir has been drained and is not in operation due to dam safety concerns. The reservoir modifications have been designed to meet Hawaiʻi Dam Safety standards. The Puʻu ʻŌpae Reservoir rebuild would utilize the existing dam materials as much as possible, supplemented with imported materials from offsite for specialized features such as the material utilized for the drains. The reservoir footprint would be slightly enlarged from the historic capacity of 88 MG to 100 MG to provide more storage capacity for both energy and irrigation. A reservoir lining system would be installed to prevent seepage and maintain the structural integrity of the reservoir embankments and excavated areas. The north and south man-made embankment sections and the west and east slopes created from natural contours would be graded to form more gradual slopes to meet Hawaiʻi State Dam Safety Standards and to support installation of the reservoir liner system.

The reservoir rehabilitation would involve the replacement of multiple structures to safely convey water into and out of the reservoir, including replacement of the spillway, installation of a new intake tower structure, and replacement of the outlet works that would provide irrigation water supply. A concrete gravity spillway would be constructed on the north side of the reservoir in the same general location as the existing overflow culvert and would provide a safety mechanism for safely channeling any flow that has potential to overtop the reservoir. Water exiting the reservoir through the spillway would go through an energy dissipation structure that would scatter or deflect the released water reducing its potential to cause soil erosion on the adjacent hillside.

A new vertical intake tower would be constructed in the southwest corner of the reservoir to supply water to the new Lower Penstock. The new intake tower would include a catwalk that extends into the reservoir and provides access to the isolation gate for the Lower Penstock. This isolation gate would remain open unless planned shutdowns of the Lower Penstock are required. A trash rack would be positioned at the opening of the intake structure to eliminate debris from flowing into the Lower Penstock.

An 18-inch low-level outlet pipe with a control gate at the opening would extend from the intake structure to the existing irrigation ditch and would be used to drain Puʻu ʻŌpae Reservoir under emergency conditions that require full draining of the reservoir. The low-level outlet would be controlled by a valve that would normally remain closed during standard operations. A 12-inch diameter irrigation pipe would be installed from the low-level outlet to the irrigation ditch adjacent to Puʻu ʻŌpae Reservoir to provide irrigation flow to DHHL and DHHL licensees. The irrigation pipe would include a flow meter and manual valve to measure and control irrigation flow releases, respectively. The manual valve would be accessible to DHHL and DHHL licensees for regulation of irrigation water drawn from the reservoir. A riprap apron would be built in the irrigation ditch where the low-level and irrigation pipe releases water to reduce potential erosion of the ditch.

An eight-foot-tall chain-link fence would be installed around the perimeter of the reservoir for public safety.

Construction Site Access and Construction Disturbance Areas

Access to Puʻu ʻŌpae Reservoir would be provided by the existing road from the Mānā Plain, labeled as Puʻu ʻŌpae Access Road in **Figure 4.39**, which would be repaired and improved as part of the Project. Improvements to the lower section of the existing Puʻu ʻŌpae Access Road may include drainage improvements, culvert replacement, and paving. Improvements to the upper section of the existing road are likely to include scraping and gravel resurfacing. The Puʻu ʻŌpae Access Road would be used for daily access during construction and Project operation. A gravel pad would be located to the north of the powerhouse for vehicular parking and equipment access to the powerhouse through an overhead door.

A temporary staging area would be established along the eastern edge of the reservoir to allow for parking, staging equipment, and construction preparation activities. Construction vehicles would gain access to the construction areas by traveling along the east or southern edges of the reservoir on the existing dam embankment road, which would be regraded and resurfaced with gravel. This area is open and would not require the removal of any trees.

Puʻu ʻŌpae Reservoir is not located on a natural stream and does not currently receive ditch flow. Any rainwater accumulation in the reservoir would be drained for construction and the reservoir would be kept dry throughout the construction period.

Construction is estimated to require 14 months. Puʻu ʻŌpae Reservoir is behind DHHL gates and not open to the public. Access by DHHL and DHHL licensees in the area would be restricted from the construction site and staging areas during construction. Construction at the reservoir would not impact KHHA's farming operations north of the reservoir or their water availability.

The reservoir currently has some vegetation growing on slopes and along the floor that would be removed as part of the modification work to comply with Hawaiʻi State Dam Safety Standards. One koa tree on the western embankment that has been used by the KHHA community as a gathering place would require removal. KIUC representatives consulted with the community on the removal of this tree and made commitments regarding the removal of this specific koa tree. The Project would work with KHHA and DHHL to harvest seeds from the koa tree prior to removal so they can be used to replant multiple new koa in the areas adjacent to Puʻu ʻŌpae Reservoir. Also, the Project would save the usable timber from the trunk of the koa and make it available to KHHA for use in future Farm Plan buildings at Puʻu ʻŌpae.

Limited and localized traffic on Trail 1 Road can be accommodated during construction of the new Upper Penstock and Puʻu ʻŌpae Reservoir and would be open for unlimited use after completion of the new Upper Penstock. However, the existing access road from Mānā Plain to Puʻu ʻŌpae would remain closed until after all construction at the reservoir is completed. This access road, referred to as the Puʻu ʻŌpae Access Road, is not currently drivable and its closure would not impact current use. After construction is completed the Puʻu ʻŌpae Access Road would be the primary access for Project operations and maintenance. The road would be open to DHHL, DHHL licensees, and future subsistence agriculture homesteaders for their use.

Figure 4.38 shows the proposed construction area at Puʻu ʻŌpae Reservoir.

Construction Equipment

Table 4-17 lists the equipment needed for construction at Puʻu ʻŌpae Reservoir.

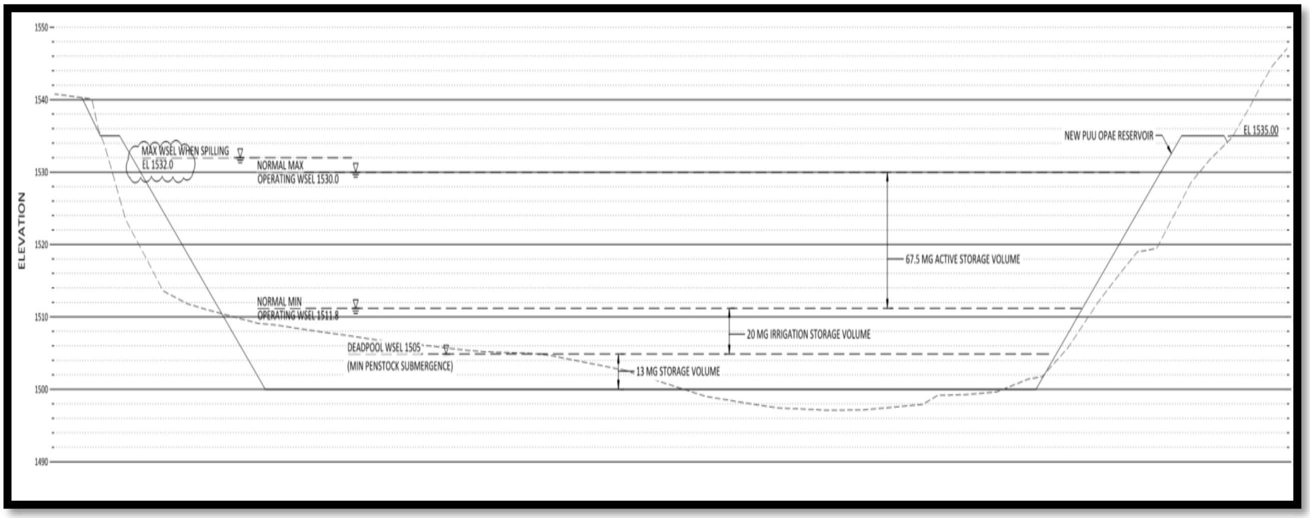
Table 4-17. Equipment Needed for Construction Activities at Puʻu ʻŌpae Reservoir

Equipment Type	Quantity	Purpose
Dozer (D6 size)	1	• Clear and grub • Assist with excavation and embankment of material
Excavator (349 size)	1	• Excavate and embank dam materials
84” Roller	1	• Compact dam materials in place
4000 Gallon Water Truck	1	• Dust control • Provide water for compaction and other activities
Loader (966 size)	1	• Load/Unload and relocate construction materials • Assist with earthwork activities
Motor Grader (CAT 140m size)	1	• Grade access roads
Articulated Dump Truck (35 TN)	3	• Haul excavation and embankment material
Backhoe (Cat 416 size)	1	• Install silt fence and assist with bypass ditch improvements
Skid Steer	1	• Assist with miscellaneous structure grade prep • Install fencing
Concrete Pump Truck	1	• Pump concrete from mixer truck to structures
RT Crane (75 TN size)	1	• Set formwork and misc. steel at intake structure
60’ Manlift	2	• Set formwork and misc. steel at intake structure
Pickups	3	• Transport crew and equipment to Project site
Transport Truck and Trailer	1	• Transport equipment to site
Dump Trucks	3	• Haul material from offsite pit to and from dam
Small generator and Air Compressor	2	• Supply power to tools
Dewatering Pumps	2	• Pump out excavated areas after rain event
Enclosed Utility Trailer	1	• House small tools and equipment on site

Proposed Operations

Water in Puʻu ʻŌpae Reservoir would come from water diverted into the Kōkeʻe Ditch Irrigation System that is stored and released at Puʻu Lua Reservoir during non-solar hours and water from cycled from Mānā Reservoir during pumped storage operations. Initially the reservoir would be filled from water diverted into the Kōkeʻe Ditch Irrigation System. Water in Puʻu ʻŌpae Reservoir would be made available for irrigation, and there would be an irrigation storage buffer of 20 MG maintained to provide a storage buffer during dry periods. Puʻu ʻŌpae Reservoir would also provide an approximate 65 MG storage capacity for water used for the pumped storage component of the Project. During normal Project operations, fluctuations of up to 18 feet would be expected in the Puʻu ʻŌpae Reservoir water surface elevation. **Figure 4.39** shows the Project footprint during operations at Puʻu ʻŌpae Reservoir and Powerhouse. **Figure 4.40** shows a diagram of the proposed storage capacity.

Figure 4.40. Proposed Storage Capacity at Puʻu ʻŌpae Reservoir



During non-solar hours, water would be released from Puʻu ʻŌpae Reservoir into the Lower Penstock through the intake tower and delivered to Mānā Powerhouse for hydroelectric generation. During the daytime, when solar is available, water that is pumped from Mānā Pumphouse would be discharged into Puʻu ʻŌpae Reservoir from the Lower Penstock. Water flowing up or down through the Lower Penstock would be regulated by the water level monitors that would be installed at the intake tower. The water level monitors would also identify if the water levels at Puʻu ʻŌpae Reservoir were reaching critical levels, which would only happen as a rare event. If this circumstance were to occur, water would be released at the spillway to avoid overtopping the embankments and flow into the reservoir would be shut off. Storm water runoff is not expected to enter Puʻu ʻŌpae Reservoir due to the topography and surrounding terrain. The spillway would only be used in cases of emergency, and water exiting the reservoir from the spillway would be discharged into the adjacent Kaʻawaloa Stream gulch, which is the same location of discharge from the existing spillway culvert. Should an event occur that causes overflow to be discharged through the spillway, the automated monitoring system would trigger an alarm.

Water diverted into Kōkeʻe Ditch would also be used to make-up for evaporative losses at Puʻu ʻŌpae Reservoir and to refill irrigation storage buffer after dry periods.

There would be two points of irrigation delivery at Puʻu ʻŌpae Reservoir: the submersible vertical turbine pump and the low-level irrigation outlet. The new submersible vertical turbine pump would provide irrigation water to KHHA's fields uphill of Puʻu ʻŌpae Reservoir and would be farmer operated through a power switch and meter located outside the Puʻu ʻŌpae facility substation fence. The pump would have a flow meter that would measure the volume of water being pumped from Puʻu ʻŌpae Reservoir for irrigation. The new 12-inch diameter irrigation pipe extending from the new low-level outlet on the south side of the reservoir would be the second point of irrigation delivery to DHHL and DHHL licensees. The new irrigation pipe would include a flow meter and manual valve to measure and control irrigation flow releases, respectively. The manual valve would be accessible and operated by DHHL and DHHL licensees for regulation of irrigation water drawn from the reservoir.

All the infrastructure would undergo routine maintenance and remain in compliance with Hawaiʻi State Dam Safety Standards. The slopes on the new dam would be maintained in a condition free of large vegetation to reduce the potential for root structures to create seepage paths that may undermine the integrity of the dam.

4.1.2.12 Lower Penstock

Current Site Conditions and Use

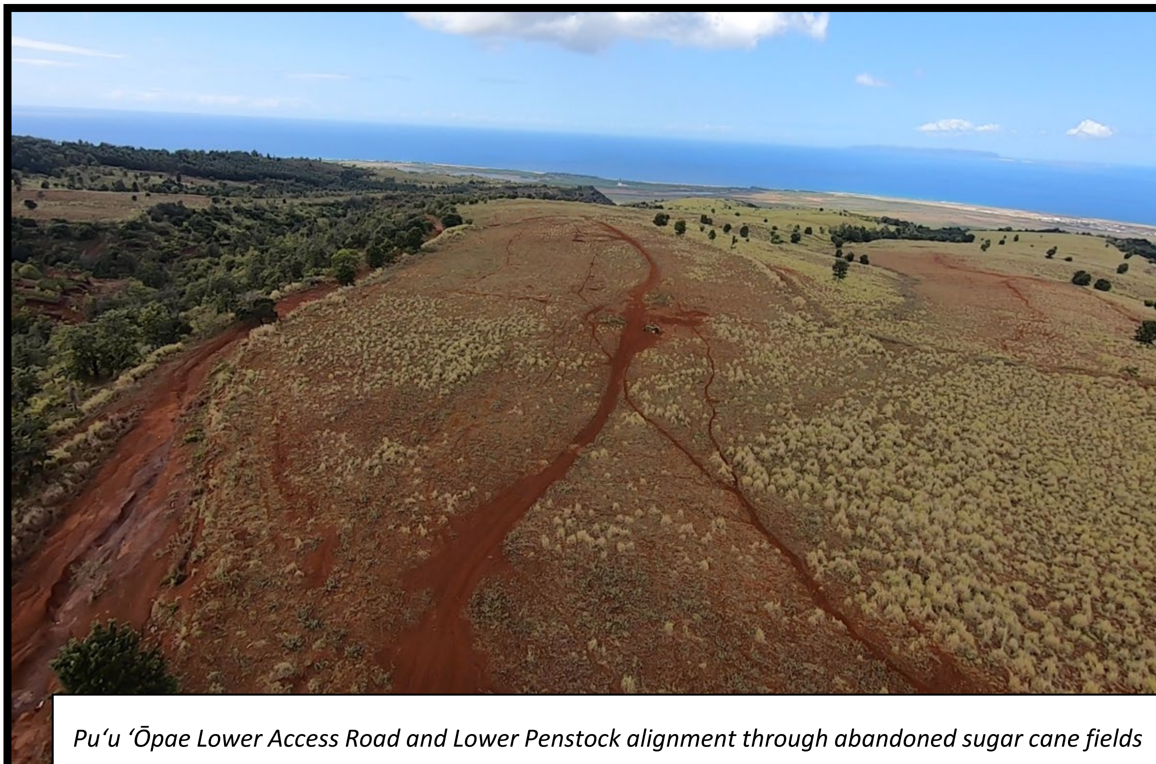
The Lower Penstock would be a new facility included in the Proposed Action.

Site Access

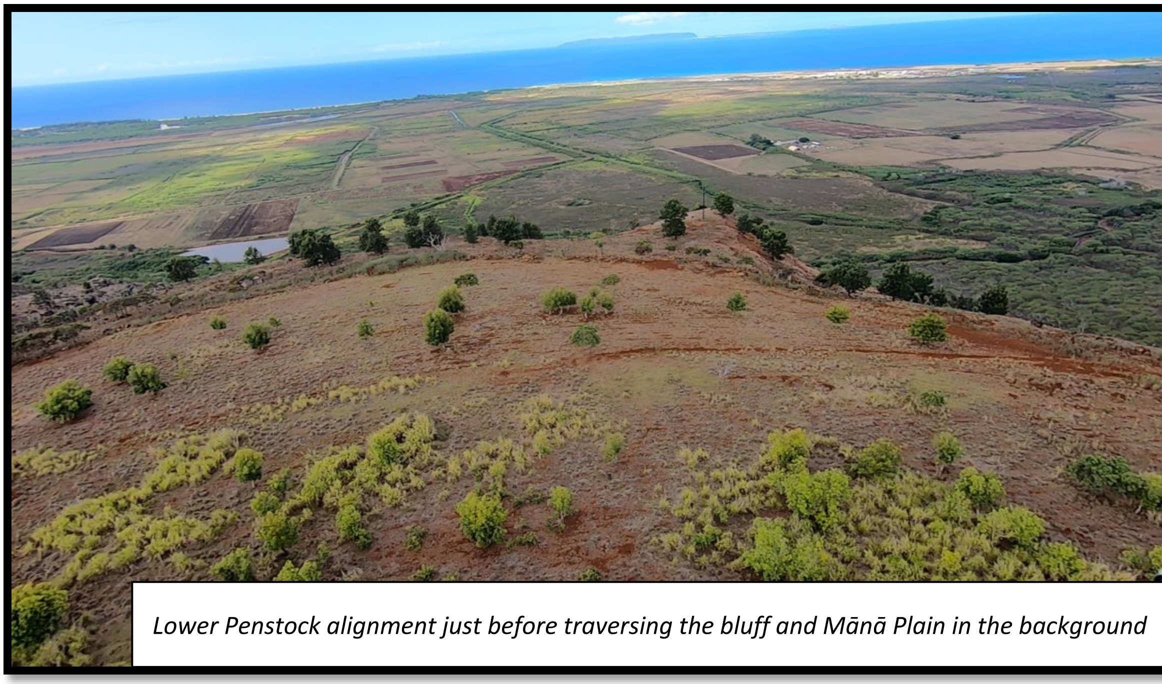
Access to the portions of the Lower Penstock on DHHL land would be provided by the existing Puʻu ʻŌpae Access Road from the Mānā Plain.

Current Operations

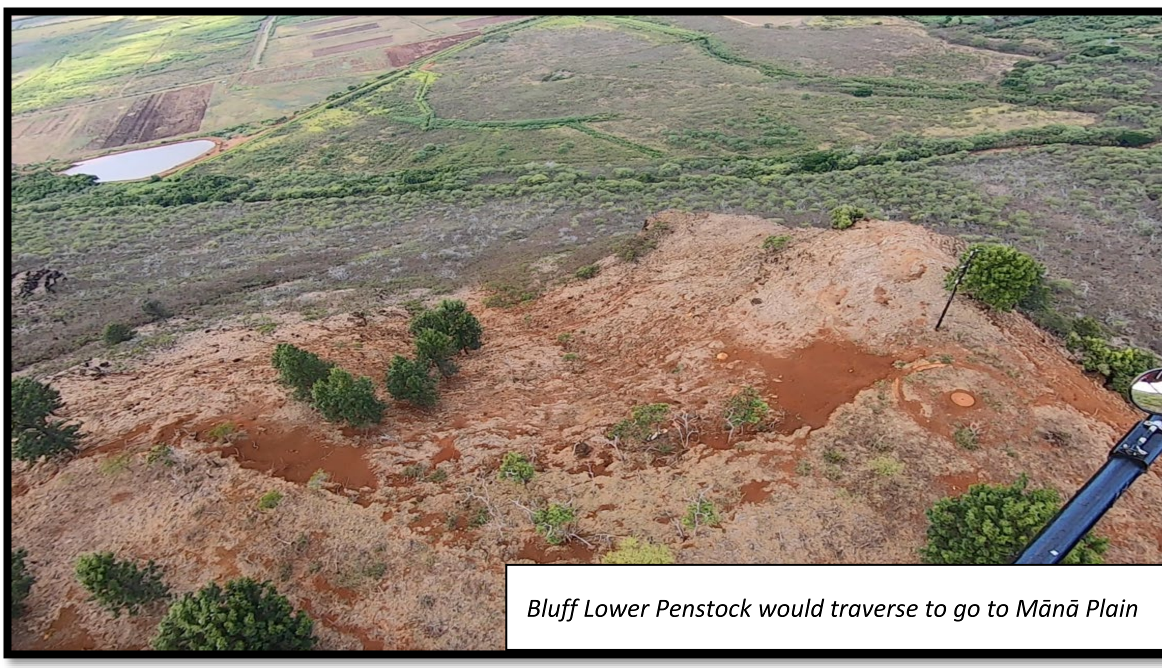
The Lower Penstock does not currently exist; therefore, there are no current operations.



Puʻu ʻŌpae Lower Access Road and Lower Penstock alignment through abandoned sugar cane fields



Lower Penstock alignment just before traversing the bluff and Mānā Plain in the background



Bluff Lower Penstock would traverse to go to Mānā Plain

Proposed Construction

Construction Activities

The new Lower Penstock would be constructed of steel and buried for its entire length of approximately 11,830 feet. The outer diameter of the Lower Penstock would range from 54 to 72 inches. The exterior and interior surfaces would be protected by a high-performance industrial lining and coating system. There are several materials that would be appropriate for the coating system based on expected service conditions, temperature and humidity, and environmental and safety conditions for field applied coating and lining repair, one of which will be selected as part of the final design process. The new Lower Penstock would be equipped with manholes, air release valves, a vacuum vent standpipe, and thrust blocks. Entrance to the new Lower Penstock would be screened preventing animals or debris from entering the penstock.

The top of the new Lower Penstock would be constructed in the native material under the floor of the Pu‘u ‘Ōpae Reservoir and extend under the southern embankment and away from the reservoir to the southwest. The upper portion of the new Lower Penstock would be buried under the existing stilling basin located southwest of the reservoir. Similar to installation of the new Upper Penstock, construction of the new Lower Penstock would occur in sections and would be installed in a cut-and-cover trench having a bottom width of a minimum of three feet wider (i.e., 18-inches each side) than the outside pipe diameter to allow access for welders to perform their work and to provide adequate space for the pipe zone material to be compacted. Each section would be constructed in an open trench with a maximum length of approximately 2,000 feet long and a maximum width of 60 feet to allow construction personnel to access the work area safely. Once the work is completed for that section of the penstock, the next section would be trenched and made available for construction personnel. A minimum soil cover of two feet would be provided above the top of the pipe; however, where the new Lower Penstock would be buried below agricultural fields there would be a minimum soil cover of four feet. The lower portions of the new Lower Penstock would traverse areas where rock may be encountered. It is anticipated that any rock encountered could be ripped and removed using an excavator. However, it is possible that other alternative removal methods may be required including controlled blasting, which would be used as a last resort to remove discrete sections of rock. In the event that controlled blasting is necessary to break up rock along the buried penstock alignment, safety measures would be implemented to ensure the safety of people and animals in the area.

The new Lower Penstock would be equipped with two flow meters, one at the top of the penstock near the Pu‘u ‘Ōpae Reservoir and one at the bottom of the penstock near Mānā Powerhouse that would monitor the flow of water through the penstock. Additionally, these flow monitors would be able to detect potential leaks occurring in the penstock during operations.

A fiber optic line and a 12.47 kV powerline would be buried along the penstock route for communication and power transmission between the Pu‘u ‘Ōpae and Mānā Powerhouses. The instrumentation systems of the West Kaua‘i Energy Project would be interconnected via this fiber optic cable. Separately, a communication cable and power branch circuit will be buried along the Lower Penstock route for communication and power from Pu‘u ‘Ōpae Reservoir to the upper flowmeter on the Lower Penstock, and from Mānā Powerhouse to the lower flowmeter on the Lower Penstock.

Site Access and Construction Disturbance Areas

Access to the portions of the Lower Penstock on DHHL land would be provided by the existing Pu‘u ‘Ōpae Access Road from the Mānā Plain, which would be repaired and improved as part of the Project. Improvements to the lower section of the existing Pu‘u ‘Ōpae Access Road may include drainage improvements, culvert replacement, and paving. Improvements to the upper section of the existing road are likely to include scraping and gravel resurfacing. The Pu‘u ‘Ōpae Access Road would be used for daily access during construction and operation. Access for construction to the portions of the Lower Penstock on ADC land would be through existing farm roads and agricultural fields on Mānā Plain.

The Lower Penstock alignment including construction staging areas primarily traverse agricultural fields and is not expected to require tree removal.

Construction of the Lower Penstock is estimated to require 15 months. The entire construction area for the Lower Penstock is on gated land and not open to the public. Access to the work sites and staging areas would be restricted during construction.

Figure 4.41 shows the proposed construction activities and disturbance area.

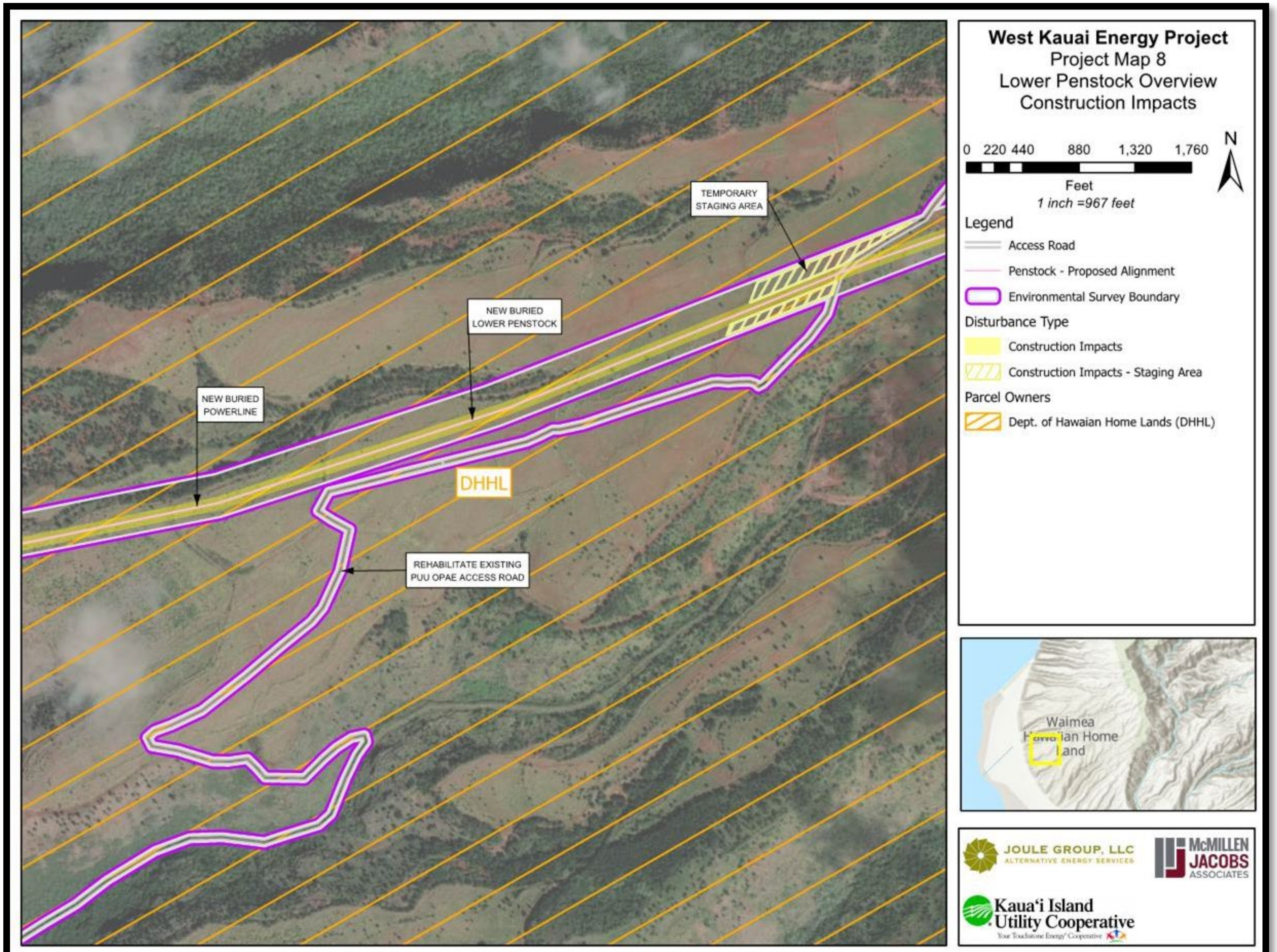
Construction Equipment

Table 4-18 lists the equipment needed to construct the Lower Penstock.

Table 4-18. Equipment Needed to Construct the Lower Penstock

Equipment Type	Quantity	Purpose
Dozer (D8 size)	2	• Clear and grub/slope grading
Excavator (349 and/or 352 size)	2	• Mass excavation/slope grading • Trench and set pipe • Ripping rock
84" Roller	1	• Compact aggregates and native material
Loader (980 size)	2	• Relocate aggregates and excavated materials • Screen excavated materials • Load/Unload penstock piping
4000 Gallon Water Truck	1	• Dust control • Provide water for compaction and other activities
Articulated Dump Truck (35 TN)	3	• Haul excavated materials and penstock piping
400 Amp Welder	2	• Weld steel penstock
Concrete Pump Truck	1	• Pump CLSM from mixer truck to trench
Pickups	4	• Transport crew and equipment to Project site
Transport Truck and Trailer	1	• Transport equipment to site
Dump Trucks	3	• Haul material from offsite pit to and from penstock
Small generator and Air Compressor	2	• Supply power to tools • Test penstock piping
Dewatering Pumps	2	• Pump out excavated areas after rain event
Enclosed Utility Trailer	1	• House small tools and equipment on site

Figure 4.41. Lower Penstock Construction Impacts



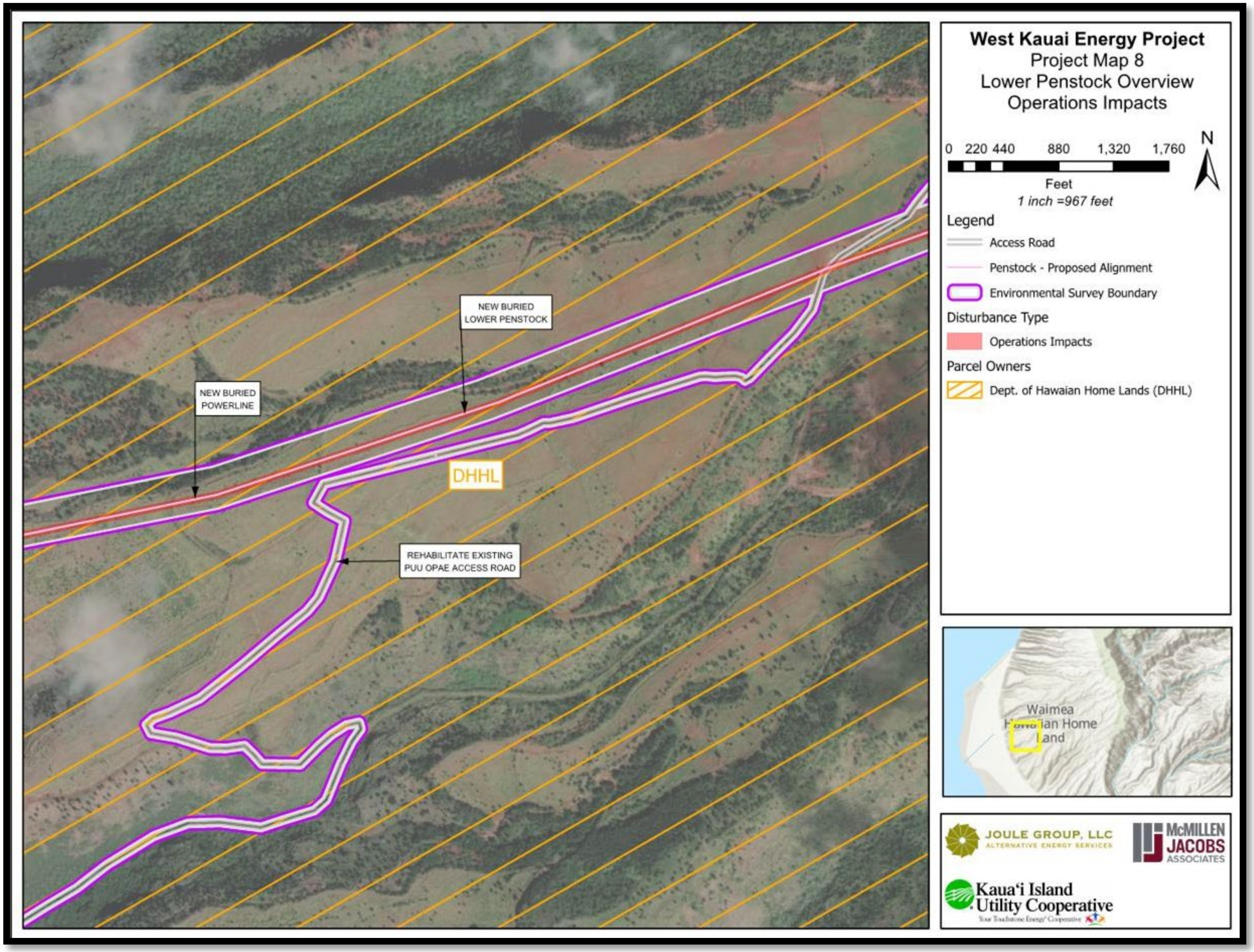
Proposed Operations

During operations, the new Lower Penstock would deliver store and release water minus any irrigation use from Puʻu ʻŌpae Reservoir to Mānā Powerhouse. The new Lower Penstock would also be used to circulate water used for pumped storage between Mānā and Puʻu ʻŌpae Reservoirs. The expected flow releases from Puʻu ʻŌpae Reservoir through the Lower Penstock would be directly tied to periods of electrical generation at Mānā Powerhouse and would primarily occur during non-solar hours. Water would be pumped from Mānā Powerhouse to Puʻu ʻŌpae Reservoir through the Lower Penstock up to Puʻu ʻŌpae during the day. The maximum flow design capacity of the Lower Penstock would be 129 MGD. The average volume of water that would flow back and forth between Puʻu ʻŌpae Reservoir and Mānā Powerhouse and Reservoir during normal pumping operations would be 55 MGD.

Vegetation maintenance over a 60-foot corridor along the penstock alignment would occur during Project operations to prevent growth of large shrubs or trees. Agricultural activities along the Lower Penstock alignment would not be impeded during Project operations.

Figure 4.42 shows the impacts during construction of the Lower Penstock.

Figure 4.42. Lower Penstock Operations Impacts



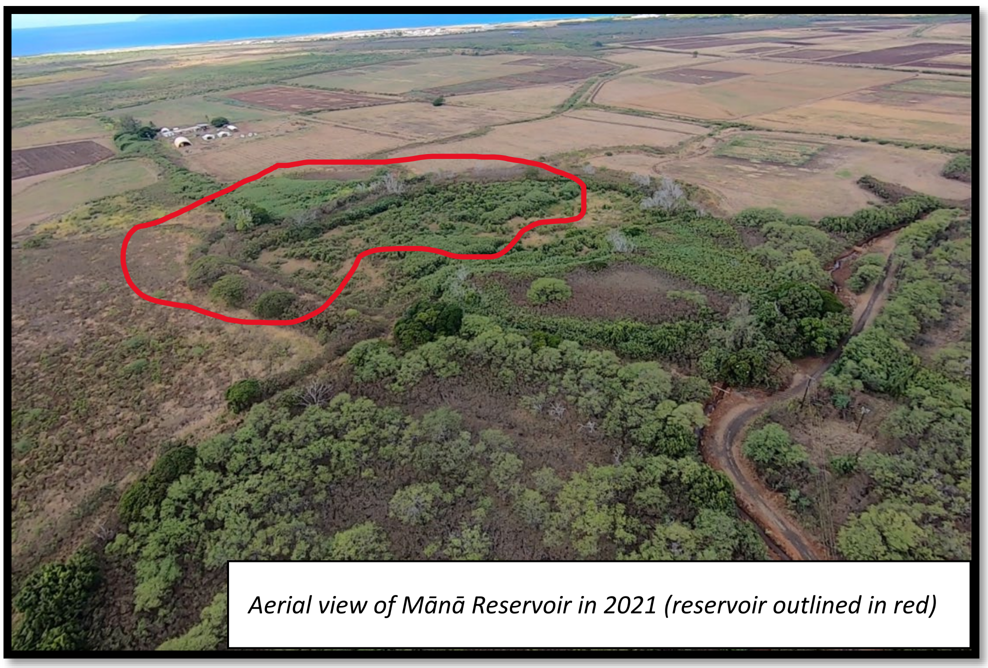
4.1.2.13 Mānā Reservoir, Powerhouse, Pumpstation, and Facility Substation

Current Site Conditions and Use

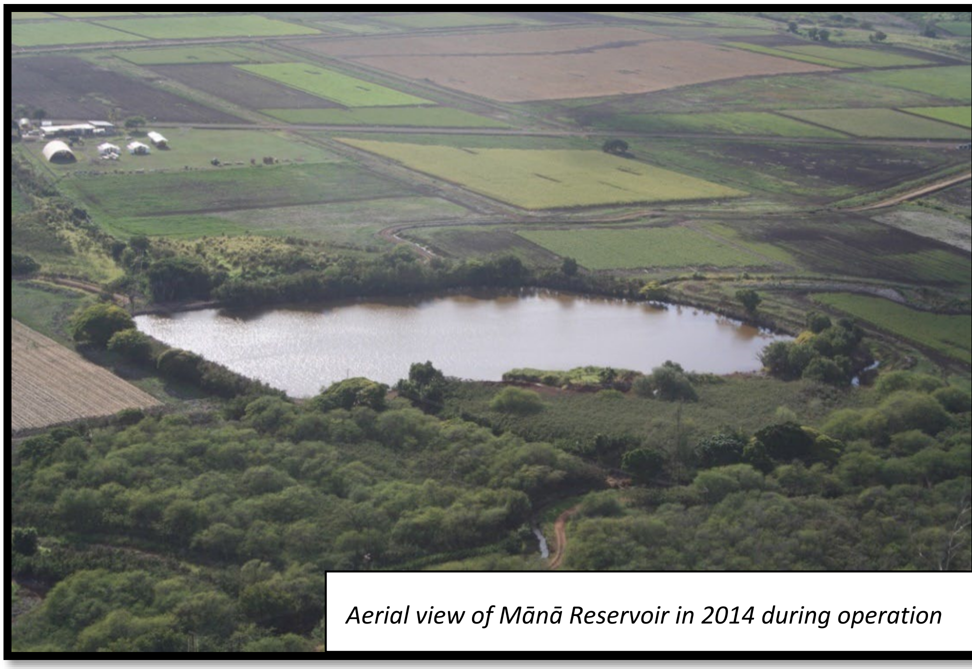
The Mānā Reservoir is located on Mānā Plain and is one in a series of small storage reservoirs built as part of the Kekaha Ditch Irrigation System. The reservoir consists of earthen embankments forming the reservoir, corrugated metal culverts with stone masonry, abandoned ditch with stone and concrete masonry, a low-level outlet consisting of a steel pipe and associated gate structure and walkway remnants, and a concrete ditch structure. The historic normal pool elevation of the reservoir was approximately 41 feet corresponding to a storage capacity of approximately 44 MG and a surface area of about 8 acres.

The current condition of the Mānā Reservoir does not meet the Hawaiʻi State Dam Safety Standards, and the reservoir has been drained until rehabilitation work can be completed. There is erosion along the western to northern portion of the existing embankment. The entire reservoir including embankments is overgrown with vegetation. At the time it was drained there was a deep layer of siltation in the reservoir floor significantly limiting storage capacity.

The Mānā Powerhouse, Pumpstation and Facility Substation would be new facilities as part of the Proposed Action.



Aerial view of Mānā Reservoir in 2021 (reservoir outlined in red)


Aerial view of Mānā Reservoir in 2014 during operation


Mānā Reservoir and dam embankment road (June 2014)


Mānā Reservoir inlet


Mānā Reservoir outlet

Mānā Reservoir dam embankment (2022)

KAA filter station

Site Access

Mānā Reservoir, Powerhouse, Pumpstation and Facility Substation locations would be accessed by existing roads on Mānā Plain.

Current Operations

The Mānā Reservoir is currently drained and not in use. Water from Kekaha Ditch is delivered through a buried HDPE pipe bypassing Mānā Reservoir and connecting to a filtration station for irrigation purposes.

The Mānā Powerhouse, Pumpstation and Facility Substation do not currently exist; therefore, there are no current operations.

Proposed Construction

Construction Activities

Enlargement of Mānā Reservoir from 44 MG to 80 MG is necessary to provide adequate storage for the pumped storage component of the West Kauaʻi Energy Project and to provide a storage buffer for irrigation. The expansion would occur by a combination of excavating the reservoir bottom, building up the embankments higher than the original structures, and modifying the overall shape of the reservoir to a rectangle. Embankments would be built up on all four sides using excavated material for embankment fill. A reservoir lining system would be installed to prevent seepage and to maintain the structural integrity of the reservoir embankments. The expansion of Mānā Reservoir would extend primarily west to northwest beyond the current footprint of the existing reservoir structure.

The reservoir would include multiple structures to safely convey water into and out of the reservoir including a pump station, tailrace, and spillway. A new spillway would be constructed of concrete and installed in the southeast embankment section and would provide a safety mechanism for safely channeling any potential excess flow that may overtop the reservoir. The spillway would route any potential overflow water through two new pipes to the existing Mānā Plain storm drain system. The pipes extending from the spillway to the storm drain system would be buried approximately two feet for the entire length. Both pipes would emerge at the existing storm drain ditch on the southeast side of the reservoir where water would be released into the Mānā Plain storm drain ditch. Riprap would be located in the existing ditch to reduce the potential for erosion. Also, a new 24-inch diameter low-level outlet pipe would be constructed along the same alignment as the discharge pipes but would be used to fully drain the reservoir, if required for emergency conditions. A new gate would be installed at the entrance to low-level outlet pipe to regulate flow and would remain closed during normal operations.

A new irrigation pipe extending from Mānā Reservoir would be constructed to provide water to farmers on Mānā Plain. The 18-inch diameter pipe would extend from the southern embankment to its outlet at Field 119, which is located immediately southeast of the reservoir. This new irrigation pipe would terminate with a manual valve that would be operated by KAA.

An 8-foot-tall chain-link fence would be installed around the perimeter of reservoir for public safety.

The Mānā Powerhouse and Pumpstation would be constructed on the northeastern edge of Mānā Reservoir and consist of a powerhouse, pumping station, and new facility substation. The new Mānā Powerhouse would be approximately 73 feet by 85 feet with a height of 45 feet and would contain a hydroelectric turbine generator with a nameplate capacity of 20 MW and turbine inlet valve, as well as auxiliary equipment such as pumps, electrical and control systems, hydraulic systems, an overhead bridge crane, and a building ventilation system. The new powerhouse would consist of a steel prefabricated building with internal steel frame to support the bridge crane. A control room and electrical room would be attached to the powerhouse. The control room may have up to two bathrooms. All waste would drain to a 1,750-gallon holding tank with a level alarm. emergency shower and eyewash facilities would be in the storage room of the powerhouse, adjacent to the battery room. As no potable water would be available at this facility, the emergency shower and eyewash will be tank fed via 500-gallon holding tank. Connected to the south of the proposed powerhouse would be a buried structure approximately 150-feet by 60-feet in plan that would contain the pumping equipment, the reservoir spillway, and the pipeline surge facilities to account for unanticipated or rapid changes in flow within the pipeline.

The new Mānā pumpstation would be constructed immediately adjacent to Mānā Powerhouse along the northeast side of the reservoir. The new pumpstation would measure approximately 120 feet in length and 50 feet in width and would consist of eight to fourteen vertical turbine pumps mounted in individual concrete intake bays. Each concrete intake bay consists of a subgrade structure spanning from the dam crest to the reservoir floor, with a total height of approximately 29 feet. The pump motors would be located outdoors on a structural concrete slab, with motor enclosures for protection against rain and windblown dust. Each of the ten pumps and motors are spaced approximately 10 feet above grade. Each pump would be approximately 20 feet of pipe and valving located 3 feet above grade and connecting each pump to the Lower Penstock.

A concrete channel would be installed at the powerhouse and along the floor of Mānā Reservoir to convey water exiting the turbine into the reservoir, which constitutes the inflow into Mānā Reservoir.

The new facility substation co-located with Mānā Powerhouse would be approximately 380 feet by 276 feet and would be located adjacent to the new powerhouse but situated with appropriate standoff distances to meet the fire protection requirements. Two incoming 12.47 kV circuits from the AES substation would deliver power to two 20/26.6/35 MVA pad mount transformers to step down the voltage for use at 4.16 kV for the new Pumpstation. Also, the local distribution providing electrical service to Mānā Powerhouse would be installed in the electrical yard. A permanent standby generator would also be installed in the electrical yard that would provide a source for backup power to Mānā Powerhouse in the event of temporary loss of local distribution power.

Site Access and Construction Disturbance Areas

Mānā Reservoir, Powerhouse, Pumpstation and Facility Substation locations would be accessed by existing roads on Mānā Plain. The existing road would be improved as needed with gravel to provide direct access to the Mānā Reservoir. The existing embankment road that circles the perimeter of the reservoir would be regraded and resurfaced with gravel.

Construction would require complete vegetation removal on all embankments and throughout the floor of the reservoir. The staging area for the construction would be located at the base of the southeast embankment. This area is a fallow agricultural field and would require the removal of existing grasses. Some vegetation removal, including trees, would be required for construction of the new powerhouse and pumpstation. Mānā Reservoir is not located on a natural stream and has been hydraulicly disconnected from the Kekaha Ditch System. Any rainwater accumulation in the reservoir would be drained for construction and the reservoir would be kept dry throughout the construction period.

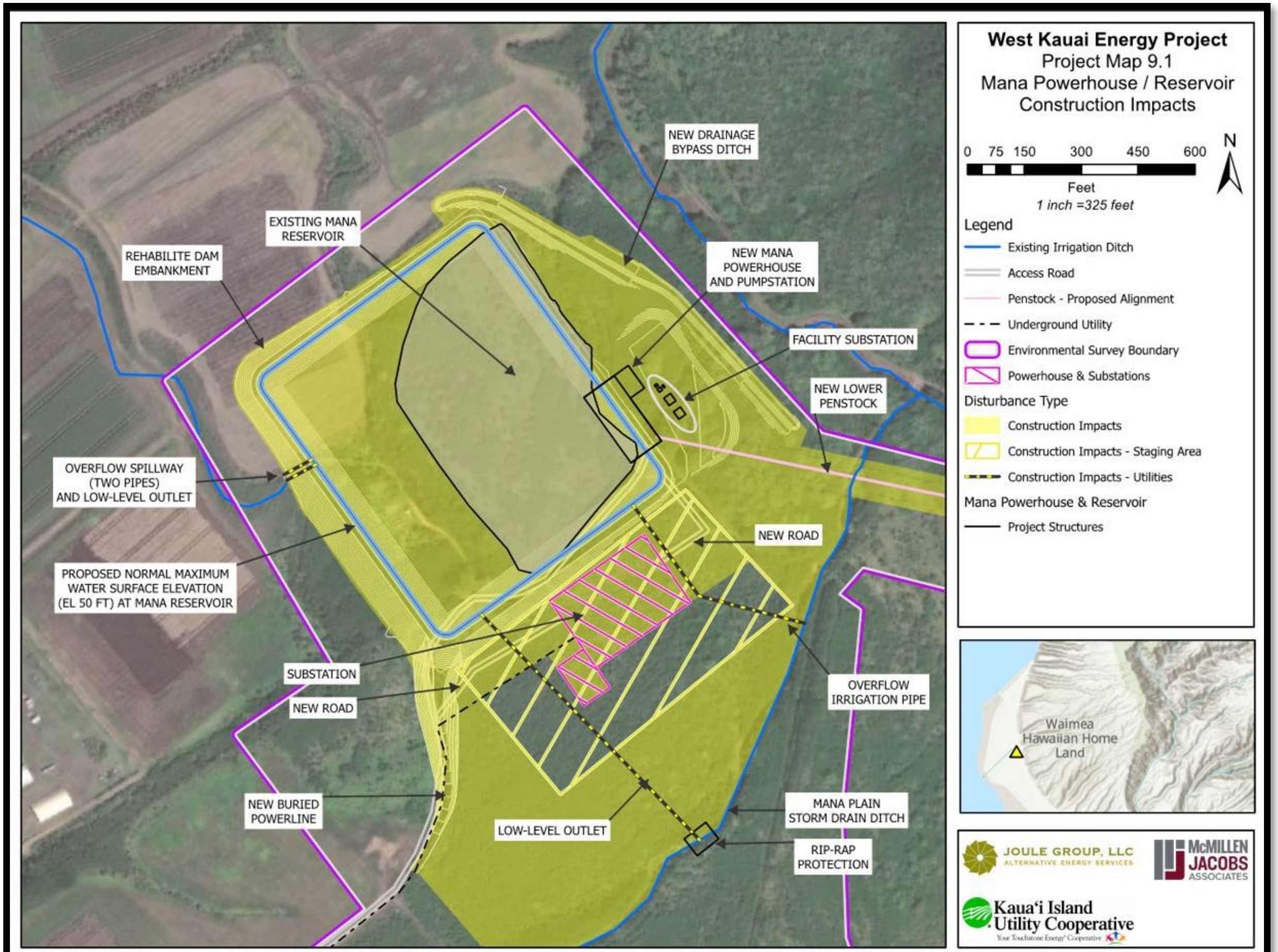
The existing KAA filter station located to the west of the Mānā Reservoir is no longer needed by KAA and would be removed to accommodate the reservoir expansion.

Construction at Mānā Reservoir is estimated to require 20 months. Construction of the Mānā Powerhouse and Pumpstation is estimated to require 10 months. The entire work site is in a gated area not accessible to the public. Access to the active work sites and staging area would be restricted during construction. However, construction at Mānā Reservoir is not expected to impact ongoing agricultural operations in fields adjacent to Mānā Reservoir and would not impede access to water for irrigation.

Figure 4.43 shows the construction activities and disturbance areas for the Mānā Reservoir modifications and construction of the new Mānā Powerhouse.

Access road to ADC lands on Mānā Plain: access to Mānā Reservoir, PV Solar Array, West Kauaʻi Energy Project Substation, and Interconnection Line

Figure 4.43. Mānā Reservoir, Powerhouse, Pumphouse, and Facility Substation Construction Impacts



Construction Equipment

Table 4-19 lists the equipment needed for construction activities at Mānā Reservoir including construction of the new powerhouse and pumpstation.

Table 4-19. Equipment Needed for Construction Activities at Mānā Reservoir

Equipment Type	Quantity	Purpose
Excavator (336 size)	1	• Structure and piping excavation/backfill
Dozer (D6 size)	1	• Assist with excavation and access road maintenance
48”-84” Roller	1	• Compact subgrade and backfill materials
4000 Gallon Water Truck	1	• Dust control • Provide water for compaction and other activities
Loader (966 size)	1	• Load/Unload and relocate construction materials • Assist with earthwork and pipe activities
Motor Grader (CAT 12m size)	1	• Grade access roads
Articulated Dump Truck (35 TN)	1	• Haul excavated materials
Skid Steer	1	• Assist with miscellaneous structure grade prep • Install fencing
Forklift	1	• Transport materials and set formwork/permanent materials
Concrete Pump Truck	1	• Pump concrete from mixer truck to structures
Crane (150 TN and 75 TN size)	2	• Pile driving • Set equipment, forms, other misc. materials
60’ Manlift	2	• Set formwork, misc. metals and install building structure
400 Amp Welder	2	• Weld steel pipe
Pickups	4	• Transport crew and equipment to Project site
Transport Truck and Trailer	1	• Transport equipment to site
Dump Trucks	3	• Haul material from offsite pit to and from dam
Small generator and Air Compressor	3	• Supply power to tools
Dewatering Pumps	2	• Pump out excavated areas after rain event
Enclosed Utility Trailer	1	• House small tools and equipment on site

Proposed Operations of Mānā Reservoir, Powerhouse, Pumpstation and Facility Substation

Initially, Mānā Reservoir would be filled using water diverted in the Kōkeʻe Ditch System and delivered through the West Kauaʻi Energy Project flowline. Mānā Reservoir would provide an irrigation storage buffer of approximately 10 MG and an estimated 52 MG capacity for energy storage. Water used for electrical generation at Mānā Powerhouse would be comprised of Kōkeʻe Ditch water stored and released from Puʻu ʻŌpae Reservoir and water cycled between Puʻu ʻŌpae and Mānā Reservoirs for pumped storage. Water used for pumping would only be comprised of the volume of water being cycled back and forth between Mānā and Puʻu ʻŌpae Reservoirs. Water diverted into Kōkeʻe Ditch would also be used for make-up of evaporative losses and to refill irrigation storage after dry periods. **Figure 4.44** shows the Project footprint of the Mānā Reservoir and Powerhouse during operation. **Figure 4.45** shows the proposed storage capacity.

Figure 4.44. Mānā Reservoir, Powerhouse, Pumphouse and Facility Operations Impacts

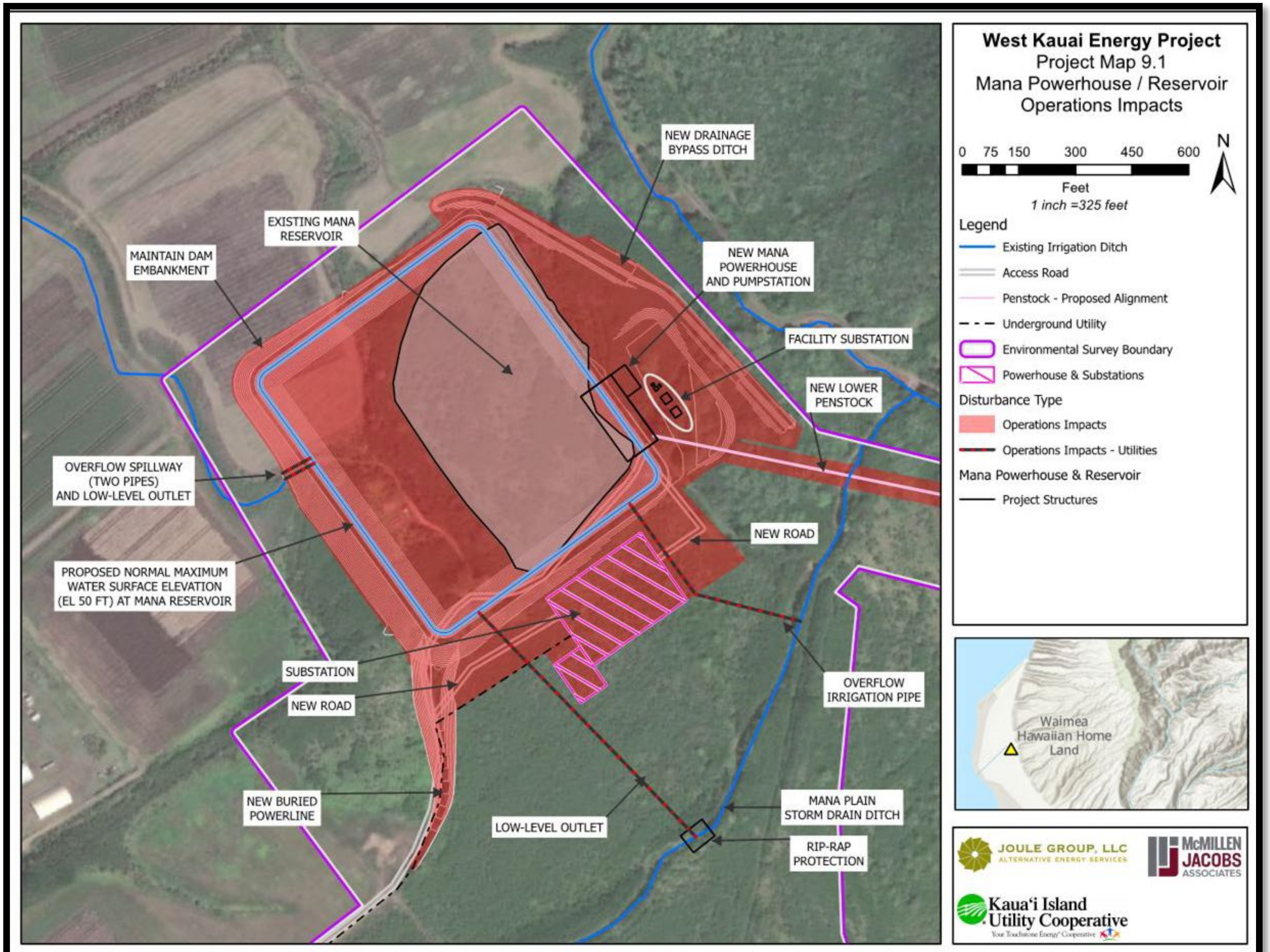
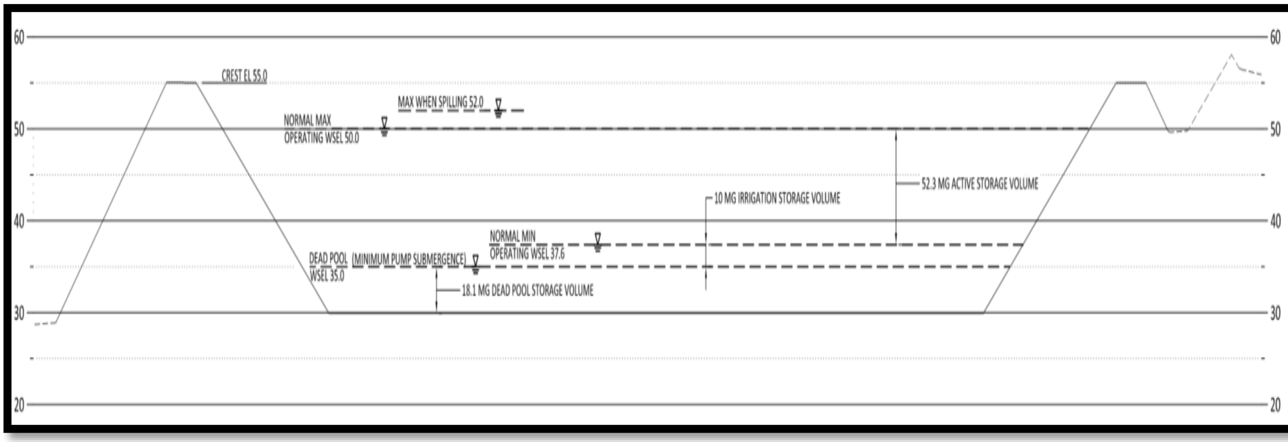


Figure 4.45. Proposed Storage Capacity of Mānā Reservoir



Stormwater runoff is not expected to enter Mānā Reservoir due to the topography and surrounding ditch infrastructure. Overflow at the spillway is expected to occur only under rare circumstances that would likely be due to either sensor failure or some other system failure. In the event of any kind of system failure, alarms would be triggered through the automated monitoring system.

All the infrastructure would undergo routine maintenance and remain in compliance with Hawaiʻi State Dam Safety Standards. The slopes on the new dam would be maintained in a condition free of large vegetation to reduce the potential for root structures to create seepage paths that may undermine the integrity of the dam.

The Mānā Powerhouse and Pump station units would be operated automatically using available stored reservoir water within their combined operating range of 5 MGD to 123 MGD (8cfs to 190 cfs) in generating mode and up to 140 MGD (215 cfs) in pumping mode. During the daylight hours water from the Mānā Reservoir would be pumped up to Puʻu ʻŌpae Reservoir through the Lower Penstock. During the evening or non-solar hours, water would be released from Puʻu ʻŌpae Reservoir through the Lower Penstock to the Mānā Powerhouse. Water entering Mānā Powerhouse would spin the turbine and generate an estimated 47 GWh per year.

It must be noted that the pumping operation cannot occur at the same time as when the Mānā Powerhouse is operating.

Water comprised of Kōkeʻe Ditch water stored and released from Puʻu ʻŌpae Reservoir and delivered to Mānā Reservoir would be delivered to KAA's irrigation system or directly to fields immediately adjacent to Mānā Reservoir for irrigation on Mānā Plain as well as other beneficial uses. Project Discharge is discussed in more detail in **Section 4.1.2.14**.

4.1.2.14 Mānā Storm Drain System and Project Discharge

Current Site Conditions

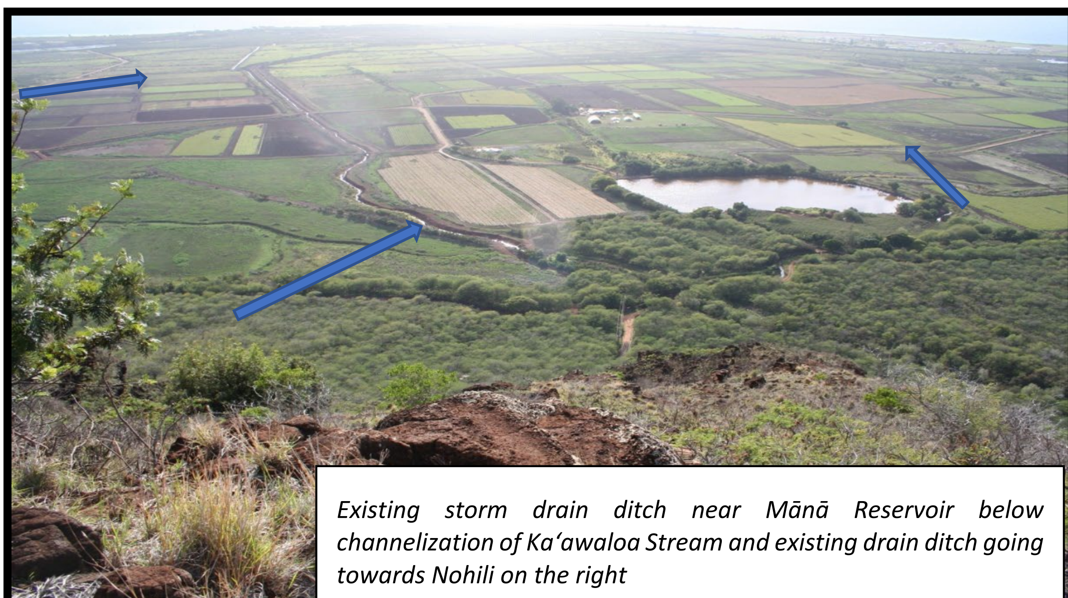
The Mānā Plain storm drain system is not part of the Proposed Action but is being described here as an existing feature on the Mānā Plain. The storm drain system was built by Kekaha Sugar Company (KSC) for the purpose of land reclamation to expand agricultural areas as shown in **Figure 4.46** for sugar cane production. KSC operated the system under a National Pollutant

Discharge Elimination System (NPDES) permit. ADC assumed ownership of the storm drain system and its NPDES permit in 2001. The NPDES permit term was administratively extended to 2011, when ADC submitted an NPDES renewal application which was later withdrawn in 2015 based on a Water Transfer Rule exemption.

The existing storm drain system is composed of approximately 40 miles of ditches and canals that were built to drain the coastal plan in Kekaha below the water table for the purpose of moving standing water out of the Mānā Plain. Historically there were three dewatering pump systems that pumped water from the ditch system to the ocean: one at Kawaiʻele (two 200 horsepower and one 100 horsepower) with a capacity of 100 MGD, one at Nohili (two 60 horsepower) with a capacity of 25 MGD; and two smaller pumps located behind the town of Kekaha (Element Environmental, 2016). The pumps lift water in the drainage ditches up and over coastal dunes and into the ocean. There are eight outlet points at which water collected in the storm drain system can enter the ocean from Polihale to east of Kekaha. These eight points include Nohili Ditch, Kinikini Ditch, Dry Ditch, Second Ditch, First Ditch, Mill Drain, Cox Drain and Kīkīaola Harbor Drain. Kinikini Ditch has historically been the primary outfall on the system, and all other outfall locations except Nohili are blocked by berms that are either removed by high flow in the system or cleared using excavators during high flow events. There are nine ephemeral streams that naturally flow onto Mānā Plain and ultimately into the ocean which were channelized into the storm drain system during its construction. One of these nine ephemeral streams is Kaʻawaloa Stream that drains the valley between Niu and Kamokalā Ridges and is located east of Mānā Reservoir. Water that enters the storm drainage system primarily comes from natural groundwater seepage and storm water runoff from ephemeral streams originating in the uplands. The storm drain system protects the Mānā Plain, PMRF, and the town of Kekaha from flooding.

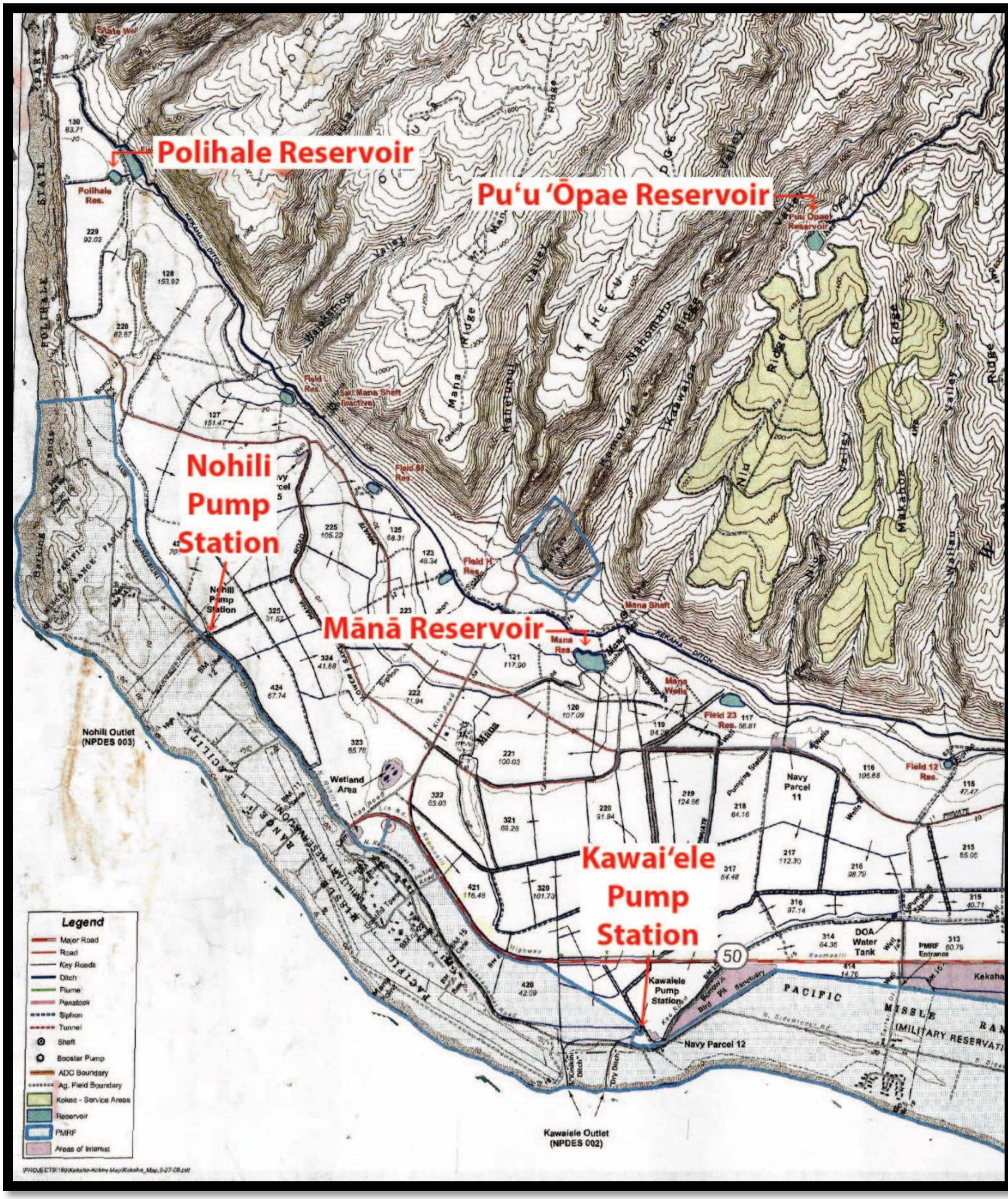
Site Access

The Mānā Plain storm drain system is accessed by Mānā Road off of Kaumualiʻi Highway via Kiko Road.



Existing storm drain ditch near Mānā Reservoir below channelization of Kaʻawaloa Stream and existing drain ditch going towards Nohili on the right

Figure 4.46. Mānā Plain Agricultural Field Layout, Nohili and Kawaiʻele Pump Stations, Existing Roads, and Other Features



Source: State of Hawaiʻi, Agribusiness Development Corporation

Typical storm drain ditch

Kawaiʻele pump station

Mānā storm drain system outfall into the ocean at Nohili

Nohili pumping station

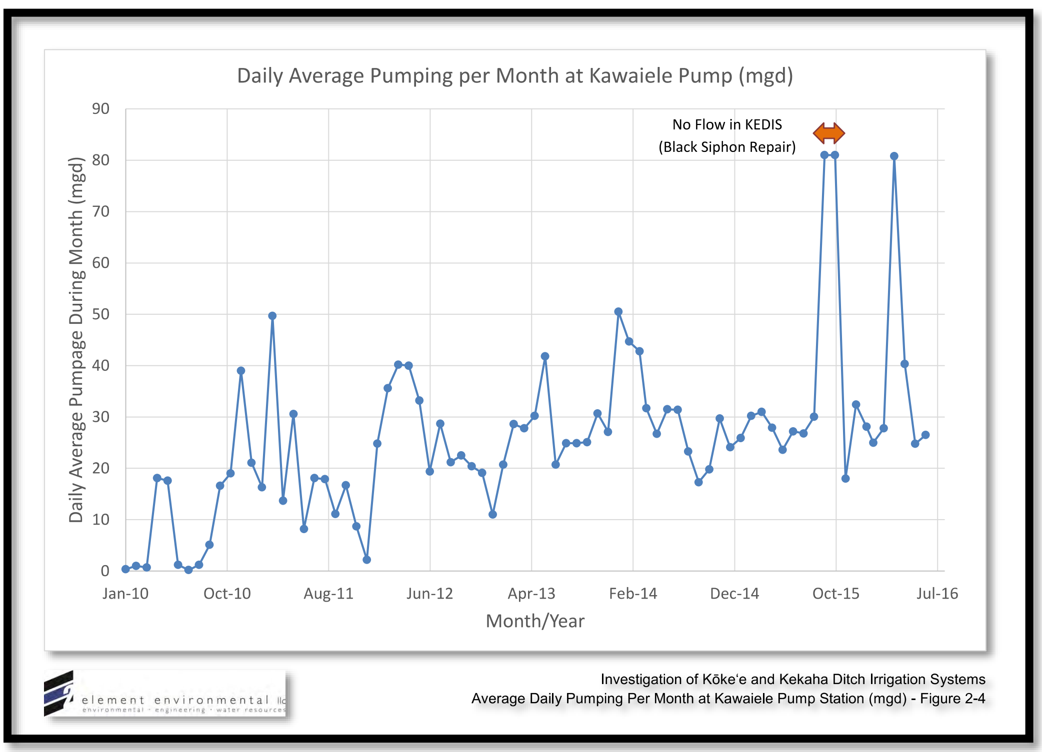
Current Operations

The Mānā storm drainage system extends through lands owned by ADC, DLNR, and the PMRF, and is currently managed by KAA under contract to PMRF who in 2004 assumed responsibility for the transfer of water and operation and maintenance of drainage pumps, ditches, and related infrastructure (ADC/DOH MOU). The pumps are powered by electricity generated at the Waimea Mauka and Waiawa hydropower plants, with backup power provided by the KIUC electric grid. If power outages occur that impact pumping operations, the storm drain system can still drain via gravity flow at Kinikini Ditch for extended periods. ADC was operating the system under NPDES Permit No. 000086, which expired in August of 2015. In 2018, ADC and DOH developed and executed an MOU that outlines an Agricultural Activities Best Management Practice Plan, Water Quality Monitoring Plan, and Drainage System Operation and Maintenance Plan.

The Nohili pumping station has been broken and offline since 2012. KAA has plans to replace the pumps at Nohili and Kawaiʻele stations. During storm events shoreline discharge may occur at First and Second Ditch or Kīkīaola Harbor Drain due to erosion of sand berms or by their removal using equipment.

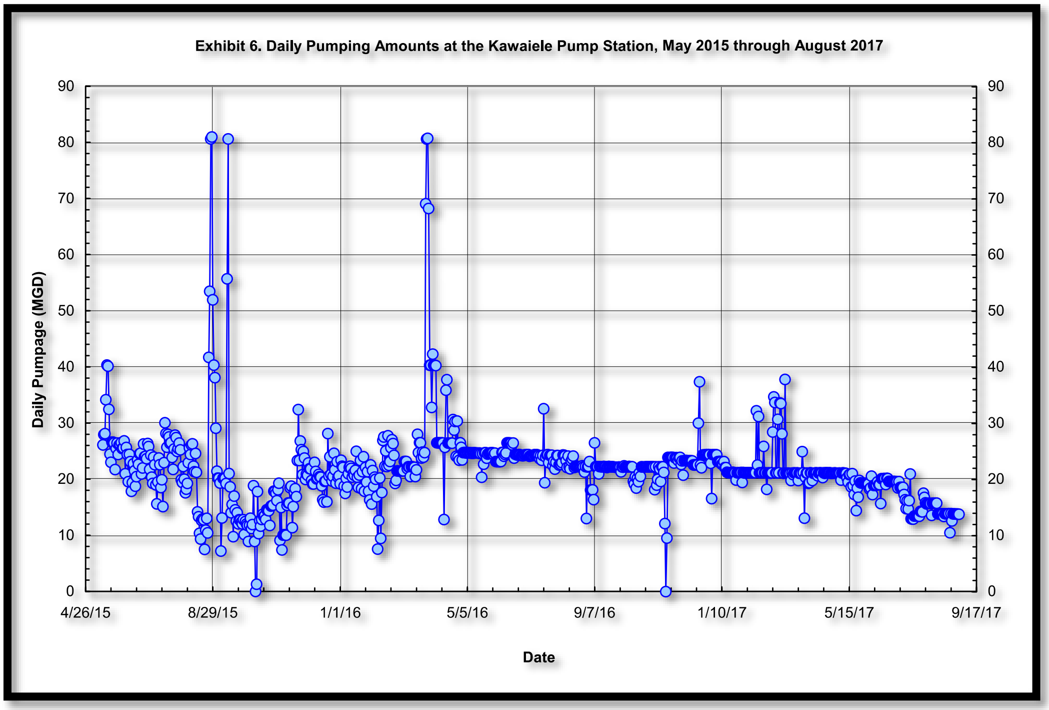
Daily average pumping per month for at Kawaiʻele pump station from January 2010 to July 2016 is shown in **Figure 4.47**. Daily pumping averages for Kawaiʻele pump station from May 2015 to August 2017 is shown in **Figure 4.48**.

Figure 4.47. Daily Average Pumping Per Month at Kawaiʻele Pump Station (Jan 2010-Jul 2016)



Source: Element Environmental, 2016

Figure 4.48. Daily Average Pumping Per Month at Kawaiʻele Pump Station (May 2015-Aug 2017)



Source: ADC/DOH MOU, Appendix 5

The time period between early August and September 2015 is of particular interest. Kekaha Ditch System was offline during that period for repairs to the black pipe siphon. Even with no water being delivered to Mānā Plain through Kekaha Ditch during that period, the daily volume of water pumped at Kawaiʻele during August and September 2015 averaged a little over 80 MGD. This daily average is significantly higher than monthly rates measured in the previous five years, and coincident with storms and heavy rainfall on Kauaʻi (Element Environmental, 2016).

KAA, with the approval of ADC, has been developing a pressurized irrigation system that would start at Field 117 Reservoir, located south of Mānā Reservoir, and extend north towards Polihale. The pressurized irrigation would replace the portion of Kekaha Ditch that runs between Field 117 Reservoir and the fields near Polihale. Construction of the pressurized system is anticipated to begin sometime within the next few years.

KAA, with approval from ADC, is actively exploring and developing plans for a reconfiguration of the Mānā Plain storm drain system that would reduce ocean discharge volumes and provide for open floodable spaces in the northern areas of Mānā Plain near Polihale in the same area where the historical Nohili wetlands were once located. **Figure 4.49** shows the locations being considered. The open floodable spaces are being developed for the purpose of increasing the capacity to address predicted sea level on Mānā Plain and to improve water quality that flows from the storm drainage system to the ocean. These open floodable spaces would also restore and enhance habitat for native wetland plants and waterbird species and would provide a beneficial use of water collected in the storm drain system. KAA applied for two grants (REPI and

NFWF) to support the development of the open floodable spaces that would also include removal of invasive species in the area. The open floodable spaces project would provide an area where storm run-off could be delivered and stored until sediment settles and clear, clean water can be transported to the ocean at either Nohili or Kawaiʻele. The operation plan as described by KAA would involve a gradual draw down of clean water from the open floodable spaces into the ocean through Nohili and Kawaiʻele pumping stations.

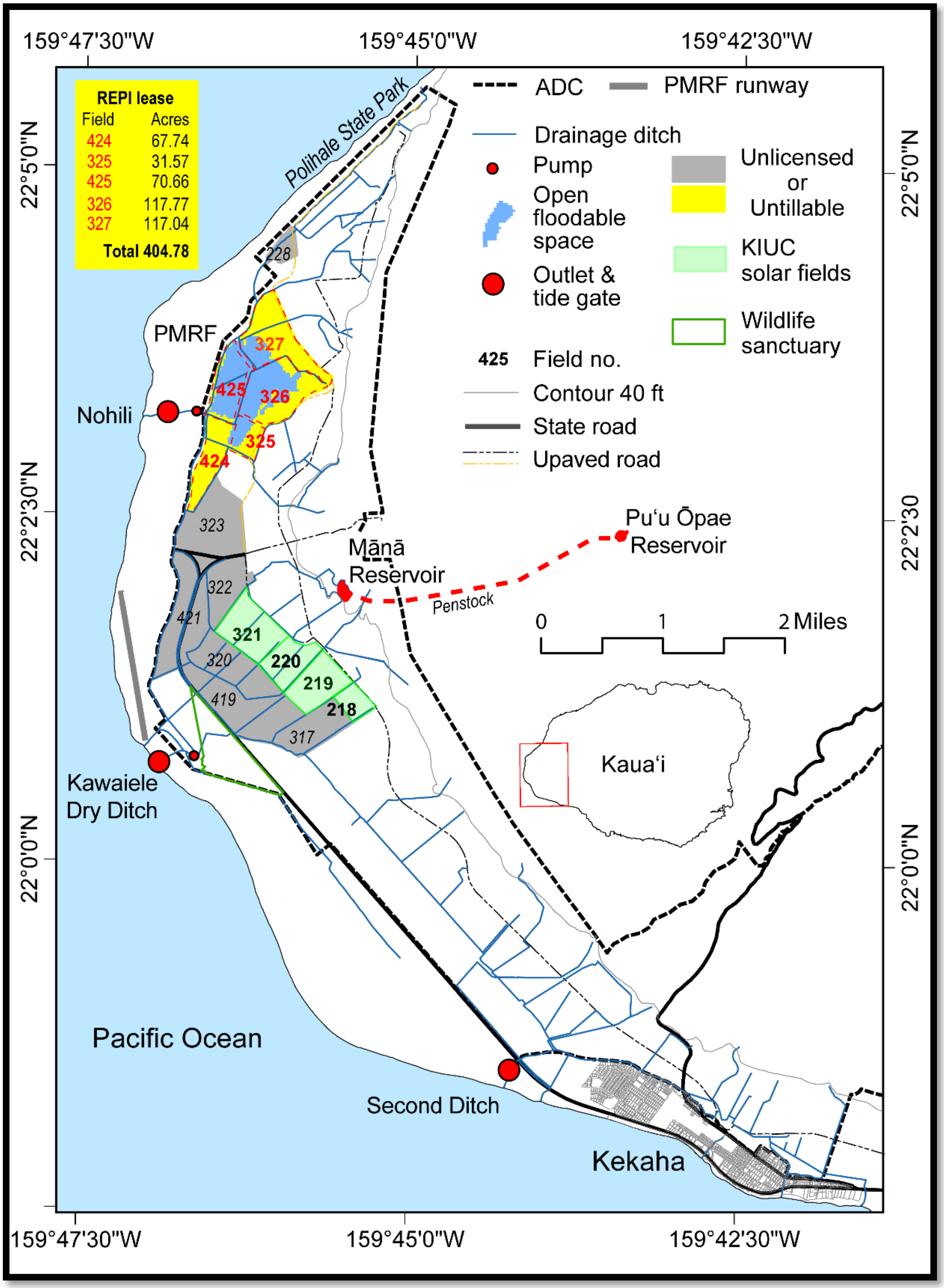
Proposed Operations

Project discharge from Mānā Reservoir would be delivered into KAA's irrigation system or directly to fields located immediately adjacent to the reservoir. It is KAA's intent to use all Project discharge for irrigation or other beneficial uses. However, in the event KAA is not able to use all Project discharge for irrigation or other beneficial uses, it would be delivered to the storm drainage system. All Project discharge would be clean, filtered water from Kōkeʻe Streams. Because the discharge would be conveyed from Mānā Reservoir through a pipe to the storm drain system, it would not come into contact with agriculture fields. The Project discharge would not convey sediment into KAA's irrigation system or the storm drain system.

The frequency and volume of discharge at Mānā Reservoir would vary through the life of the Project and is based on several factors including the following:

- Streamflow variability
- Maintenance of the Phase Two IIFS
- Kōkeʻe Ditch capacity above and below Puʻu Lua Reservoir
- Puʻu Lua Reservoir storage capacity
- Irrigation uses along the West Kauaʻi Energy Project flow path
- Generation needs during non-solar hours
- Reservoir make-up water used for reservoir refilling and for evaporative losses at all three reservoirs

Figure 4.49. Potential Reconfiguration of the Mānā Plain Storm Drain System



Source: Gomez, 2021

As shown in **Figure 4.50**, modeled outflow from Mānā Reservoir indicates a monthly average range of 8 to 17 MGD without any irrigation usage along the West Kauaʻi Energy Project flowline above Mānā Reservoir, and a monthly average range of 0.8 to 9.5 MGD after irrigation withdrawals above Mānā Reservoir. The higher ranges would occur during high rain/storm events (typically in winter and spring) and the lower ranges would occur during dry periods (typically late summer). It is important to note **Figure 4.50** is a modeled monthly average that does not show daily fluctuations in water availability. **Figure 4.51** shows daily fluctuations within the modeled year of 2020. Daily fluctuations will vary from year to year as will annual averages.

This outflow at Mānā Reservoir would be delivered to KAA and other farmers on Mānā Plain for the beneficial uses including irrigation on Mānā Plain for loʻi and other diversified agriculture, and for the open floodable spaces being developed by KAA near Nohili. If outflow at Mānā Reservoir cannot be used for irrigation or other beneficial uses on Mānā Plain, it would be delivered through pipes to the storm drainage system.

Figure 4.50. Modeled Average Monthly Outflow from Mānā Reservoir Based on Actual Data for Kawaikōī Stream and Modeled Flows for Waiakōali, Kauaʻikinanā, and Kōkeʻe Streams

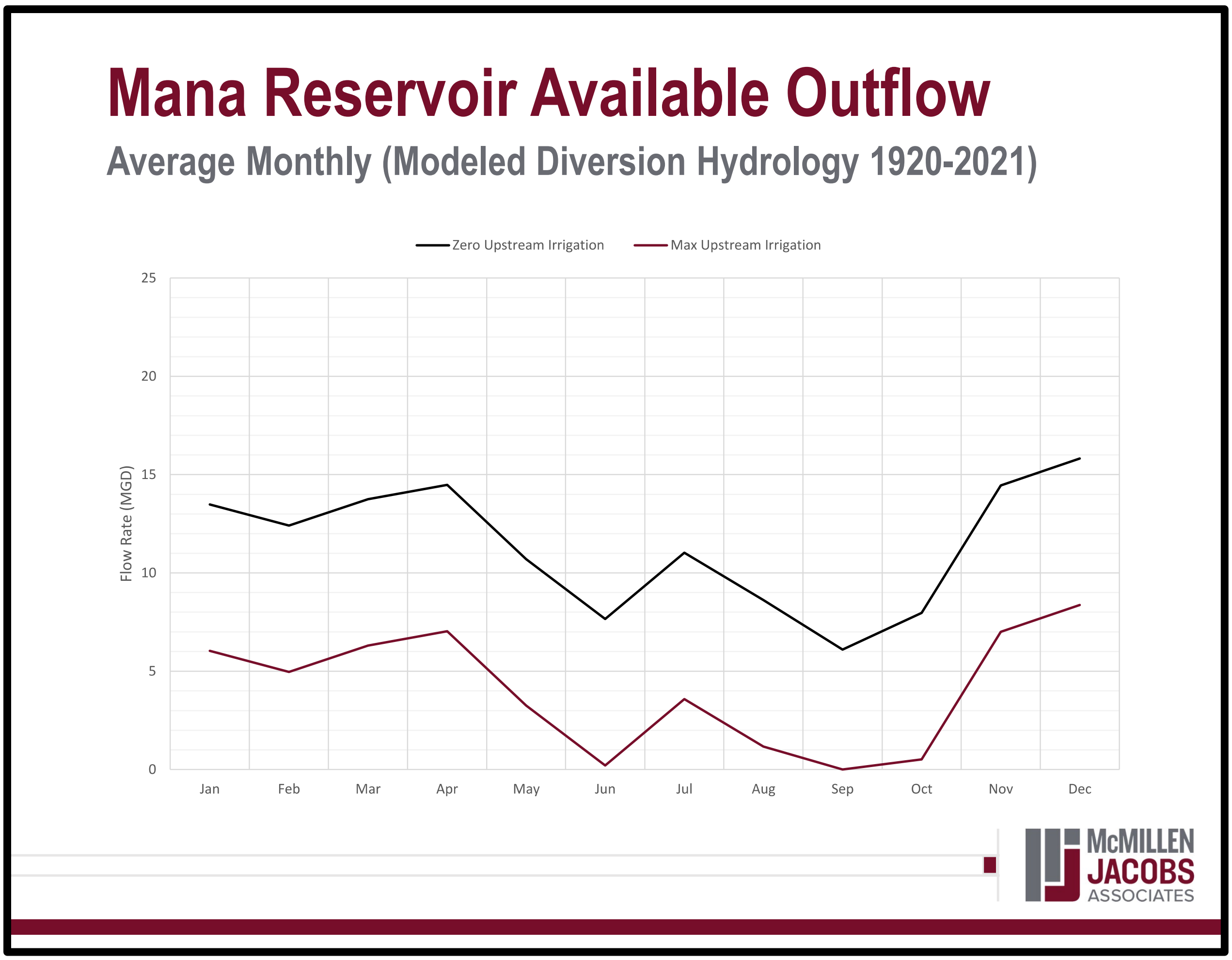
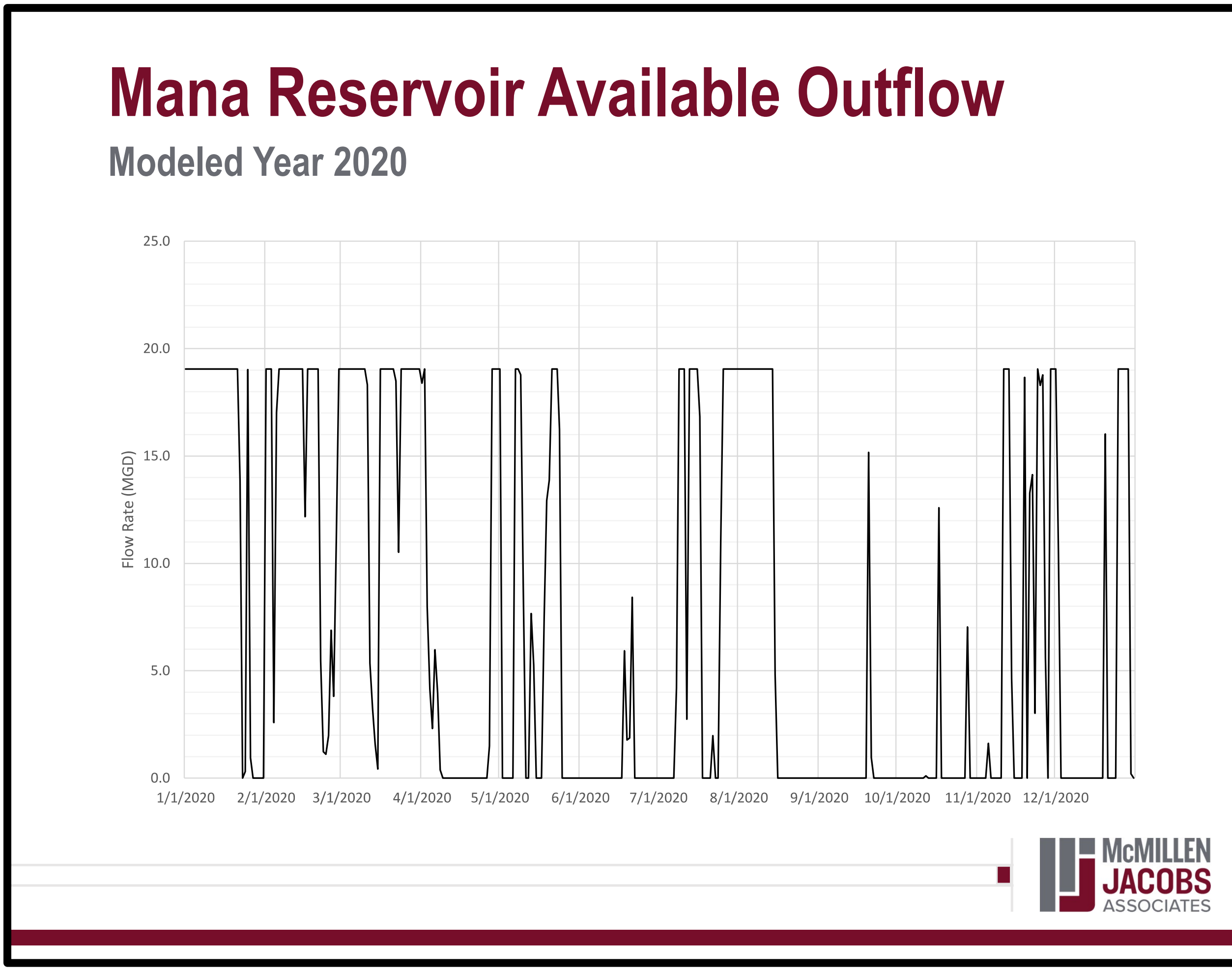


Figure 4.51. Daily Fluctuations Within Modeled Year 2020 of Outflow from Mānā Reservoir



To explain potential discharge from the West Kauaʻi Energy Project, various hypothetical situations are provided below that bracket the potential range of volume and frequency and include the factors that affect discharge as listed above.

- **Hypothetical Scenario #1: Heavy rains and clouds throughout the entire upper watershed, Puʻu ʻŌpae and Kekaha, and through much of Kauaʻi**

  This scenario would be considered a non-solar period and West Kauaʻi Energy Project store and release hydro generation would be needed in lieu of burning diesel. Stream flows would be high. It is assumed that under these conditions, irrigation would not be needed or used. It is also assumed that initially during this scenario (the first day or two), reservoirs would need refilling. The volume of refilling required would depend on the length of the dry period preceding the rain event. During this scenario, streamflow would be well above the IIFS, diversions would be operating at full capacity, reservoirs would be refilled, the release at Puʻu Lua Reservoir would be at full capacity of 26 MGD, and store and release generation at Puʻu ʻŌpae and Mānā Powerhouses would be utilizing the full 26 MGD to generate electricity. After energy generation at both powerhouses, the full 26 MGD would be discharged at Mānā Reservoir and assuming there would be no irrigation needs on Mānā Plain due to rain, delivered to the open floodable spaces or pumped into the ocean at Kawai‘ele or Nohili after the initial period of refilling reservoirs. It is assumed that water usage at the State Parks bathrooms would continue regardless of weather conditions, and it may be that some small water usage would be needed by DHHL regardless of rain conditions. However, for purposes of bracketing the potential of maximum discharge, those smaller uses aren't being considered in volume calculations. During this hypothetical scenario, pumping would not be occurring due to lack of solar generation to power the pumps, and all generation would depend on Kōke‘e diversions and reservoir storage. The duration of this type of event would be directly related to the length of the rain/cloud event and how quickly stream flows drop after the subsidence of the rain/cloud event. This hypothetical scenario is not expected to occur regularly or frequently.

- **Hypothetical Scenario #2: Heavy rains and clouds in the upper watershed and through much of Kaua‘i, but not at Pu‘u ‘Ōpae or in Kekaha**

  This hypothetical scenario would be considered a non-solar period and West Kaua‘i Energy Project store and release hydro generation would be needed in lieu of burning diesel. Stream flows would be high. Because it would not be raining in the lower areas of Pu‘u ‘Ōpae and Kekaha, it is assumed that in this scenario all irrigation uses would be utilized in their full volumes. It is also assumed that initially during this type of scenario (the first day or two), reservoirs would need refilling. The volume of refilling required would entirely depend on the length of the dry period preceding the rain event. During this scenario, streamflow would be well above the IIFS, diversions would be operating at full capacity, reservoirs would be refilled as needed, the release at Pu‘u Lua Reservoir would be at full capacity of 26 MGD, and irrigation deliveries would be at full volume. Store and release generation at Pu‘u ‘Ōpae Powerhouse would be approximately 24 MGD The store and release generation at Mānā Powerhouse would be approximately 18.5 MGD minus reservoir refilling at Pu‘u ‘Ōpae. The discharge from Mānā Reservoir would be approximately 18.5 MGD minus reservoir refilling, which would be available for irrigation on Mānā Plain and to supply water to the open floodable spaces or for any other beneficial uses. This hypothetical scenario is expected to occur only during multiple day heavy rain/cloud events throughout much of Kaua‘i. While the frequency of these types of events varies from year to year, it is not expected to occur regularly or for long durations.

- **Hypothetical Scenario #3: Average rainfall in the upper watershed, intermittent and brief showers through much of Kaua‘i, and dry conditions at Pu‘u ‘Ōpae and in Kekaha**

  This hypothetical scenario would have both solar and non-solar periods and West Kaua‘i Energy Project energy generation would be the result of both store and release hydro generation and pumped storage. During the day, pumps would be pumping water from Mānā Reservoir to Pu‘u ‘Ōpae Reservoir using West Kaua‘i Energy Project PV/BESS generation. During evening hours, store and release hydro generation would occur at Pu‘u ‘Ōpae and Mānā Powerhouses and pumped storage generation would occur at Mānā Powerhouse. It is also assumed in this hypothetical scenario that irrigation withdrawals would be occurring in their full volumes due to dry conditions at Pu'u 'Ōpae and on Mānā Plain, and all three reservoirs would require refilling. The volume of water available for release at Pu'u Lua Reservoir would depend on stream flow volumes after the IIFS, reservoir storages levels, and Kōke'e Ditch capacity upstream of Pu'u Lua Reservoir. If stream flows are average, the first priority would be refilling Pu'u Lua Reservoir and less than 26 MGD would be released at Pu'u Lua Reservoir. It is estimated that 5 MGD would be available at Pu'u 'Ōpae Powerhouse approximately 50% of the time based on average flows from the four streams diverted into Kōke'e Ditch and the full volume of irrigation deliveries being withdrawn above Pu'u 'Ōpae Powerhouse. In this hypothetical scenario it is expected that there would be variable discharge from Mānā Reservoir ranging from 0 to 3.55 MGD. It is estimated that 3.55 MGD would discharge at Mānā Reservoir approximately 45% of the time if irrigation deliveries at full volume are withdrawn upstream of Mānā Powerhouse. The irrigation storage buffers at Pu'u 'Ōpae and Mānā Reservoirs could be utilized in this scenario if the volume of water available for release at Pu'u Lua Reservoir is less than irrigation demand. This hypothetical scenario is expected to occur regularly and represent a good portion of regular West Kaua'i Energy Project operations.

- **Hypothetical Scenario #4: Low rainfall in the upper watershed, intermittent and brief showers through much of Kaua'i, and dry conditions at Pu'u 'Ōpae and in Kekaha**

  This hypothetical scenario would have both solar and non-solar periods and West Kaua'i Energy Project generation would be the result of both store and release hydro generation and pumped storage. During the day, pumps would be pumping water from Mānā Reservoir to Pu'u 'Ōpae Reservoir using West Kaua'i Energy Project PV/BESS generation. During evening hours, store and release hydro generation would occur at Pu'u 'Ōpae and Mānā Powerhouses and pumped storage generation would occur at Mānā Powerhouse. It is also assumed in this hypothetical scenario that irrigation withdrawals would be occurring in their full volumes due to dry conditions and all three reservoirs would require refilling. The volume of water available for release at Pu'u Lua Reservoir would depend on stream flow volumes after the IIFS, reservoir storages levels, and Kōke'e Ditch capacity upstream of Pu'u Lua Reservoir. If stream flows are low, the first priority for any diverted water would be refilling Pu'u Lua Reservoir and the release from Pu'u Lua Reservoir could be as low as 2 MGD. It is estimated that 1.8 MGD is available for release from Pu'u Lua Reservoir 100% of the time. Also, refilling of both Pu'u 'Ōpae and Mānā Reservoirs would be an operational priority as well as providing for irrigation withdrawals to the extent water is available. During the driest of times, stream flow availability would drop below irrigation needs as indicated in **Section 4.1.1.2** and could result in no store and release hydro generation at Pu'u 'Ōpae and Mānā Powerhouses. In this hypothetical scenario it is expected that there would be no discharge occurring from Mānā Reservoir assuming full withdrawal of irrigation deliveries upstream of Mānā Reservoir. This hypothetical scenario is expected to occur less frequently than Scenario #3 but more frequently than Scenarios #1 and #2 and is representative of common West Kaua'i Energy Project operations. Under these kinds of circumstances, generally dry conditions in both the upper watershed and on Mānā Plain, it would be essential for farmers on Mānā Plain to have irrigation delivered through Kekaha Ditch. The storage capacity at all three reservoirs would provide irrigation along the Project flowline for a period of time during dry conditions, but reservoir storage capacities are limited and would not have the capacity to provide the full irrigation volumes along the Project flowline through extended dry periods.

It is impossible to describe every single possible operating scenario; however, these hypothetical scenarios are generally representative of a range for anticipated conditions as described in each. During extended periods of dry conditions, it is possible that there would be no store and release hydro generation and Project generation would entirely be the result of pumped storage generation at Mānā Powerhouse. This is not expected to occur regularly or frequently but is expected to occur intermittently during the drier summer months over the course of the Project's life.

Potential Uses of Project Discharge at Mānā Reservoir

Kōkeʻe Ditch water released from Puʻu Lua Reservoir and used for renewable energy generation at Puʻu ʻŌpae and Mānā Powerhouses, would be discharged at Mānā Reservoir for a number of beneficial uses on Mānā Plain. Project discharge would be available for irrigation on Mānā Plain as a first priority use of discharge. Water for irrigation would be delivered from Mānā Reservoir directly to fields adjacent to Mānā Reservoir or piped into KAA's pressurized irrigation system, or both. Irrigation uses of water delivered through West Kauaʻi Energy Project would include approximately 100 acres of loʻi kalo that is being developed by KAA in Field 119, which is located immediately southwest of the reservoir, an agricultural component that would be implemented between solar panels in the area where the PV Solar Array would be located, and other diversified agricultural operations on Mānā Plain. Based on information provided by KAA, it is the Applicant's understanding that KAA's pressurized irrigation system would have the capacity to deliver 12 MGD to fields at the northern end of Mānā Plain to provide for future agricultural expansion in those areas if water is available for irrigation. Based on information provided by KAA, it is the Applicant's understanding that there is an estimated irrigation demand of 6 MGD for farming on Mānā Plain based on current license agreements and license agreements currently in discussion for near term future farming on Mānā Plain. The license agreements in discussion include approximately 1000 acres in melons interspersed with other seasonal crops, and loʻi kalo cultivation in Field 119. The specific agricultural use within the PV solar array area has not been determined, but agricultural options such as dryland taro or alfalfa are being explored with KAA and local farmers. Water for these irrigation uses would be supplied through a pipe extending through the southeastern embankment to KAA's pressurized irrigation system and/or directly from Mānā Reservoir to fields 119, 218, 219, 220, and 321. A manual valve at each connection would be provided for farmer-based operation.

During high rain events when Project discharge exceeds what is needed for irrigation on Mānā Plain, Project discharge would be transported through open ditch to fields northwest of Mānā Reservoir where KAA has plans to revert fields to open floodable spaces (fields 425, 324, 326, and 327) or into the existing storm drainage system. The proposed area for the open floodable spaces is approximately 200 acres and could receive and store water delivered from West Kauaʻi Energy Project before it is gradually pumped into the ocean at Nohili or Kawaiʻele. For reference, 26

MGD is roughly equivalent to about 80 acre-feet per day. Eventually, water entering the open floodable spaces would be discharged into the ocean through the Nohili or Kawaiʻele pumping stations.

Project discharge from Mānā Reservoir would be clean, filtered water and is expected to dilute existing potential pollutants or chemical contaminants that may be present in water from other sources in the existing storm drainage system. This would result in an overall improved water quality of water that is discharged from the storm drainage system into the ocean at either Nohili or Kawaiʻele.

KIUC and AES are working with ADC and KAA in the exploration of beneficial uses of Project discharge from Mānā Reservoir. Explorations into other beneficial uses of Project discharge include the potential for KAA to use Project discharge to refill smaller existing reservoirs to increase storage on Mānā Plain in other areas of Mānā Plain.

The existing storm drainage system and the pressurized irrigation system on Mānā Plain is not part of West Kauaʻi Energy Project, and both are operated by KAA. KAA, with approval from ADC, is in the process of developing the improvements to the storm drainage system operations to address a number of issues including storm water runoff sediment conveyance and future sea level rise predictions. KIUC and AES will continue to collaborate with ADC and KAA throughout West Kauaʻi Energy Project development and operation to maximize beneficial use of Project discharge on Mānā Plain.

ADC has submitted an NPDES application to DOH and the operations of the Mānā Plain storm drainage system would be regulated by the DOH through the NPDES permit.

4.1.2.15 PV Solar Array

Current Site Condition

The PV Solar Array would be a new facility included in the Proposed Action.

Site Access

Access to the new solar array would be via existing gravel agricultural roads from Kiko Road off of Kaumualiʻi Highway.

Mānā Plain existing conditions

Current Operations

The PV Solar Array does not currently exist; therefore, there are no current operations.

Proposed Construction and Access to the Site

Construction Activities

The Proposed Action would include the construction of a 35 MWac PV Solar Array. The PV Solar Array would consist of a series of 515- to 535-watt solar panels. Based on preliminary design, approximately 106,000 solar panels would make up the 56 MWdc solar panel array. The exact quantity will be refined based on the final solar panel manufacturer, make, and model available at the time. The PV system would be mounted via single axis trackers and have a nameplate rating of 56 MWdc. Single axis trackers move from east to west and follow the sun’s direction. Single axis tracker systems can increase electricity production by more than 30% versus traditional fixed tilt systems (Solar Feeds, 2019).

A 70 MWh lithium-ion battery energy storage system (BESS) composed of 28 lithium-ion battery units would be used to store PV energy and smooth PV output to provide firm power to the pumps or directly to the grid. The battery energy storage system would include (28) 1,300-kilowatt (approximate) lithium-ion battery units, collectively providing approximately 70 MWh of total storage. Each battery unit would be housed in a container approximately 10 feet (height) by 8 feet (width) by 40 feet (length). Based on preliminary design, 2 battery containers would be installed on each concrete equipment pad (also referred to as a Power Conversion Station, or

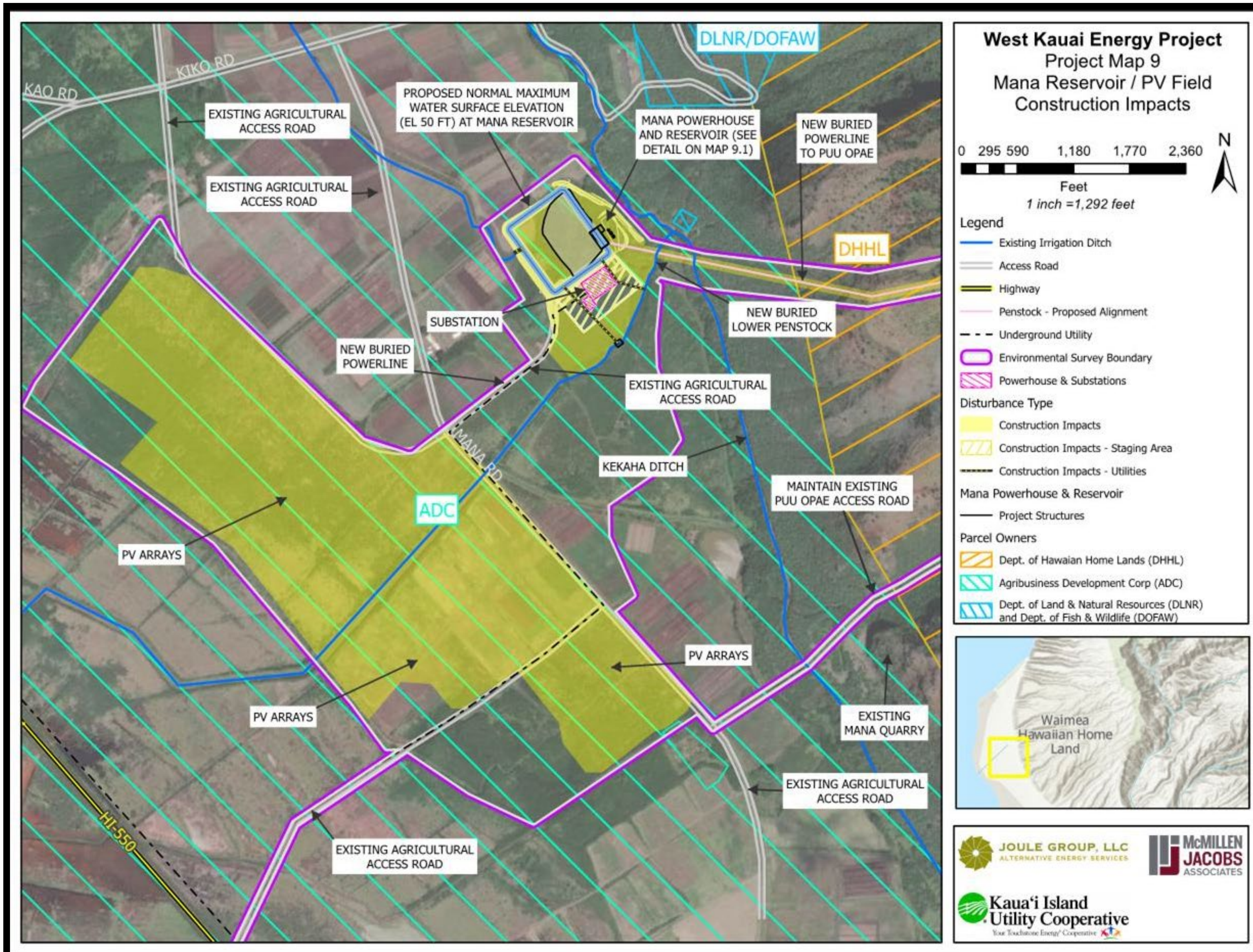
PCS) and there would be a total of 14 Power Conversion Stations. In addition to battery containers, each PCS would contain an inverter, transformer, miscellaneous electrical equipment, auxiliary power and communications equipment. Dimensions of the PCS will depend on final system design and manufacturer make and model of the various components. A typical PCS is approximately 3,500 square feet. Based on preliminary design, the 14 PCS pads are dispersed amongst the solar panel arrays and positioned on the mauka side of the solar panel arrays.

The PV Solar Array would be constructed on approximately 350 acres of agricultural lands to the west of the Mānā Reservoir. The location of the proposed PV Solar Array was selected based on recommendations made through collaborative discussions with local farmers because they are less suited for agricultural production due to water retention issues and heavy clay content, and these areas have only been in limited use in recent years. The use of these lands by the Applicant would require an agricultural component and would provide ADC lease rent income and is further described in **Section 5.10.2.2**.

While this portion of the Project construction involved over 50% of the total disturbance area, it is the simplest of all the construction activities since the land has already been cleared and graded in the past for agricultural purposes. The area of temporary disturbance would be 375 acres. The laydown areas are contiguous with the Mānā Reservoir footprint and would be shared as needed. The PV and substation work would be done simultaneously with the Mānā Reservoir and Powerhouse construction. The construction area would encompass 375.0 acres as shown in **Figure 4.52**.

Access to the solar array would be via existing gravel agricultural roads leading from existing public roads to a new parking area constructed at the proposed Mānā Powerhouse.

Figure 4.52. PV Solar Array Construction Impacts



Construction activities in the solar field area are expected to include transport and delivery of solar equipment and materials, site preparation, equipment installation, revegetation and/or a compatible agricultural use such as dry taro or alfalfa. Each of these activities is generally described below. As further discussed below, construction of the solar array, BESS, facility substation, and switchyard is expected to occur over an approximately 20-month period beginning after all applicable approvals have been obtained (estimated to occur in mid-2023). Over the course of the construction period, the average number of workers expected to be at the solar field site would range from approximately 20 to 40 workers per day. Parking for construction workers occur entirely within the Project area.

Site Preparation

Initial site preparation would involve clearing and grubbing of vegetation followed by installation of Best Management Practices (BMPs) as described below and grading within the solar field area. Clearing, grubbing and grading would be phased, and soil would be stabilized as appropriate. Service roads and staging areas would also be established. It is anticipated that the staging areas would rotate throughout the solar field area as the solar array is built out, with these areas installed incrementally as needed; in total, it is anticipated that staging would require approximately 25 acres (non-contiguous) within the solar field area. Staging may also be shared with construction at the Mānā Reservoir. For each staging area, some grading may be conducted to level the ground surface, with geotextile materials and compacted gravel installed as needed. Similarly, installation of new service roads would also involve grading, smoothing and placement of geotextile material and compacted gravel. Clearing, grubbing, and grading would be conducted using equipment such as bulldozers, excavators, compactors, graders, and front-end loaders. Water trucks may be used to provide moisture for compaction as well as dust control during construction as needed.

Implementation would incorporate BMPs to avoid and minimize potential impacts to the surrounding environment. BMPs would include various procedures, practices, treatments, structures and/or devices designed to eliminate and minimize the potential discharge of pollutants to downstream waters. The BMPs to be implemented would be determined in accordance with applicable regulatory requirements, including those associated with the NPDES program and Kauaʻi County Code Section 22-7.17 Specifications for Grading Grubbing and Stockpiling, which require approval of a Stormwater Pollution Prevent Plan and Drainage and Erosion Control Plan prior to construction (respectively). Specific BMPs would address erosion prevention, sediment control, and good housekeeping. No ground disturbing activities would occur until BMPs have been properly implemented.

In addition, sediment basins would be installed to capture and treat storm water in areas with increased impervious surfaces associated with the solar array. Minimal solar field area, including the area beneath the solar modules, would require grading such that the existing drainage patterns would not be altered. In general, grading would be focused around the service roads, and equipment pads. The sediment basins would be located within the solar field area and would be designed to retain and allow for settlement and evaporation of storm water, as needed to maintain peak flows at or below pre-development levels. The size and design of the basins would be based on site-specific conditions as well as the requirements of the DPW County of Kaua'i Storm Water Runoff System Manual.

Installation of Solar Equipment

Following site preparation activities, the general sequence for construction would involve installation of the following: (1) racking system, (2) electrical collector system, (3) solar photovoltaic modules and associated wiring, (4) concrete equipment pads, (5) electrical equipment, (6) battery units, and (7) fencing. Given the design tolerances of these facilities and the relatively low gradient of the solar array area, a minimal amount of earthwork is expected. As further detailed below, grading for installation of the solar equipment is expected to be limited to the areas comprising the service roads and equipment pads, as well as in localized areas within the solar arrays.

Overall, the extent of ground disturbance associated with the solar photovoltaic system is expected to be relatively minimal, as the racking system would be installed using structural posts and can tolerate the existing gradient within the solar field area (based on the manufacturers' specifications); grading would be limited to localized areas as needed to smooth existing topography. The posts for the racking system would be installed using a hydraulic pile driver or augur with approximate depths of up to 20 feet (depending on soil conditions). The frames and other components of the racking system would be bolted to the piles, with the solar photovoltaic modules affixed to the frames.

Trenches would be excavated for both the DC electrical wiring, as well as some alternating current (AC) low-voltage wiring and communications wiring (running from the solar photovoltaic modules to the power conversion stations) and the medium-voltage collector lines (running from the power conversion stations to the substation) using wheel- or track-mounted excavators (or similar). The trenches for the DC and low- voltage electrical wiring would be up to 20 feet wide and 4-6 feet deep to accommodate multiple circuits of wiring. The trenches for the medium-voltage collector lines would be up to 20 feet wide and 4-6 feet deep. Following placement of the electrical lines, excavated soil would be backfilled into the trench and tamped back to the appropriate level of compaction per the design specifications. Although not anticipated, if the desired trench depth cannot be achieved (due to prohibitive subsurface conditions), the electrical wiring or collector lines would be covered with concrete slurry in accordance with the applicable electrical code requirements.

The equipment pads would involve excavation and installation of concrete. Excavated soil would either be used elsewhere within the Project area or hauled to an approved offsite facility. Concrete for the pads would be delivered in ready-mix concrete trucks; the Project would not include a concrete batch plant. Once the equipment pads and substation and switchyard foundations have been installed, the battery units and various electrical equipment would be installed. All electrical equipment and wiring would be installed and inspected in accordance with applicable code requirements and best industry practices.

Once fully installed, the solar components are expected to have a total operations area of approximately 303.2 acres with a footprint of new impervious surfaces of approximately 3 acres. It is important to note that these dimensions are estimates based on the current level of design.

The exact dimensions will be refined through the final design process; in particular, refinements are anticipated based on KIUC technical review and the engineering, permitting, and equipment procurement process.

Revegetation

A compatible agricultural use would be located within the PV Solar Array after construction is completed. Following construction, areas that have been temporarily disturbed would be revegetated for soil stabilization and erosion control purposes. It is anticipated that revegetation would involve application of hydroseeding, with a suitable mix of native and/or non-invasive grass species. Any species used for revegetation would also be considered in terms of compatibility with potential onsite compatible agricultural activities.

Post Construction Site Control

In addition to revegetation of temporarily disturbed areas, permanent BMPs would be implemented to address long-term stormwater requirements. To the extent practicable, the BMPs would be incorporated in accordance with the requirements of the Kaua'i County Rules for the Design of Storm Water Treatment Best Management Practices. The specific strategies and measures would be identified as part of a Stormwater Quality Best Management Practices and Maintenance Plan, which would be submitted for approval prior to construction.

Proposed Operations

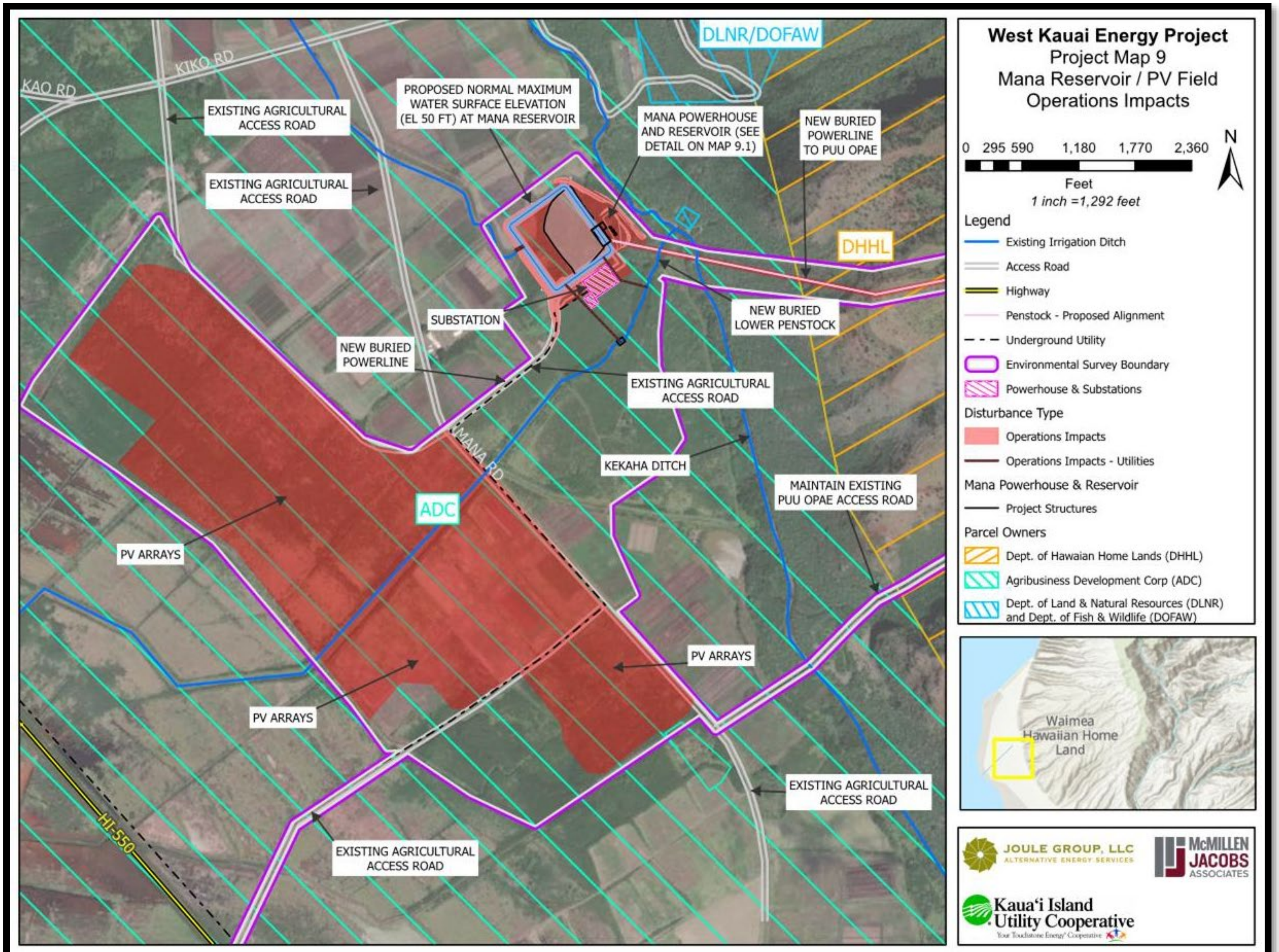
Following construction and commissioning, the solar equipment would generally involve passive operations for solar power generation. Metering equipment would send solar PV system performance and production data to continuously monitor servers. Electronic notification would be sent to the operations and maintenance team if these data indicate the system is underperforming. If necessary, a technician would be dispatched to the solar field to address any issues. AES would employ dedicated staff to remotely monitor the solar array on a full-time basis. To support ongoing activities within the solar field area, such as maintenance and vegetation management, it is estimated that an average of two to four workers would visit the site per day.

Periodic maintenance and inspection of the facilities would occur intermittently over the course of solar array operations and would include testing and replacement of component parts such as the inverters, transformers, and facility substation equipment.

Vegetation within the solar field area would be managed throughout the life of the solar equipment. In addition to a possible compatible agricultural use, vegetation management could also include mowing, weed whacking, and localized application of herbicide, if needed. Vegetation would be actively monitored and managed to control combustible materials, while still providing sufficient cover for erosion control as well as for agricultural purposes.

Figure 4.53 shows the Project footprint of the PV Solar Array during operations.

Figure 4.53. PV Solar Array Operations Area



4.1.2.16 West Kauaʻi Energy Project Substation

Current Site Conditions

The Project Substation would be a new facility included in the Proposed Action.

Site Access

Access to the new Project Substation would be via existing gravel agricultural roads from Kiko Road off of Kaumualiʻi Highway.

Current Operations

The Project Substation does not currently exist; therefore, there are no current operations.

Proposed Construction and Access to the Site

The new Project Substation would be where all electrical energy generation from the Project would be delivered including store and release hydroelectric generation, pumped storage generation, and solar direct to grid generation. The Puʻu ʻŌpae and Mānā Powerhouses have co-located facility substations that convert voltage to allow delivery of power through the buried powerlines between Puʻu ʻŌpae and Mānā facility substations and the Project Substation. The co-located Puʻu ʻŌpae and Mānā Powerhouse facility substations are shown on **Figure 4.39** and **Figure 4.44**.

The new Project Substation would include an AES owned substation and a KIUC owned substation that would be divided by a fence. These two co-located substations together make up the Project substation.

The new Project Substation site and construction staging area are contiguous with the Mānā Reservoir footprint and would be shared as needed. The Project Substation construction would be done simultaneously with the PV solar array, Mānā Reservoir, and Mānā Powerhouse construction. The new Project Substation would impact approximately 7.47 acres and occupy approximately 2.4 acres during operations.

The new Project Substation would be constructed on the southeast side of Mānā Reservoir in a section of agricultural Field 119 on Mānā Plain. The new Project Substation would have a footprint of approximately 2 acres and would be constructed on Hawaiʻi Land Study Bureau (LSB) class B soils. The LSB assigns a rating of A to E to agricultural land, with A being the most productive land and E being the least productive land. The Proposed Action would be located on lands designated B. Pursuant to HRS Chapter 205-4.5, those facilities in areas with Land Study Bureau (LSB) Class B and C soils require a Special Use Permit and must meet certain conditions relating to agricultural activities and decommissioning.

The Project Substation would consist of a breaker-and-a-half bus arrangement of one 16.8 MVA power transformer, five 57kV transmission lines, nine 69kV gas circuit breakers, and an outdoor metal-clad switchgear and control enclosure consisting of four medium voltage (12.47 kV) breakers. Grading is expected for the new Project Substation, and a 6-inch layer of substation-grade crushed rock would be placed over the entire foundation and extending a minimum of four feet outside the fenced area.

The new Project Substation foundation would involve the addition of fill material being placed on top of the existing grade, which would raise the subgrade elevation, thus minimizing flooding risks. Excavated material from other areas within the Project area such as at Mānā Reservoir would be used for fill material. Concrete for the pads and foundation would be delivered in ready-mix concrete trucks; the Proposed Action would not include a concrete batch plant. Substation steel structures would be galvanized rather than painted and would be anchored in place by pile-driven steel. Bare overhead conductors would be placed with the minimum distance required for personal safety. Gas circuit breakers would be mounted to concrete foundations. Once the new substation foundations have been completed, the various electrical equipment would be installed. All electrical equipment and wiring would be installed and inspected in accordance with applicable code requirements and best industry practices.

The new Project Substation bus would consist of an aluminum seamless bus pipe and copper conductor. A secondary oil containment system would be constructed to contain an oil spill from the single power transformer inside the substation. The Project Substation would have a Spill Prevention, Control, and Countermeasure plan specific to the substation and location in accordance with federal guidelines.

Electrical lines entering the new Project Substation would include:

- One buried 12.4kV distribution line from Puʻu ʻŌpae Powerhouse Facility Substation
- One buried 57kV transmission line from Mānā Powerhouse Facility Substation
- Two buried 57kV transmission lines from the PV Solar Array
- One overhead 57kV transmission line from the Project Substation to PMRF Substation (KIUC Interconnection Line)

The Project Substation would be enclosed by a perimeter chain-link fence with a total height not to exceed eight feet.

Access to the Project Substation for construction and operation would be provided through existing roads on Mānā Plain. Two new driveways into the Project Substation parking area would be constructed. One would extend from the existing Mānā Reservoir access road to the new substation parking area, and the second would extend from the Mānā Reservoir embankment road on the east corner of the reservoir near the new Mānā Pumpstation.

Proposed Operations

Following construction, within the Project Substation, AES would own and maintain the AES substation and KIUC would own and maintain the KIUC substation.

All power generated by the West Kauaʻi Energy Project would be delivered to the Project Substation through buried lines from the Puʻu ʻŌpae Powerhouse Facility Substation, Mānā Powerhouse Facility Substation, and the PV Solar Array. From the Project Substation, all energy generated by the West Kauaʻi Energy Project would be delivered through a new overhead Interconnection Line discussed further in **Section 4.1.2.17**.

4.1.2.17 West Kauaʻi Energy Project Interconnection Line

Current Site Conditions

The West Kauaʻi Energy Project Interconnection Line would be a new facility included in the Proposed Action.

Site Access

Access to the new West Kauaʻi Energy Project Interconnection Line would be via existing gravel agricultural roads from Kiko Road off of Kaumualiʻi Highway.

Current Operations

The West Kauaʻi Energy Project Interconnection Line does not currently exist; therefore, there are no current operations.

Proposed Construction and Access to the Site

Mānā Plain access road. Interconnection line would be installed within cleared edges of the road

The new West Kauaʻi Energy Project Interconnection Line would be constructed, owned, and operated by KIUC. To deliver power from the West Kauaʻi Energy Project Substation to KIUC's electrical transmission system, KIUC would install a new overhead 57.1 kV transmission line (West Kauaʻi Energy Project Interconnection Line) between the new West Kauaʻi Energy Project Substation and KIUC's existing transmission system on Kaumualiʻi Highway near PMRF. The new West Kauaʻi Energy Project Interconnection Line would be located on Mānā Plain on ADC land and would follow the alignment of existing dirt roads that extend between Mānā Reservoir and Kaumualiʻi Highway. The new interconnection line would be approximately two miles in length. Additionally, KIUC would reconductor approximately one mile of existing transmission line extending from PMRF Substation to Mānā Substation. Approximately two miles of new All-Dielectric Self-Supporting (ADSS) single mode fiber optic line would be installed between the new West Kauaʻi Energy Project Substation and the existing PMRF Substation to allow KIUC's system to control, protect, and communicate with West Kauaʻi Energy Project. The combination of the new overhead interconnection line, reconductoring of existing transmission, and the addition of the fiber optic line would allow KIUC to deliver all energy generation from West Kauaʻi Energy Project to KIUC's system in a dispatchable manner.

Installation of the new West Kauaʻi Energy Project Interconnection Line and fiber optic line would be within the cleared edges of the existing dirt roads and would not involve vegetation clearing or grading. Construction would involve installation of approximately 35 new poles approximately 80 feet in height. Poles would be drilled in place using an auger to an approximate depth of 10 to 12 feet. The new 57.1kV transmission interconnection would be hung between poles as the top layer, and the fiber optic line would be installed below.

Each hole would be individually drilled, and pole compacted in place resulting in no loose dirt piles that could be conveyed into the storm drainage system as sediment. Therefore, the potential for stormwater runoff concerns would be minimal during construction. Compaction around poles would prevent erosion of disturbed soil. If, for any reason, holes are not immediately filled and compacted, loose soil would be contained onsite in a manner that would prevent conveyance into the storm drain system or loose soil would be removed from the site. Construction would occur alongside road edges and not impact or change the existing vegetation barrier along storm drain ditch embankments and therefore would not result in erosion along embankments. Consistent with the ADC/DOH MOU regarding BMPs on Mānā Plain, hydro-seeding of a sod-forming grass would occur after pole installation in any areas of ground disturbance to provide a protective cover of vegetation over disturbed areas. Also, dust control measures would be implemented during construction to limit and avoid dust dispersion. Water trucks would be used to provide moisture for compaction as well as dust control during construction as needed.

The new West Kauaʻi Energy Project Interconnection Line would replace an approximate two-mile section of existing transmission and distribution lines extending from PMRF to Polihale State Park. These existing sections of transmission and distribution lines between PMRF and Polihale State Park would be completely removed so no overhead lines would be present in their current location, thus removing all potential impacts associated with those overhead lines. Installation of the new West Kauaʻi Energy Project Interconnection Line would also include minimization measures to reduce the risk of waterbirds and seabirds colliding with the overhead lines. Minimization measures would include the following:

- Limiting height of lines to the extent possible while still complying with applicable safety codes, federal and PUC guidelines.
- Limiting the number of layers on poles to the extent possible while still complying with applicable safety codes, federal and PUC guidelines, meaning lines are configured with on the horizontal plane rather than vertical.
- Installing reflective or LED diverters.

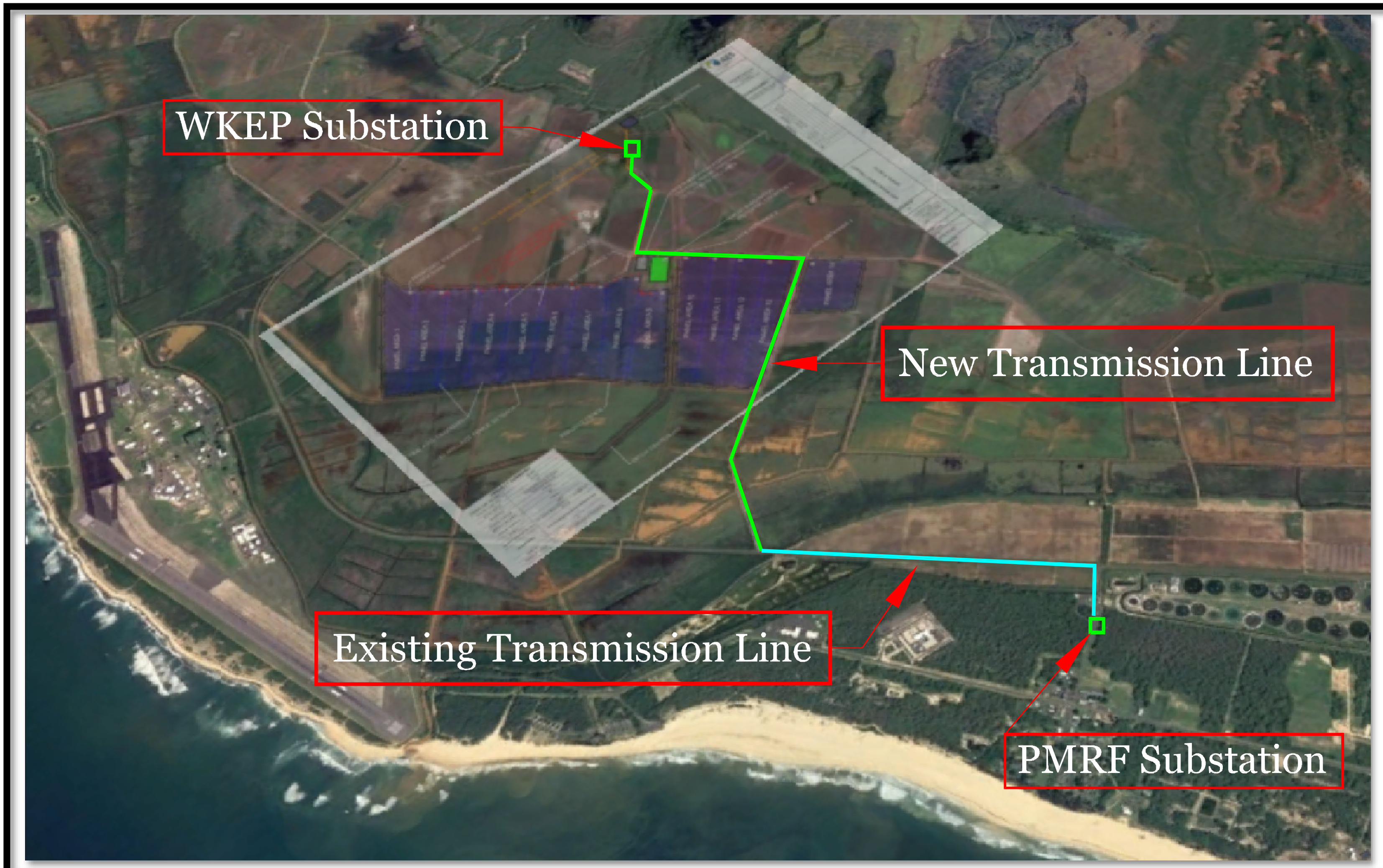
The new West Kauaʻi Energy Project Interconnection Line would be an extension of KIUC's existing transmission system. KIUC would assume cost of ownership, maintenance, and operation of the new West Kauaʻi Energy Project Interconnection Line after installation. Reconductoring of KIUC's existing transmission system would be a change to existing infrastructure and would not include new construction, ground disturbance, vegetation clearing, or additional land use. The entire section of line being reconductored would occur on KIUC's existing transmission circuit and is located within the State highway right of way.

Construction activities related to this new West Kaua‘i Energy Project Interconnection Line are not expected to impact any threatened or endangered species.

Construction access would be through existing access roads on Mānā Plain. The work site is located behind ADC gates and not accessible to the public. Construction would not restrict or impact access to ADC licensees and farmers on Mānā Plain.

Figure 4.54 shows the location of the new West Kaua‘i Energy Project Interconnection Line and new fiber optic lines in green and the section of existing KIUC transmission line being reconductored in blue.

Figure 4.54. West Kaua'i Energy Project Interconnection Line



Proposed Operations

Once construction is completed (overhead lines are hung on poles), the West Kauaʻi Energy Project Interconnection Line would be owned and operated by KIUC as part of their island-wide electrical grid system. For purposes of the new West Kauaʻi Energy Project Interconnection Line, operation is being defined as when the lines are hanging in the air. Once the lines are strung between poles, they are considered operational and are covered under KIUC's Habitat Conservation Plan (HCP). KIUC's overhead electrical lines that are greater than 30 feet in height have been shown to impact three species of threatened and endangered seabirds including Newell's shearwater, Hawaiian Petrel, and band-rumped storm petrel, and five threatened and endangered species of waterbirds including Hawaiian goose, Hawaiian duck, Hawaiian coot, Hawaiian stilt, and Hawaiian common gallinule. To address this risk of potential take of threatened and endangered species, KIUC operates their overhead electrical transmission system through a HCP that specifically outlines minimization of impacts and mitigation focused on protection, rehabilitation, and population growth for the species at risk of powerline collisions. The HCP covers all overhead lines greater than 30 feet. Because the new West Kauaʻi Energy Project Interconnection Line would be part of KIUC's overhead electrical transmission lines and would be over 30 feet in height, it would be covered under KIUC's HCP, and would comply with HCP minimization, avoidance, monitoring and reporting measures included in the HCP. Potential impacts to threatened and endangered seabirds and waterbirds associated with the new West Kauaʻi Interconnect Line and that cannot be minimized or avoided would also be mitigated through KIUC's HCP mitigation plan. A brief history of KIUC's HCP is outlined below and a copy of *KIUC's Short-Term Seabird Habitat Conservation Plan* (Short-Term HCP) is included in **Appendix E**.

In May of 2011, USFWS approved KIUC's Short-Term HCP for a period of five years. The Short-Term HCP addressed Newell's shearwater, Hawaiian petrel, and band-rumped storm petrel, which were known at that time to be adversely affected by KIUC facilities. Even though the Short-Term HCP was limited to a period of five years, KIUC, in coordination with USFWS and DOFAW, continued implementing minimization, avoidance, and mitigation as outlined in the Short-Term HCP beyond the five-year term. In addition, in consultation with USFWS and DOFAW, KIUC expanded minimization, avoidance, and mitigation actions beyond the scope of the Short-Term HCP and consistent with the development of the longer-term HCP.

Before the Short-Term HCP was prepared, relatively little was known about the distribution, population, and behaviors of the three listed seabirds on Kauaʻi, or the extent of the effects of KIUC's facilities and operations on these species. Thus, a central purpose of the Short-Term HCP was to have KIUC, in concert with multiple conservation partners, implement a suite of specific monitoring and research projects and use the resulting new information to inform the development and implementation of a subsequent HCP that would have a longer permit duration.

At the time the take authorization for the Short-Term HCP was issued to KIUC in 2011, USFWS and DOFAW expected that KIUC would receive longer-term take coverage under the *Kauaʻi Seabird Habitat Conservation Plan* (KSHCP). However, by 2015, a decision was made that KIUC needed to prepare a separate longer-term HCP covering only KIUC's facilities and operations that could result in take of the three listed seabirds. Through KIUC's Short-Term HCP powerline monitoring plan, the overhead lines have been shown to also adversely affect five species of waterbirds including Hawaiian goose, Hawaiian duck, Hawaiian coot, Hawaiian stilt, and Hawaiian common gallinule; however, these adverse effects to waterbirds are far less than the powerline collision impacts to seabirds.

In collaboration with USFWS and DOFAW, KIUC has been developing the new HCP that will likely have a permit term of 30 to 50 years and would address the potential for take through powerline collision of three species of threatened and endangered seabirds including Newell's shearwater, Hawaiian petrel, and band-rumped storm petrel, and five threatened and endangered species of waterbirds including Hawaiian goose, Hawaiian duck, Hawaiian coot, Hawaiian stilt, and Hawaiian common gallinule. The longer-term draft HCP is expected to be ready for submission to the Endangered Species Recovery Committee and for public review in the fourth quarter of 2022. Because the new HCP is being developed in collaboration with USFWS and DOFAW, a Federal Incidental Take Permit and State Incidental Take License is anticipated as a result of completion and approval of the new HCP. More than 10 years of data collected by KIUC and its HCP partners through the Short-Term HCP and informed by KIUC's conservation activities conducted over the last 11 years. KIUC is already implementing almost the full suite of conservation actions (minimization, avoidance, and mitigation) included in the longer-term draft HCP. The HCP conservation actions associated with powerline collision impacts include the following:

- Reduction of powerline collisions by 65% through a minimization plan including static wire removal, undergrounding lines, reconfiguration of lines, and installation of reflective and LED diverters.
- Powerline monitoring and reporting of collisions.
- Protect and expand seabird colonies by managing 10 conservation sites. Management actions would include:
  - Monitoring of identified seabird colonies
  - Predator control within conservation sites
  - Construction of predator exclusion fences at two conservation sites
  - Implementation of social attraction techniques to expand seabird colonies within protected conservation sites
  - Vegetation management to improve habitat around seabird colonies within conservation sites
- Monitoring and tracking of seabird population dynamics
- Funding of Save our Shearwaters Program, which provides rehabilitation services for both seabirds and waterbirds

KIUC submits annual reports to USFWS and DOFAW summarizing HCP minimization, avoidance, and mitigation actions for each calendar year which includes reporting on all the data collected under the HCP. Also, the KIUC HCP team conducts monthly meetings with USFWS and DOFAW to provide monthly progress reports on HCP actions and to discuss any issues and/or concerns that need addressing. In addition, the KIUC HCP team meets with USFWS and DOFAW once annually, typically in October, to discuss the ongoing development of the HCP, provide year to date summaries of HCP actions for that year, and review and discuss scopes of work and workplans for the following year.

The location of the new West Kauaʻi Energy Project Interconnection Line on Mānā Plain is within an area considered to have relatively low risk of seabird collisions based on over 10 years of powerline monitoring data conducted to date. However, due to the high presence of waterbirds in the Mānā Plain area there is a higher risk of waterbird collision with the new West Kauaʻi Energy Project Interconnection Line. Monitoring of other overhead lines on Mānā Plain indicate some risk of powerline collisions to threatened and endangered waterbirds and one species protected by the Migratory Bird Treaty Act (MBTA): the black-crowned night heron. The potential level of impacts for both waterbirds and the black-crowned night heron is small but does exist. Monitoring for one year of a different interconnection line also located on Mānā Plain in the same general area of high waterbird activity resulted in documentation of one powerline collision of a Hawaiian goose and one powerline collision of a black-crowned night heron. Based on minimization monitoring through the end of 2021 by species expert biologists, minimization actions in the form of reflective diverter installation on the lines shown to pose risk on Mānā Plain has proven effective in reducing powerline collisions by an estimated 90% for the species of concern in this area.

The new overhead West Kauaʻi Energy Project Interconnection Line would include the following HCP minimization applications:

- Removing approximately 2 miles of existing overhead powerlines between PMRF and Polihale State Park
- Limiting height of lines to the extent possible while still complying with applicable safety codes, federal and PUC guidelines.
- Limiting the number of layers on poles to the extent possible while still complying with applicable safety codes, federal and PUC guidelines, meaning lines are configured with on the horizontal plane rather than vertical.
- Installing reflective or LED diverters.

In addition, as part of the HCP, the new overhead line would be monitored specifically as a new line on the system, and long-term as part of KIUC's electrical overhead transmission system. This means that initially after installation, focused monitoring of the new overhead line would occur for at least one year and may be extended beyond one year if the data suggest further focused monitoring is needed. This type of initial monitoring is designed to determine the level of risk introduced by the new line, if the minimization is effective, and whether other minimization may be appropriate. As part of the HCP there is also system-wide monitoring that incorporates any new overhead lines as they are constructed into the HCP long-term monitoring plan, which would extend throughout the entire HCP term. If take of threatened or endangered species were to occur as a result of the new West Kauaʻi Energy Project Interconnection Line, it would be covered through KIUC's HCP take limit and anticipated Federal Incidental Take Permit and State Incidental Take License.

While development of the longer-term HCP is still underway and not available for public review at this time, KIUC is already implementing most HCP actions and protocols included in the plan related to powerline risks to threatened and endangered seabirds and waterbirds. KIUC is in compliance for takes associated with powerline collisions of threatened and endangered seabirds and Hawaiian waterbirds. HCP-related minimization also reduces potential impacts to MBTA species.

4.1.2.18 Kekaha Ditch and Existing Mānā Plain Irrigation Delivery

Current Site Conditions

Kekaha Ditch (Credit: University of Chicago)

Construction of Kekaha Ditch started in May 1906 and was completed in September 1907. Kekaha Ditch conveyed water diverted from the Waiahulu Stream, Koaiʻe Stream, and Waimea River and originally extended through 16 miles of mauka lands and 4 miles through the lowlands (Wilcox, 1996). The diversions on Kekaka Ditch were typical plantation style passive diversions that diverted all water into the ditch system during low and normal flows. This water was used to irrigate plantation lands of the Kekaha-Mānā Plain. By 1920, water from Kekaha Ditch, which connected with the pre-existing Mānā Pump Ditch, was being used to irrigate approximately 2,700 acres of land.

Currently, the Kekaha Ditch Irrigation System diverts water from the Waimea River from three diversions: Koaiʻe, Waiahulu, and Waimea. The water in Koaiʻe Stream runs through a short tunnel that daylights approximately 100 feet above the Waiahulu Diversion into Waiahulu Stream. At the Waiahulu Diversion, combined Koaiʻe and Waiahulu flows are diverted into Kekaha Ditch and runs through a series of sections of open ditch and 23 tunnels to a steel penstock. The water entering the steel penstock is transported to the existing Waimea (Mauka) Hydropower Plant where hydroelectrical energy is generated. The Waimea (Mauka) Hydropower Plant is discussed below. Water is discharged into Waimea River at the Waimea (Mauka) Hydropower Plant tailrace. The diversion for the main portion of the Kekaha Ditch System is located immediately downstream of the tailrace of the Waimea (Mauka) Hydropower Plant, where water is diverted from Waimea River at the Waimea Diversion. From the Waimea Diversion, water travels through the Kekaha Ditch along the east side of Waimea Canyon following the alignment of the Waimea River through a series of lined and unlined ditch sections and through two flumes, the Pali Flumes, located just under a mile south of the existing Waimea (Mauka) Hydropower Plant. Beyond the flumes, Kekaha Ditch continues in a southernly direction in a series of lined and unlined sections to the “Black Pipe” siphon, which crosses the Waimea River from the east to the west side. After crossing the Waimea River, Kekaha Ditch continues south on the west side of the Waimea River through mainly unlined ditch sections and two tunnels. A wooden diversion structure is present in this section that allows ditch water to be returned to the Waimea River (Element Environmental, 2016).

At Waimea Canyon Drive/Highway 550, Kekaha Ditch crosses under the highway and contines in a westerly direction and delivers irrigation water to the Mānā Plain. In January 2015 a new section of four-inch pipe was constructed to supply the Menehune Ditch with water from the Kekaha Ditch Irrigation System. Menehune Ditch channels water through the lower portion of the Waimea River Valley to individual taro farmers. Approximately 0.25-mile northwest of Waimea Canyon Drive/Highway 550, a diversion structure diverts water from the main Kekaha Ditch Irrigation System to two former plantation reservoirs above the town of Waimea. This water is used by the Waimea Wastewater Treatment Plant. Approximately 1.5 miles northwest of Waimea Canyon Drive/Highway 550, a relatively small amount of water enters the Kekaha Ditch Irrigation System from water discharged into fallow fields from the terminal end of the Kōkeʻe Ditch Irrigation System. Further west, a small reservoir believed to be used for firefighting purposes receives water from the Kekaha Ditch Irrigation System (Element Environmental, 2016).

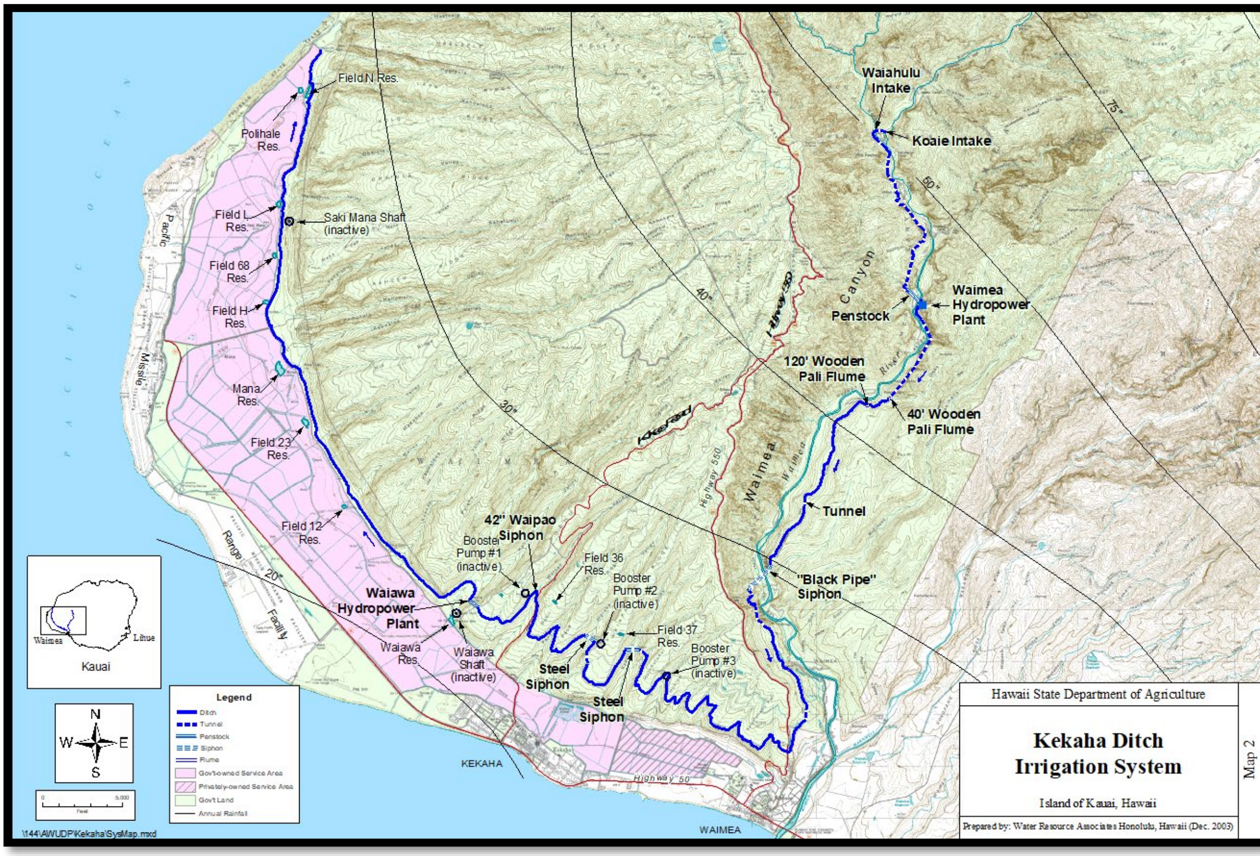
Beyond this, the unlined Kekaha Ditch runs from the northwestern side of Kapilimao Valley to Kōkeʻe Road along the hills above the town of Kekaha and then continues from Waipao Valley to just past Hoʻea Valley. Approximately 1.5 miles west of Kekaha, water in Kekaha Ditch enters a steel penstock and is delivered to the Waiawa Hydropower Plant, discussed below. At Waiawa, water is also diverted from the main Kekaha Ditch to the 9 MG capacity Waiawa Reservoir. Past the Waiawa Hydropower Plant, Kekaha Ditch travels along the base of the bluffs that abut the Mānā Plain. From this section of the Kekaha Ditch Irrigation System, water is routed to three unlined, earthen reservoirs: Field 12, Field 23, and Mānā. These reservoirs serve as forebays to filter stations used to provide water or drip and sprinkler irrigation to the surrounding agricultural fields. However, as discussed in **Section 4.1.2.13**, Mānā Reservoir is currently drained and overgrown and currently Kekaha Ditch flow bypasses Mānā Reservoir through a buried HDPE pipe. The current storage capacity of Field 12 and 23 Reservoirs is unknown due to the accumulation of sediments and lack of maintenance. Beyond this point, the Kekaha Ditch Irrigation System runs northward from Kaʻawaloa Valley to the Field N Reservoir at the end of the system at Polihale State Park.

The Kekaha Ditch Irrigation System includes two hydropower plants: Waiawa Hydropower Plant and Waimea (Mauka) Hydropower Plant.

- **Waiawa Hydropower Plant:** Built in 1908 and located near the end of the system. The plant has a 500-kW capacity and optimally operates using 21 MGD of water to produce around 425 kW of electricity. The power generated by the Waiawa Hydropower Plant is transmitted via powerlines to various booster pumps on the Mānā Plain to irrigate the fields as well as to the dewatering pumps at Kawaiʻele, Nohili, and Kekaha (Element Environmental, 2016).
- **Waimea (Mauka) Hydropower Plant:** Built in 1911 on the west bank of the Waimea River. The original plant was destroyed in 1948 by a large flood event, and a new plant was constructed in 1952 on the east bank of the Waimea River. The plant has a maximum capacity of 1,200 kW but generally runs at 1,00 kW using 34 MGD of water. The power generated by the Mauka Hydropower Plant is transmitted via powerlines that run up the western slope of Waimea Canyon towards Kōkeʻe (Element Environmental, 2016).

The Kekaha Ditch Irrigation System is shown in **Figure 4.55**.

Figure 4.55. Kekaha Ditch Irrigation System



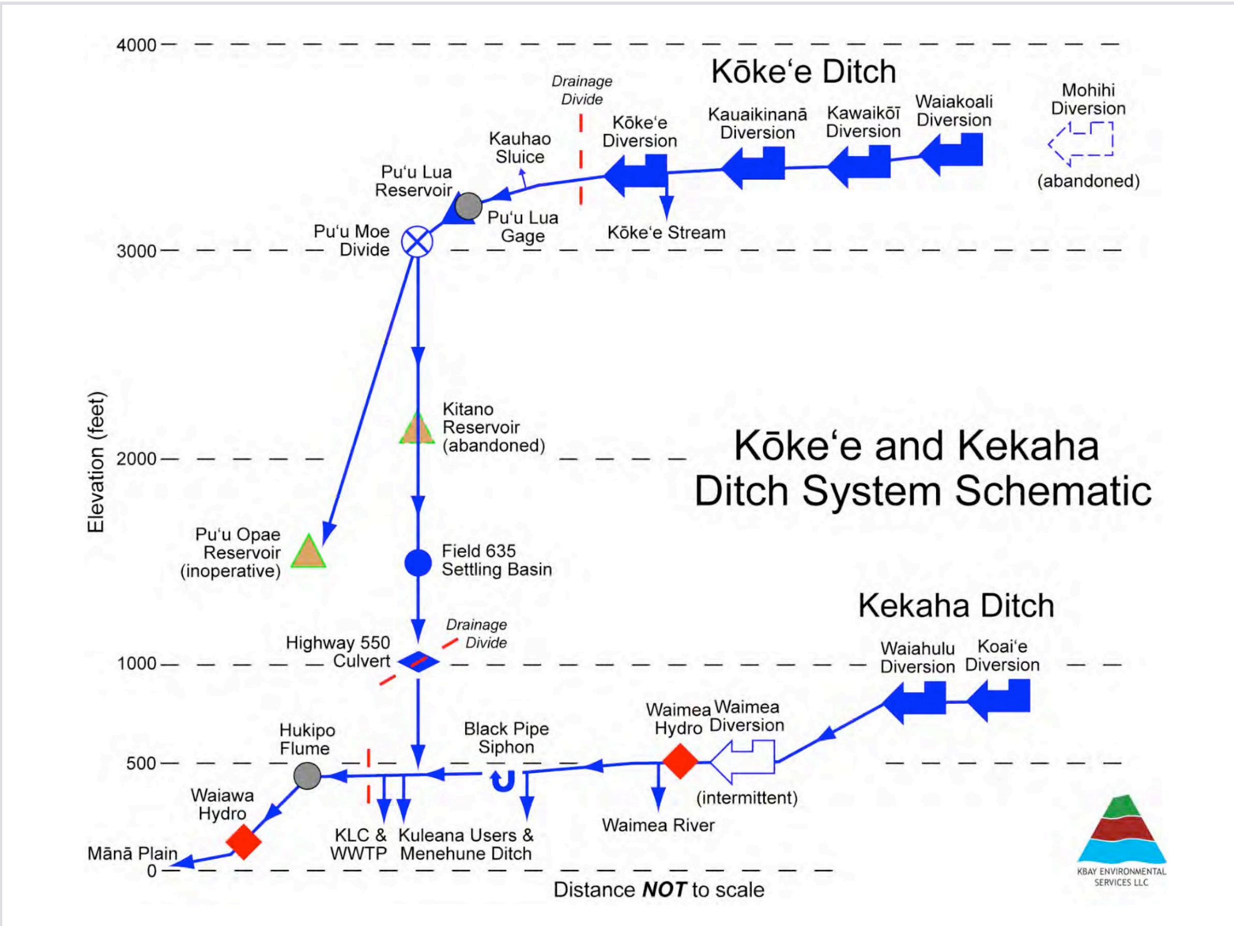
Current Operations

KAA, under agreement to ADC, operates and maintaines the Kekaha Ditch Irrigation System, which currently supplies irrigation water for agricultural activities on Mānā Plain for KAA members, other ADC tenants, Menehune Ditch, Waimea Wastewater Treatment Plant, and other water users along the Kekaka Ditch Irrigation System alignment. Water delivered through the Kekaha Ditch Irrigation System is used to irrigate several agricultural crops including taro, papayas, banana, eggplant, citrus, melons, green onions, coffee, alfalfa, corn, soy, sunflower, and cover crops grown on approximately 2,800 acres of land on Mānā Plain based on February 2022 reports to CWRM. Other Kekaha Ditch water users on Mānā Plain include Kīkīaola Land Company, one Kuleana owner, Shredco, and Waiaka Hog Farmers Cooperative. The estimated average daily water demand between 2010 and 2014 self-reported by the major KAA tenants averaged approximately 5.8 MGD during this five-year period (Element Environmental, 2016). Reported water usage in February 2022 was approximately 2.5 MGD.

KAA monitors both instream flow volumes at Kekaha Ditch Irrigation System stream diversions and volume of flow at certain locations along Kekaha Ditch including the Hukipo flume, which is located approximately 2.45 miles from where the ditch exits the Waimea River watershed. Monitoring of Kekaha Ditch Irrigation System stream diversions and water flow at Hukipo flume is based on the Waimea Mediation Agreement and required monitoring for IFS for Kekaha Ditch.

The Kekaha Ditch Irrigation System delivers water to the Menehune Ditch through a 4-inch pipe. Currently, a small volume of water, estimated to be approximately 1 MGDfrom the tailend of the southern branch of the Kōke'e Ditch Irrigation System supplements Kekaha Ditch flow upstream of Menehune Ditch. The connection between Menehune Ditch and Kekaha Ditch and the current location of where water from Kōke'e Ditch Irrigation System supplements Kekaha Ditch is shown in the line diagram below.

Figure 4.56. Kōke'e and Kekaha Ditch System Schematic



As noted in **Section 4.1.2.13**, Mānā Reservoir is not in operation and is currently bypassed via an HDPE buried pipe that runs from Kekaha Ditch upstream of Mānā Reservoir to a filter station, from which water is dispersed to tenants.

For the last several years, KAA has been developing plans for replacing the section of Kekaha Ditch between Mānā Reservoir and Polihale State Park with a pressurized pipe system to reduce water loss, increase efficiency, and reduce maintenance costs.

KAA and ADC have been actively working with farmers to increase diversified agriculture on Mānā Plain. Currently there is active development of plans for approximately 100 acres of taro lo'i in the fields immediately adjacent to Mānā Reservoir. It is anticipated that the taro lo'i cultivation will receive irrigation water directly from Mānā Reservoir after West Kaua'i Energy Project is in service. There is also current development of extensive melon cultivation on Mānā Plain.

Energy is generated from two existing hydropower plants on the Kekaha Ditch Irrigation System. Waimea (Mauka) Hydropower Plant is located in Waimea Canyon and receives water from the Waiahulu and Koaiʻe Diversions. The mean daily power generated from the two hydropower plants from 2010 to 2015 was 432 kW and 328 kW respectively (CWRM, 2016). KAA has plans to repower the Waiawa Hydropower Plant based on irrigation demand as required by the Waimea Mediation Agreement. Energy generated by Waimea (Mauka) and Waiawa Hydropower Plants is used by KAA as sources of power for their farming operations. Excess power is sold to KIUC through a PPA.

Proposed Operations

Operations of the Kekaha Ditch Irrigation System is not part of the Proposed Action. The only portion of the Kekaha Ditch Irrigation System affected by the Proposed Action is the rehabilitation and use of Mānā Reservoir as described in **Section 4.1.2.13**. Historically, the Kōkeʻe and Kekaha Ditch Irrigation Systems did not connect and operated simultaneously but separately, serving diffrent areas of land. The Proposed Action would connect Mānā Reservoir with the Kōkeʻe Ditch Irrigation System in that flows from Kōkeʻe Ditch and associated diversions would be delivered to Mānā Reservoir through the Project via the new penstocks. As noted above, the Mānā Reservoir is not currently operating as part of the Kekaha Ditch Irrigation System and has been bypassed with an HDPE buried pipe.

In recent years, KAA installed a pipe at the end of the southern branch of the Kōkeʻe Ditch Irrigation System that delivers water to Kekaha Ditch. During the Proposed Action, there would be no change to this infrastructure and through this connection, West Kauaʻi Energy Project would be able to deliver water to Menehune Ditch as a back-up source when the Kekaha Ditch Irrigation System is closed for repairs or maintenance. There are no other changes to the Kekaha Ditch Irrigation System infrastructure or operations associated with the Proposed Action.

4.1.3 Solid and Hazardous Waste Management

4.1.3.1 Decommissioning

At the end of the operational life of the Project, system components would be decommissioned as described below. In accordance with the land agreements (and where applicable, HRS Section 205-4.5(a)(21)), decommissioning would involve removal of certain equipment associated with the Project and returning the Project area to substantially the same condition as existed prior to Project development. Because decommissioning is not expected to occur for many years, a specific end-of-life management plan would be developed during the term of the Project that would include compliance with all rules, regulations, best practices, and land agreements in effect at the time. Based on information available today, the activities that would be expected to occur as part of decommissioning are summarized below[4].

[4] Decommissioning activities would be conducted in accordance with all relevant ordinances and regulatory requirements that are in place at the time of decommissioning. Because decommissioning would not be expected to occur for many years, and given that regulatory requirements could change, the applicable permitting and

While it is difficult to stipulate what may be appropriate and allowable for end of useful life disposition 25 – 50 years or more from now, the Project understands its responsibility for removing equipment and restoring the site to its original condition at the end of the Project life, in accordance with laws, ordinances, regulations, and standards. Decommissioning would commence once the Project has been fully de-energized and isolated from all external electrical connections, in coordination with KIUC. Consistent with the measures described for construction and operation of the Project, BMPs would be implemented and maintained throughout the decommissioning phase as needed to avoid and minimize potential impacts to the surrounding environment, particularly those related to dust, erosion, and stormwater. The complete decommissioning consists of the disassembly, removal, and disposal of (1) solar PV modules and racking system, including steel posts; (2) battery units; (3) inverters and transformers; (4) electrical wiring and connections; (5) substation components; (6) hydroelectric powerhouse and pumping station components; (6) communication equipment; and (6) fencing. Following removal of Project equipment, site restoration would be conducted as described further below.

Disposal, Salvage and Reuse During Decommissioning

The decommissioning would be conducted in accordance with industry standards, rules, regulations, and laws in effect at the time. Equipment and materials would be salvaged or recycled to the extent feasible and in coordination with licensed sub-contractors, local waste haulers, and/or other facilities that recycle construction/demolition waste; the remaining materials would be disposed of by the contractor at authorized sites either on island or on the mainland in accordance with applicable laws. All waste requiring special disposal (e.g., transformers) would be handled according to regulations that are in effect at the time of disposal. Some equipment may require draining of oil or gasses before disposal (e.g., transformers, certain substation/switchyard equipment). Locations of authorized centers for disposal, recycling and salvage centers would be determined closer to the time of decommissioning and could be either on island or on the mainland.

Transformers

It is currently envisioned that transformers, substation equipment, and certain transmission infrastructure will be drained of any oil or gases, and the empty items will be recycled or disposed of accordingly, at an accepting facility. The oil that is drained will be tested and, if it meets spec used oil criteria, will be used as fuel for KIUC's Port Allen diesel generating units, assuming that spec used oil is still allowed to be used/disposed of in such a manner at that time in the future. In the event that the drained oil does not meet spec used oil criteria or is not able to be used as fuel, it will be disposed of according to the applicable regulations in effect at the time of disposal. It can be assumed that foundation rubble and general waste would be transported to a landfill while grounding transformers, bus bars and other valuable materials would be taken to a reprocessing center for salvage value.

regulatory requirements would be reviewed with the appropriate local and state agencies prior to decommissioning activities to ensure compliance.

Transformers that are damaged or at the end of their useful life would be repurposed, salvaged, and/or recycled either locally or on the mainland.

PV Modules, Associated Support Systems, and Collection Systems

The solar panels would be repurposed, salvaged, and/or recycled. Currently, damaged solar panels are consolidated into pallets and sent to the mainland for recycling/disposal. However, because decommissioning of the Proposed Action isn't expected to occur for many years, an end-of-life treatment plan would be developed during the term of the Proposed Action based on all rules, regulations and industry standards in effect at the time. Since the panels have a useful life exceeding 30 years, they can still be used for energy production (either via extending the PPA or for other applications locally or on the mainland). Businesses are forming that will buy back solar panels at the end of their PPA, and this may be an option at the time of decommissioning. Solar panels that cannot be re-purposed would be recycled or disposed of in accordance with all regulations, guidelines, and requirements as well as standard industry practices in effect at the time, including compliance with HAR 11-273.1, Hazardous Waste management: Standards For Universal Waste Management.

Solar panels are expected to still have residual value even at the end of their useful life. Because many of the materials that comprise a solar panel are recyclable, the solar panels can be delivered to a recycling facility for treatment. Several such centers exist across the mainland at this time. Other raw materials that make up the PV support system such as aluminum, steel, and copper will be recycled or salvaged for scrap value either locally or on the mainland.

BESS

Currently, batteries are delivered back to a facility overseas or in the mainland as designated by the manufacturer. The disassembly and removal of all materials from the Project site, high-grade materials such as the containerized steel containers, and large copper cabling, can be sent to reprocessing centers for salvage value.

Penstocks and Pumped Storage Hydroelectric Equipment

Penstocks and the pumped storage hydroelectric equipment have a useful life of 80 to 100 years, and are expected to have a residual value even at the end of their useful life. The penstocks and pumped storage hydroelectric equipment, in accordance with the land agreements, may be transferred to the landowner if desired at the end of the Project. If the landowner does not want the penstocks and/or other equipment, the components would be decommissioned and removed from the Project site and reused, salvaged, recycled, or disposed of either locally or on the mainland.

Restoration

Following removal of the Project equipment, site restoration would be conducted such that the physical conditions of the Project area are returned to substantially the same condition as existed prior to the Project development; these activities may include (1) removal of gravel and other aggregate material, (2) localized grading and disking to match surrounding elevations and/or aerate soil, (3) replacement of topsoil, and (4) revegetation of disturbed areas with an appropriate hydroseed mix. Decommissioning would occur within a reasonable amount of time from the conclusion of Project operation. Decommissioning plans would be communicated with the landowner, the public, and the regulatory agencies prior to and during the decommissioning phase, as appropriate.

Decommissioning Financial Security

Prior to the start of commercial operations, the Applicant would deliver financial security in the form of a Letter of Credit, bond, or similar financial instrument) to cover the estimated cost of decommissioning in accordance with the applicable land agreements. Typically, the estimated cost of decommissioning is prepared by a licensed engineer, architect, or contractor with experience in the scope of similar construction. Proof of the financial security would be delivered to the appropriate county planning commission prior to the commencement of commercial generation, as required in HRS Section 205-4.5

4.1.3.2 Waste Management

The following is a summary of planned waste management procedures for once operational, including handling of damaged materials that require replacement:

- Trash stored outdoors will be stored in trash cans or dumpsters with lids. The Applicant will contract for trash removal from the Project area to the Kekaha Landfill and will not rely on municipal services.
- If any waste stream is determined to be hazardous, then the hazardous waste would be accumulated and stored in accordance with all the applicable local, state and federal regulations.
- All hazardous waste containers will be marked with a Hazardous Waste label containing the following: the words "Hazardous Waste," generator name, generator address, contents, hazardous properties (toxic, flammable, corrosive, etc.), physical state (e.g. liquid or solid), the accumulation start date, and storage start date.
- Hazardous waste containers will be in good condition, compatible with the waste stored inside, and will be kept closed when not in use. Liquid hazardous wastes will not be stored in open top drums.
- Aisle space will be provided between hazardous waste containers in storage.
- Incompatible hazardous waste will not be placed in the same container.
- Secondary containment will be provided for liquid hazardous wastes in containers of 55-gallon capacity or greater.
- Employees who handle hazardous waste will receive training.
- Universal waste, such as solar panels, will be disposed of in accordance with HAR 11-273.1

Employees who sign hazardous waste manifests will have current U.S. DOT HazMat training.

The Applicant understands that the current local landfill in Kekaha has limited capacity. However, it is up to Kauaʻi County to determine if, when and where a new landfill would be established. In situations where landfill capacity is limited and would not be able to accommodate Project waste, overflow waste would be disposed of on the mainland at appropriate recycling and disposal facilities.

Waste Treatment

The applicant does not intend to treat hazardous wastes onsite.

Waste Testing Methods

Any testing conducted to classify potential RCRA Hazardous Waste will use a method(s) included in the EPA publication, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846).

Transportation

All wastes will be hauled offsite via truck. Hazardous wastes will be transported using insured and registered hazardous waste haulers under a Uniform Hazard Waste Manifest. Hazardous wastes and materials transported from the site in containers will be packaged in a Department of Transportation (DOT) approved shipping container appropriate (e.g. correct packing group) for the waste in question.

Disposal and Treatment Facility

A profile will be generated for each hazardous or special waste stream with the disposal/treatment facility for review and approval by the Applicant prior to the initial waste pickup. Applicant will confirm that the proposed facility is licensed to accept the waste in question and does not have any record of serious regulatory violations.

Waste Management During Facility Closure

After a planned, unplanned, or temporary facility closure any stored hazardous waste containers will be transported offsite as detailed in the procedures above as soon as practical, by a licensed contractor.

4.2 No-Action Alternative

4.2.1 General Concerns

Under the No-Action Alternative, the integrated renewable energy and irrigation Project would not be constructed resulting in several outcomes and impacts as follows:

- **Energy Generation on Kauaʻi**

  The No-Action Alternative would result in difficulty in reaching the State mandate of 100% renewable energy and would likely result in the continued reliance on fossil fuel generation for extended lengths of non-solar hours. Solar plus battery is not a direct replacement of the Project, as discussed in **Section 4.3.1.2**. Limiting KIUC to only solar plus battery options as renewable penetration increases would result in decreased system reliability, the increased likelihood of outages during extended cloudy and rainy periods, and increased costs to members for alternative storage solutions. **Section 4.3.1.1** includes a discussion on the limitations and/or infeasibility of other renewable technologies on Kauaʻi.

  Renewable energy options on Kauaʻi are limited to hydropower, solar plus battery, and biofuel. West Kauaʻi Energy Project is the only realistic utility scale hydropower and pumped storage Project on Kauaʻi. Under the No-Action Alternative, Kauaʻi energy resources would be limited to solar plus battery, small existing hydropower, and biofuels. The high cost of biofuels makes the use of biofuel on Kauaʻi prohibitive. KIUC's electricity generation portfolio already includes a high penetration of solar plus battery. Due to limitations on battery storage duration and significant cost increases in long duration battery storage, it is not feasible to replace the long duration storage available through West Kauaʻi Energy Project with solar plus battery. In addition, hydropower generation is an important generation resource for Kauaʻi due to the nature of the natural resource. Hydropower generation is generally available and at peak capacity during high rain, storm, and multi-day cloudy events when solar is not available. This type of balancing of natural resource availability is an important component of KIUC's Strategic Plan for stabilization of electrical generation and customer's electricity rates.

- **Instream Flow Standards**

  Under the No-Action Alternative, the Phase One IIFS as established by the Waimea Mediation Agreement would remain in effect. The modifications necessary to implement the Phase One IIFS for the four diversions on the Kōkeʻe Ditch Irrigation System would be completed by KIUC after all permits, approvals, and necessary land easements are received. These modifications would occur under a separate and independent Project from the Proposed Action and are discussed in more detail in **Section 1.2.2**. The Waimea Mediation Agreement is included as **Appendix A** in this Final EA. **Table 4-20** provides a comparison of the Phase One and Phase Two IIFS Rules.

Table 4-20. Comparison of Phase One and Phase Two IIFS Rules

Stream	Phase One IIFS	Phase Two IIFS		
	Set value in any flow conditions	Established Value	Phase Two IIFS if stream flow is below or equal to established value	Phase Two IIFS if streamflow is above the established value
Kōkeʻe	0.2	0.2 MGD	Natural flow up to 1.2 MGD	Natural flow up to 1.2 MGD
Kauaʻikinanā	1.2	1.2 MGD	2/3 of stream flow	0.6 MGD
Kawaikōī	6.4	6.4 MGD	2/3 of stream flow	4.0 MGD
Waiakōali	1.3	1.3 MGD	2/3 of stream flow	0.8 MGD

- **Stream Flow**

  If the West Kauaʻi Energy Project is not constructed and water needs along Kōkeʻe Ditch remain consistent with current uses, more water on average would remain in the Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe Streams than during West Kauaʻi Energy Project operation. The Phase One IIFS was set based on current water needs along Kōkeʻe Ditch at the time of CWRM approval in April 2017 and did not account for DHHL's water reservation of 6.93 MGD.

In the absence of West Kauaʻi Energy Project and based on existing water uses estimated to be approximately 1.5 to 2 MGD along the Kōkeʻe Ditch, more water on average would be left in Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe Streams than during West Kauaʻi Energy Project operations and streamflow volumes would be expected to remain relatively consistent with what they are currently. This flow left in the four streams under current conditions and in the absence of West Kauaʻi Energy Project provides an overall average increase of stream flow into Poʻomau and Waiahulu Streams upstream of the Waiahulu Diversion. This increase in available stream flow also results in an increase to available stream flow for diversion into Kekaha Ditch.

The Phase One IIFS modifications would improve the diversions to increase reliability of implementation of the IIFS at the diversion rather than being diverted into the ditch and then returned to the stream a few hundred feet downstream of the diversion. However, automatic gates would not be installed at the four diversions, and manual operations for Kōkeʻe Ditch Irrigation System diversions would continue and be required to meet the Phase One IIFS. This means that during changing flow conditions, ditch operators would have to go to the site to make changes to pani boards and/or gate adjustments. Site access would have limitations during rain and/or storm events that affect road conditions and ford crossings, and limitations to site access would result in delays to gate and pani board adjustments. This could result in short-term periods where the Phase One IIFS would not be met at the point of diversion until after gate and/or pani board adjustments could be made. The exception to this is Kōkeʻe Stream, which would retain all-natural flow due to the Phase One IIFS modifications.

Monitoring of stream flow and ditch flow would be limited to monitoring devices installed through the Phase One IIFS modifications. Also, there would be no stream flow gage installed on Kōkeʻe Stream.

- **Habitat Needs for Native Species**

  Due to the Kōkeʻe Ditch diversions being located at the back end of the watershed, West Kauaʻi Energy Project diversions are expected to have minimal impact on native stream habitat for aquatic species of concern (see **Section 5.3.2**). In the absence of West Kauaʻi Energy Project, there may be small improvements over time to native stream habitat between the Kōkeʻe diversions and Waiahulu Diversion. However, since minimal impacts are expected as a result of the Kōkeʻe diversions, minimal improvement above Waiahulu Diversion is expected from reduced diversion volumes. The results of the West Kauaʻi Energy Project Diversion Assessment using the HSHEP Model indicates that 98% of suitable habitat for aquatic species of concern is located downstream of the Waiahulu Diversion on the Kekaha Ditch Irrigation System with only ʻōpae kalaʻole (*Atyoida bisulcata*) having a small portion (3%) of its suitable habitat above the Kōkeʻe diversions and in the reaches between the Kōkeʻe diversions and the Waiahulu Diversion. As a result of this expected distribution of aquatic species of concern, impacts found lower than the Waiahulu Diversion on the Kekaha Ditch in the watershed have a greater effect than those further upstream at the Kōkeʻe diversions or in the reach between the Kōkeʻe diversions and Waiahulu Diversion. Also, stream surveys for the West Kauaʻi Energy Project

Diversion Assessment were conducted after adoption of the Phase One IIFS, and restoration of streamflow at Kōkeʻe diversions occurred to the greatest extent possible without modification work that required permits. As noted in **Section 1.2.2.1**, the stream flow still diverted at each site but not needed for existing water uses on the system is returned a few hundred feet downstream of each diversion. Therefore, the restored flow from the Phase One IIFS in Poʻomau and Waiahulu Streams (upstream of Waiahulu Diversion) has already occurred and was an existing condition during the time of the West Kauaʻi Energy Project stream surveys.

The potential impacts to suitable habitat downstream of Waiahulu Diversion for aquatic species of concern would be entirely dependent on Kekaha Ditch operations. An IIFS has been set for the Kekaha Ditch diversions and Waimea River below Kekaha Ditch diversions, the values of which are the same value both prior to West Kauaʻi Energy Project operation and post West Kauaʻi Energy Project operation. Therefore, the current IIFS for Kekaha Ditch diversions and Waimea River below Kekaha Ditch would remain the same in the absence of West Kauaʻi Energy Project. Under the No-Action Alternative, current average flow in Waiahulu Stream is expected to continue unless there is a change in water needs along the Kōkeʻe Ditch Irrigation System.

- **Existing Infrastructure**

  Existing infrastructure that would be repaired, utilized, and funded by West Kauaʻi Energy Project is currently owned and managed by three separate State agencies: DLNR, DHHL, and ADC. If West Kauaʻi Energy Project is not constructed, it would be up to these three State agencies to determine whether long-term operations of the existing infrastructure would occur and, if so, how that would be funded. Another possibility is the existing infrastructure would be decommissioned. The fact that portions of the system are managed by different State agencies complicates current operations and would further complicate what would happen in the absence of West Kauaʻi Energy Project. It is not appropriate for the Applicant to speculate on future State considerations and decisions regarding the existing infrastructure. However, for purposes of this analysis and based on Applicant discussions with State agencies managing the existing infrastructure, some possible options have been considered, as discussed in **Section 4.2.2**.

- **New Infrastructure**

  Under the No-Action Alternative, impacts associated with the existing infrastructure entirely depends on the State's decision regarding whether to continue operating the existing infrastructure or to decommission it. As discussed in **Section 4.2.2**, even decommissioning would involve some impacts similar to the Proposed Action.

  Under the No-Action Alternative, new infrastructure associated with the Proposed Action would not be constructed, which includes the Upper and Lower Penstocks, the Puʻu ʻŌpae Powerhouse and Substation, the Mānā Powerhouse and Pump Station, the PV Solar Array and BESS, and the West Kauaʻi Energy Project Substation and Interconnection Line. Vegetation clearing is associated with all these new features except the Interconnection Line.

- **Agricultural and Other Opportunities on Kauaʻi**

  Future opportunities and potential for diversified agriculture on the west side of Kauaʻi would be negatively impacted without the Proposed Action's financial, managerial, and operational contributions.

  - Necessary road repairs would not be completed, and future road repairs and maintenance would remain the responsibility of the State.
  - The cost of necessary improvements to the Kōkeʻe Ditch Irrgation System and the three state-owned reservoirs would be borne by the state and would likely be passed on in whole or in part to agricultural tenants.
  - Enhanced fire suppression capabilities would not be realized if the rehabilitation of Puʻu ʻŌpae and Mānā Reservoirs was not otherwise undertaken.

- **DHHL**

  Under the No-Action Alternative, one of the greatest impacts is those to DHHL and DHHL beneficiaries currently on the Puʻu ʻŌpae lands and those beneficiaries who would have future opportunities for homesteading through DHHL's Puʻu ʻŌpae Kuleana Homestead Settlement Plan. In the absence of the Proposed Action, the implementation of water delivery, repair of roads, and installation of an electrical line to DHHL mauka lands would likely not occur, leaving the lands not viable for the foreseeable future and implementation of the Puʻu ʻŌpae Kuleana Homestead Settlement Plan unlikely (see **Section 1.4**). While it may be possible that DHHL may in the future decide to fund and implement these improvements at Puʻu ʻŌpae, they are not part of DHHL's 20-year plan.

4.2.2 Site-Specific Considerations

4.2.2.1 Kōkeʻe Ditch Irrigation System

The Kōkeʻe Ditch Irrigation System currently serves existing uses but at a very limited capacity. The ditch system is in heavy disrepair in certain sections, specifically the sections between Puʻu Lua Reservoir and Puʻu Moe Divide and the western branch extending through DHHL lands to Puʻu ʻŌpae. Disrepair and lack of regular maintenance on sections of the ditch system have led to erosion issues, failure of water delivery, and repetitive temporary repairs to sections.

It is unknown what will happen with the Kōkeʻe Ditch Irrigation System in the long term if West Kauaʻi Energy Project is not constructed. The maintenance and operation of the Kōkeʻe Ditch Irrigation System involves significant costs, and the Applicant is not aware of any entity other than West Kauaʻi Energy Project that has voiced an interest in continuing the long-term maintenance, operation, and liability of the ditch system. While the Phase One IIFS modifications would be completed by KIUC per the Waimea Mediation Agreement, ownership and operations of the ditch system would remain with ADC and KAA in the absence of West Kauaʻi Energy Project. The cost of any repairs, upgrades, and maintenance to the Kōkeʻe Ditch Irrigation System would not be carried by West Kauaʻi Energy Project and would immediately fall to ADC and KAA, which may be dependent in large part on discretionary legislative appropriations. Farming organizations typically do not produce sufficient revenue to maintain extensive irrigation systems like the

Kōkeʻe Ditch Irrigation System. ADC and KAA have sought legislative appropriations in the past to make repairs to both Kōkeʻe and Kekaha Ditch Irrigation Systems, and it seems reasonable to assume legislative appropriations would be needed to facilitate the ongoing maintenance and operation of the Kōkeʻe Ditch Irrigation System. If West Kauaʻi Energy Project were not in place to provide funding of long-term maintenance and operations, this could result in the continuance of reduced operations at current levels and lower levels of maintenance consistent with current operations. Alternatively, the Kōkeʻe Ditch Irrigation System could be closed or abandoned, in which case there would be no way to deliver water to Puʻu Lua Reservoir, DHHL, ADC mauka lands, and other uses on the system. Decisions involving the long-term operations of the ditch system would be integrally linked with decisions around repairs and operations of Puʻu Lua Reservoir (see **Section 4.2.2.2**).

Maintaining Status Quo of Kōkeʻe Ditch Operations

If operations of Kōkeʻe Ditch Irrigation System by ADC and KAA were to stay consistent with current operations, it would significantly limit DHHL's ability to develop the lands around Puʻu ʻŌpae including DHHL's Puʻu ʻŌpae Kuleana Settlement Plan. The Phase One IIFS does not account for DHHL's water reservation and may need to be amended to allow for that volume of flow to be diverted and delivered to DHHL lands on a regular basis. The condition of the Kōkeʻe Ditch between Puʻu Lua Reservoir and Puʻu Moe Divide and the condition of the western ditch branch extending from Puʻu Moe Divide to Puʻu ʻŌpae Reservoir would require implementation of some deferred maintenance and repairs in order to reliably deliver DHHL's water reservation. These improvements would be outside the scope of current operations.

If operations remained consistent with current status and no repairs or improvements were implemented at the diversions or along the Kōkeʻe Ditch Irrigation System, it would result in less vegetation clearing, less impacts to historic properties, and limitations to agricultural development on the mauka lands.

Modifications and/or Repairs to the Kōkeʻe Ditch Irrigation System

If Kōkeʻe Ditch Irrigation System long-term operations were to be continued in the absence of West Kauaʻi Energy Project, potential impacts associated with vegetation clearing at each diversion site would depend on the level of repairs and/or improvements implemented. If repairs and/or improvements were implemented for long-term operations, they would likely result in similar levels of vegetation clearing and similar levels of impacts to historic properties. The specifics of each diversion site are discussed in more detail below.

Waiakōali Diversion

To continue safe long-term operations at Waiakōali Diversion, the left abutment would require some repair/reinforcement and the overflow weir channel would require sediment removal and clearing. These repairs would require similar levels of vegetation removal as the Proposed Action to complete the work or to gain equipment access to the work area and involve similar levels of impacts to historic properties.

The Phase One IIFS modification work at Waiakōali Diversion that would be completed by KIUC as a separate and independent Project would result in implementation of the Phase One IIFS at the diversion and remote monitoring via satellite but would not involve automatic operations. Therefore, gate changes/settings would require manual operation as it does currently. Equipment installation required for remote data collection would involve the similar levels of impacts to vegetation removal and historic properties as the Proposed Action. The Phase One IIFS modification work would result in remote monitoring of ditch flow and the IIFS remaining at the diversion, which combined would also provide natural stream flow above the diversion.

Kawaikōī Diversion

To continue safe long-term operations at Kawaikōī Diversion, the headwall would require some reinforcement to address scouring and erosion of the ditch wall beneath the concrete form of the headwall and the gate at the tunnel entrance would require some repair. These repairs would require similar levels of vegetation removal as the Proposed Action to complete the work or to gain equipment access to the work area and would involve similar levels of impacts to historic properties as the Proposed Action.

The Phase One IIFS modification work at Kawaikōī Diversion that would be completed by KIUC as a separate and independent Project would result in implementation of the Phase One IIFS at the diversion but would not involve remote monitoring or automatic operations. Manual operations of gate changes/settings would continue, and manual collection of data would be required. The Phase One IIFS modification work would result in monitoring of ditch flow. In the absence of West Kauaʻi Energy Project, monitoring of the IIFS remaining in the stream would not be installed. The IIFS remaining in the stream would be a calculation of natural stream flow monitoring at the existing USGS gage on Kawaikōī Stream and ditch flow collected through monitoring installed with the Phase One IIFS modification work.

Kauaʻikinanā Diversion

Kauaʻikinanā Diversion would not require any immediate repairs to continue safe operations. The diversion structure is in relatively good condition and the gate controlling the ditch tunnel inlet is operable.

The Phase One modification work at Kauaʻikinanā Diversion that would be completed by KIUC as a separate and independent Project would result in implementation of the Phase One IIFS at the diversion but would not involve remote monitoring or installation of automatic operations. The Phase One IIFS modification work would involve monitoring of the ditch flow and the IIFS remaining in the stream, both of which would require manual collection.

Also, through the Phase One IIFS modification work a stream gage would be installed on Kauaʻikinanā Stream, but the location isn't suited for long-term stability and would likely require replacement after high stream flow events. The stream flow gage would be equipped with remote monitoring. Installation of the Kauaʻikinanā Stream gage and monitoring equipment would require similar levels of vegetation removal as the Proposed Action to complete the work or to gain equipment access to the work area. There would be no expected impacts to historic properties in the absence of the Proposed Action at Kauaʻikinanā Diversion.

Kōkeʻe Diversion

Kōkeʻe Diversion would likely require either a gate replacement or gate repairs to continue safe, long-term operations. In addition, the platform providing access to perform gate adjustments is in a state of disrepair and would likely require replacement. These repairs would require similar levels of vegetation removal as the Proposed Action to complete the work or to gain equipment access to the work area and would involve similar levels of impacts to historic properties specific to the gate structure.

The Phase One IIFS modification work at Kōkeʻe Diversion that would be completed by KIUC as a separate and independent Project would result in implementation of the Phase One IIFS at the diversion but would not involve installation of automatic operations. Therefore, manual operation of the gate would continue. The Phase One IIFS modification work would also separate ditch flow from natural stream flow, allowing for more clearly defined monitoring of ditch flow and stream flow. The Phase One IIFS modification work would include monitoring of the IIFS remaining in the stream and monitoring of the ditch flow upstream of Kōkeʻe Diversion but not ditch flow downstream of Kōkeʻe Diversion and would involve remote monitoring via satellite. Natural stream flow of Kōkeʻe Stream could be monitored at the IIFS point during low flows when natural stream flow does not overtop the dam, but there would be no monitoring mechanism in place for Kōkeʻe Stream flow in all conditions.

The Phase One IIFS modification work would require similar levels of vegetation removal as the Proposed Action to complete the work or to gain equipment access to the work area and similar levels of impacts to historic properties.

Decommissioning of Kōkeʻe Ditch Irrigation System

Decommissioning of the Kōkeʻe Ditch Irrigation System would require some work at each diversion to permanently block ditch inlets. Methods to do this could vary widely at each site, but the most permanent solution would be removal of the dams and concrete walls installed at the ditch inlets. This would require similar or greater levels of vegetation removal as the Proposed Action to complete the work or to gain equipment access to the work area and involve similar or greater levels of impacts to historic properties. However, it would also result in increased streamflow in each stream and in the reach of stream between the Kōkeʻe diversions and Waiahulu Diversion. Overall increases in the Waimea River would depend on Kekaha Ditch operations.

Since the Kōkeʻe Ditch Irrigation System is the only reliable source of water for DHHL and ADC mauka lands, if the ditch system were to be closed or abandoned the most significant impact would be to DHHL and other current water users on the system on ADC mauka lands. Future farming opportunities would become extremely limited or nonexistent on all the available agricultural land located mauka of Mānā Plain that have historically been served by the Kōkeʻe Ditch Irrigation System.

In the absence of West Kauaʻi Energy Project, the ability to deliver water from the diversions on the Kōkeʻe Ditch Irrigation System to Mānā Plain would be limited to the current method of tail water from the southern branch of Kōkeʻe Ditch being released into a natural gulch and eventually making its way to Kekaha Ditch. The Kekaha Ditch Irrigation System would remain the sole source of irrigation for agriculture on the Mānā Plain. This means the draw of water from Waimea River and its tributaries to serve water needs outside of the watershed would primarily occur in the middle reaches where the primary habitat for native species occurs.

In summary, the primary result of the No-Action Alternative is that stream flows would remain relatively consistent with what they currently are under the Phase One IIFS assuming current uses on the Kōkeʻe Ditch Irrigation System also remain consistent with current status. Vegetation clearing and impacts to historic properties would likely be similar with repairs and/or improvements or less without repairs and/or improvements.

If West Kauaʻi Energy Project were not in place to provide funding of long-term maintenance and operations, this could result in the continuance of reduced operations at current levels and lower levels of maintenance consistent with current operations, or closure of the Kōkeʻe Ditch Irrigation System.

4.2.2.2 Puʻu Lua Reservoir

Puʻu Lua Reservoir currently does not meet Hawaiʻi State Dam Safety Standards and operations have been limited to 60 feet, which has been used to maintain a limited trout population for fishing and provide some limited storage for irrigation needs downstream of Puʻu Lua Reservoir. In discussions with DLNR Land Division and DLNR Engineering and Dam Safety, it is the Applicant's understanding that Puʻu Lua Reservoir cannot continue operations in its current state. Rehabilitation actions to satisfy Hawaiʻi State Dam Safety Standards are necessary for the reservoir to continue operations even at a reduced capacity. DLNR has conveyed to the Applicant the probable closure of Puʻu Lua Reservoir if West Kauaʻi Energy Project does not go forward, which would also mean closure of the popular trout fishing program. Alternatively, if the State decided to implement rehabilitation of Puʻu Lua Reservoir, the design and level of rehabilitation work would determine the operational capacity after the rehabilitation was completed.

Closure and Decommissioning of Puʻu Lua Reservoir

If Puʻu Lua Reservoir were closed, the reservoir would need to be decommissioned by breaching the dam or some other form of decommissioning acceptable to DLNR Engineering and Dam Safety. Decommissioning is likely to result in some vegetation clearing, the level of which would depend on the details of the work. Because flow delivered through the Kōkeʻe Ditch Irrigation System runs through Puʻu Lua Reservoir, it would impact operations of the Kōkeʻe Ditch System. In this situation, either the Kōkeʻe Ditch Irrigation System would need to also be permanently closed or the State could undertake repairs to the bypass ditch at Puʻu Lua Reservoir and use the repaired bypass ditch to route Kōkeʻe Ditch flow to users downstream on the mauka lands. The bypass ditch currently is inoperable and requires significant repair and tunnel replacement, which would be necessary to convey flow into Kōkeʻe Ditch downstream of Puʻu Lua Reservoir. Repairs to the bypass ditch would involve similar levels of vegetation clearing and impacts to historic properties as with the Proposed Action and would likely also require road improvements similar to the Proposed Action to safely transport equipment to the site.

Decommissioning of Puʻu Lua Reservoir would also result in permanent loss of waterbird habitat. Waterbirds frequent the reservoir even at the currently reduced operational level.

Rehabilitation of Puʻu Lua Reservoir

If rehabilitation of Puʻu Lua Reservoir were to be undertaken by the State, it is likely to result in a similar impact with regards to major infrastructure improvements, vegetation clearing, and road improvements. It is also likely to result in a similar level of impact to historic properties as rehabilitation work would at least require replacing inoperable historic equipment, removal of vegetation on the embankments, regrading of slopes, and the addition of a spillway at the reservoir. However, the automated equipment that would be installed as part of West Kauaʻi Energy Project would likely not be implemented and the reservoir would continue to be operated manually. Manual operations would require someone to access the site, which would be limited during high rain and/or storm events that affect road access.

In the absence of West Kauaʻi Energy Project, any rehabilitation work and long-term operations of the reservoir would remain with the State.

4.2.2.3 Puʻu Moe Divide

Since Puʻu Moe Divide is part of the Kōkeʻe Ditch Irrigation System and owned by ADC and operated by KAA, the previous discussion regarding Kōkeʻe Ditch Irrigation System applies. The function and purpose of Puʻu Moe Divide is to split Kōkeʻe Ditch water and channel it into ditches serving two separate areas of mauka lands: DHHL's lands to the west and ADC's lands to the south. The entire structure is in heavy disrepair and would require repairs to continue operating long-term. The control gate to the ditch segment delivering water to DHHL lands would require replacement. Severe erosion around and downstream of the structure would require remediation of some form to prevent further erosion and continue long-term operations. This work is expected to result in similar levels of vegetation removal and impacts to historic properties as the Proposed Action.

If Kōkeʻe Ditch Irrigation System were permanently closed, Puʻu Moe Divide would no longer be needed. However, as noted above, this would result in no water being delivered to DHHL and ADC mauka lands.

4.2.2.4 Upper Penstock, Western Branch of Kōkeʻe Ditch, and DHHL Storage Tank

Under the No-Action Alternative, the Upper Penstock would not be constructed, and the western branch of Kōkeʻe Ditch would continue to be the only method of water delivery to DHHL's Puʻu ʻŌpae mauka lands. There are current users on DHHL land that draw water from this section of open ditch. This section of Kōkeʻe Ditch is in significant disrepair with several problematic areas that have either been temporarily addressed through short-term repairs or not repaired resulting in erosion, ditch breaches, water loss, and failure of water delivery. In the past few years, KHHA has performed some limited maintenance on portions of this section of ditch on DHHL land, and over several years KAA has contributed to some repairs. Reliable irrigation to DHHL's Puʻu ʻŌpae lands would require DHHL or DHHL tenants to invest significant resources in ditch repairs and long-term maintenance of the open ditch.

Repairs and improvements to this section of ditch are expected to result in some vegetation removal along the full length of the ditch (over 4 miles) and may also result in some impacts to historic properties depending on the level and detail of repairs. It is unknown what level of repairs would be needed to address the erosion and water loss that currently occurs on this section of ditch, and therefore unknown what level of impacts associated work may have.

Under the No-Action Alternative, the DHHL storage tank would not be replaced. The existing tank has been inoperable for some time. Water availability at the DHHL pastoral lots would remain entirely dependent on the volume flowing in the western ditch branch and storage at Puʻu Lua Reservoir during dry periods.

Improvements to Trail One Road would not occur and long-term maintenance of the road would remain the responsibility of the State.

4.2.2.5 Puʻu ʻŌpae Reservoir

Puʻu ʻŌpae Reservoir is not in service and Kōkeʻe Ditch water is being routed into the gulch on the north side of the reservoir. Because Puʻu ʻŌpae Reservoir has not been operational for a number of years and because restoration of the reservoir is not in DHHL's 20-year plan, it seems most likely that the reservoir would be decommissioned in the absence of West Kauaʻi Energy Project. The decommissioning of Puʻu ʻŌpae Reservoir would permanently remove the potential of water storage for irrigation or other uses in the area. Decommissioning of the reservoir would also result in permanent loss of waterbird habitat. Waterbirds frequented the reservoir when it was in service and have been observed at the reservoir on occasion when rainwater is ponded on an intermittent basis.

Alternatively, should DHHL decide to fund the rehabilitation and ongoing maintenance of Puʻu ʻŌpae Reservoir, costs associated with the necessary work would be DHHL's responsibility, which would lead to increased cost to DHHL. Either decommissioning or rehabilitation would involve some vegetation removal at the site at similar levels as the Proposed Action and would result in a similar impact to the historic property.

4.2.2.6 Lower Penstock

The Lower Penstock is a new feature and does not replace any existing infrastructure. Under the No-Action Alternative, the Lower Penstock would not be constructed, and any vegetation removal associated with the Lower Penstock would not occur. Also, the electrical lines that would provide electrical service connection at Puʻu ʻŌpae that would be buried with the Lower Penstock as part of West Kauaʻi Energy Project, would not be installed. This would mean that if DHHL or DHHL tenants on Puʻu ʻŌpae lands wanted electrical service, they would be required to fund installation of electrical lines running several miles from Kaumualiʻi Highway or Mānā Plain.

As part of West Kauaʻi Energy Project, the new Lower Penstock would hydraulically connect the Kōkeʻe Ditch to Mānā Plain. Under the No-Action Alternative, the ability to deliver water from the diversions in the Kōkeʻe Ditch Irrigation System to Mānā Plain would be limited to the current method of tail water from the southern branch of Kōkeʻe Ditch being released into a natural gulch and eventually making its way to Kekaha Ditch. The Kekaha Ditch Irrigation System would remain the sole source of irrigation for agriculture on the Mānā Plain. This means the draw of water from Waimea River and its tributaries to serve water needs outside of the watershed on Mānā Plain would primarily occur in the middle reaches where the primary habitat for native species occurs.

Under the No-Action Alternative, Puʻu ʻŌpae Lower Access Road improvements would not occur. The road is currently not serviceable and would require improvements to facilitate long-term use. Improvements to the lower access road would result in similar levels of vegetation removal as the Proposed Action. Alternatively, the road could be abandoned, which would result in only one road into the Puʻu ʻŌpae area.

4.2.2.7 Mānā Reservoir

Mānā Reservoir is not operational. In 2018, ADC and KAA drained the reservoir and installed a new pipe routing Kekaha Ditch flow around the reservoir to other irrigation infrastructure. The reservoir is covered with heavy vegetation growth and could not be operated without significant rehabilitation and repairs. It is the Applicant's understanding that in the absence of West Kauaʻi Energy Project, ADC and KAA would decommission the reservoir.

Closure and Decommissioning of Mānā Reservoir

If Mānā Reservoir were decommissioned, the work required by Dam Safety for decommissioning, such as breaching the dam, would require some vegetation removal. The extent of vegetation removal associated with decommissioning is unknown but is assumed to be less than full rehabilitation. Decommissioning the reservoir would have similar impacts to historic properties as the Proposed Action since decommissioning would involve the loss of historic integrity and a permanent loss of the structure. It is assumed that permanent closure of Mānā Reservoir would not impact current irrigation operations since the reservoir has been out of use since 2018. However, Mānā Reservoir is the largest storage reservoir on Mānā Plain, and decommissioning would cause permanent loss of the storage capacity of irrigation water delivered through Kekaha Ditch, which could limit agricultural expansion on Mānā Plain. There are smaller reservoirs located on Mānā Plain that are operated by ADC and KAA for purposes of irrigation storage, and it is unknown whether these could provide sufficient storage for potential future agricultural expansion.

Decommissioning of the reservoir would also result in permanent loss of waterbird habitat. Waterbirds frequented the reservoir when it was in service.

Rehabilitation of Mānā Reservoir

It is assumed that ADC and KAA would not undertake rehabilitation of Mānā Reservoir in the absence of West Kauaʻi Energy Project since the reservoir has already been abandoned. However, should this change, rehabilitation would likely not involve enlargement of the reservoir but would still likely result in similar impacts as the Proposed Action with regards to major infrastructure improvements and vegetation clearing. Rehabilitation would likely result in a similar level of impact to the historic property as rehabilitation would require replacement of inoperable historic equipment, regrading of embankment slopes, and the addition of a spillway at the reservoir. However, the automated equipment that would be installed as part of West Kauaʻi Energy Project would likely not be implemented, and the reservoir would continue to be operated manually. Manual operations would require someone to access the site, which typically is not an issue on Mānā Plain even during rain/storm events.

4.2.2.8 Mānā Powerhouse, Pumpstation and Facility Substation

Under the No-Action Alternative, the Mānā Powerhouse, Pumpstation and Facility would not be constructed, and the renewable energy generation and long-term storage benefits of the Proposed Action would not be realized.

4.2.2.9 PV Solar Array

Under the No-Action Alternative, the PV Solar Array and BESS would not be constructed. The land would remain in its current state and available for agricultural use. The land is fallow at this time, but it is assumed it would eventually be licensed for agricultural use since it has been specifically designated for agricultural use and zoned as LSB Class B. Under the No-Action Alternative, the full acreage would be available for agriculture rather than the shared use with solar panels that would result with the Proposed Action. Since the area has been fallow for some time and vegetation growth has occurred throughout the entire area, agricultural use at the site would involve similar levels of vegetation removal as the Proposed Action to convert the fields back into production.

As noted in **Section 5.3.2**, there are no expected impacts to waterbirds or seabirds as a result of the PV Solar Array; therefore, there would be no expected improvements to conditions for waterbirds or seabirds due to the absence of the PV Solar Array.

4.2.2.10 West Kauaʻi Energy Project Substation and Interconnection Line

Under the No-Action Alternative, the West Kauaʻi Energy Project Substation and Interconnection Line would not be constructed. The West Kauaʻi Energy Project Substation would have been constructed on agricultural land adjacent to Mānā Reservoir. In the absence of West Kauaʻi Energy Project, the land would remain in its current state and available for agricultural use. Because the area has been fallow for some time and vegetation growth has occurred throughout the area, agricultural use at the site would involve similar levels of vegetation removal as the Proposed Action to convert the field back into production.

Under the No-Action Alternative, the Interconnection Line would not be constructed and the existing transmission line from Mānā Substation to PMRF Substation would remain in place. Because the new Interconnection Line would be constructed within the existing road edge and does not require any vegetation removal and does not have any impacts to historic resources, there would be no change in impacts to historic resources or associated with vegetation removal. Potential impacts associated with powerline collisions from the overhead interconnection line would be the same with the existing section of transmission line that would be left in place in the absence of West Kauaʻi Energy Project. Thus, there would be no change in potential impacts of powerline collisions in the absence of construction of the new Interconnection Line.

4.2.3 Comparison of Impacts

Table 4-21 provides a comparison between Proposed Action vegetation removal and land use impacts and the No-Action Alternative vegetation removal and land use impacts.

Table 4-21. Comparison of Vegetation and Land Use Impacts Between the Proposed Action and No-Action Alternative

Project Component	Construction Impacts (acres)	Operation Impacts (acres)	No-Action Alternative: Continued Operations with Repairs/Improvements	No-Action Alternative: Closed or Decommissioned
Waiakōali Diversion	0.09	0.01	similar	similar or greater
Kawaikōī Diversion	0.15	0.01	similar	similar or greater
Kauaʻikinanā Diversion	0.11	0.01	similar	similar or greater
Kōkeʻe Diversion	0.03	0.01	similar	similar or greater
Puʻu Lua Reservoir	21.66	17.68	similar	similar or slightly less
Puʻu ʻŌpae Reservoir, Powerhouse, and Facility Substation	40.85	22.59	similar for reservoir - zero for powerhouse	similar or slightly less for reservoir – zero for powerhouse
Mānā Reservoir, Powerhouse, Pumpstation, and Facility Substation	44.82	29.45	similar for reservoir – zero for powerhouse	similar or slightly less for reservoir – zero for powerhouse
Puʻu Moe Divide	0.25	0.09	similar	zero
Upper and Lower Penstock	77.54	47.13	similar vegetation removal for western branch of Kōkeʻe Ditch – zero impacts to land use	zero
PV Solar Array	375.0	285.58	similar vegetation removal – zero impacts to land use	n/a
West Kauaʻi Energy Project Substation	7.47	2.4	similar vegetation removal – zero impacts to land use	n/a
TOTAL	**567.97**	**422.58**	**n/a**	**n/a**

4.3 Alternatives Considered But Not Carried Forward for Further Analysis

4.3.1 Alternative Projects

KIUC has been working steadily towards reducing its dependence on imported oil and shifting its generation portfolio to renewable resources since 2008.

As potential projects are considered, they are constantly compared with other available project and technology alternatives based on cost, risk, and operational characteristics. Technologies have evolved rapidly over the last fifteen years in terms of availability, reliability, and pricing. Many different project types and technologies have been considered through both studies and research as well as Requests for Proposal (RFP) directed at developers and manufacturers of utility scale generation.

4.3.1.1 Unfeasible Technologies

Two common renewable energy technologies which have been successfully employed in Hawaiʻi but are not feasible on Kauaʻi are geothermal and wind.

Geothermal

Geothermal energy has played a role in Hawaiʻi's firm energy supply for many years. It is a clean, mature, and often cost-effective technology which uses the thermal energy from volcanic activity to drive turbines and generate power. Geothermal power production requires groundwater temperatures of 225 to 662 degrees Fahrenheit (°F), which are commonly understood to only be available on Hawaiʻi island and possibly Maui. USGS drilled six groundwater monitoring wells near Līhuʻe in 1996 and discovered water temperatures between 75°F and 80°F, which is inadequate for geothermal power production[6].

Wind

Wind energy has become a leading low-cost renewable power generation option in much of the world. With technology improvements, economies of scale and mass adoption the cost of wind power has been reduced to a very competitive level. The typical energy production patterns of wind power are different than solar and the steady trade winds in the Hawaiian Islands make it an attractive renewable technology. However, Federally-listed endangered seabirds are present on Kauaʻi making the use of wind power infeasible at this point in time, and the cost of a wind project of similar size does not compare favorably to the Proposed Action.

4.3.1.2 Feasible Technologies

Two common renewable energy technologies which have been successfully employed in Hawaiʻi and Kauaʻi are solar and hydroelectric.

Solar and Solar-Plus-Storage

Utility scale solar energy derived from PV panels has decreased in cost by a factor of five in the past 15 years, from $0.40 to $0.49 in 2005 to under $0.10 on Kauaʻi in 2020. This cost reduction

[6] KIUC Renewable Energy Technology Assessments – Black & Veatch, March 2005

has led to the rapid adoption of solar power by KIUC over the past several years, with six major PV projects totaling 77 MW of installed capacity being added to KIUC's grid. This sizable quantity of utility solar now comprises a large portion of KIUC's energy supply. When combined with the impacts from 40 MW of customer-owned solar generation, the effects of the intermittent day-time-only solar generation become significant. To help counter this situation, KIUC's last three solar projects incorporated battery storage of four to five hours duration allowing much of the solar output to be shifted to the evening and nighttime hours. Solar-plus-storage remains KIUC's favored option for its low cost and more flexible siting. As solar generation quantities continue to increase on KIUC's grid, issues surrounding production characteristics are amplified and the storage and dispatch aspects of a considered project become more critical. KIUC's solar-plus-storage projects all use lithium-ion battery technology with an average duration of four to five hours. The batteries provide rapid response but, because of their short duration, are only able to support the grid for four to five hours. For this reason, intermittent renewables such as solar now need to be paired with long-duration bulk storage to maintain grid reliability through extended periods of rainy weather or generating unit breakdowns. While batteries could be over-built to provide long-duration bulk-storage, the cost of delivered energy would be more than the Proposed Action[7], and it would not provide the same level of grid support due to relying solely on inverters to deliver the energy (whereas the Proposed Action relies primarily on synchronous generators to deliver the energy to the grid).

Hydroelectric

Hydroelectric power is the oldest source of energy on Kauaʻi, and it is renewable. The wet climate and mountainous terrain of Kauaʻi are ideal for hydroelectric energy production. From 2009 to 2011, hydroelectric was the only utility-scale renewable in KIUC's generation mix, with several legacy irrigation system hydropower facilities contributing approximately 10% of Kauaʻi's electricity. A new hydroelectric plant on Gay & Robinson lands plus improvements at other hydroelectric plants increased the annual hydroelectric contribution to 14% of the island's needs by 2020. A new hydroelectric plant is typically more expensive than a new solar plant and takes many more years to develop due to the additional permitting requirements. However, hydroelectric power has a very low life-cycle cost because it lasts for many years beyond the repayment of the construction loan. It also has a very low carbon footprint due to less raw material and manufacturing and end-of-life disposition impacts. In Hawaiʻi and around the world, older hydroelectric plants are often the least expensive forms of generation available. The primary challenge with hydroelectric power is resource availability and siting concerns. While Kauaʻi has ideal conditions for hydroelectric energy, the island is small and other uses or environmental concerns limit the number of viable sites and greatly extend the timeframe required to permit and construct a hydroelectric facility. KIUC undertook investigations of hydroelectric potential in 2005. In 2010, KIUC conducted feasibility studies on multiple hydroelectric resource sites. The study work identified six technically and economically viable

[7] KIUC's information request from the Consumer Advocate in Attachment 12d (pg 114 of 340) provides a comparable Project size cost estimate for a solar plus battery only Project from a third party. https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A21E12B54638F01844

sites around the island. The Proposed Action's Kōkeʻe Ditch Irrigation System-based project was selected as the most beneficial renewable energy project available to KIUC.

4.3.1.3 Alternative Fuels

Three common alternative fuels to generate power were reviewed for Kauaʻi: biofuels, biomass, and liquefied natural gas (LNG). Use of any of these would result in greenhouse gas (GHG) emissions, although production of certain biofuels and biomass could offset those GHG emissions.

Biofuels

In 2014 KIUC conducted an RFP for alternative fuels including green fuels such as biogas and biodiesel. Regionally produced biodiesel was the most compelling. However, the pricing was notably more expensive than KIUC's naphtha and diesel sources, and the logistics required to meet KIUC's fuel needs proved challenging. Additionally, market and production risks did little to reduce KIUC's exposure to fuel cost volatility. Ultimately, switching to biofuels proved to be less attractive than continuing to use diesel and naphtha while seeking renewable energy projects such as solar and hydroelectric.

KIUC is currently conducting another RFP, specifically for biodiesel, as of date of publication of this Final EA.

Biomass

Kauaʻi has one biomass power plant: the Green Energy Team facility located near Kōloa. It operates thousands of acres of tree plantations across the island, harvesting and chipping the trees for transport to the power plant, where the wood chips are burned in a boiler to generate steam which drives a turbine to generate electricity. Approximately 10% of Kauaʻi's annual electricity is produced by the Green Energy Team facility.

Historically, biomass-to-energy was the largest and most common form of renewable energy in Hawaiʻi, with the sugar mill's combustion of bagasse as a source of steam for both process heat and power generation. After the downturn of the Hawaiian sugar industry, both the agricultural source of biomass and the systems to utilize it went away. As a byproduct fuel, bagasse made sense for the sugar mills, but if power generation is the primary purpose, dedicated agricultural crops are typically an expensive fuel because they require substantial labor to grow and transport the fuel to the biomass power plant. The Green Energy Team facility is the highest cost source of renewable energy on the KIUC system.

Liquified Natural Gas (LNG)

While not a renewable technology, LNG has long been acknowledged as a viable clean "bridge" fuel to help transition from dirtier fossil fuels to fully renewable options. In 2014 and 2015, KIUC conducted an in-depth investigation of the importation of LNG to Kauaʻi from continental North America. The envisioned solution also involved modification of existing thermal generating units and the replacement of some older units with high-efficiency gas-powered generators. While not a renewable resource, the fuel change would beneficially diversify fuel supply and decrease pollution. KIUC's pursuit of the fuel change strategy was dropped after the State committed to 100% renewable energy by 2045.

4.3.2 Alternative Layouts

Two alternative layouts were examined: Kitano and Hāʻeleʻele Ridge.

The Kōkeʻe Ditch Irrigation System and the hydroelectric potential of the location are well known and have been investigated many times over the past decades by many entities ranging from independent developers, the BLNR[8], the Hawaiʻi Department of Economic Development[9] (now known as the Department of Business, Economic Development & Tourism), U.S. Army Corps of Engineers (USACE)[10], and the Bureau of Reclamation. The publicly available studies and literature created by these past investigations in combination with new research and analysis formed the basis for both the alternatives and the selection of the Proposed Action.

KIUC's examination was driven by different goals and parameters than the past work. Factors included the following:

- The need for renewable energy generation diversity
- The need for cost effective long duration storage of intermittent solar energy
- Significant pricing pressure to equal "least-cost-alternatives"
- The desire for a multipurpose project that served the community and the State in ways beyond energy generation
- A development path that brought diverse stakeholders together in a mutually beneficial manner
- The ability to utilize existing infrastructure as available

4.3.2.1 Kitano Alternative Layout

The Kitano Alternative Layout, as shown in **Table 4-22**, is a two-powerhouse layout that extends south from Puʻu Moe Divide to Kitano Reservoir and then from Kitano down to Menehune.

Table 4-22. Kitano Alternative Layout

Reservoirs (upper/middle/lower)	Pipe Length (LF upper/LF lower)	Head (upper drop/ lower drop)	Landowners
Puʻu Lua / Kitano / none	26,700 ft / 23,500 ft	1,145 ft / 2,100 ft	ADC, DLNR, Private

In 2010, the Kitano layout was the first west side project layout that was examined seriously and successfully made it through the selection criteria. The southerly pipe route from Puʻu Lua to Waimea and use of Kitano as a middle reservoir is a layout that has been identified and studied by many previous resource assessments, most notably the U.S. Bureau of Reclamation in 2004.

[8] "Puu Lua – Kokee Hydroelectric Project Feasibility Study" Hawaii Board of Land and Natural Resources, 1984

[9] "Economic Potential of The Proposed Kokee Project" State of Hawaii Department of Economic Development, 1962

[10] "Hydroelectric Power Assessment – State of Hawaii – Section 905(b) WRDA 1986 Analysis Report", 2011

Ultimately the layout was not chosen because it would not deliver water to DHHL to the point of planned use as identified in DHHL's water reservation and the Puʻu ʻŌpae Kuleana Homestead Settlement Plan. The Kitano Alternative would only have the capacity to serve irrigation needs on ADC and KAA mauka lands, ADC and KAA land on the Mānā Plain, and one small use on DHHL's land for Mauka Village. In addition, the Kitano Alternative conflicts with the Waimea Mediation Agreement in that it is not the project described in the agreement and would not be delivering DHHL's water reservation. Details regarding the Kitano Alternative Layout are provided in **Figure 4.57**.

4.3.2.2 Hāʻeleʻele Ridge Alternative Layout

In 2013, a layout utilizing a pipe alignment along Hāʻeleʻele Ridge was identified as an alternative that had both technical advantages, such as steep pipe gradient, and the ability to incorporate pumped storage and on-site solar power. This configuration extended west from Puʻu Lua Reservoir to Polihale as shown in **Figure 4.58**.

The layout was promising enough to do geotechnical investigations, engineering, and cost analysis in 2015. While technically and economically favorable, the layout was ultimately not chosen because of construction risk in the lower section of pipeline and the inability to directly serve DHHL lands with water used for generation. In addition, the Hāʻeleʻele Ridge Alternative conflicts with the Waimea Mediation Agreement in that it is not the Project described in the agreement and would not be delivering DHHL's water reservation. Details regarding the Hāʻeleʻele Ridge Alternative Layout are provided in **Table 4-23**.

Figure 4.57. Kitano Alternative Layout

Figure 4.58. Hāʻeleʻele Ridge Layout

Table 4-23. Hāʻeleʻele Ridge Alternative Layout

Reservoirs (upper/middle/lower)	Pipe Length (LF upper/LF lower)	Head (upper drop/lower drop)	Landowners
Puʻu Lua / none / Polihale (new)	25,000 / none	3,230 ft / none	ADC, DLNR

4.3.3 Closed Loop Pumped Storage

A variation of the Proposed Action that was a closed loop pumped storage Project was considered as a third alternative. The closed loop variation did not include portions of Proposed Action above Puʻu ʻŌpae Reservoir so there was no use of the Kōkeʻe Ditch Irrigation System or Puʻu Lua Reservoir, no irrigation delivery, and no store-and-release hydroelectric power generation. This alternative would be pumped storage only utilizing Mānā and Puʻu ʻŌpae Reservoirs, with the same Lower Penstock alignment and Mānā Powerhouse and solar array location as the Proposed Action. Water use would be limited to moving the same volume of water back and forth each day for energy storage, hence the title "closed loop", and would depend on either the Kekaha Ditch Irrigation System or new wells for makeup water due to evaporation losses.

This pumped storage only alternative is technically feasible but was not selected for the following reasons:

- **Economics:** The pumped storage only alternative is more expensive on a per/kWh basis without the additional generation from the store-and-release hydroelectric portion.[11]
- **Limited DHHL Benefits:** The alternative would use DHHL land and Puʻu ʻŌpae Reservoir but would not provide the delivery of DHHL's water reservation or associated infrastructure improvements, would not involve the same level of road improvements, would not deliver electricity to Puʻu ʻŌpae Reservoir, and would not be in alignment with DHHL's land planning and future uses at Puʻu ʻŌpae.
- **Limited Community and Agricultural Benefits:** As outlined in the Waimea Mediation Agreement and described in **Section 1.2**, the Proposed Action would deliver DHHL's water reservation and water for irrigation to other entities and points of use along the Project flowline. The store and release water from Kōkeʻe diversions would not be part of the closed loop alternative. Therefore, the closed loop alternative would not be able to deliver DHHL's water reservation or other irrigation needs and would therefore be in conflict with the Waimea Mediation Agreement. The closed loop system alternative would not include repairs and maintenance of the Kōkeʻe Ditch Irrigation System or rehabilitation and maintenance of Puʻu Lua Reservoir. These structures would remain the responsibility of ADC and DLNR respectively as would any improvements or rehabilitation necessary to continue operations.

[11] Please find the financing model in KIUC's information request from the Consumer Advocate in Attachment 12d(pg. 109 of 340): https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A21E12B54638F01844

- **Reduced Storage.** The elimination of Kōkeʻe Ditch Irrigation System water and Puʻu Lua Reservoir capacity removes up to 1,000 MWh of bulk storage from the Project. This bulk storage cannot be cost-effectively achieved with solar and is a critical component as KIUC moves towards 100% renewable generation.
- **Dispatch.** The store-and-release hydroelectric facility at Puʻu ʻŌpae is fully dispatchable, which is complementary to KIUC's existing solar generation. No other hydroelectric facility on Kauaʻi has the ability to do time-of-day dispatch.
- **Make Up Water.** A "closed loop" system still loses water to evaporation and needs a source of water. Large volumes would not be needed but makeup water would be required from either Kekaha Ditch of wells on Mānā Plain.

5 Affected Environment, Potential Impacts, and Avoidance and Minimization Measures

This chapter details the affected environment, potential impacts associated with construction and operation of the Proposed Action and No-Action Alternative, and proposed measures to avoid or minimize impacts to specific resources. For some resources, impacts would differ depending on the facility. These include water resources, soils and geology, biological resources, archaeological resources, recreational resources, and visual resources. For these resources, impacts associated with construction and operation of the Proposed Action has been discussed based on facility. However, traditional cultural practices and resources, traffic and transportation, socioeconomic impacts, noise impacts, air quality impacts, impacts associated with natural hazards, and impacts associated with climate change and sea level rise are not facility-specific and consider the Proposed Action as a whole.

5.1 Water Resources

5.1.1 Affected Environment – Water Resources

5.1.1.1 Groundwater

As shown in **Figure 5.1**, the Proposed Action is located within the Waimea and Kekaha aquifer systems of the Waimea hydrologic unit.

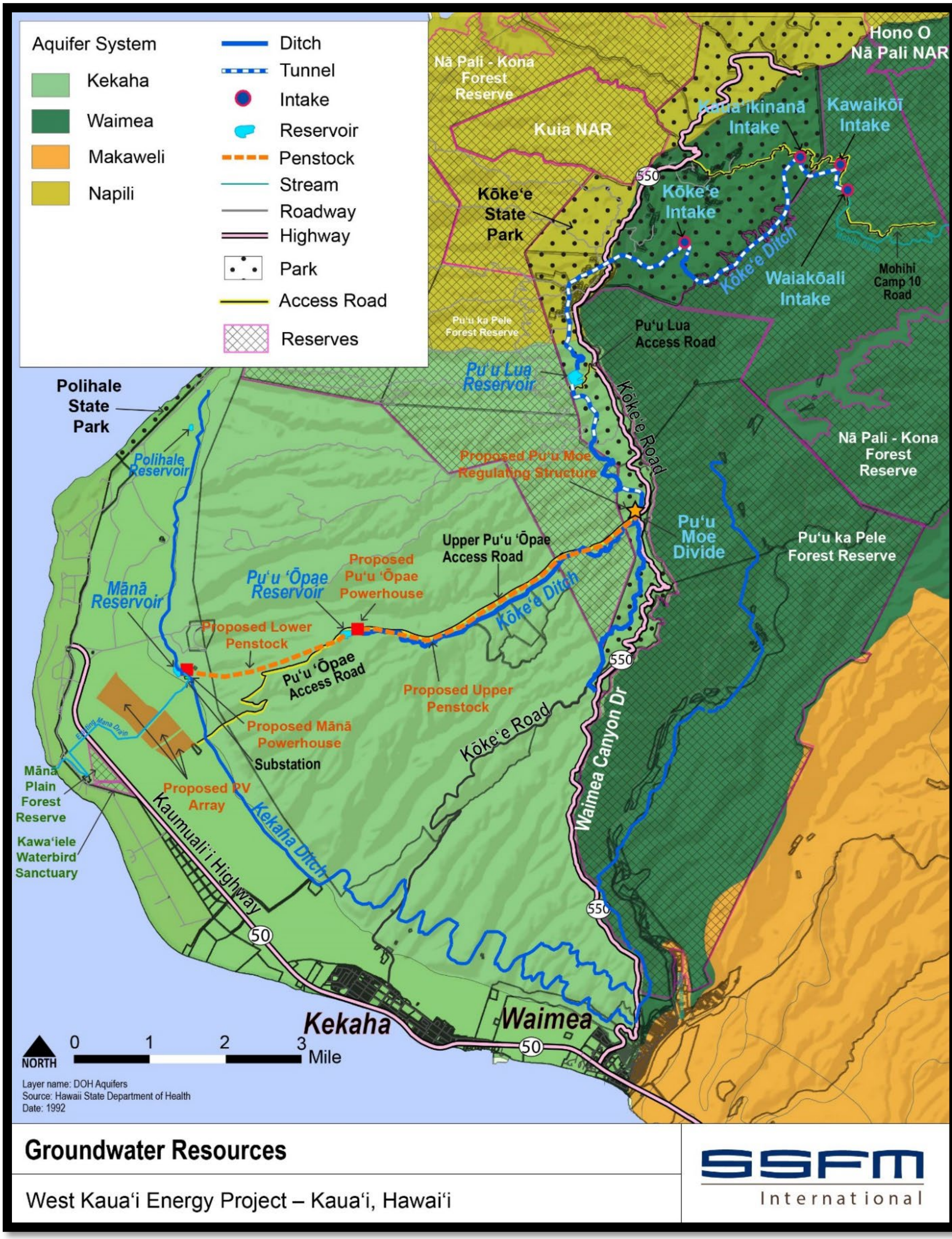
The Waimea aquifer system has a sustainable yield of 37 MGD (CWRM, 2008). The Waimea aquifer system consists solely of the Waimea River drainage above the confluence with the Makaweli River. Average annual rainfall in the Waimea aquifer system area is 95 inches. Groundwater discharges into the many streams and the Waimea River, which are diverted at several locations into ditches and tunnels for transport to agricultural fields.

The Kekaha aquifer system has a sustainable yield of 10 MGD (CWRM, 2008). Having an annual average rainfall of 33 inches, the Kekaha aquifer is the driest aquifer system on Kauaʻi. Surface drainage includes small, non-perennial streams that flow onto the Mānā Plain. This is an artesian aquifer that has been developed as a source of irrigation supply. Potable water is obtained from wells near Kekaha and Waimea at the inland edge of the Mānā Plain (Mink and Lau, 1992).

5.1.1.2 Surface Waters

The Proposed Action is located within the Waimea River basin which is located on the west side of the Island of Kauaʻi, Hawaiʻi. The river is 12.1 miles in length, one of the longest rivers in the Hawaiian Islands, and drains an area of approximately 85 square miles, which is almost 15% of the island. Originating on the leeward side of the mountains in the Alakaʻi Swamp, the highest area in the watershed is 5,240 feet elevation. Mean annual precipitation in the watershed is 96.9 inches, ranging from over 240 inches at the top of the watershed to less than 25 inches near the river mouth (Hydrology NW, 2016).

Figure 5.1. Groundwater Resources



As shown in **Figure 5.2**, there are many perennial and ephemeral streams within the Project area, and within the Kaʻawaloa and Waimea River watersheds. The Waimea River watershed is 55,014.74 acres and land use is predominantly forest/open space. The Kaʻawaloa watershed is 4,231.84 acres and land use in the watershed is predominantly scrub/shrub with the lower portions being predominantly agricultural use (Parham et.al, 2008; CRAMP, 2008).

There are 38 streams, both ephemeral and perennial, within the Waimea River watershed (Parham et al., 2008), many of which originate from the Alakaʻi Swamp. The main stem of the Waimea River is a little over 11 miles long, starts at the confluence of the Waiahulu and Koaiʻe Streams, and intersects with the Makaweli River approximately 6,000 feet upstream of where the mouth of the Waimea River discharges into the ocean. An overview map of the Waimea River watershed with stream locations, the Proposed Action Project features, and the existing Kōkeʻe and Kekaka ditch systems are shown in **Figure 5.3**.

There are multiple man-made ditch systems within the Waimea River watershed: the Kōkeʻe Ditch Irrigation System, which would be utilized by the Proposed Action: the Kekaha Ditch Irrigation System; the Olokele Ditch; the Menehune Ditch; and the Mānā Plain Storm Drain System. The ditch systems were constructed during the plantation era in the early 1900s primarily for irrigation purposes, but also hydroelectric facilities were constructed on both the Kekaha Ditch Irrigation System and the Olokele Ditch. The Kekaha, Olokele, Menehune, and Mānā Plain ditches are not part of the Proposed Action. The Olokele Ditch is located in the eastern portion of the Waimea River watershed on the Olokele River, which is a tributary to the Makaweli River that joins the Waimea River approximately 6,000 feet upstream of where the Waimea River drains into the ocean. The Olokele Ditch is not related to or impacted by the Proposed Action and is not discussed further in this document. The Menehune Ditch is located in the low elevation of the Waimea River valley and is currently supplied through the Kekaha Ditch Irrigation System. During operations, the connection between Kōkeʻe Ditch and Kekaha Ditch would provide the mechanism for the Project to deliver water through the southern branch of the Kōkeʻe Ditch to Menehune Ditch through Kekaha Ditch as a backup irrigation source when Kekaha Ditch is undergoing repair or maintenance. The Mānā Plain storm drain system is an existing feature on the Mānā Plain that was built by KSC for the purpose of land reclamation to expand agricultural areas on Mānā Plain for sugar cane production (see **Section 4.1.2.14**). The storm drainage system is still in operation and continues to drain the low-lying areas on Mānā Plain for agricultural use, and the system protects the town of Kekaha and PMRF from flooding.

The Kōkeʻe and Kekaha Ditch Irrigation Systems are both located on tributaries to the mainstem Waimea River several miles upstream of the confluence of the Makaweli River. The Kōkeʻe Ditch Irrigation System is located within the upper reaches of the watershed and the four primary contributing streams are, from east to west, Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe. The diversions on these four streams are located between 3,424- and 3,353-feet elevation. Waiakōali, Kawaikōī, and Kauaʻikinanā Streams originate from the northwestern portions of the Alakaʻi Swamp, and merge downstream of the diversion sites with Mōhihi Stream to form Poʻomau Stream. Mōhihi Stream is not diverted into the Kōkeʻe Ditch Irrigation System. Kōkeʻe Stream is solely sourced by precipitation runoff and joins Halemanu Stream to form Waiahulu Stream. Poʻomau Stream merges with Waiahulu Stream approximately one mile upstream of the confluence of Waiahulu and Koaiʻe Streams.

The primary diversions on the Kekaha Irrigation Ditch System are located on Waiahulu Stream and Koaiʻe Streams at approximately 780 feet elevation just before their confluence, and on the main stem Waimea River at approximately 550 feet elevation. Koaiʻe Stream originates from the southeastern, wetter portion of the Alakaʻi Swamp (Element Environmental, 2016) and has some contributing tributaries sourced by precipitation run off.

Other tributaries to the Waimea River downstream of the Waiahulu and Koaiʻe Streams include Waiʻalae and Mokihana Streams, neither of which are diverted. Additionally, there are a number of points of groundwater contributions to the Waimea River and its tributaries with a combined estimated volume of around 20 MGD. Estimates of groundwater contributions indicate that the largest groundwater input is from Waiahulu Stream after the confluence with Poʻomau Stream and is thought to be surfacing in Poʻomau Stream since above the confluence Waiahulu is ephemeral (Element Environmental, 2016). USGS has recently installed a gage on the section of Waiahulu below the confluence with Poʻomau in an effort to measure groundwater contributions on this section of stream. Other sources of groundwater contributions come from Koaiʻe and Waiʻalae Streams and to a lesser degree on the section of the Waimea River between the diversions on Waiahulu and Koaiʻe Streams and the Waimea Mauka Powerhouse (Element Environmental, 2016).

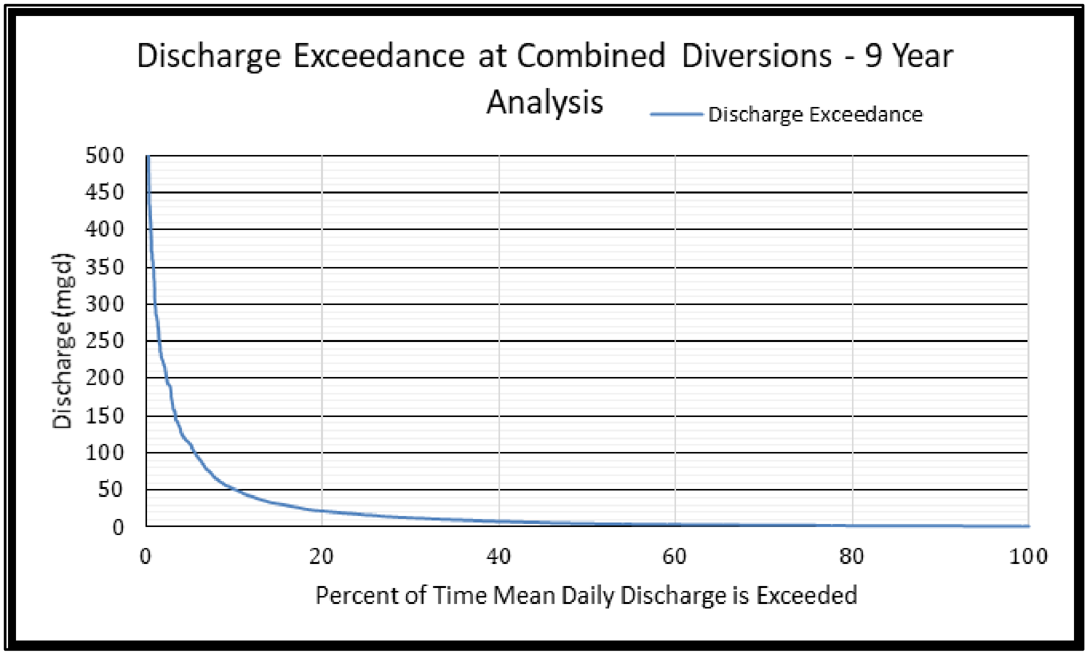
Other surface waters in the Project vicinity include the three reservoirs also shown on **Figure 5.2**: Puʻu Lua, Puʻu ʻŌpae Reservoir, and Mānā Reservoir. Kitano Reservoir is also shown but is no longer operational.

As mentioned above, the four primary contributing streams to the Kōkeʻe Ditch Irrigation System are, from east to west, Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe. Extensive hydrology analysis was performed on the available historic USGS streamflow data for these four streams as well as the larger Waimea River basin (see **Appendix F**). To understand the expected volumes of water at each of the four diversion sites, hydrology work was done to extend and expand the USGS records for the four subject streams. Hydrology and detailed modeling were performed for the four diversion sites for nine water years, which included three dry, three wet, and three average water abundance years within a period between 1991 and 2013. Because of the incomplete USGS records at the four diversion sites during concurrent time periods, this analysis used various techniques to provide concurrent multiple year flow data for each of the four diversions sites. **Figure 5.4** shows the summarized results of that analysis, a flow duration curve for the combined streamflow for the nine-year period.

Figure 5.2. Surface Waters

Figure 5.3. Waimea River Watershed

Figure 5.4. Flow Exceedance for Primary Kōkeʻe Ditch Contributing Streams



Source: Trutta Environmental Solutions, LLC.

Water quality sampling was conducted as part of the stream habitat assessment, included as **Appendix G**. Water quality variables sampled included water temperature (°C), dissolved oxygen (% saturation), and turbidity. Water quality measurements are "point-in-time" measurements that vary with weather conditions but still provide an indication of the water suitability for stream animals under the observed conditions. Results of the water quality sampling are provided in **Table 5-1.**

The tributary streams that the Proposed Action's diversions are located on are not included in the 305 (b) Assessment of State Waters List. However, the mainstem of the Waimea River is on the 305(b) Assessment list. The sampling location on the mainstem Waimea is identified as not in attainment (i.e. does not meet water quality goals) for total phosphorus and turbidity in the dry season. However, the Department of Health (DOH) Clean Water Branch (CWB) has determined that the Waimea River is a low priority for initiating total maximum daily load (TMDL) development (i.e., a plan for restoring impaired waters) within the current monitoring and assessment cycle (DOH-CWB, 2018).

Table 5-1. Water Quality Sampling Results

Sampling Area	Date Sampled	Temp. (°C)	Dissolved Oxygen	Turbidity
Waiakōali Stream				
Above Diversion	2/10/2018	13.57	8.55	0.18
Below Diversion	2/10/2018	14.41	3.23	5.82
Road Crossing 75 M D.S.	2/10/2018	13.87	7.22	1.11
Observations	**The water in this segment showed a tannic tint as it flowed from the Alakaʻi swamp. Water quality was good above the diversion but had low dissolved oxygen and higher turbidity immediately below the diversion. Dissolved oxygen increased rapidly downstream and turbidity decreased as shown by the results for the water quality measurement at the road crossing which is 75 m downstream from the diversion.**			
Kawaikōī Stream				
Above Diversion	2/9/2018	14.80	8.89	0.41
Below Diversion	2/9/2018	14.97	8.92	0.67
Road Crossing	2/9/2018	15.93	7.62	0.32
Below Road Crossing	2/9/2018	14.99	8.81	0.84
Observations	**Water quality readings were generally good throughout the survey segment and the water was stained dark with tannic acid from the Alakaʻi Swamp.**			
Kauaʻikinanā Stream				
Below Diversion	2/12/2018	15.17	8.91	0.57
Kauaʻikinanā Stream Above Diversion Downstream of Confluence with Ditch	2/12/2018	15.23	8.89	0.58
Kauaʻikinanā Stream Above Confluence with Ditch	2/12/2018	15.06	8.88	0.07
Observations	**Water quality was good throughout all sections with high dissolved oxygen and low turbidity. The water in Kauaʻikinanā Stream was clear.**			
Kōkeʻe Stream				
Kōkeʻe Stream Down	2/10/2018	14.09	9.05	3.28
Kōkeʻe Stream Up	2/10/2018	14.53	8.56	2.09
Kōkeʻe Ditch Inflow	2/10/2018	13.92	9.09	2.54
Observations	**Water quality was good throughout the sample area with low turbidity and high dissolved oxygen**			
Other Points Downstream in Waimea Canyon				
Waiahulu Stream	6/15/2018	21.78	9.10	1.04
Poʻomau Stream	6/15/2018	22.55	8.82	0.63
Waimea River	6/15/2018	22.94	8.49	2.33

Source: Trutta Environmental Solutions, LLC.

5.1.2 Potential Impacts – Water Resources

5.1.2.1 Construction

Proposed Action

There is a mixture of repairs, rehabilitation, and new construction in each area, and many of these activities could potentially impact surface water resources. Specifically, construction of the Proposed Action would involve vegetation clearing that would produce debris and ground disturbing activities that may produce sediment from soil erosion during and after excavation and construction, which may impact water quality (e.g., turbidity) at the construction site as well as adjacent watercourses. Contaminants associated with equipment during construction could impact surface water and groundwater. Sound construction planning and execution coupled with extensive use of BMPs would ensure that these potential impacts are either eliminated or minimized greatly. These impacts to water resources during construction would be short-term and temporary; therefore, construction impacts would be less than significant.

Kōkeʻe Ditch Irrigation System

As discussed in **Section 4.1.2.1**, the entire length of the Kōkeʻe Ditch Irrigation System between the diversions and the Puʻu Moe Divide would be inspected, cleaned, repaired, and improved as appropriate to ensure efficient water delivery and longevity. Construction activities could produce debris and may produce sediment that may impact water quality within the ditch system. Contaminants associated with construction equipment could leak and impact water quality within the ditch system. These impacts would be short-term and temporary; therefore, construction impacts to the Kōkeʻe Ditch Irrigation System would be less than significant.

Additional impacts to the Kōkeʻe Ditch Irrigation System would be associated with the modifications to the diversion structures, as described in the sections below.

Waiakōali Diversion

Construction at Waiakōali Diversion would primarily involve repairs or small modifications to the existing infrastructure that are within the footprint of the existing structure or within existing cleared areas along the ditch bank (see **Section 4.1.2.2**).

There would be a total of 0.09 acre of ground disturbance during construction at Waiakōali Diversion. Ground disturbing activities may produce sediment from soil erosion during and after excavation and construction, which may impact water quality (e.g., turbidity) at the construction site as well as adjacent watercourses. BMPs would be employed to keep disturbed sediments from flowing downstream (see **Section 5.1.3**).

In addition to ground disturbing activities, leaks in the existing dam face would be sealed by drilling and injecting pressurized grout within the structure. Dry conditions would be necessary during repairs that require concrete. Sandbags would be used to temporarily block the ditch entrance to maintain dry conditions within the ditch channel during construction. Additionally, sandbags would be used to temporarily channel stream water around work areas involving repairs to the dam resulting in localized dry areas, but also maintaining continuous streamflow within the stream channel. By providing a dry work area, there would be no impact to water quality from sealing leaks in the dam. After construction is completed, all sandbags would be removed.

Contaminants associated with construction equipment could leak and impact groundwater quality and/or water quality within the ditch system. BMPs would be employed to minimize impacts from pollutants associated with construction equipment (see **Section 5.1.3**).

The proposed construction work at Waiakōali Diversion is estimated to take up to four weeks and is expected to occur during the dry season when streamflows are low. The dewatering associated with construction is expected to occur for a period of three weeks.

Kawaikōī Diversion

Construction at Kawaikōī Diversion primarily involves repairs or small modifications to the existing infrastructure that are within the footprint of the existing structure or within existing cleared areas along the ditch bank (see **Section 4.1.2.3**).

There would be a total of 0.15 acre of ground disturbance during construction at Kawaikōī Diversion. Ground disturbing activities that produce sediment from soil erosion during and after excavation and construction, which may impact water quality (e.g., turbidity) at the construction site as well as adjacent watercourses. BMPs would be employed to keep disturbed sediments from flowing downstream (see **Section 5.1.3**).

In addition to the ground disturbing activities, grout would be pumped in and around the fissures and cracks to provide a more watertight seal to control leakage through the boulders that make up the existing dam. All stream flow would be diverted during construction to provide a dry working area during repairs to the diversion and to implement ditch modifications. Temporary cofferdams consisting of sandbags with plastic liners would be situated upstream of the diversion between rocks acting as a temporary dam. Streamflow would be routed around the construction area using bypass pumps and a pipe. By providing a dry work area, there would be no impact to water quality from sealing leaks in the dam.

Contaminants associated with construction equipment could leak and impact groundwater quality and/or water quality within the ditch system. BMPs would be employed to minimize impacts from pollutants associated with construction equipment (see **Section 5.1.3**).

Three bypass pumps (similar to a sump pump) would be installed upstream of the temporary cofferdams. These pumps would pump water from Kawaikōī Stream into a pipe located along the streambank and extending below the construction area. Water would be conveyed through this pipe and released back into Kawaikōī Stream downstream of the diversion. Once construction is completed the sandbags, bypass pumps, and pipe would be removed, and stream flow would return to its natural course.

Construction at this site is anticipated to require five weeks and is expected to happen in the dry season when stream flows are low. The dewatering associated with construction is expected to occur for a period of four weeks.

Kaua‘ikinanā Diversion

Construction at the Kaua‘ikinanā Diversion involves repairs or small modifications to the existing infrastructure that are within the footprint of the existing structure or within existing cleared areas along the ditch bank, and construction of new features outside the existing diversion structure footprint. In addition, there is significant erosion and undercutting of the existing masonry wall on the downstream side of the ditch inlet and under the existing catwalk. Repairs to this area would involve clearing loose rubble, debris, and shotcrete and then rehabilitating this wall with grouted boulders and riprap to prevent further erosion (see **Section 4.1.2.4**).

There would be a total of 0.11 acre of ground disturbance during construction at Kaua‘ikinanā Diversion. Ground disturbing activities that produce sediment from soil erosion during and after excavation and construction, which may impact water quality (e.g., turbidity) at the construction site as well as adjacent watercourses. BMPs would be employed to keep disturbed sediments from flowing downstream (see **Section 5.1.3**).

Repairs to the masonry wall near the ditch inlet would need to be conducted in dry conditions. Temporary rerouting of the unnamed stream would occur as well as blocking Kaua‘ikinanā Stream flow from entering the area at the ditch inlet. A temporary cofferdam consisting of sandbags with plastic liners would be located where the unnamed stream enters the section of ditch just upstream of the Kaua‘ikinanā Ditch inlet. Pumps would be positioned in a shallow trench in the ditch near the tunnel and would pump water from the unnamed stream into a pipe. The pipe would extend along the ditch bank to Kaua‘ikinanā Stream just upstream of the diversion. Water would be released from the pipe into the Kaua‘ikinanā Stream where it would flow through the slot on the existing Kaua‘ikinanā Diversion. Kaua‘ikinanā Stream flow would be temporarily blocked from entering the area around the ditch inlet through the use of temporary cofferdams consisting of sandbags with plastic liners. The cofferdams would restrict streamflow from entering the ditch inlet and push all Kaua‘ikinanā Stream flow through the slot or over the dam crest. By providing a dry work area, there would be no impact to water quality from repairs to the masonry wall. Once construction is complete the sandbags, bypass pumps, and pipe would be removed, and stream flow would return to its natural course and ditch inlet flow would resume.

Contaminants associated with construction equipment could leak and impact groundwater quality and/or water quality within the ditch system. BMPs would be employed to minimize impacts from pollutants associated with construction equipment (see **Section 5.1.3**).

Construction and dewatering associated with construction at this site is estimated to require 4 weeks and is expected to occur during the dry season when stream flows are low.

Kōke‘e Diversion

Construction at the Kōke‘e Diversion involves repairs or small modifications to the existing infrastructure that are within the footprint of the existing structure or within existing cleared areas along the ditch bank (see **Section 4.1.2.5**).

There would be a total of 0.03 acre of ground disturbance during construction at Kōke‘e Diversion. Ground disturbing activities may produce sediment from soil erosion during and after excavation and construction, which may impact water quality (e.g., turbidity) at the construction site as well as adjacent watercourses. BMPs would be employed to keep disturbed sediments from flowing downstream (see **Section 5.1.3**).

Temporary dewatering of Kōkeʻe Stream would occur during construction of the new concrete weir and other modifications. A temporary cofferdam consisting of sandbags with plastic liners would be located within Kōkeʻe Stream upstream of the diversion, Kōkeʻe Ditch, and proposed location of the new concrete weir. A dewatering pump would be positioned in a shallow trench upstream of the sandbags and would reroute Kōkeʻe Stream flow into a pipe. The pipe would extend around the diversion area to the downstream side of the diversion. Water would be released from the pipe into the Kōkeʻe Stream downstream of the diversion structure. Gates on the Kōkeʻe Ditch System upstream of where Kōkeʻe Ditch flow enters the diversion pool upstream of the diversion and Kōkeʻe Stream would be closed, stopping all ditch flow from entering the diversion pool. By providing a dry work area, there would be no impact to water quality from construction of the new concrete weir. Once construction is complete the sandbags, bypass pumps, and pipe would be removed, and stream flow would return to its natural course and Kōkeʻe Ditch flow would resume.

Contaminants associated with construction equipment could leak and impact water quality within the ditch system. Contaminants associated with construction equipment could leak and impact groundwater quality and/or water quality within the ditch system. BMPs would be employed to minimize impacts from pollutants associated with construction equipment (see **Section 5.1.3**).

The proposed construction and associated dewatering at Kōkeʻe Diversion is expected to require five weeks to complete and would be conducted during the dry season when stream flows are low.

Puʻu Lua Reservoir

Repairs and modifications to Puʻu Lua Reservoir are intended to bring the dam into compliance with Hawaiʻi State dam safety standards and restore operational storage capacity. The planned work at Puʻu Lua Reservoir involves major reconstruction of the reservoir embankments and water control structures (see **Section 4.1.2.6**).

There would be a total of 21.66 acres of ground disturbance during construction at Puʻu Lua Reservoir. Ground disturbing activities may produce sediment from soil erosion during and after excavation and construction, which may impact water quality (e.g., turbidity) at the construction site as well as adjacent watercourses. BMPs would be employed to keep disturbed sediments from flowing downstream (see **Section 5.1.3**).

Contaminants associated with construction equipment could leak and impact groundwater quality and/or water quality within the ditch system. BMPs would be employed to minimize impacts from pollutants associated with construction equipment (see **Section 5.1.3**).

The reservoir would be drained for construction activities to take place. Construction would occur during the dry time of the year to minimize difficulties with erosion control and soil handling. If heavy precipitation occurs, construction may be suspended until dry conditions return. Construction is expected to require 10 months and will likely impact one fishing season.

Puʻu Moe Divide

A new regulating structure would be constructed at Puʻu Moe Divide on the northwest side of Trail 1 Road that would operationally replace the existing regulating structure. However, the existing regulating structure would be left in place and not disturbed. Kōkeʻe Ditch just above the Puʻu Moe Divide would be excavated to build a new concrete regulating structure to split the flow of water (see **Section 4.1.2.7**).

There would be a total of 0.25 acre of ground disturbance during construction at Puʻu Moe Divide. Ground disturbing activities may produce sediment from soil erosion during and after excavation and construction, which may impact water quality (e.g., turbidity) at the construction site as well as adjacent watercourses. BMPs would be employed to keep disturbed sediments from flowing downstream (see **Section 5.1.3**).

Contaminants associated with construction equipment could leak and impact groundwater quality and/or water quality within the ditch system. BMPs would be employed to minimize impacts from pollutants associated with construction equipment (see **Section 5.1.3**).

During construction at Puʻu Moe Divide, Kōkeʻe Ditch flow would be routed around the construction area either in a pipe or in the open ditch. This work would not restrict water availability. Construction at Puʻu Moe Divide is estimated to require 4 months.

Upper and Lower Penstocks

The Proposed Action includes construction of the Upper and Lower Penstocks, which would be constructed of steel and buried for their entire length (see **Sections 4.1.2.8** and **4.1.2.12**, respectively).

There would be a total of 77.54 acres of ground disturbance during construction of the Upper and Lower Penstocks, 30.41 acres of which would be temporary and only during construction. Ground disturbing activities may produce sediment from soil erosion during and after excavation and construction. BMPs would be employed to keep disturbed sediments from entering watercourses (see **Section 5.1.3**). Contaminants associated with construction equipment could leak and impact groundwater quality and/or water quality within adjacent watercourses. BMPs would be employed to minimize impacts from pollutants associated with construction equipment (see **Section 5.1.3**).

Construction of the Lower Penstock is estimated to require 15 months.

Puʻu ʻŌpae Reservoir, Powerhouse and Facility Substation

The new Puʻu ʻŌpae Powerhouse and Facility Substation would be constructed at the northeastern corner of Puʻu ʻŌpae Reservoir. The existing Puʻu ʻŌpae Reservoir has been drained and is not in operation due to dam safety concerns. The reservoir modifications have been designed to meet Hawaiʻi State Dam Safety Standards (see **Sections 4.1.2.10** and **4.1.2.11**, respectively).

There would be a total of 40.85 acres of ground disturbance during construction at Puʻu ʻŌpae Reservoir. Of this, 21.47 acres would be temporary. Puʻu ʻŌpae Reservoir is not located on a natural stream and does not currently receive ditch flow. Any rainwater accumulation in the reservoir would be drained for construction and the reservoir would be kept dry throughout the construction period. Ground disturbing activities may produce sediment from soil erosion during and after excavation and construction. BMPs would be employed to keep disturbed sediments from entering watercourses (see **Section 5.1.3**). Contaminants associated with construction equipment could leak and impact groundwater quality and/or water quality within adjacent watercourses. BMPs would be employed to minimize impacts from pollutants associated with construction equipment (see **Section 5.1.3**).

Construction of the powerhouse is estimated to require 15 months. Construction of Puʻu ʻŌpae Reservoir is estimated to require 14 months.

Mānā Reservoir, Powerhouse, Pumphouse and Facility Substation

Enlargement of Mānā Reservoir from the historic capacity of 44 MG to 80 MG is necessary to provide adequate storage for the pumped storage component of the West Kauaʻi Energy Project and to provide a storage buffer for irrigation. The expansion would occur by a combination of excavating the reservoir bottom, building up the embankments higher than the original structures, and modifying the overall shape of the reservoir to a rectangle. The Mānā Powerhouse, Pumpstation and facility substation would be constructed on the northeastern edge of Mānā Reservoir (see **Section 4.1.2.13**).

Construction would require complete vegetation removal on all embankments and throughout the floor of the reservoir. The staging area for the construction would be located at the base of the southeast embankment. This area is a fallow agricultural field and would require the removal of existing grasses. Some vegetation removal, including trees, would be required for construction of the new powerhouse and pumpstation. Mānā Reservoir is not located on a natural stream and has been hydraulically disconnected from the Kekaha Ditch System. Any rainwater accumulation in the reservoir would be drained for construction and the reservoir would be kept dry throughout the construction period.

There would be a total of 44.16 acres of ground disturbance during construction at Mānā Reservoir. Ground disturbing activities may produce sediment from soil erosion during and after excavation and construction. BMPs would be employed to keep disturbed sediments from entering watercourses (see **Section 5.1.3**). Contaminants associated with construction equipment could leak and impact groundwater quality and/or water quality within adjacent watercourses. BMPs would be employed to minimize impacts from pollutants associated with construction equipment (see **Section 5.1.3**).

Construction at Mānā Reservoir is estimated to require 20 months. Construction of the Mānā Powerhouse and Pumpstation is estimated to require 10 months.

PV Solar Array

The PV Solar Array would be constructed on approximately 350 acres of agricultural lands makai or southwest of Mānā Reservoir (see **Section 4.1.2.15**). The PV work would be done simultaneously with the Mānā Reservoir, Powerhouse, and Facility Substation construction.

There would be a total of 375 acres of ground disturbance during construction of the PV Solar Array, 89.42 acres of which would be temporary and only during construction. Ground disturbing activities may produce sediment from soil erosion during and after excavation and construction. BMPs would be employed to keep disturbed sediments from entering watercourses (see **Section 5.1.3**). Contaminants associated with construction equipment could leak and impact groundwater quality and/or water quality within adjacent watercourses. BMPs would be employed to minimize impacts from pollutants associated with construction equipment (see **Section 5.1.3**).

Project Substation

The Project Substation would be constructed on approximately 7.47 acres of agricultural lands south of Mānā Reservoir (see **Section 4.1.2.16**). Ground disturbing activities may produce sediment from soil erosion during and after excavation and construction. BMPs would be employed to keep disturbed sediments from entering watercourses (see **Section 5.1.3**). Contaminants associated with construction equipment could leak and impact groundwater quality and/or water quality within adjacent watercourses. BMPs would be employed to minimize impacts from pollutants associated with construction equipment (see **Section 5.1.3**).

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur and the proposed rehabilitation of existing irrigation infrastructure and long-term maintenance of those structures would not be funded by the Project. Puʻu Lua Reservoir would remain under management of DLNR, Puʻu ʻŌpae Reservoir would remain under the management of DHHL, and Mānā Reservoir would remain under management of ADC. The necessary rehabilitation work to bring the reservoirs into compliance with Hawaiʻi State Dam Safety Standards or decommissioning of the reservoirs would fall to the State.

Under the No-Action Alternative, KIUC's Kōkeʻe Diversion Modification Project would be completed as a separate and independent project, which would involve modifications to the four Kōkeʻe diversions for implementation of the Phase One IIFS as outlined in the Waimea Mediation Agreement. However, the Kōkeʻe Ditch Irrigation System would remain under management of ADC as would the long-term maintenance and compliance with the Phase One IIFS. This could result in the continuance of reduced operations and limited maintenance increasing the likelihood of erosion-related water quality impacts in the Kōkeʻe Ditch Irrigation System. It could also result in closure of the Kōkeʻe Ditch Irrigation System, which would leave DHHL's Puʻu ʻŌpae lands without a water resource. Road improvements would fall to the State, which may result in increased possibilities for storm water-related erosion of the unimproved access roads.

5.1.2.2 Operation

Proposed Action

The baseline for assessing potential impacts on water resources considers that the Kōkeʻe Ditch Irrigation System is an existing diversion system that has been in place and operational since the early 1900s. This EA is not intended to address plantation diversion operations. Several changes have occurred in the watershed over the last century, including, but not limited to, the construction of the irrigation and existing hydroelectric systems, the introduction of invasive plant and animal species, and increased human traffic and usage in areas made accessible by new and improved roads. For the purposes of this EA, the analysis of potential impacts is based on the current condition and uses within the Waimea River watershed and the surrounding environment. Operation of the Proposed Action would not introduce any pollutants or chemical contamination to the water diverted and used by the Project.

The Proposed Action's implementation of the Phase Two IIFS would minimize impacts to diverted streams by maintaining flow volumes in stream channels that have been determined by CWRM sufficient to meet the instream needs including those of aquatic habitat and stream biota. The Proposed Action's design and long-term maintenance would reduce water losses on the Kōkeʻe Ditch Irrigation System and increase water delivery efficiency compared to current conditions. The replacement of the 4.5 miles of open ditch west of the Puʻu Moe Divide with the new Upper Penstock would result in increased system efficiency through elimination of saturation losses that occur in the earthen ditch. Additionally, the Lower Penstock and its ability to deliver water to the Mānā Plain may provide opportunity for overall efficiency increases by providing water for irrigation on Mānā Plain. The reconstructed Puʻu ʻŌpae and Mānā Reservoirs will be lined, decreasing saturation losses and increasing storage efficiency.

Kōkeʻe Ditch Irrigation System

The Proposed Action would initiate the Phase Two IIFS as outlined in the Waimea Mediation Agreement and involve diversion of water from streams in the upper reaches of the Waimea River watershed for DHHL's water reservation, hydroelectric generation, and other irrigation and consumptive uses in the Project area. These diversions would reduce the amount of water left in the stream downstream of each diversion and on the Waimea River. However, the Proposed Action would ensure that the Phase Two IIFS requirements would remain in the natural stream channels using automated intakes at each of the diversion locations. The automation of the system would provide real time flow adjustments and compliance with the Phase Two IIFS set by CWRM. New concrete weirs constructed for the Proposed Action would be constructed in a way that supports migration of native aquatic species, and implementation of the IIFS would ensure a wetted path over the weirs.

The Phase Two IIFS for both the Kōkeʻe and Kekaha Ditch Irrigation Systems were established with the understanding and agreement that both the Proposed Action and the Kekaha Irrigation Ditch Operations would continue simultaneously. The diversions on the Kōkeʻe Ditch Irrigation System may reduce the amount of water available to divert at Waiahulu into Kekaha Ditch. Specifically, there may be potential impacts to water available for diversion into Kekaha Ditch at

Waiahulu Diversion during lower stream flow conditions. There is also a potential impact to the existing hydro's, Waimea (Mauka) and Waiawa, during lower stream flows.

In addition to the Phase Two IIFS, groundwater contributions on the Waiahulu Stream downstream of the four Kōkeʻe Ditch Irrigation System diversions would increase natural stream flows available for habitat and aquatic life as well as the off-stream uses lower in the watershed. A stream habitat assessment was conducted between February and June 2018 and specifically focused on the upper reaches of the Waimea River, its major tributaries and the four diverted streams associated with the Proposed Action. The full report is provided in **Appendix G**.

The addition of flow measurement points and recording devices to the diverted stream above each intake and at key points along the ditch would support efficient and compliant use of the water resources as well as provide data collection of natural stream flows on all four streams. Operational compliance with the Phase Two IIFS set by CWRM over the life of the Proposed Action would be a benefit to all users of water on the system.

Repairs and maintenance of the entire length of the Kōkeʻe Ditch Irrigation System between the diversions and the Puʻu Moe Divide would be funded and completed by the Applicant as part of the Proposed Action to improve water delivery efficiency and infrastructure longevity.

Loss of water due to saturation or other losses that may occur during delivery and storage prior to beneficial use is a potential impact to surface water quantity. In general, there is very little loss of water that can be observed within the Kōkeʻe Ditch System (Element Environmental, 2016).

The Proposed Action would connect the Kōkeʻe Ditch Irrigation System to the Mānā Plain, and through Project related infrastructure would provide a source of water for irrigation to the agricultural fields on Mānā Plain. The 60% design for the Proposed Action includes three separate physical locations where the Project could deliver Project discharge from Mānā Reservoir for existing and future irrigation needs and other beneficial uses of water on Mānā Plain. If irrigation water is delivered through the Proposed Action and for uses on Mānā Plain, there would be the potential for reduced diversion into Kekaha Ditch during normal to wet conditions in the lower reaches of the Waimea River where native species are prevalent. However, during dry conditions when less water is available in Kōkeʻe, it would be necessary for Kekaha Ditch to deliver irrigation water for farmers on Mānā Plain.

Puʻu Lua Reservoir

The reservoir rehabilitation would be funded and completed by the Applicant as part of the Proposed Action and would include increasing storage capacity from approximately 60 MG at Puʻu Lua Reservoir to approximately 200 MG. This increase would improve irrigation and power production water availability by allowing high streamflow events to be stored for use during drier periods, thereby providing agriculture and energy benefits while minimizing impacts to water resources. They would also enhance the fishing and recreational resources at Puʻu Lua Reservoir.

At Puʻu Lua Reservoir, the increase in depth and storage volume would most likely result in lower overall water temperatures and combined with the increase in water flow, would likely increase dissolved oxygen levels within and down ditch of Puʻu Lua Reservoir. Dissolved oxygen is a measure of how much oxygen is dissolved in the water and therefore the amount of oxygen available to living aquatic organisms. Higher dissolved oxygen levels increase water quality.

Upper Penstock

The Upper Penstock would be a new facility that would replace the existing western branch of Kōkeʻe Ditch that currently transports water from Puʻu Moe Divide to Puʻu ʻŌpae Reservoir. This branch of Kōkeʻe Ditch is in a state of significant disrepair and functions in a limited capacity with significant water loss and erosion issues. Replacement of the ditch with a pipe is necessary for efficient water delivery to the Puʻu ʻŌpae area.

Water delivered through the new Upper Penstock would be for the purpose of store and release hydroelectric generation, irrigation and/or make up water for evaporative losses at Puʻu ʻŌpae and Mānā Reservoirs. Water entering the new Upper Penstock would be filtered and screened at the new Puʻu Moe Regulating Structure. The maximum capacity of the Upper Penstock would be 26 MGD, corresponding to the capacity of the Kōkeʻe Ditch between Puʻu Lua Reservoir and Puʻu Moe Divide. The total volume of water delivered through the Upper Penstock would range from 3 to 26 MGD depending on the following considerations:

- Volume of water available in the stream
- Implementation of the Phase Two IIFS
- Kōkeʻe Ditch capacity
- Puʻu Lua Reservoir storage capacity
- Irrigation/consumptive uses along the Project flowline above Puʻu ʻŌpae Powerhouse

Regulating water flow through the Upper Penstock would be automated through new control and monitoring systems installed as part of the Project.

Operation of the Upper Penstock would have no impact on water quality, but would likely result in slighter lower water temperatures than delivery through an open ditch. There would not be any pollutants or chemical contamination to the water flowing through the Upper Penstock.

Puʻu ʻŌpae Powerhouse, Reservoir and Facility Substation

Operation of the proposed Puʻu ʻŌpae Powerhouse and Facility Substation would not cause water pollution as no foreign objects or chemicals would be introduced to the water during its passage through the penstocks, pumps, or turbines. Additionally, there is no heat removal or addition to the water as it passes through the powerhouses. There would be no impact to water quality of surface waters from the operation of the Proposed Action.

The reservoir rehabilitation would be funded and completed by the Applicant as part of the Proposed Action and would include increasing storage capacity from the historic capacity of 88 MG to 100 MG at the Puʻu ʻŌpae Reservoir. Currently the reservoir is not operable due to not meeting Hawaiʻi Dam Safety Standards, and the Proposed Action would bring the reservoir back into operational use. This increase would improve irrigation storage capacity and power production water availability by allowing high streamflow events to be stored for use during drier periods, thereby providing agriculture and energy benefits while minimizing impacts to water resources.

The pumped storage operation regime involves moving water back and forth between the off-stream Puʻu ʻŌpae and Mānā Reservoirs. This recycling of water may cause the stored water to increase in temperature during sunny periods when there is limited flow through the Kōkeʻe Ditch Irrigation System. This change in temperature profile may be different than past irrigation-only storage operations but is not expected to be a significant change as to affect water quality.

Lower Penstock

During operations, the new Lower Penstock would deliver store and release water minus any irrigation use from Puʻu ʻŌpae Reservoir to Mānā Powerhouse. The new Lower Penstock would also be used to circulate water used for pumped storage between Mānā and Puʻu ʻŌpae Reservoirs. The expected flow releases from Puʻu ʻŌpae Reservoir through the Lower Penstock would be directly tied to periods of electrical generation at Mānā Powerhouse and would primarily occur during non-solar hours. Water would be pumped from Mānā Powerhouse to Puʻu ʻŌpae Reservoir through the Lower Penstock up to Puʻu ʻŌpae during the day. The maximum flow design capacity of the Lower Penstock would be 129 MGD. The average volume of water that would flow back and forth between Puʻu ʻŌpae Reservoir and Mānā Powerhouse and Reservoir during normal pumping operations would be 55 MGD.

Operation of the Lower Penstock would have no impact on water quality. There would not be any pollutants or chemical contamination to the water flowing through the Lower Penstock.

Mānā Reservoir, Powerhouse, Pumpstation and Facility Substation

The reservoir rehabilitation would be funded and completed by the Applicant as part of the Proposed Action and would include increasing storage capacity from the historic capacity of 44 MG to 80 MG for the Mānā Reservoir. Currently the reservoir is not operable due to not meeting Hawaiʻi Dam Safety Standards, and the Proposed Action would bring the reservoir back into operational use. This increase would improve irrigation and power production water availability by allowing high streamflow events to be stored for use during drier periods, thereby providing agriculture and energy benefits while minimizing impacts to water resources.

The pumped storage operation regime involves moving water back and forth between the off-stream Puʻu ʻŌpae and Mānā Reservoirs. This recycling of water may cause the stored water to increase in temperature during sunny periods when there is limited flow through the Kōkeʻe Ditch Irrigation System. This change in temperature profile may be different than past irrigation-only storage operations.

Operation of the proposed Mānā Powerhouse would not cause water pollution as no foreign objects or chemicals would be introduced to the water during its passage through the penstocks, pumps, or turbines. Additionally, there is no heat removal or addition to the water as it passes through the powerhouses. There would be no impact to water quality of surface waters from the operation of the Proposed Action.

Water Management and Discharge

Project discharge would be clean, filtered water from Kōkeʻe Stream. Because the discharge is conveyed through a pipe to the storm drain system, it would not come into contact with agriculture fields and therefore not contain any potential pesticide runoff from those fields. The West Kauaʻi Energy Project discharge would not convey sediment into the storm drain system and is expected to dilute any potential pollutants already present in the system from other sources.

ADC has submitted an NPDES permit application to the Department of Health for the operation of the Mānā Plain Storm Drainage System, and future operations would be regulated by Department of Health.

Solar PV Array, West Kauaʻi Energy Project Substation, and Interconnection Line

Operation of the PV Solar Array, the Project Substation and the Interconnection Line would have no impact on water resources, as it would not require the use of water resources to operate.

No-Action Alternative

Under the No-Action Alternative, the Phase One IIFS would remain in effect. KIUC's Kōkeʻe Diversion Modification Project would be completed as a separate and independent Project, which would involve modifications to the four Kōkeʻe Ditch Irrigation System diversions for implementation of the Phase One IIFS as outlined in the Waimea Mediation Agreement. The existing Kōkeʻe Ditch Irrigation System would remain under management of ADC, as would long-term maintenance and compliance with the Phase One IIFS, which could result in the continuance of reduced operations or closure of the system. Any repairs and rehabilitation of the system would fall to the State, as would the cost of delivery of irrigation water to users of the system. Irrigation on the Mānā Plain would remain solely reliant on the Kekaha Ditch System. Closure of the Kōkeʻe Ditch Irrigation System would leave DHHL's lands without a water resource.

Under the No-Action Alternative, Puʻu Lua Reservoir would remain under management of DLNR. In order to continue operations, rehabilitation work would be required to meet current Hawaiʻi State Dam Safety Standards. DLNR would either have to fund the rehabilitation work or breach the dam and decommission the reservoir. Puʻu ʻŌpae Reservoir would remain under management of DHHL and Mānā Reservoir would remain under management of ADC. Neither reservoir could be brought into active use without the necessary repairs and upgrades to meet Hawaiʻi State Dam Safety requirements. Alternatively, all three reservoirs could be decommissioned, which would also be a significant cost to the State. Decommissioning would have an impact on reliable water delivery to recreational and agricultural users, the trout fishing program, and the potential of renewable hydroelectric energy in the region.

Under the No-Action Alternative, stream flows would remain relatively consistent with what they currently are under the Phase One IIFS assuming current uses on the Kōkeʻe Ditch Irrigation System also remain consistent with current status. Vegetation clearing and impacts to historic properties would likely be similar with repairs and/or improvements or less without repairs and/or improvements.

5.1.2.3 Stormwater Management and Drainage

The Project would have limited impacts to existing drainage patterns during construction and post-construction operation, and in some cases would improve existing drainage conditions after construction is complete. The existing drainage patterns were identified as part of the existing site condition assessment, and then incorporated into the Project design or modified where required to protect new and rehabilitated facilities. Where possible, existing drainage patterns would be maintained with the proposed improvements to existing structures and with the new facilities. Some impacts during construction are unavoidable and would be minimized and/or mitigated through BPMs.

Construction

Temporary rerouting of existing storm drainage around construction sites would be necessary to dewater the area during construction. In general, temporary rerouting would not permanently alter normal drainage patterns or conditions. During construction, temporary BMPs would be implemented to avoid or minimize sediment migration from the construction site and to protect water quality. A brief description of storm drainage modifications at each construction site are shown in **Table 5-2** below.

Table 5-2. Storm Drainage Modifications

FACILITY	TEMPORARY DRAINAGE MODIFICATION	MITIGATION
Kōkeʻe Ditch Diversion Structures	Route drainage away from the existing to dewater during construction.	Implement BMPs to protect receiving water quality before discharging storm water. Isolate dewatering pumps, where applicable, to ensure no impacts to water quality downstream of construction.
Puʻu Lua Dam	During construction, route Kōke'e Ditch flows around the reservoir through repaired bypass ditch. Collect drainage and contain within the reservoir during construction. On the downstream side of the dam, maintain the existing drainage patterns and route to downstream end of dam toe to discharge into natural drainage gulch. Spillway construction would route drainage to downhill side of the energy dissipation structure.	Implement BMPs along the downhill slope of construction areas and at all discharge points to prevent sediment migration from the construction site.
Puʻu Moe Regulating Structure	Route Kōke'e Ditch flows during construction around the construction work area through above ground temporary piping. Maintain existing drainage route to southern branch of Kōkeʻe Ditch.	Implement BMPs along edge of construction areas and at discharge points to protect water quality.
Upper Penstock	Route storm drainage to downhill side of work areas. Ditch flow would be routed around construction areas through temporary above ground piping.	Implement BMPs along downhill slope at discharge points to protect water quality and minimize sediment migration.

Table 5-2. Storm Drainage Modifications (Cont.)

FACILITY	TEMPORARY DRAINAGE MODIFICATION	MITIGATION
Puʻu ʻŌpae Powerhouse	Construction drainage would be routed to the north of the powerhouse site. Natural storm runoff will be routed away from the existing reservoir to the north and south sides into natural drainage areas during construction.	Implement BMPs along the downhill side of the work area to minimize sediment transport.
Lower Penstock	Drainage will be routed away from the penstock trench and construction area to the downhill side of the penstock alignment and discharged into the natural vegetation during construction.	Install BMPs on the downhill side of the penstock alignment to control sediment and protect water quality at storm drainage discharges.
Mana Powerhouse and Pump Station	During construction drainage will be routed away from the construction site into existing drainage ditches.	BMPs would be implemented on the downhill side of the construction area to collect sediment and protect water quality.
Puʻu ʻŌpae Upper and Lower Access Roads	Route storm drainage to downhill side of work areas into existing drainage ditches.	BMPs would be implemented along the downhill slope at discharge points to protect water quality and to minimize sediment migration.
Mana Substation	During construction, drainage will be routed away from construction site and into existing drainage ditches.	Install BMPs on the downhill side of the construction area to protect water quality and minimize sediment migration.

Post Construction and Operation

A brief description of post construction drainage at each site is shown in **Table 5-3** below.

Table 5-3. Post Construction Drainage

FACILITY	DRAINAGE MODIFICATION	MITIGATION
Diversion structures	Restore original drainage patterns.	Replant disturbed construction areas.
Puʻu Lua Reservoir	Restore original drainage patterns.	Replant disturbed construction areas.
Puʻu Moe Regulating Structure	Final grading will restore original drainage patterns.	Replant disturbed construction areas.
Upper Penstock	Restore original drainage patterns.	Final grading will restore to near original contours. Culverts would be installed to cross roadway as well as local drainages to maintain existing drainage patterns post construction. Replant disturbed construction areas.

Table 5-3. Post Construction Drainage (Cont.)

FACILITY	DRAINAGE MODIFICATION	MITIGATION
Puʻu ʻŌpae Powerhouse and Reservoir	Reroute drainage from the powerhouse and east hillside to the north and south sides of the dam and reservoir. Route drainages from the north and south sides of the dam to the natural drainages on both sides. Restore drainage on the west side to the original site contours and drainage patterns.	Implement permanent BMPs on new drainage courses and areas disturbed during construction. Final grading would route drainage away from the powerhouse and the reservoir dam embankment to natural drainage areas on the north and south sides of the reservoir and new powerhouse. Permanent BMPs would be implemented including revegetation on new drainage courses and areas disturbed during construction.
Lower Penstock	Restore original drainage patterns.	Post construction, permanent BMPs would be implemented including revegetation. Original drainage patterns will be restored post construction with vegetation to provide filters for storm drainage. Replant disturbed construction areas.
Mānā Powerhouse and Pump Station	Post construction, stormwater drainage that overflows the banks of Kaʻawaloa Stream during 100-year flood events will be channelized to split flow to the north and south. Smaller storm events will follow the existing drainage patterns into the existing channelized storm drainage ditch. Drainage from the new facilities will be routed into newly constructed drainage ditches that convey drainage into existing drainage ditches. powerhouse and reservoir facilities. Route drainage from the north and south sides of the dam to the natural drainages on both sides. Restore drainage on the west side to the original site contours and drainage patterns.	Install permanent grading along the dam and reservoir perimeter and regrade the site to collect storm drainage to the north and south. Implement permanent BMPs including revegetation on new drainage courses and areas disturbed during construction.
Puʻu ʻŌpae Upper and Lower Access Roads	Restore original drainage patterns.	Final grading will restore to near original contours. Culverts would be installed to cross roadway as well as local drainages to maintain existing drainage patterns post construction. Replant disturbed construction areas.

Table 5-3. Post Construction Drainage (Cont.)

FACILITY	DRAINAGE MODIFICATION	MITIGATION
Mānā Substation	Install oil.water separators in substation to remove contaminants from stormwater. Route drainage away from the substation to the natural drainage to the southeast. Install a culvert below the substation driveways to maintain drainage away from Mānā Reservoir and Substation.	Replant disturbed construction areas.

Minimal solar field area, including the area beneath the solar modules, would require grading such that the existing drainage patterns would not be altered. Sediment basins would be installed in the solar array area to capture and treat stormwater in areas with increased impervious surfaces associated with the solar array area. Sediment basins would be designed to retain and allow for settlement and evaporation of storm water, as needed, to maintain peak flows at or below pre-development levels. The size and design of the basins would be based on site-specific conditions as well as requirements of the DWP County of Kaua'i Storm Water Runoff System Manual.

There are no changes to existing drainage due to the construction of the new Interconnection Line. For installation on the new Interconnection Line, each hole would be individually drilled, and pole compacted in place resulting in no loose dirt piles that could lead to sediment migration and protect water quality in the adjacent storm drainage ditches. Compaction around poles would prevent erosion of disturbed soil. If, for any reason, holes could not be immediately filled and compacted, loose soil would be removed from the site. Consistent with the ADC/DOH MOU regarding BMPs on Mānā Plain, hydroseeding of a sod-forming grass would occur after pole installation in any areas of ground disturbance.

A Storm Water Pollution Prevention Plan would be developed prior to construction to identify measures to reduce potential soil erosion and sediment transport during construction activities. Upon completion of construction activities, all temporary erosion and sediment control measures, fencing and staging area materials would be removed.

Temporary and/or permanent BMPs would be implemented during construction to avoid and minimize potential impacts to the surrounding environment. BPMs would include various procedures, practices, treatments, structures, and/or devices designed to eliminate and minimize the potential discharge of pollutants to downstream waters. The BMPs implemented would be determined in accordance with applicable regulatory requirements, including those associated with the NPDES program and Kaua'i County Code Section 22-7.17 Specifications for Grading, Grubbing, and Stockpiling, which require approval of a Stormwater Pollution Prevention Plan and Drainage Erosion Control Plan prior to construction (respectively). Specific BMPs would address erosion prevention, sediment control and good housekeeping. No ground disturbing activities would occur until BMPs have been properly implemented.

5.1.3 Avoidance and Minimization Measures – Water Resources

The majority of the Proposed Action's construction activities would happen well away from surface water resources, along the ditch system footprint to the west of Waimea Canyon. The Applicant would obtain all required permits and comply with permit conditions to minimize impacts to water resources. Permits would include, but may not be limited to, the following:

- NPDES Individual Permit from the Clean Water Branch of the DOH for stormwater discharge associated with construction activities
- NPDES Dewatering Permit from the Clean Water Branch of the DOH for discharges associated with construction activity dewatering
- Section 401, Water Quality Certification from the Clean Water Branch of the DOH
- Section 404, Clean Water Act permit from the USACE
- Stream Channel Alteration Permit from DOH-CWRM
- Stream Diversion Works Permit from DOH-CWRM

Construction plans and specifications would include BMPs to minimize erosion on the Project site during and after construction, as well as measures to contain runoff on-site during construction. Temporary erosion control measures would be used during construction to prevent soil loss and to minimize surface runoff into adjacent areas and streams, as well as to minimize the likelihood of spills from construction equipment. BMPs may include, but not be limited to, the following:

- Temporary erosion control measures would be used during construction to prevent soil loss and to minimize surface runoff into adjacent wetlands and streams
- Turbidity and siltation from Project-related work would be minimized and contained within the Project area by silt containment devices, which would be maintained for the life of the construction period and until the Project area is stabilized.
- No work would occur during adverse weather conditions or flooding.
- All Project construction-related debris and sediment containment devices would be removed and disposed of at an approved site.
- All Project construction-related materials and equipment to be placed or used in an aquatic environment would be inspected for pollutants including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use.
- Fueling of Project-related vehicles and equipment would take place away from the aquatic environment. A contingency plan for accidental spills of petroleum products would be developed and retained on-site. Absorbent pads and containment booms would be stored on-site to facilitate clean-up of accidental petroleum releases.
- Project construction-related materials would not be stockpiled in or in close proximity to aquatic habitats and would be protected from erosion to prevent materials from being carried into waters by wind or rain.

- All deliberately exposed soil or under-layer materials used near water would be protected from erosion and stabilized as soon as possible with geotextile, filter fabric, vegetation matting, or hydroseeding.

5.2 Soils and Geology

5.2.1 Affected Environment – Soils and Geology

As shown in **Figure 5.5**, the facilities associated with the Proposed Action cross several soil types. The upper portion of the ditch system and the associated diversions are on soils of the Kōkeʻe Series and Oli Series. The middle section of the ditch system between the Puʻu Moe Divide and Puʻu ʻŌpae Reservoir is located on soils of the Puʻu ʻŌpae Series and the Paaiki Series. The section of the Project area between Puʻu ʻŌpae Reservoir and Mānā Reservoir is predominately located on soils within the Niu Series. The lower part of the Project area on the Mānā Plain is located on soils of the Nohili, Kekaha, and Kaloko Series. Descriptions of these soil series are provided in **Table 5-4**.

As shown in **Figure 5.6**, the majority of the Proposed Action overlays the Waimea Canyon Basalt geological unit. The Mānā Reservoir and the proposed Mānā Powerhouse, PV Solar Array, and Project substation are located on the Alluvium geological unit. Waimea Canyon Basalt forms the majority of the island of Kauaʻi, and the Project area is located within the Nāpali Formation of the Waimea Canyon Basalt geological unit. The Nāpali Formation is highly permeable; however, that permeability has been greatly reduced by weathering and the deposition of secondary materials in openings. As a result, surface storage of water in unlined reservoirs behind dams has been successful (MacDonald et.al, 1960).

The Alluvium geological unit of the Mānā Plain is composed of alluvium washed down from the uplands. The portion of Project site on Mānā Plain is underlain by lagoon deposits, which are poorly consolidated sediments deposited in the shallow lagoon that once existed on the Mānā Plain between Kekaha and Barking Sands (MacDonald et.al, 1960).

Figure 5.5. Soils

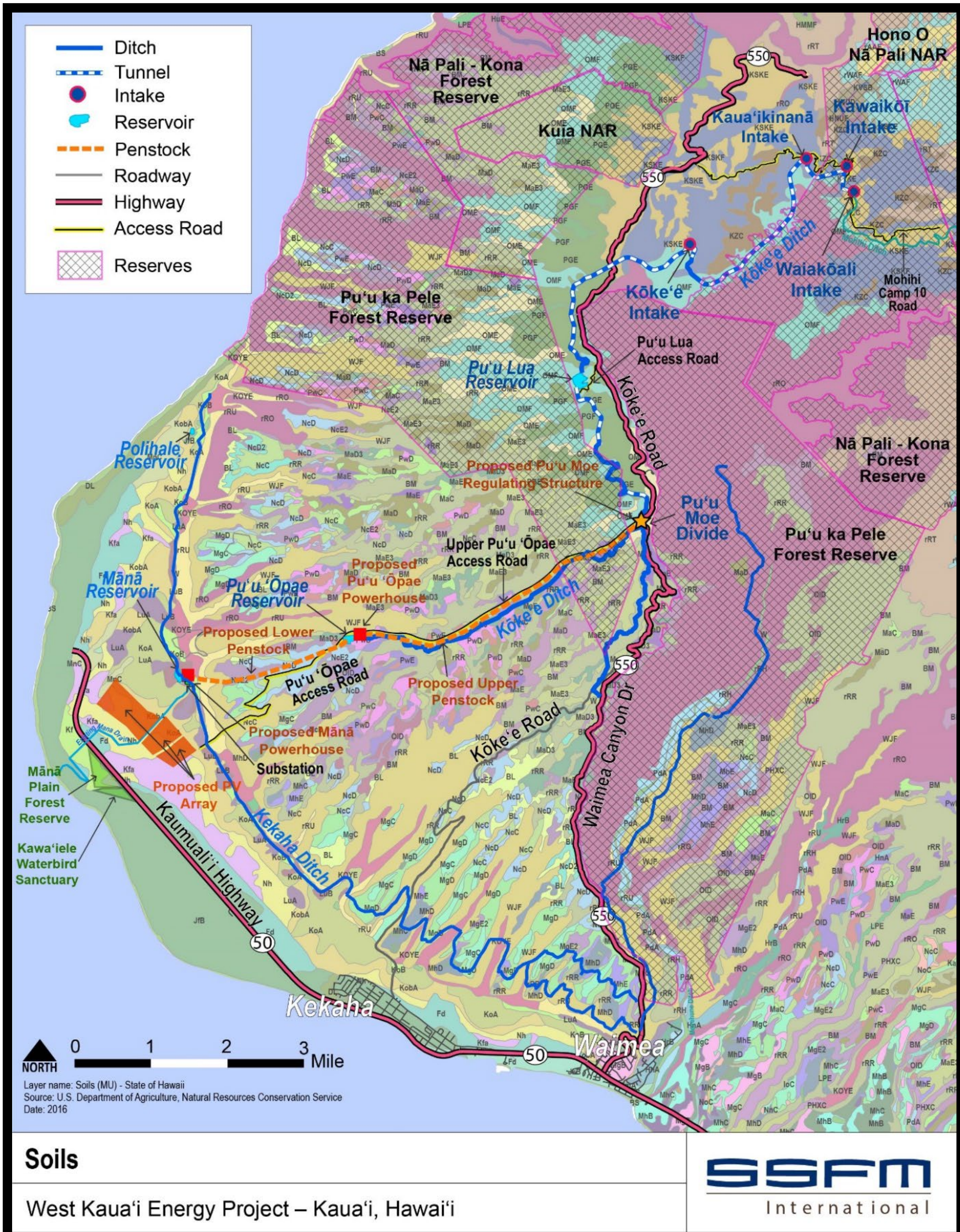
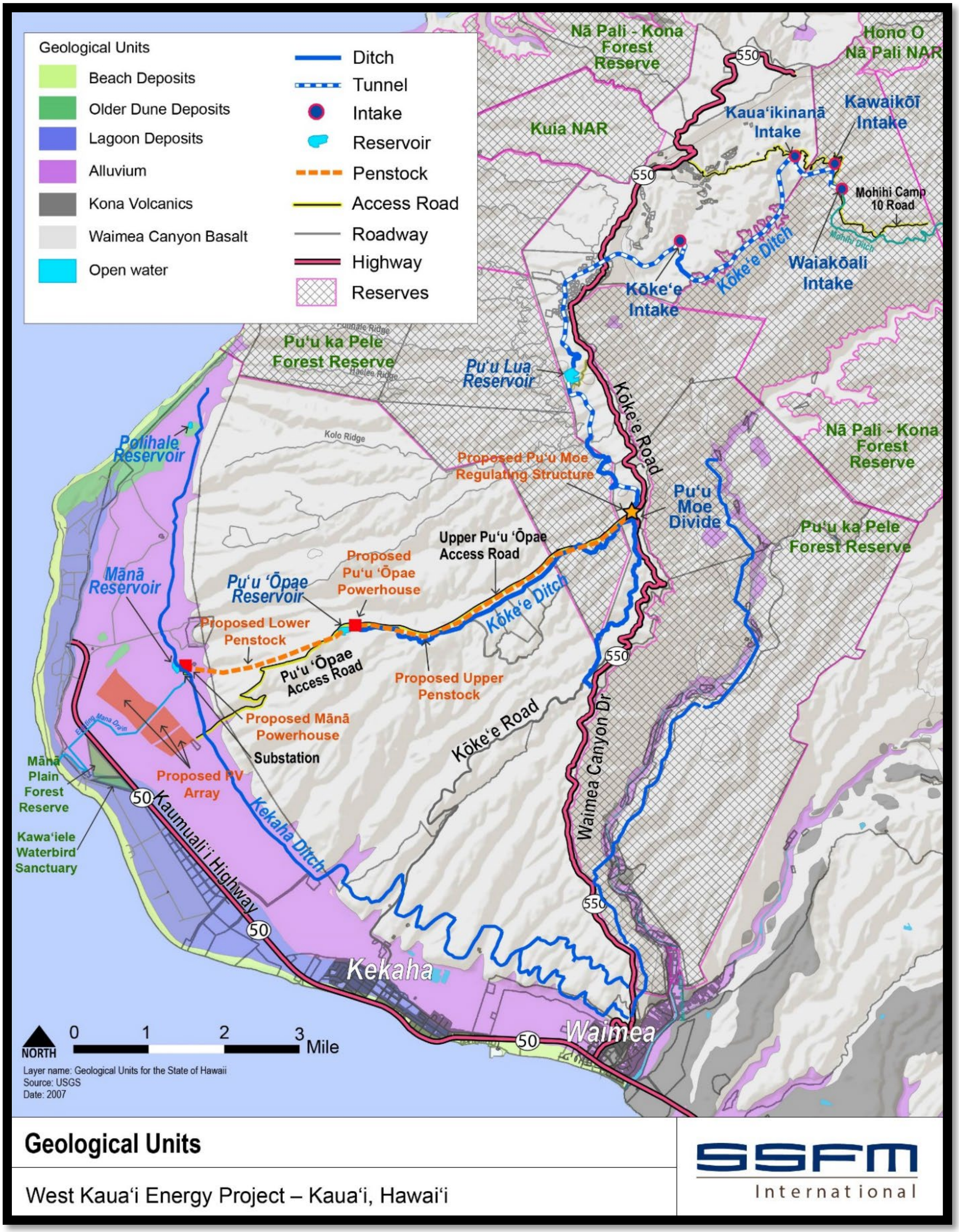


Table 5-4. Soil Series Within the Project Area

Soil Series	Elevation	Description
Kōkeʻe Series	3,400 to 4,200 feet	Consists of well-drained soils on uplands. These soils were developed in material weathered from basic igneous rock, probably mixed with volcanic ash. These soils are used for water supply, wildlife habitat, and woodland.
Oli Series	1,000 to 2,250 feet	Consists of well-drained, moderately deep to deep soils on uplands and occurs on the sides of gulches. These soils developed in volcanic ash deposited over basic igneous rock. They are gently sloping to very steep. Runoff is very rapid, and erosion is severe. These soils are used for sugarcane, pasture, woodland, and wildlife habitat.
Puʻu ʻŌpae Series	500 to 2,500 feet	Consists of well-drained soils on uplands. These soils developed in material weathered from basic igneous rock. They are moderately sloping to steep. These soils are used for pasture, woodland, and wildlife habitat.
Niu Series	750 and 1,800 feet	Consists of well-drained soils on uplands. These soils developed in material weathered from basic igneous rock, possibly mixed with volcanic ash. These soils are used for irrigated sugarcane, pasture, wildlife habitat, and woodland.
Kekaha Series	Nearly sea level to 150 feet	Consists of well-drained soils on alluvial fans and flood plains. These soils were developed in alluvium washed from upland soils. They are nearly level to steep and are used for irrigated sugarcane, pasture, and wildlife habitat.
Nohili Series	Nearly sea level to a few feet above sea level	Consists of poorly drained soils on coastal plains. These soils developed in alluvium that was deposited over marly lagoon deposits. They are nearly level. These soils are used for irrigated sugarcane and are all under cultivation.
Kaloko Series	Sea level to 20 feet	Consists of poorly drained soils on coastal plains. These soils were developed in alluvium derived from basic igneous rocks. The alluvium has been deposited over marly lagoon deposits. The soils are nearly level, and are used for irrigated sugarcane and pasture.

Source: Foote, et.al, 1972

Figure 5.6. Geological Units



5.2.2 Potential Impacts – Soils and Geology

5.2.2.1 Construction

Proposed Action

Geologic conditions at the Project sites impose no overriding constraints on the Proposed Action. Effects on geology and soils from construction of the Proposed Action would be limited to temporary ground disturbance activities and the potential for disturbed soils in the construction areas to be eroded as a result of being carried away by storm water runoff or wind. Avoidance and minimization measures would be implemented to minimize soil erosion as described in **Section 5.2.3**. All construction-related materials and equipment used would be inspected for pollutants that may impact soil quality including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use.

Kōkeʻe Ditch Irrigation System

As discussed in **Section 4.1.2.1**, the entire length of the Kōkeʻe Ditch Irrigation System between the diversions and the Puʻu Moe Divide would be inspected, cleaned, repaired, and improved as appropriate to ensure efficient water delivery and longevity. Ground disturbance activities would have the potential for disturbed soils in the construction areas to be eroded as a result of being carried away by storm water runoff or wind. Avoidance and minimization measures would be implemented to minimize soil erosion as described in **Section 5.2.3**. All construction-related materials and equipment used would be inspected for pollutants that may impact soil quality including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use.

Construction at Waiakōali Diversion would primarily involve repairs or small modifications to the existing infrastructure that are within the footprint of the existing structure or within existing cleared areas along the ditch bank (see **Section 4.1.2.2**). There would be a total of 0.09 acre of ground disturbance during construction at Waiakōali Diversion.

Construction at Kawaikōī Diversion primarily involves repairs or small modifications to the existing infrastructure that are within the footprint of the existing structure or within existing cleared areas along the ditch bank (see **Section 4.1.2.3**). There would be a total of 0.15 acre of ground disturbance during construction at Kawaikōī Diversion.

Construction at the Kauaʻikinanā Diversion involves repairs or small modifications to the existing infrastructure that are within the footprint of the existing structure or within existing cleared areas along the ditch bank, and construction of new features outside the existing diversion structure footprint. In addition, there is significant erosion and undercutting of the existing masonry wall on the downstream side of the ditch inlet and under the existing catwalk. Repairs to this area would involve clearing loose rubble, debris, and shotcrete and then rehabilitating this wall with grouted boulders and riprap to prevent further erosion (see **Section 4.1.2.4**). There would be a total of 0.11 acre of ground disturbance during construction at Kauaʻikinanā Diversion.

Construction at the Kōkeʻe Diversion involves repairs or small modifications to the existing infrastructure that are within the footprint of the existing structure or within existing cleared areas along the ditch bank (see **Section 4.1.2.5**). There would be a total of 0.03 acre of ground disturbance during construction at Kōkeʻe Diversion.

Repairs and modifications to Puʻu Lua Reservoir are intended to bring the dam into compliance with Hawaiʻi State Dam Safety Standards and restore operational storage capacity. The planned work at Puʻu Lua Reservoir involves major reconstruction of the reservoir embankments and water control structures (see **Section 4.1.2.6**). There would be a total of 21.66 acres of ground disturbance during construction at Puʻu Lua Reservoir.

A new regulating structure would be constructed at Puʻu Moe Divide on the northwest side of Trail 1 Road that would operationally replace the existing regulating structure. However, the existing regulating structure would be left in place and not disturbed. Kōkeʻe Ditch just above the Puʻu Moe Divide would be excavated to build a new concrete regulating structure to split the flow of water (see **Section 4.1.2.7**). There would be a total of 0.25 acre of ground disturbance during construction at Puʻu Moe Divide.

Upper and Lower Penstocks

The Proposed Action includes construction of the Upper and Lower Penstocks, which would be constructed of steel and buried for their entire length (see **Sections 4.1.2.8** and **4.1.2.12**, respectively). There would be a total of 77.54 acres of ground disturbance during construction of the Upper and Lower Penstocks. Ground disturbance activities would have the potential for disturbed soils in the construction areas to be eroded as a result of being carried away by storm water runoff or wind. Avoidance and minimization measures would be implemented to minimize soil erosion as described in **Section 5.2.3**. All construction-related materials and equipment used would be inspected for pollutants that may impact soil quality including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use.

Puʻu ʻŌpae Reservoir, Powerhouse, and Facility Substation

The new Puʻu ʻŌpae Powerhouse and Facility Substation would be constructed at the northeastern corner of Puʻu ʻŌpae Reservoir. The existing Puʻu ʻŌpae Reservoir has been drained and is not in operation due to dam safety concerns. The reservoir modifications have been designed to meet Hawaiʻi State Dam Safety standards (see **Sections 4.1.2.10** and **4.1.2.11**, respectively). There would be a total of 40.85 acres of ground disturbance during construction at Puʻu ʻŌpae Reservoir that would include rehabilitation of the reservoir and construction of the new Puʻu ʻŌpae Powerhouse and Facility Substation. Ground disturbance activities would have the potential for disturbed soils in the construction areas to be eroded as a result of being carried away by storm water runoff or wind. Avoidance and minimization measures would be implemented to minimize soil erosion as described in **Section 5.2.3**. All construction-related materials and equipment used would be inspected for pollutants that may impact soil quality including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use.

Mānā Reservoir, Powerhouse, Pumphouse and Facility Substation

Enlargement of Mānā Reservoir from the historic capacity of 44 MG to 80 MG is necessary to provide adequate storage for the pumped storage component of the West Kauaʻi Energy Project and to provide a storage buffer for irrigation. The expansion would occur by a combination of excavating the reservoir bottom, building up the embankments higher than the original structures, and modifying the overall shape of the reservoir to a rectangle. The Mānā Powerhouse and Pumpstation would be constructed on the northeastern edge of Mānā Reservoir and consist of a powerhouse, pumping station, and new facility substation (see **Section 4.1.2.13**).

Construction would require complete vegetation removal on all embankments and throughout the floor of the reservoir. The staging area for the construction would be located at the base of the southeast embankment. This area is a fallow agricultural field and would require the removal of existing grasses. Some vegetation removal, including trees, would be required for construction of the new powerhouse and pumpstation. Mānā Reservoir is not located on a natural stream and has been hydraulically disconnected from the Kekaha Ditch System and the Mānā Plain storm drainage system. Any rainwater accumulation in the reservoir would be drained for construction and the reservoir would be kept dry throughout the construction period.

There would be a total of 44.82 acres of ground disturbance during construction at Mānā Reservoir that would include expansion of the reservoir and construction of the new Mānā Powerhouse, Pumphouse and Facility Substation. Ground disturbance activities would have the potential for disturbed soils in the construction areas to be eroded as a result of being carried away by storm water runoff or wind. Avoidance and minimization measures would be implemented to minimize soil erosion as described in **Section 5.2.3**. All construction-related materials and equipment used would be inspected for pollutants that may impact soil quality including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use.

PV Solar Array

The PV Solar Array would be constructed on approximately 350 acres of agricultural lands makai or southwest of Mānā Reservoir. The PV work would be done simultaneously with the Mānā Reservoir, Powerhouse, Pumphouse and Facility Substation construction (see **Section 4.1.2.15**). There would be a total of 375 acres of ground disturbance during construction of the PV Solar Array. BMPs would be employed to minimize soil erosion. Ground disturbance activities would have the potential for disturbed soils in the construction areas to be eroded as a result of being carried away by storm water runoff or wind. Avoidance and minimization measures would be implemented to minimize soil erosion as described in **Section 5.2.3**. All construction-related materials and equipment used would be inspected for pollutants that may impact soil quality including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use.

The Project Substation would be constructed on approximately 7.4 acres of agricultural land south of Mānā Reservoir. This would occur simultaneously with construction of Mānā Reservoir, Powerhouse, Pumpstation and Facility Substation (see **Section 4.1.2.16**). BMPs would be employed to minimize soil erosion. Ground disturbance activities would have the potential for disturbed soils in the construction areas to be eroded as a result of being carried away by storm water runoff or wind. Avoidance and minimization measures would be implemented to minimize soil erosion as described in **Section 5.2.3**. All construction-related materials and equipment used would be inspected for pollutants that may impact soil quality including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use.

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur and there would be an increased likelihood of erosion related soil impacts due to the unmaintained reservoir embankments and ungraded access roads.

5.2.2.2 Operation

Proposed Action

Kōkeʻe Ditch Irrigation System

Under the Proposed Action, existing diversion and earthen ditch infrastructure would continue existing operations but with greatly increased oversight, due to the flow monitoring and automation on the system, and maintenance. This would result in a decreased likelihood of extent of soil related impacts from events such as storms and ungulate damage.

The operation of the rehabilitated access roads used to safely support operation and maintenance traffic would have a positive impact to soil as the maintenance of the roads and culverts would reduce the potential for soil erosion. Pollutants from vehicles that access these roads during operation of the system would be minimal.

The rehabilitated reservoirs would use either liners or rock armoring, as well as more gradual embankment slopes to eliminate or prevent soil erosion potential.

Upper and Lower Penstock

The operation of the Upper and Lower Penstock would have no impacts to geology or soil resources.

Puʻu ʻŌpae and Mānā Powerhouses, Mānā Pumpstation, and Facility Substations

The operation of the Puʻu ʻŌpae and Mānā Powerhouses, Mānā Pumpstation and Facility Substations would have no impacts to geology or soil resources.

The operation of the rehabilitated access roads used to safely support operation and maintenance traffic would have a positive impact to soil as the maintenance of the roads and culverts would reduce the potential for soil erosion. Pollutants from vehicles that access these roads during operation of the system would be minimal.

PV Solar Array, West Kauaʻi Energy Project Substation, and Interconnection Line

The operation of the PV Solar Array, West Kauaʻi Energy Project Substation, and Interconnection Line would have no impacts to geology or soil resources.

No-Action Alternative

Under the No-Action Alternative, responsibility for the operation and ongoing maintenance of existing reservoirs and the Kōkeʻe Ditch System would remain the responsibility of the State. If the reservoirs remain in their current state, there would be an increased likelihood of erosion related soil impacts on the embankments. The rehabilitation improvements necessary to meet Hawaiʻi State Dam Safety Standards or decommissioning of the reservoirs would be the responsibility of the State. The Kōkeʻe Ditch Irrigation System would remain under management of ADC and could result in a continuance of reduced operations or closure of the system. Road maintenance and repairs would fall to the State and may result in the increased likelihood of erosion related soil impacts if roads are left unmaintained.

5.2.3 Avoidance and Minimization Measures – Soils and Geology

The Applicant would obtain all required permits and comply with permit conditions to minimize impacts to soils. Permits would include, but may not be limited to, the following:

- NPDES Individual Permit from the Clean Water Branch of the DOH for stormwater discharge associated with construction activities
- NPDES Dewatering Permit from the Clean Water Branch of the DOH for discharges associated with construction activity dewatering
- Grading, Grubbing, and Stockpiling Permits from the County of Kauaʻi, Department of Public Works

As part of the permit process, the Applicant would prepare a construction site BMP plan that would include an erosion and sediment control plan, a site-specific plan to minimize erosion of soil and discharge of other pollutants into State waters, and descriptions of measures that would minimize the discharge of pollutants via stormwater after construction is complete.

BMPs would include some or more of the following measures:

- Temporary soil stabilization techniques throughout construction to minimize disturbed soils being carried away by water or wind.
- Watering or applying dust suppressants at active work areas and Project access roads, as needed.
- Installing dust screens or wind barriers around the construction site.
- Installation of Filter Sock Perimeter Controls adjacent and down slope from disturbed areas.
- Cleaning nearby pavements and paved roads after construction.
- Covering open trucks carrying construction materials and debris.
- Limiting areas to be disturbed at any given time.
- All Project construction-related materials and equipment used are to be inspected for pollutants including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use.
- Fueling of Project-related vehicles and equipment would take place away from the Project area. A contingency plan for accidental spills of petroleum products would be developed

and retained on-site. Absorbent pads and containment booms would be stored on-site to facilitate clean-up of accidental petroleum releases to the soil.

BMPs would be installed prior to ground-disturbing activities and would be inspected and maintained throughout the construction period.

5.3 Biological Resources

5.3.1 Affected Environment – Biological Resources

The following subsections provide an overview of the biological resources within the Project area. A terrestrial flora and fauna survey and a stream habitat survey have been conducted as part of the HRS Chapter 343 process.

The flora and fauna surveys were conducted between August and October 2018 and in March 2022, which comprised both pedestrian (foot) and reconnaissance-level (automobile) ground surveys of a 981-acre study area in western Kauaʻi. The Proposed Action is entirely within this 981-acre study area. Flora surveys were conducted to document vegetation types; plant species, including the potential for special-status plant species to occur in the study area; and areas designated as critical habitat. The presence of plants traditionally gathered for cultural use were also noted. Fauna surveys were conducted to document all birds, mammals, reptiles, amphibians, fish, and invertebrate species seen or heard. Any signs, such as scat or tracks, were also noted. Surveys for the endangered Hawaiian hoary bat were conducted by noting areas of suitable foraging and roosting habitat as indicators of potential presence. The results of the flora and fauna surveys are summarized later in this **Section 5.3.1** and potential impacts are summarized in **Section 5.3.2** below. The complete *Terrestrial Flora and Fauna Technical Report for the Proposed Puʻu ʻŌpae Water/West Kauaʻi Energy Project* is provided in **Appendix H** of this EA.

Stream fish and habitat assessments were conducted on the upper Waimea River and its tributaries (Mōhihi, Waiakōali, Kawaikōī, Kauaʻikinanā, Kōkeʻe, Waiahulu, and Poʻomau streams) in February and June of 2018 to collect habitat, biota, water quality, and stream discharge data. The primary goal of this assessment was to document the current native stream animals' habitat both above and below the stream diversions on four tributary streams of the Waimea River and above the Waiahulu Diversion to provide baseline samples to assess impacts of the West Kauaʻi Energy Project.

In addition to information gained from the direct surveys in the streams impacted by the diversions, data from the surveys were used to help assess the impacts of the Project on the native stream animals and their habitats under several conditions using the Hawaiian Stream Habitat Evaluation Procedure (HSHEP) model. The HSHEP model was designed to assess the impacts of stream diversion on stream species and captures the major aspects of native stream animal ecology, the typical geomorphology of Hawaiian streams, and common modifications to the environment. The underlying assumption with the HSHEP model is if adequate habitat for the native stream animals is available, then the broader aspect of stream ecosystem health would also be protected.

When addressing the major aspects of native stream animal ecology and their interaction with stream diversions, the HSHEP model quantifies:

- the loss of instream habitat resulting from the removal of water from a stream,
- the loss of habitat resulting from direct habitat modification (changing a natural stream bottom to concrete, etc.),
- loss of habitat resulting from a barrier to animal movement, and
- loss of animals due to entrainment into water diversion systems.

Four scenarios were analyzed using the HSHEP model. The first two scenarios were intended to estimate minimum and maximum potential impact conditions: (1) No-Diversion scenario which serves as an estimate of the minimum (no) impact to native stream animals' habitat and the (2) Full-Diversion scenario which represents the maximum impact scenario for comparison. Two additional scenarios were also modeled to address specific Project conditions: (3) IIFS Flow Restoration scenario that reflects flow conditions described by the state mandated IIFS and (4) Current Conditions scenario based on conditions we observed during the Project surveys.

In addition to assessing different stream diversion scenarios, the stream species in **Table 5-5** were included in the stream habitat assessment. These species were included for the following reasons:

1. These species were identified as "Species of Greatest Conservation Need" in the Hawaiʻi Statewide Aquatic Wildlife Conservation Strategy.
2. These species have been observed on Kauaʻi and statewide.
3. All of these species have a diadromous life history, meaning that they migrate from the freshwater stream to the ocean and back again. This potentially exposes the migrating animals to barriers in the stream pathway, entrainment into water diversion systems, and elimination of suitable habitat resulting from structures associated with the ditch system and its diversions.
4. The DAR Aquatic Surveys Database has distribution and habitat use information for each of these species.
5. The HSHEP model has habitat suitability indices developed for each of these species.
6. Hapawai (Neritina vespertine) was not included as it is primarily a marine/estuarine species and would not be found far inland in freshwater streams.

Table 5-5. Stream Species Included in Stream Habitat Assessment

Organism Type and Family	Scientific name	Hawaiian name
Freshwater fish (family Gobiidae)	*Awaous stamenius*	ʻOʻopu nākea
	Lentipes concolor	ʻOʻopu alamoʻo
	Stenogobius hawaiiensis	ʻOʻopu naniha
	Sicyopterus stimpsoni	ʻOʻopu nōpili
Freshwater fish (family Eleotridae)	*Eleotris sandwicensis*	ʻOʻopu akupa
Freshwater shrimp (Crustacean) (family Atyidae)	*Atyoida bisulcata*	ʻŌpae kalaʻole
Freshwater prawn (Crustacean) (family Palaemonidae)	*Macrobrachium grandimanus*	ʻŌpae ʻoehaʻa
Freshwater snail (Mollusk) (family Neritidae)	*Neritina granosa*	Hīhīwai

Based on the results of the assessment, primary conclusions concerning the Proposed Action's diversions were:

- The location of the Kōkeʻe Ditch diversions at the back end of the Waimea River watershed minimizes the overall impact of these diversions on native stream animal habitat. It is important to realize that the Waimea River system is one of the largest in the Hawaiian Islands and the Kōkeʻe diversions are located far inland on upper tributary streams. The native stream animals of concern are all amphidromous. The adults live and reproduce in the freshwater streams. When the eggs hatch, the larvae must drift downstream to further develop in the ocean. After some time, they will return to migrate upstream as post-larvae to find suitable habitat to grow and reproduce. Results from the HSHEP model suggests that the majority of native stream animal habitat (89%) is located downstream of the Waiahulu diversion on the Kekaha Ditch system (not part of the Project). Only opae kalaʻole (*Atyoida bisulcata*) had suitable habitat above the Kōkeʻe diversions, amounting to only 3% of its suitable habitat in the entire Waimea River system. As a result of the migratory life history of these animals, impacts found lower in the watershed level have a greater effect than those found further upstream.
- Instream habitat was good throughout the survey area and restoration of streamflow as defined in the IIFS will improve habitat suitability. Generally, all the sites within the Project area have high-quality habitat conditions under current operating conditions. With the exception of the immediate area around the Kōkeʻe Ditch diversions, the streams had minimally impacted shoreline vegetation, an excellent mix of substrate and cover present, low embeddedness, cool water temperature, high dissolved oxygen and low turbidity. Most habitat problems associated with diversions were related to the reduction in flow below the diversion. The IIFS flow standards outlined in the Waimea Mediation Agreement for the streams diverted into Kōkeʻe Ditch will likely alleviate much

of the direct problems associated with the current 100% diversion of flow on instream habitat and are predicted to increase 33% of the overall available habitat.

The complete *Puʻu ʻŌpae Hydropower Diversion Assessment using HSHEP Model* is provided in **Appendix G** of this Final EA.

5.3.1.1 Vegetation Classifications

The Hawaiʻi GAP (HIGAP) vegetation data layer describes 12 vegetation cover types in the 968-acre study area as shown in **Table 5-6**. Field surveys confirmed that that HIGAP data was highly representative of the study area.

Table 5-6. Area of Vegetation Cover Types in the Study Area

Vegetation Cover Type	Area (acres)	% of Total
Agriculture	491	50%
Alien Forest	128	13%
Alien Shrubland	121	12%
Very Sparse Vegetation to Unvegetated	93	9%
Closed Koa-ʻŌhiʻa Forest	49	5%
Water	32	3%
Open/Closed ʻŌhiʻa Forest	25	3%
Native Mesic to Dry Forest and Shrubland	16	2%
Koa Haole Shrubland	12	1%
Kiawe Forest and Shrubland	7	1%
Alien Grassland	7	1%
Low-Intensity Developed	2	<1%
Total	**983**	**100%**

Agriculture

According to the HIGAP vegetation layer, the Agriculture vegetation type makes up 50% of the study area. Approximately 80% is in the PV Solar Array footprint and 20% is at the Lower Penstock and Mānā Reservoir footprints. In the study area, this vegetation type consists of abandoned sugarcane (*Saccharum* sp.) fields. The sugarcane has been replaced over time by weedy ruderal species such as Guinea grass (*Urochloa maxima*) and koa haole (*Leucaena leucocephala*), which are the two most common species in this type. Other species noted during the surveys include kiawe (*Prosopis pallida*), castor bean (*Ricinus communis*), lion's ear (*Leonotis nepetifolia*), swollen fingergrass (*Chloris barbata*), and comb hyptis (*Hyptis pectinata*). The nonnative ruderal vines bitter melon (*Momordica charantia*), teasel gourd (*Cucumis dipsaceus*), *Macroptilium atropurpureum,* purple bushbean (*Macroptilium atropurpureum*), and little bell (*Ipomoea triloba*) can be seen scattered throughout. Grass species and koa haole dominate the middle of the fallow fields, with other herbaceous and woody species along the margins and near ditches and other waterways.

Alien Forest

Alien Forest is the most common vegetation type in upcountry portions of the study area. According to the HIGAP vegetation layer, this vegetation type makes up 13% of the study area. This vegetation type is described as "Mixed, typically dense canopies of alien tree species, often plantation forest plantings, with dominants including, but not limited to: *Eucalyptus*, *Casuarina*, *Falcataria*, *Araucaria*, *Fraxinus*, *Melaleuca*, *Psidium*, and *Grevillea* spp" (Gon et al., 2006). Various eucalyptus species (*Eucalyptus* spp.), likely introduced as forestry plantings, are the predominant overstory species in this vegetation type in the study area. Other dominant overstory species vary with location, elevation, and rainfall levels and include sugi pine (*Cryptomeria japonica*), mainly at Kawaikōī Intake; slash pine (*Pinus elliottii*), at Puʻu Lua Reservoir and the Upper Penstock; black wattle (*Acacia mearnsii*)*,* at Puʻu ʻŌpae and Puʻu Lua Reservoirs; and silk oak (*Grevillea robusta*), mainly in the Kōkeʻe Diversion but found near many portions of the study area. Remnant stands of the native koa (*Acacia koa*) and ʻōhiʻa (*Metrosideros polymorpha*) are occasionally in the overstory. When present, the midstory of this vegetation type is most often dominated by strawberry guava (*Psidium cattleianum*), an invasive species that can establish in the shade of other, larger trees. Understory species establishing in the dense shade of eucalyptus and other alien trees are uncommon; however, nonnative herbaceous species and grasses establish readily at the margins of this vegetation type. Dominant species vary depending on location and include barbas de indio (*Andropogon bicornis*), a highly invasive grass being spread by maintenance work and found at the Lower Penstock, the Puʻu ʻŌpae Reservoir, and the Upper Penstock; West Indian dropseed (*Sporobolus indicus*), a common nonnative grass seen in most locations; narrow-leaved plantain (*Plantago lanceolata*), a nonnative herbaceous species seen along roads and other disturbed areas in many sites; and kahili ginger (*Hedychium gardnerianum*) and prickly Florida blackberry (*Rubus argutus*)*,* two common invasive species found in the understory in several locations. Vining species found in this vegetation type in the study area include Japanese honeysuckle (*Lonicera japonica*) and earring flower (*Fuchsia magellanica*).

Alien Shrubland

According to the HIGAP vegetation layer, the Alien Shrubland vegetation type makes up 12% of the study area. Alien Shrubland is in located at the PV Solar Array site, the Kōkeʻe Intake, Lower Penstock, Puʻu ʻŌpae Reservoir, and Upper Penstock. Shrub and tree species common in this vegetation type in the study area include kiawe*,* koa haole*,* klu (*Vachellia farnesiana*)*,* and lantana (*Lantana camara*)*.* The native shrub species pūkiawe (*Leptecophylla tameiameiae*) and ʻaʻaliʻi (*Dodonaea viscosa*) are scattered in the Upper Penstock area. Herbaceous species in this vegetation type are consistent with the species seen along margins in the Alien Forest. Barbas de indio grass is common in this vegetation type and mainly colonizes disturbed roadside areas, but it is also capable of growing in the thick uluhe (*Dicranopteris linearis*) thickets occasionally seen in this vegetation type.

Closed Koa-ʻŌhiʻa Forest and Open/Closed ʻŌhiʻa Forest

According to the HIGAP vegetation layer, the Closed Koa-ʻŌhiʻa Forest and Open/Closed ʻŌhiʻa Forest vegetation types make up 8% of the study area. Open forests have sparser canopy cover than closed forests. A strictly native species-dominated overstory was rarely seen in the study area; rather, these forests tended to have koa and ʻōhiʻa co-dominating with invasive species such as firetree (*Morella faya*), Eucalyptus, sugi pine, and black wattle. The midstory is often a co-dominant mixture of native and non-native species. Native species include hāpu‘u fern (*Cibotium* sp.), pilo (*Kadu* sp.), Alani (*Melicope* sp.), ‘ahakea lau li‘i (*Bobea brevipes*), naupaka kuahiwi (*Scaevola procera*), and kāwa‘u (*Ilex anomala*). Non-native species include kahili ginger and strawberry guava. The understory consists of uluhe (a native fern) with a mixture of non-native herbaceous species along the margins, including narrow-leaved plantain (*Plantago lanceolata*), West Indian dropseed, and Meyens flatsedge (*Cyperus meyenianus*). Japanese honeysuckle and earring flower are seen twining in sunnier, more open portions of these vegetation types.

Water

Reservoirs, streams, and irrigation ditches found in the agricultural portions of the study area provide habitat for several nonnative hydrophytic plant species, including sourbush (*Pluchea carolinensis*), umbrella sedge (*Cyperus involucratus*), and California grass (*Urochloa mutica*). Upper-elevation water features were bordered by a variety of mostly non-native grass species, including barbas de indio, bristly foxtail (*Setaria verticillata*), meadow ricegrass (*Ehrharta stipoides*), and dallis grass (*Paspalum dilatatum*). Ruderal species such as milkwort (*Polygala paniculata*), horseweed (*Conyza canadensis*), and comb hyptis (*Hyptis pectinata*) are also commonly seen.

Native Mesic to Dry Forest and Shrubland

The Native Mesic to Dry Forest and Shrubland vegetation type consists of approximately 2% of the vegetation in the study area. Gon et al. (2006) describe this vegetation type as follows: “Vegetation a composite of low forest and adjacent shrubland types, typically in lowland mesic to dry-mesic settings, typically on steep to moderate slopes, where topography hinders ability to distinguish between specific types, but typically including koa-dominated forest types and ‘a‘ali‘i and other dry shrublands, adjacent to Koa-‘Ōhi‘a Forest at higher elevations.” Koa is the most common native tree in these areas, and the non-native species ironwood (*Casuarina equisetifolia*), silk oak, eucalyptus, paperbark (*Melaleuca quinquenervia*), and slash pine are found throughout. Shrub species include pūkiawe, ‘a‘ali‘i, and lantana, and uluhe dominates the understory in this vegetation type in the study area.

Koa Haole Shrubland and Kiawe Forest and Shrubland

The Koa Haole Shrubland and Kiawe Forest and Shrubland vegetation types account for a combined total of less than 2% of the vegetation in the study area. Shrublands dominated by koa haole and kiawe were noted in lowland, agricultural portions of the study area. The descriptions of these two vegetation types are combined because of their similarities. The overstory is made up mainly of these two species, punctuated occasionally by non-native trees such as mango (*Mangifera indica*), monkeypod (*Samanea saman*), and eucalyptus. Guinea grass and castor bean are in the midstory, and common ruderal species such as lion’s ear, ‘uhaloa (*Waltheria indica*), comb hyptis, and cocklebur (*Xanthium strumarium* var. *canadense*) dominate the understory and nearby areas.

Alien Grassland

The Alien Grassland vegetation type accounts for 1% of the vegetation in the study area. Non-native grasses such as swollen fingergrass (*Chloris barbata*), Guinea grass, and pitted beardgrass (*Bothriochloa pertusa*) are on the margins of most agricultural fields in the study area. Mixed in with these grasses is a variety of ruderal herbaceous species, similar to those found within the Agriculture, Koa Haole Shrubland, and Kiawe Forest and Shrubland vegetation types.

Low-Intensity Developed

The Low-Intensity Developed vegetation type accounts for less than 1% of the vegetation in the study area. Areas labeled as Low-Intensity Developed are described by Gon et al. (2006) as constructed areas mixed with substantial amounts of vegetated surface. Within the study area, this HIGAP designation mainly refers to small sheds, quarry structures, and other human-made items related to past and present land use.

5.3.1.2 Special-Status Flora and Critical Habitat

Special-status flora refers to plant species listed by the USFWS and the State of Hawaiʻi as threatened, endangered, or candidate species. There are nine special-status plant species with USFWS-designated critical habitat within the upperwatershed portion of the study area, specifically in the Kōkeʻe and Kauaʻikinanā Intakes: Montane Mesic Unit 1, Montane Mesic Unit 2, and Montane Wet Unit 2. **Table 5-7** identifies the flora species with designated critical habitat within the Project area. As noted in the table, all of these flora species are endangered. Critical habitat areas are shown **Figure 5.7.**

Table 5-7. Flora Species with Designated Critical Habitat Within the Study Area

HIGAP Vegetation Classification	Species	Status
Kōkeʻe Intake (Montane Mesic – Unit 2)		
Alien Forest	*Nothocestrum peltatum*	E
	Xylosma crenatum	E
	Remya Kauaʻiensis	E
	Solanum sandwicense	E
Kauaʻikinanā Intake (Montane Wet – Unit 2)		
Open-ʻŌhiʻa Forest (uluhe)	*Xylosma crenatum*	CE
	Dubautia latifolia	CE
	Solanum sandwicense	E
	Nothocestrum peltatum	CE
	Remya Kauaʻiensis	E

CE = Critically Endangered
E = Endangered

There were no special-status plant species found during ground surveys of the study area even though some facilities are located within critical habitat designated for those flora species.

However, DOFAW has identified 18 federally listed endangered, threatened, or otherwise rare plant species that may occur in or near the study area: *Asplenium dielmannii, Cyanea leptostegia, Euphorbia halemanui, Exocarpos luteolus, Gahnia aspera* subsp. *globosa, Melanthera fauriei, Melanthera waimeaensis, Myrsine mezii, Panicum niihauense, Poa sandvicensis, Pritchardia minor, Schiedea lychnoides, Schiedea viscosa, Sesbania tomentosa, Sicyos lanceoloideus, Sicyos waiMānāloensis, Spermolepis hawaiiensis,* and *Wilkesia hobdyi.* Although these species were not found during ground surveys of the study area, it is possible that they could or do exist in these areas, particularly on steep cliffs and gulches inaccessible to grazing ungulates. Giant Kōkeʻe (*Cyanea leptostegia*) was observed along the Kōkeʻe Diversion access road. This species is listed as a Species of Concern by the USFWS, but there are no management actions required for Species of Concern.

5.3.1.3 Native Vegetation

The majority of the study area is dominated by alien forest, shrubland, and grassland (agriculture land). Common invasive forest and grassland species typically form monocultures that outcompete native plants, causing further disturbance and decreasing the potential for native and unique species to occur. However, the areas around the Kauaʻikinanā and Kawaikōī Diversions contain 50% or greater cover of native vegetation. The east end of the Kōkeʻe Diversion access road is the most native-species dominated portion of the study area. It consists of an overstory of koa with an understory of ʻukiʻuki (*Dianella sandwicensis*) and an array of native shrub and tree species in the mid-story. Native species, and especially threatened and endangered species, have higher potential to occur in higher elevation landcover types and are more likely to occur in areas that pigs and goats cannot access, such as cliff faces and other steep topography.

5.3.1.4 Rapid ʻŌhiʻa Death

Rapid ʻŌhiʻa Death (ROD) disease has been found on the islands of Hawaiʻi, Kauaʻi, Maui, and Oʻahu. On Kauaʻi, both species of the fungal pathogens causing ROD have been identified: *Ceratocystis lukuʻŌhiʻa* and *Ceratocystis huliʻŌhiʻa.* The *Ceratocystis* fungus enters the tree through a wound (e.g., broken limb, twig, scuffed exposed root) and grows in the sapwood of infected ʻōhiʻa trees. *Ceratocystis lukuʻŌhiʻa* can kill an ʻōhiʻa tree in a week, whereas *Ceratocystis huliʻŌhiʻa* may take months to years. Humans are thought to be a main vector through the movement of wood or contaminated tools, gear, and vehicles from one location to another. Other potential vectors include feral ungulates and beetles.

5.3.1.5 Fauna

The fauna observed in the study area includes species that are endemic, indigenous, migratory, and nonnative introductions. The endemic, indigenous, and migratory species often require specific niche habitats and are frequently locally abundant where they occur. The nonnative introduced species tend to be more generalist and often occupy a broad range of habitats.

Figure 5.7. Critical Habitat for Hawaiian Plants

Avifauna

The birds observed in the study area are species commonly found in water reservoirs, waterways, agricultural fields, shrubland, and forest areas 8 to 3,500 feet above sea level in northwestern Kaua'i. In all, 34 bird species were documented, 16 of which are protected by the Migratory Bird Treaty Act (MBTA). All 34 bird species identified, where identified, and status are shown in **Table 5-8**.

The 'i'iwi, Hawaiian duck, Hawaiian goose, and Hawaiian moorhen were detected during the field surveys. One 'i'iwi was detected at the Kaua'ikinanā Diversion, which is in the forest wildlife habitat of the study area. Six Hawaiian geese were observed flying over the proposed PV Solar Array, and 11 Hawaiian geese and one Hawaiian moorhen were observed foraging in the Mānā Reservoir. Hawaiian ducks were observed foraging and loafing in the Pu'u Lua and Pu'u 'Ōpae Reservoirs (five at Pu'u Lua and two at Pu'u 'Ōpae).

Table 5-8. Birds Observed In and Near the Study Area

Common Name	Scientific Name	Location(s)[1]	Status[2]	MBTA
African silverbill	*Euodice cantans*	PO	NN	
Apapane	*Himatione sanguinea*	KKW, K	E	X
Barn owl	*Tyto alba*	K	NN	X
Black-crowned night heron	*Nycticorax nycticorax*	MR	I	X
Black francolin	*Francolinus francolinus*	MR	NN	
Brazilian cardinal	*Paroaria coronata*	KKW, PL, PO, K	NN	
Cattle egret	*Bubulcus ibis*	MR	NN	X
Chestnut munia	*Lonchura atricapilla*	MR	NN	
Common myna	*Acridotheres tristis*	KKW, MR, PL, PO	NN	
Erckel's francolin	*Pternistis erckelii*	KKW, PL, PO	NN	
Feral chicken	*Gallus domesticus*	KKW, MR, PL, PM, PO	NN	
Gray francolin	*Francolinus pondicerianus*	MR	NN	
Great frigatebird	*Fregata minor*	PO	I	X
Hawaiian duck[3]	*Anas wyvilliana*	PL, PO	E	X
Hawaiian moorhen[3]	*Gallinula galeata sandvicensis*	MR	E	X
House finch	*Haemorhous mexicanus*	KKW, MR, PL, PO	NN	X
'I'iwi[3]	*Drepanis coccinea*	KKW	E	X
Japanese bush warbler	*Horornis diphone*	MR	NN	

Table 5-8. Birds Observed In and Near the Study Area (Cont.)

Common Name	Scientific Name	Location(s)[1]	Status[2]	MBTA
Japanese white-eye	*Zosterops japonicus*	KKW, MR, PL, PM, PO, K	NN	
Kauai amakihi	*Chlorodrepanis stejnegeri*	KKW	E	X
Kauai ʻelepaio	*Chasiempis sclateri*	KKW, K	E	X
Melodious laughingthrush	*Garrulax canorus*	KKW, MR, PL, PO, K	NN	
Hawaiian goose[3]	*Branta sandvicensis*	MR	E	X
Northern cardinal	*Cardinalis*	MR, PO	NN	X
Northern mockingbird	*Mimus polyglottos*	MR, PO	NN	X
Pacific golden-plover	*Pluvialis fulva*	PL, PO	M	X
Red avadavat	*Amandava amandava*	MR	NN	
Ring-neck pheasant	*Phasianus colchicus*	MR	NN	
Rock dove	*Columba livia*	MR, PO	NN	
Scaly-breasted munia	*Lonchura punctulata*	KKW, MR, PL	NN	
Spotted dove	*Spilopelia chinensis*	MR, PO	NN	
Wandering tattler	*Tringa incana*	PL	M	X
White-rumped shama	*Copsychus malabaricus*	KKW, MR, PL, PO, K	NN	
Zebra dove	*Geopelia striata*	MR, PO	NN	

1 Kauaʻikinanā Intake, Kawaikōī Intake, and Waiakōali Intake = KKW; Mānā Reservoir = MR; Puʻu Lua Intake = PL; Puʻu Moe = PM; Puʻu ʻŌpae = PO; and Kōkeʻe Intake = K

2 Status: E = endemic, I = indigenous, NN = nonnative permanent resident, M = migrant

3 Federally and state-listed endangered birds detected during ground surveys

Four special-status forest bird species were observed in the study area: ʻiʻiwi, Kauaʻi thrush, Kauaʻi akepa, and Kauaʻi creeper. These species are recognized by the USFWS and the State of Hawaiʻi as threatened, endangered, or candidate. Three additional native forest bird species that are not threatened, endangered, or candidate were observed during surveys: ʻapapane (*Himatione sanguinea*), Kauai ʻamakihi (*Chlorodrepanis stejnegeri*), and Kauai ʻelepaio (*Chasiempis sclateri*). ʻApapane and Kauai ʻamakihi are covered under the MBTA. In addition, five passerines and three francolin species, all of which are nonnative, may be present within forests or forest margins: black francolin (*Francolinus francolinus*), Erckel's francolin (*Pternistis erckelii*), gray francolin (*Francolinus pondicerianus*), Japanese bush warbler (*Horornis diphone*), Japanese white-eye (*Zosterops japonicus*), melodious laughingthrush (*Garrulax canorus*), northern mockingbird (*Mimus polyglottos*), and white-rumped shama (*Copsychus malabaricus*).

The Federal and State-listed special-status avifauna species are discussed below.

Mammals

Mammals detected during the surveys include cow (*Bos taurus*), feral goat (*Capra hircus*), feral pig (*Sus scrofa*), domestic dog (*Canis familiaris*), and feral cat (*Felis catus*). No other mammals were observed during the ground surveys, although rat (*Rattus* spp.) and mouse (*Mus musculus*) are expected to occur.

Terrestrial Reptiles and Amphibians

No terrestrial reptiles or amphibians are native to Hawaiʻi. The garden skink (*Lampropholis delicata*), house gecko (*Hemidactylus frenatus*), and American bullfrog (*Rana catesbeiana*) are the only reptile or amphibian species detected during the ground surveys.

Insects and Invertebrates

Twenty-six invertebrate individuals were observed during the survey. Of these, 24 were identified to the genus or species level. Of these, two species are endemic to Hawaiʻi (potter wasp [*Euodynerus* sp.] and a damselfly [*Megalagrion* sp.]) and two are indigenous (green darner [*Anax junius*] and golden skimmer [*Pantala flavescens*]). The remaining species are nonnative introductions: house fly (*Musca domestica*), black soldier fly (*Hermetia illucens*), honey bee (*Apis* sp.), black and yellow mud dauber (*Sceliphron caementarium*), katydid (*Microcentrum rhombifolium*), gray bird grasshopper (*Schistocerca nitens*), Rambur's forktail damselfly (*Ischnura ramburii*), familiar bluet damselfly (*Enallagma civile*), spot-winged glider (*Pantala hymenaea*), roseate skimmer dragonfly (*Orthemis ferruginea*), American lady butterfly (*Vanessa virginiensis*), black witch moth (*Ascalapha odorata*), cabbage white (*Pieris rapae*), Southern green stinkbug (*Nezara viridula*), aedes mosquito (*Aedes* sp.), carpenter bee (*Xylocopa sonorina*), orb-weaver spider (*Gasteracantha cancriformis*), Hawaiian garden spider (*Argiope appensa*), variable ladybird beetle (*Coelophora inaequalis*), Fuller rose beetle (*Naupactus cervinus*), and various ants. All are common in northwest Kauaʻi.

Special-Status Fauna and Critical Habitat

Special-status fauna refers to wildlife species listed by the USFWS and the State of Hawaiʻi as threatened, endangered, or candidate. The USFWS and DOFAW list 14 special-status species that may occur in the study area as shown in **Table 5-9.**

These species could either occur in or transit over, in the case of seabirds, the study area based on the wildlife habitat present.

Table 5-9. Special Status Fauna Species with Potential to Occur Within the Study Area

Common Name	Scientific Name	Status
Hawaiian hoary bat	*Lasiurus cinereus semotus*	E
Hawaiian petrel	*Pterodroma sandwichensis*	E
Scarlet Honey Creeper	*Drepanis coccinea*	E
Newell's shearwater	*Puffinus auricularis newelli*	T
Band-rumped storm-petrel	*Oceanodroma castro*	C
Nēnē	*Branta sandvicensis*	E
Hawaiian duck	*Anas wyvilliana*	E
Common moorhen (Hawaiian stilt)	*Gallinula chloropus sandvicensis*	E
Hawaiian coot	*Fulica Americana alai*	E
Black-necked stilt	*Himantopus himantopus knudseni*	E
ʻIʻiwi or Kauaʻi thrush	*Myadestes palmeri*	E
Kauaʻi akepa (Akekeʻe)	*Loxops caeruleirostris*	E
Kauaʻi creeper (ʻAkikiki)	*Oreomystis bairdi*	C
Picture-wing fly	*Drosophila sharpi*	E

E = Endangered
T = Threatened
C = Candidate

Four special-status species—ʻiʻiwi, Hawaiian duck, Hawaiian goose, and Hawaiian gallinule—were detected during the field surveys. One ʻiʻiwi was detected at the Kauaʻikinanā Diversion, which is in the forest wildlife habitat of the study area. Six Hawaiian geese were observed flying over the proposed solar field, and 11 Hawaiian geese and one Hawaiian gallinule were observed foraging in the Mānā Reservoir. Hawaiian ducks were observed foraging and loafing in the Puʻu Lua and Puʻu ʻŌpae Reservoirs (five at Puʻu Lua and two at Puʻu ʻŌpae).

There is a known band-rumped storm-petrel colony in Waimea Canyon. This colony is located approximately 0.5 mile from the nearest portion of the study area, which is Puʻu Lua Reservoir. In addition, dense forest occurs between the proposed Project area and the colony, which provides a buffer from potential disturbances (personal communication, Andre Raine, Archipelago Research and Conservation, February 2, 2022). Therefore, this petrel colony is very unlikely to be impacted by the Project.

Although not observed in the study area, the potential for the presence of Hawaiian hoary bat was assessed based on the presence of suitable habitat and vegetation types; no acoustic survey was conducted. Hawaiian hoary bats forage and roost in pastures, croplands, orchards, forests, and developed lands such as golf courses, urban areas, and suburban yards. Hawaiian hoary bats are solitary and roost in exotic and native woody vegetation. They could forage throughout the study area and roost in the trees of the study area's 210 acres of forest wildlife habitat type. The birthing and pup-rearing season typically occurs between June 1 and September 15. It is common for adult females to leave flightless young unattended in “nursery” trees and shrubs while foraging. Hawaiian hoary bats have been recorded at Puʻu Lua Reservoir, Puʻu Ka Pele Forest Reserve, and as far downslope as Puʻu ʻŌpae (DOFAW Kauaʻi Branch 2021). This bat species has been documented roosting in forested habitat and could forage over all the vegetation types throughout the study area.

Although not observed in the study area, the picture-wing fly lives in montane forest habitats of Kauaʻi and are threatened by habitat destruction and introduction and spread of invasive species. The picture-wing fly breed year-round, with increased egg-laying and larval development following the rainy season, where they feed on decaying matter and lay eggs on decomposing bark of trees. One of the two known populations of picture-wing fly on Kauaʻi occur on the western end of the Alakaʻi Swamp in the Nā Pali Forest Reserve, which is adjacent to Waiakōali, Kawaikōī, and Kauaʻikinanā Diversions. Additionally, the species were also collected at Kōkeʻe Stream, within Kōkeʻe State Park. The picture-wing fly can be present within cleared forest vegetation along the ditch and tunnel areas within montane forest habitats.

Portions of the Proposed Action in the upper watershed are located within areas designated as critical habitat for the akekeʻe, ʻakikiki, and the picture-wing fly. Critical habitat is defined as those areas of habitat that are known to be essential for an endangered or threatened species to recover and that require special management protection. In critical habitat areas, any private actions that involve federal funding must consult with the USFWS to ensure that any action undertaken is not likely to result in the destruction or adverse modification of the critical habitat. Critical habitat areas in relation to the Proposed Action are shown in **Figure 5.8**, **Figure 5.9**, and **Figure 5.10**.

Game Animals

Much of the Proposed Action is located in the Kekaha Game Management Area, which is open year-round for various hunts. Wildlife includes feral goat, black-tail deer, feral pigs, and game birds. Game birds on Kauaʻi include the following: ring-necked pheasant, green pheasant, gray frankolin, black frankolin, Erckels francolin, Chukar partridge, Japanese quail, spotted dove, and barred dove.

Figure 5.8. Critical Habitat for Akeke'e

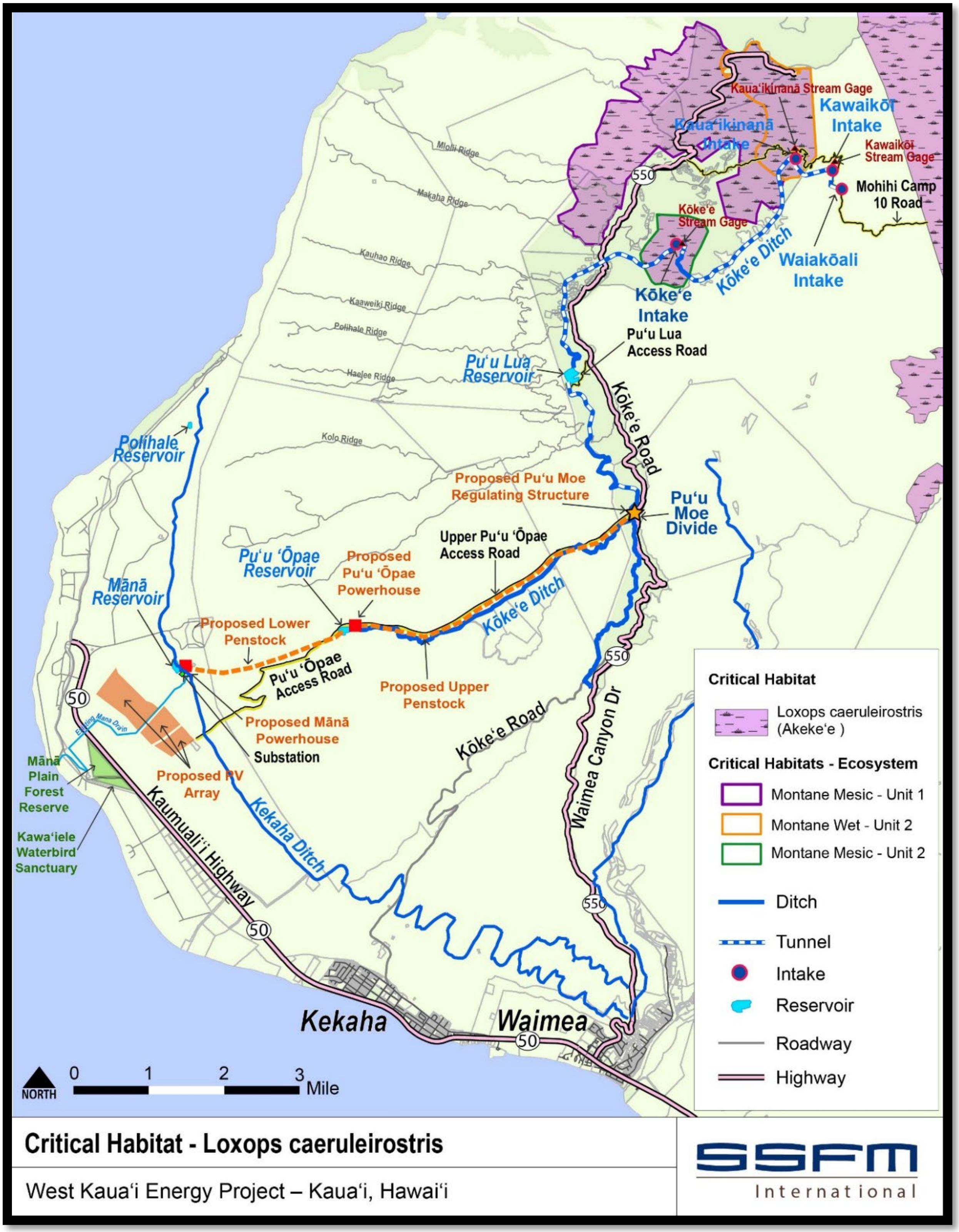


Figure 5.9. Critical Habitat for ʻAkikiki

Figure 5.10. Critical Habitat for Picture-wing Fly

5.3.1.6 Stream Habitat and Biota

The upper Waimea River and its tributaries (Mōhihi, Waiakōali, Kawaikōī, Kauaʻikinanā, Kōkeʻe, Waiahulu, and Poʻomau streams) were surveyed in February 2018 and June 2018 to collect habitat, biota, water quality, and stream discharge data. Generally, all of the sites within the study area had high-quality habitat conditions. With the exception of the immediate area around the diversions, the streams had minimally impacted shoreline vegetation, an excellent mix of substrate and cover present, low embeddedness, cool water temperature, high dissolved oxygen, and low turbidity. Although habitat conditions were good, no native amphidromous stream animals were observed in any of the upper tributary sites (Waiakōali, Kawaikōī, Kauaʻikinanā, Kōkeʻe Streams).

Within the Project area, streams were separated into three different groups:

- **Blackwater streams in the upper forested basins:** In the blackwater streams in the upper forested basins, the crayfish (Procambarus clarkii), dojo (Misgurnus anguillicaudatus), and a few green swordtails (Xiphophorus hellerii) were observed above and below the diversions.
- **Clearwater streams in the upper forested basins:** In the clearwater streams in the upper forested basins, primarily rainbow trout was observed. The trout were numerous in the deeper pools and appear to have self-sustaining populations. We also observed rainbow trout in the ditches between these streams, which indicates they may be moving between streams. The presence of rainbow trout indicate that water quality and habitat is suitable for these relatively large stream fish. Their presence above and below the diversion suggests that suitable instream habitat has existed consistently over a number of years in these streams even with current diversion conditions.
- **Lower canyon streams within the Waimea watershed below the Project diversions:** In the lower canyon streams above the Waiahulu Diversion, large numbers of native stream fishes were observed. The most common were ʻoʻopu nōpili (Sicyotperus stimpsoni) and ʻoʻopu nākea (Awaous stamenius). In addition, the survey found small, medium, and large-sized fish of each species, confirming that consistent recruitment of upstream migrating young fish was occurring and that the habitat quality supported adult fishes. The HSHEP model predicted suitable habitat for these two species in the Waimea Canyon stream segments above Waiahulu Diversion. The consistent streamflow restoration with the instream flow standards at the Kōkeʻe diversions as outlined in the Waimea Mediation Agreement should support the continued occurrence of the native stream fishes and likely will increase population sizes by improving habitat conditions during dry conditions above the Waiahulu Diversion.

The seepage study showed that the streams in the upper Waimea River system gain water from ground water or subsurface flow. Thus, even in dry conditions with 100% diversion of water, the stream channel would slowly re-water as you travel downstream. The study could not determine the exact location or rate at which the streams would re-water, but the data support some natural recharge in the streams below the diversions. The IIFS flow standards for the streams diverted into the Kōkeʻe Ditch will likely alleviate much of the direct problems associated with the 100% diversion of flow on instream habitat and are predicted to restore 33% of the overall habitat.

Direct field observations of stream discharge, instream habitat, and biota were combined with the HSHEP model to assess the impacts of the Proposed Action's water diversion into the Kōkeʻe Ditch Irrigation System on native amphidromous stream animal habitat.

The results from the HSHEP model provided a predicted distribution for seven native stream species habitats throughout Waimea River. The seven species included: oʻopu alamoʻo (*Lentipes concolor*), oʻopu nakea (*Awaous stamenius*), oʻopu nōpili (*Sicyotperus stimpsoni*), oʻopu naniha (*Stenogobius hawaiiensis*), oʻopu akupa (*Eleotris sandvicensis*), opae kalaʻole (*Atyoida bisulcata*), opae oehaʻa (*Macrobrachium grandimanus*), and hihiwai *(Neritina granosa)*. Total stream length and suitable habitat percentages were summarized in two sections:

- The entire Waimea River basin area between the mouth of the Waimea River and the stream origin of tributaries included in this study.
- The upper basin stream length between the Waiahulu Diversion and stream origin of the upper tributaries.

Within the entire Waimea River basin, the majority of stream length (72%) and native stream animal habitat (89%) is found below the Waiahulu Diversion as the Waiahulu diversion is far up in the watershed. It is important to note that a number of species were not predicted to have habitat upstream of the Waiahulu diversion. This includes oʻopu alamoʻo (*Lentipes concolor*), oʻopu naniha (*Stenogobius hawaiiensis*), oʻopu akupa (*Eleotris sandvicensis*), ʻŌpae oehaʻa (*Macrobrachium grandimanus*), and hihiwai *(Neritina granosa)*. Each of these species was expected to be found in the Waimea River watershed but not upstream of the Waiahulu diversion. The species presence in the watershed, but not above Waiahulu diversion is primarily a result of these species most commonly being found near the ocean and not far inland. The Waiahulu diversion is approximately 11 miles inland from the ocean which is quite far by Hawaiian stream standards. For these species, habitat and flow conditions are more influenced by the Waiahulu Diversion than the upper Kōkeʻe Diversions associated with this Project.

With respect to the basins upstream of the Waiahulu diversion, while 69% of the stream length was found above Kōkeʻe diversions, only 13% of suitable habitat for all species was located above Kōkeʻe diversions, compared to the stream segments between the Kōkeʻe diversions and the Waiahulu diversion. For the basins upstream of the Waiahulu diversion, suitable habitat was predicted to occur for opae kalaʻole (*Atyoida bisulcata*), oʻopu nakea (*Awaous stamenius*) and oʻopu nōpili (*Sicyotperus stimpsoni*), in descending order respectively. Only opae kalaʻole (*Atyoida bisulcata*) had suitable habitat above the Kōkeʻe diversions, amounting to only 3% of its suitable habitat in the entire Waimea River system. Therefore, the effects of the diversions will be primarily observed on native stream animal habitat in Waimea Canyon. The observed issues with stream dewatering immediately below the Kōkeʻe Diversions will likely be eliminated with the proposed IIFS for these diversions. The IIFS and proposed fish passage friendly design on new water control structures will improve stream connectivity and provide access to the miles of good stream habitat above the Kōkeʻe Diversions.

The effects of interbasin transfer of diverted water will be reduced under the proposed Project with comparison to current conditions. Under current conditions, some of the water diverted from Waiakōali and Kawaikōī Streams was being released into Kauaʻikinanā and Kōkeʻe Streams. The effects of this were especially dramatic in Kōkeʻe Stream. Downstream of the diversion, the channel was overfull with water when compared to the stream above the diversion (≈ 0.5 cfs above versus 5 cfs below). This water provided additional habitat as it flowed downstream greater than what would be expected from natural streamflow alone. The HSHEP model was designed in collaboration with biologists and managers at DAR and DAR's position was no additional habitat is credited for flows over the natural streamflow because of interbasin water transfer.

While interbasin transfer of water may not increase habitat within the HSHEP model when determining overall impact, we may have seen positive effects of the water in Waiahulu Stream in Waimea Canyon. This stream was expected to have 2.1 cfs flow while we measured 6.6 cfs. Instream conditions were excellent, and we observed numerous native fishes in the lower end of Waiahulu Stream. Decreases in the fish populations after the interbasin transfer water is returned to its natural stream course may occur as conditions in Waiahulu Stream return to a more natural (lower) flow. The converse of this condition is that Poʻomau Stream should see improved conditions as its contributing streams would have IIFS standards which may result in increased fish populations. Overall, the reduction of interbasin water transfer in the upper tributary streams will return the streams to a more natural habitat distribution.

5.3.1.7 Wetlands

As per the National Wetland Inventory (NWI), the Mānā Plain is classified as Freshwater Emergent Wetland including the area proposed for the PV Solar Array, Mānā Powerhouse, Pumphouse, Facility Substation and the WKEP Substation. **Figure 5.11** below is a USGS map showing the remaining wetlands on Mānā Plain in 1910, all of which are outside the Proposed Action footprint.

Other designated wetlands within the Project area are the streams and existing reservoirs. As shown on **Figure 5.12**, streams are designated as Riverine and the reservoirs are designated as Freshwater Ponds.

Freshwater Emergent Wetlands refer to herbaceous marsh, fen, swale, or wet meadows. Riverine designated wetlands refer to riverine deepwater and associated wetlands. Freshwater Ponds refer to palustrine, unconsolidated bottom, palustrine aquatic bed (USFWS, 2018).

A wetlands delineation study was conducted by AECOS in 2015 for an area on Mānā Plain adjacent and to the north of the Proposed Action footprint. The study was conducted for one of the alternative projects that KIUC considered, a pumped storage project located along Hāʻeleʻele Ridge. A draft report was prepared and discussed preliminarily with Army Corps, but the report was not finalized because the project was not selected for further development. Conclusions of the report indicate the area does not currently support wetlands based on the lack of hydrophytic or facultative plants, lack of hydritic soils, and primarily due to the dewatering and elimination of ponding through the Mānā Plain Storm Drainage System. The study found that the vast majority of Mānā Plain has been converted to upland due to decades of draining for agricultural use

(AECOS 2015). Approximately 200 acres of wetland remain on Mānā Plain, which includes Kawaiʻele Waterbird Sanctuary and Mānā Plain Forest Reserve (DOFAW 2012).

The NWI aquatic features shown extensively across the Mānā Plain — including a wetland indicated on the crop field that is the lower Project area—are coded PEM1Fd: semi permanently flooded palustrine (wetland) systems dominated by persistent, Emergent aquatic vegetation with the special modifier “d” indicating a “...partially drained wetland ...hydrologically altered but soil moisture is sufficient to support some hydrophytes.” The “d” is also used to indicate wetlands connected by extensive ditch networks. However, the definition includes the following, certainly applicable to the project area: “Totally drained areas are not considered wetland if they can no longer support hydrophytes” (USFWS, 2009) (AECOS 2015).

There are recent efforts and proposals to restore wetland habitat in certain areas of Mānā Plain, but all of these are outside the Proposed Action footprint.

While the AECOS study did not cover the immediate Project area, it is representative of the agricultural fields in the general area and that would be utilized by the Project. The Applicant is currently undertaking a wetlands delineation study for the specific portions of the Project located on Mānā Plain. Based on a preliminary review, it is expected that the conclusions will be the same as the 2015 study and draft report.

Figure 5.11. ***1910 USGS map of wetlands on Mānā Plain***

5.3.2 Potential Impacts – Biological Resources

5.3.2.1 Construction

Proposed Action

Most of the construction activities that would occur as part of the Proposed Action are not in high sensitivity flora and/or fauna areas or in stream habitats and are repairs and rehabilitation of existing facilities. The majority of new construction that would occur is not located in areas of high sensitivity for flora and/or fauna. The following subsections describe the potential impacts to flora, fauna, and stream habitat and wetlands during construction and operation of the Proposed Action.

Impacts to Hawaiian forest birds could occur from construction activities in the upper watershed areas, specifically Puʻu Lua Reservoir, the Waiakōali, Kawaikōī, and Kauaʻikinanā Diversions, the forested areas of the Upper Penstock, and the access roads to these facilities. Hawaiian forest birds are highly sensitive to increased noise, habitat loss, invasive species, and human presence, which can significantly impair their already low reproductive success. Access roads in the upper watershed areas are all existing, heavily used roads with regular maintenance activity similar to what would be implemented as part of the Proposed Action. Existing use includes tourist and local traffic for camping, hunting with dogs, hiking, and other public recreation. Other existing road use includes but is not limited to State maintenance of roads, campgrounds at Waiakōali and Kawaikōī diversions, trail maintenance, and other State purposes; by ADC/KAA for ditch maintenance; by USGS for access to USGS stream gage above Kawaikōī Diversion; by community for access to seasonal cabins/lodging, by community to access Camp Slogget; and others. The upper watershed areas and Puʻu Lua Reservoir are also subject to regularly scheduled low-flying tourist helicopters (approximately on either half hour or one-hour intervals) with noise levels such that conversation on the ground at the sites is difficult when they are passing over. Vegetation clearing would be restricted to the minimum amount necessary. Impacts to Hawaiian forest birds would be minimized to the extent practicable as described in **Section 5.3.3**.

Figure 5.12. NWI Wetlands

Impacts to seabirds could occur from the use of nighttime lighting during construction. It has been generally suggested that artificial lighting can adversely impact seabirds that may pass through the area at night causing disorientation, which could result in collision with man-made objects or grounding of birds. Impacts to seabirds would be minimized to the extent practicable as described in **Section 5.3.3**.

The potential for the presence of the Hawaiian hoary bat was assessed based on the suitable habitat. The Hawaiian hoary bat has been documented roosting in forested habitat and could roost in forest trees and vegetation throughout the study area. Impacts to the Hawaiian hoary bat could occur due to vegetation removal, which can temporarily displace bats that are using the vegetation for roosting. As bats use multiple roosts within their home territories, this disturbance from the removal of vegetation is likely to be minimal. However, during the pupping season from about June 1 to September 15 each year, female bats carrying pups may be less able to rapidly vacate a roost site when the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they forage, and very small pups may be unable to flee a tree that is being felled. Impacts to the endangered Hawaiian hoary bat would be minimized to the extent practicable as described in **Section 5.3.3**.

Construction activities in the Project areas would potentially have a short-term impact on fauna. The noise and concentrated human activity may temporarily disrupt the habitat for the various species of birds and mammals that are known to exist in the area. However, Project construction is occurring is areas already developed and where human activity and road/infrastructure maintenance regularly occurs. Wildlife is expected to retreat from the area while construction is taking place but return after the Project is in operation. Since construction would be short-term and temporary and is occurring in areas already exposed to human disturbance, it is expected that construction of the Proposed Action would have less than significant impacts on terrestrial fauna.

The southern house mosquito (*Culex quinquefasciatus*) is present throughout forested areas of the Project area. This nocturnal mosquito species is the primary vector for avian malaria (caused by *Plasmodium relictum*) and avian poxvirus (caused by *Poxvirus avium*), two diseases that kill Hawaiian honeycreepers (Atkinson and LaPointe 2009; Samuel et al. 2015). The southern house mosquito occurs in Hawaiʻi from sea level to approximately 4,921 feet amsl during the winter months, to up to or just over 6,000 feet amsl during the warmer summer months (Ahumada et al. 2004; Freed et al. 2005; Samuel et al. 2015). The larval stage of this mosquito species is completed in natural or human-created stagnant bodies of water such as standing surface water, vehicle tracks, pig wallows, ground pools, and tree cavities. The Proposed Action is unlikely to nominally increase mosquito populations within the higher elevation areas of the Project footprint due to the existing abundance of non-Project-related breeding habitat within the wider area. This includes substantial areas of potential mosquito breeding habitat within intermittent pockets of standing water on stream margins, pig wallows, and surface water within the general location of the Project. Project related improvements to existing access roads would decrease existing ruts and potholes thereby reducing opportunities for pooling of stagnant water. However, as a precautionary measure, strategies to avoid the creation of mosquito breeding habitat are provided in **Section 5.3.3**.

The majority of the construction activities would take place at sites well away from streams and natural water courses. The primary construction activities in or adjacent to streams and water courses are the repairs and modifications at the existing diversion sites on the Kōkeʻe Ditch Irrigation System. Construction-related impacts to adjacent streams and ditches would include placement of concrete at and below the ordinary high-water mark, vegetation clearing, and minor ground disturbance activities. These activities create the potential for disturbed soils in the construction areas to be eroded and conveyed to adjacent streams as a result of being carried away by storm water runoff or wind. Aquatic species at these streams may be impacted by increased turbidity and sedimentation from construction. The combination of limited in-water construction activities and BMPs would result in minimal impacts to aquatic species, wetlands, and stream habitats during construction, as discussed in **Section 5.3.3**.

Waiakōali Diversion and Access Road

The Waiakōali Diversion access road primarily passes through forest dominated by strawberry guava; however, the area also contains scattered native plant species such as ʻōhiʻa, ʻalaʻa (*Planchonella sandwicensis*), pilo (*Coprosma* sp.), and *Kadua* sp. The immediate margins of the road primarily contain non-native broadleaved herbs and sedges. No roadside vegetation clearance would be required. Some limited trimming of vegetation that is overhanging or extending into the roadway may be required during the construction.

Alien Forest and Open/Closed ʻŌhiʻa Forest vegetation type at Waiakōali Diversion. ʻŌhiʻa forest with firetree and strawberry guava. Dallis grass and prickly Florida blackberry dominate open areas.

Construction at Waiakōali Diversion would encompass 0.09 acre and would include minor clearing. This limited vegetation removal would comprise smaller trees, predominantly strawberry guava, and shrubs that have grown in the overflow spillway or immediately adjacent to the left abutment. Specific areas of clearing include an approximately 10 foot by 20 foot area in the overflow spillway and an approximate 2 foot by 2 foot area downstream of the left abutment. In addition, there would be trimming of overhanging branches on the existing road that extends from Mōhihi-Camp 10 Road to provide adequate height clearance for vehicles and equipment accessing the site.

Vegetation in the immediate vicinity of the diversion consists of non-native disturbance-adapted species, including dallis grass and Florida blackberry. Surrounding vegetation is described by HIGAP as Open/Closed ʻŌhiʻa Forest. Care should be taken during construction to avoid damaging native trees.

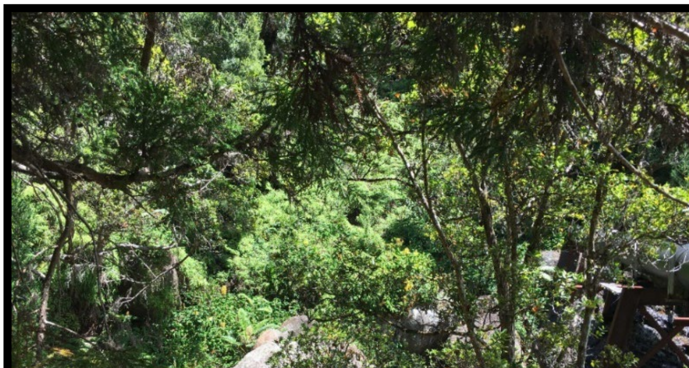
The streambanks located below the diversion consist of strawberry guava forest with patches of kahili ginger and Florida blackberry in more open areas. Occasional koa, ‘ōhi‘a, and the invasive New Zealand laurel (*Corynocar*pus laevigatus) also occur within this area.

The federally threatened ‘i‘iwi was recorded near Waiakōali Diversion during the field survey. It is possible that Kaua‘i thrush, Kaua‘i ‘akepa, and Kaua‘i creeper, as well as the MBTA species ‘apapane and Kaua‘i ‘amakihi, may also occur within this portion of the study area. Specific measures to protect special-status forest bird species at this and other forested sites within the study area are outlined in **Section 5.3.3**.

Kawaikōī Diversion and Access Road

The margins of the existing access road that connects Mōhihi – Camp 10 Road with the Kawaikōī Diversion is composed primarily of non-native sugi pine and strawberry guava forest. These vegetated margins of the road are unlikely to be modified or cleared during construction as they have previously been maintained.

The access road to the picnic area on the eastern side of the site is surrounded by non-native sugi pine with a primarily bare understory, except for occasional nonnative Chinese privet (*Ligustrum sinense*). No vegetation clearing is proposed in that location.



Open/Closed ‘Ōhi‘a Forest vegetation type at Kawaikōī Diversion. ‘Ōhi‘a with a mix of native and alien species, including kahili ginger, earring flower, and ‘ama‘u.

Construction at Kawaikōī Diversion would encompass 0.15 acre and would include minor clearing around the existing Kawaikōī Diversion for construction access. Specifically, there would be an approximate 2,614 square foot area that would be cleared on the west side of the stream and ditch embankment between the ditch bank and existing spur road. This area is predominantly filled with small guava and ginger. Vegetation removal would avoid mature trees. In addition, there would be trimming of overhanging branches along the existing spur road that extends from Mōhihi-Camp Road 10 to the diversion structure on the west side of Kawaikōī Stream to provide adequate height clearance for vehicles and equipment accessing the site.

The immediate margins of the intake site where disturbance would occur comprise a mix of native and non-native forest. The areas of native forest comprise ‘ōhi‘a, koa, ‘ōlapa (*Cheirodendron* sp.), pilo, and patches of palapalai (*Microlepia strigosa*) in more open areas. Although it is likely that some of the native plant species within the immediate vicinity of the intake would need to be cleared for construction, effort would be made to limit this clearance of native vegetation.

It is possible that the federally threatened ʻiʻiwi, as well as Kauaʻi thrush, Kauaʻi ʻakepa, Kauaʻi creeper, and the MBTA species ʻapapane and Kauaʻi ʻamakihi may occur within the general vicinity of the Kawaikōī Diversion. Specific measures to protect special-status forest bird species at this and other forested sites within the study area are outlined in **Section 5.3.3**.

Kauaʻikinanā Diversion and Access Road

The area immediately adjacent to the Camp 10 Road bridge at the northern-most end of the Kauaʻikinanā study area comprises non-native vegetation that would not be adversely impacted during construction. However, this area contains a steep slope on which native tree, shrub, and fern species are growing that would not be impacted during construction. Species that are present on the slope include: ʻōhiʻa, koa, olomea (*Perrottetia sandwicensis*), and uluhe.

Open/Closed ʻŌhiʻa Forest vegetation type at Kauaʻikinanā Diversion. Dominant non-native species include strawberry guava, firetree, and dallis grass.

The access road between the bridge and the Kauaʻikinanā Diversion appears to have been well maintained in the past and therefore the margins of the road are relatively clear of vegetation. However, plants of māmaki (*Pipturus albidus*), ʻaʻaliʻi, pilo, and pūkiawe occur along the road and would be avoided.

The area immediately surrounding the intake contains dense areas of native trees—including ʻōlapa, ʻahakea lau liʻi ʻolena (*Coprosma waimeae*), and *Kadua* sp.—that should be avoided during construction to the extent possible. There is no vegetation clearing anticipated for construction at the Kauaʻikinanā Diversion.

Similar to Kawaikōī Diversion, the Kauaʻikinanā Diversion could potentially provide habitat for federally threatened ʻiʻiwi, as well as Kauaʻi thrush, Kauaʻi akepa, Kauaʻi creeper, and the MBTA species ʻapapane and Kauaʻi ʻamakihi. The Kauaʻikinanā Diversion is located within designated critical habitat for Kauaʻi akepa, Kauaʻi creeper and the Hawaiian picture-wing fly. Specific measures to protect special-status species at this and other forested sites within the study area are outlined in **Section 5.3.3**.

Kōkeʻe Diversion and Access Road

The Kōkeʻe Diversion access road passes through native mesic koa forest that contains an understory of golden hala pepe (*Dracaena aurea*), hame (*Antidesma platyphyllum*), ʻākia (*Wikstroemia furcata*), ʻukiʻuki, and poʻola nui (*Bidens cosmoides*). One giant kokeʻe (*Cyanea leptostegia*), a USFWS Species of Concern, was recorded within 10 feet of the road edge during the survey. In addition, plants of the federally endangered ʻakoko (*Euphorbia halemanui*) are known to grow along the road (DOFAW Kauaʻi, pers. comm.). There would be no disturbance of the vegetation within this intact native forest, including cutting or spraying vegetation along the corridor of the access road due to the presence of these species. Helicopters would be used to transport materials to the intake site, and this road would only be used by light vehicles to access the intake. Therefore, any impacts to the native vegetation are likely to be reduced if vehicles are required to stay within the footprint of the road and travel at low speeds to avoid mud and dust impacting native plants on the immediate margins of the road.

Vegetation around Kōkeʻe Intake. Area consists primarily of the Alien Shrubland vegetation type, likely spread through ongoing maintenance work. The area is designated critical habitat. Vegetation includes white ginger, lantana, and Mexican elder surrounded by the Closed ʻŌhiʻa Forest vegetation type.

The area surrounding the Kōkeʻe Diversion primarily contains non-native shrubland comprising Mexican elder (*Sambucus mexicana*), lantana, and white ginger (*Hedychium coronarium*). It is likely that most of the proposed construction work would take place within this portion of the study area. As such, no native vegetation would be removed or impacted during the Proposed Action.

Vegetation around Puʻu Lua Reservoir. Includes a patchy mosaic of native vegetation types. Forestry trees Eucalyptus and silk oak co-dominate with koa. Native shrubs pukiawe and aʻaliʻi co-dominate with non-native olive in the mid-story. Non-native grasses dominate roadsides and margins of the reservoir.

Based on the known distribution of the MBTA species ʻapapane and Kauaʻi ʻamakihi (Paxton et al., 2016), it is possible that both species could be present, at least periodically, at Kōkeʻe Diversion. The Kauaʻikinanā Diversion is located within designated critical habitat for Kauaʻi akepa, Kauaʻi creeper and the Hawaiian picture-wing fly. Specific measures to protect special-status species at this and other forested sites within the study area are outlined in **Section 5.3.3**.

The temporary disturbance area at Kōkeʻe Diversion would be 0.04 acre. The long-term impact would encompass 0.01 acre.

Puʻu Lua Reservoir and Access Road

Vegetation on the margins of the access road to Puʻu Lua Reservoir would not be removed. However, some limited trimming of vegetation that is overhanging or extending into the roadway may be required during the construction and operational phases. No special-status native plant species were recorded along the margins of the access road during the survey.

Construction equipment would need to maneuver around the embankment to access various construction areas. An access corridor approximately 50-feet-wide downstream of the buttress would be cleared of trees to provide access. Additionally, a short (approximately 300 feet) temporary access spur extending from the existing access road would be constructed to provide access to the dam embankment construction site. Construction of this access spur would involve the removal of mature trees. In addition, Puʻu Lua Reservoir construction would involve removal of mature trees on the existing dam embankment, along the bypass channel, and around the perimeter of the reservoir footprint. Additional maintenance vegetation removal would occur along the Puʻu Lua embankment roads and at the reservoir inlet. Mature non-native forest would be cleared from the embankments and peninsula surrounding the reservoir. No special-status native plants were recorded within this portion of the study area; however, Puʻu Lua Reservoir is located within USFWS designated critical habitat for nine special-status plant species. The removal of these trees would require consideration of impacts on Hawaiian hoary bats, native forest birds and special-status plant species.

Hawaiian hoary bat has previously been recorded at Puʻu Lua Reservoir (DOFAW Kauaʻi Branch, 2021). Therefore, the measures for bats that are outlined in **Section 5.3.3** would be followed when working in this area.

Puʻu Lua Reservoir is known to provide habitat for the federally endangered Hawaiian duck. The reservoir and surrounding areas may also provide habitat for the federally endangered Hawaiian goose and Hawaiian stilt. The measures outlined in **Section 5.3.3** to reduce impacts on these species would be implemented during the construction and operational phases of the Project within the vicinity of the reservoir.

Puʻu Lua Reservoir is classified as a freshwater pond by the NWI. Construction associated with the expansion of this reservoir would result in temporary impacts to this NWI-identified wetland.

Upper and Lower Penstock

Construction of the Upper and Lower Penstock would require approximately 77.54 acres of vegetation removal. The most significant area of vegetation removal would be along the new Upper Penstock alignment, where a 60-foot-wide corridor would be cleared to allow construction of the buried pipeline. The mauka areas of the alignment predominately consist of forest vegetation types. Approximately 1.3 miles, the upper portion, of the Upper Penstock construction would occur in forested areas and would result in tree removal. The lower sections of the Upper Penstock traverse areas generally more open, but still may require some limited tree removal.

Vegetation at the Upper Penstock. Mosaic of Alien Shrubland and Alien Forest gradating to Native Mesic to Dry Forest and Shrubland and Open/Closed ʻŌhiʻa Forest vegetation types at higher elevations. Overstory of ironwood, strawberry guava, Formosa koa, and Eucalyptus with occasional native koa and ʻōhiʻa. Bristly foxtail, Cyclosorus parasiticus, and milkwort can be found on forest margins, roadsides, and along ditches.

It is likely that Hawaiian hoary bat occurs and native and non-native MBTA forest bird species occur within the non-native trees that are located within the footprint of the Upper and Lower Penstock. The removal of this vegetation would need to consider impacts on Hawaiian hoary bats and native forest birds. Specific measures to protect Hawaiian hoary bat and special-status forest bird species at this site are outlined in **Section 5.3.3**. The makai areas of the alignment are mostly agricultural.

Overlooking Lower Penstock with Agriculture and Alien Shrubland vegetation types. Dominant species include lantana, klu, koa haole, buffel grass, Guinea grass, and various herbaceous ruderal species.

The margins of a section of Niu Valley Road on the lower slopes of Makahoa Ridge were surveyed in March 2022. These road margins contained non-native vegetation comprising Koa Haole Shrubland. Some limited trimming of vegetation that is overhanging or extending into the roadway may be required during the construction and operational phases. There is a wiliwili (*Erythrina sandwicensis*) grove located upslope from this access road; however, this area of forest would not be impacted by any actions taken to improve this section of road.

Due to limited vegetation and negligible forestation in the mauka Lower Penstock areas on Niu Ridge, clearing would consist of shrub and grasses in the fallow agricultural areas impacted by construction. The vegetation cover of the makai segment of the Lower Penstock alignment between the edge of Niu Ridge and the new Mānā Powerhouse consists of open land, shrub, and small trees. A corridor ranging from 60- to 100-feet-wide would be cleared along this portion of the Lower Penstock alignment.

Puʻu ʻŌpae Reservoir, Powerhouse, and Facility Substation

Construction of Puʻu ʻŌpae Reservoir, Powerhouse and Facility Substation would impact 40.85 acres and would include vegetation clearing. Puʻu ʻŌpae Reservoir currently has some vegetation growing on slopes and along the floor that would be removed as part of the modification work to comply with Hawaiʻi State Dam Safety Standards. Mature nonnative trees and at least one large koa tree would be removed from the embankment immediately surrounding the reservoir as part of the proposed Project. KIUC representatives consulted with the community on the removal of this tree and made commitments regarding the removal of this specific koa tree. The Project would work with KHHA and DHHL to harvest seeds from the koa tree prior to removal so they can be used to replant multiple new koa in the areas adjacent to Puʻu ʻŌpae Reservoir. Also, the Project would save the usable timber from the trunk of the koa and make it available to KHHA for use in future Farm Plan buildings at Puʻu ʻŌpae.

Vegetation around Puʻu ʻŌpae Reservoir. Tree species include silk oak, black wattle, Eucalyptus, and strawberry guava. ʻUhaloa, lantana, barbas de indio, and other ruderal species dominate the understory and margins.

In addition, nonnative shrubland would be removed near the entrance of the reservoir where the powerhouse would be located. Storm drainage ditches that parallel the lower portion of the Puʻu ʻŌpae access road would be cleared of vegetation as part of road repair work. No special-status native plants were recorded within this portion of the study area.

Hawaiian hoary bat has been recorded between the diversions and Puʻu ʻŌpae Reservoir (DOFAW Kauaʻi Branch, 2021). Hawaiian duck was recorded at Puʻu ʻŌpae Reservoir during the survey. In addition, it is possible that Hawaiian goose and Hawaiian stilt may also use habitat at the reservoir. However, the reservoir is not currently operational and the only standing water is from rainwater which dries up between rain events. Therefore, the reservoir does not provide consistent habitat for the Hawaiian goose and Hawaiian stilt and any use of the area by these species would likely be intermittent. The measures outlined in **Section 5.3.3** to reduce impacts on these species would be implemented during the construction and operational phases of the Project within the vicinity of the reservoir.

The Puʻu ʻŌpae Reservoir is classified as a freshwater pond by the NWI. However, as previously stated, the reservoir is not currently operational and the only standing water is from rainwater which dries up between rain events.

Mānā Reservoir, Powerhouse, Pumpstation and Facility Substation

The Project would encompass 44.16 acres at Mānā Reservoir that would include the expansion of Mānā Reservoir and construction of the Mānā Powerhouse, Pumpstation and Facility Substation. The currently drained Mānā Reservoir is currently covered with a combination of grass and shrub and some mature trees inside and around the perimeter of the reservoir. The margins of the Mānā Reservoir and the proposed powerhouse, pumpstation and facility substation are dominated by nonnative vegetation. All vegetation that is currently growing within the reservoir and on the surrounding embankments would be removed during the proposed Project.

Mānā Reservoir area construction footprint in Agriculture vegetation type. Dominant plants include koa haole, Guinea grass, lion's ear, and castor bean.

The Mānā Powerhouse, Pumphouse and Facility Substation location is currently covered with a combination of grass and shrubs. These shrubs would be completely removed to allow for construction of the new Powerhouse.

The staging area for construction would be located at the base of the southeast embankment. This area is a fallow agricultural field and would require the removal of existing grasses.

No special-status native plant species were recorded within these areas. Occasional native plant species were recorded around waterways and reservoirs and include ʻākulikuli (*Sesuvium portulacastrum*), kaluhā (*Bolboscoenus maritimus* subsp. *paludosus*), and pāʻūʻohiʻiaka (*Jacquemontia sandwicensis*).

The Mānā Reservoir was historically known to provide habitat for the federally endangered Hawaiian gallinule and Hawaiian goose and may also provide habitat for the federally endangered Hawaiian duck, Hawaiian coot, and Hawaiian stilt. However, the reservoir is not currently operational and the only standing water is from rainwater which dries up between rain events. Therefore, the reservoir does not provide consistent habitat for Hawaiian waterbirds and any use of the area by these species would likely be intermittent. The measures outlined in **Section 5.3.3** to reduce impacts on these species would be implemented during the construction and operational phases of the Project within the vicinity of the reservoir.

The Mānā Reservoir is classified as a freshwater pond by the NWI. However, as previously stated, the reservoir is not currently operational and the only standing water is from rainwater which dries up between rain events.

PV Solar Array, Project Substation and Interconnection Line on the Mānā Plain

The total area of disturbance during construction of the PV Solar Array would be approximately 303.2 acres and the total area of disturbance during construction of the Project Substation would be approximately 7.47 acres, both of which would occur in agricultural lands to the south and west of the Mānā Reservoir on the Mānā Plain. The location of the proposed PV Solar Array was selected based on recommendations made through collaborative discussions with local farmers because they are less suited for agricultural production due to water retention issues and heavy clay content, and these areas have only been in limited use in recent years.

Solar area construction footprint in Agriculture and Alien Shrubland vegetation types. Dominant plants include koa haole and Guinea grass.

The Mānā Plain is dominated by non-native shrubland and grassland and developed agriculture land. The entire area within the PV Solar Array and the Project Substation footprint consists of overgrown or fallow agricultural fields. A portion of these fields have been cultivated recently, but the majority have been out of production for a few years and are currently covered with shrubs and small trees. The PV Solar Array and Project Substation areas would be cleared completely. No special-status native plant species were recorded within this portion of the study area. The areas of roadside in which the proposed interconnection line would be constructed to connect the Project with the electrical grid were surveyed in March 2022. These areas of roadside contained nonnative vegetation and no special-status native plant species were located.

The seasonally inundated areas of the Mānā Plain where the proposed PV Solar Array and Project Substation would be constructed is known to provide habitat for the federally endangered Hawaiian gallinule and Hawaiian goose and may also provide habitat for the federally endangered Hawaiian duck, Hawaiian coot, and Hawaiian stilt. The measures outlined in **Section 5.3.3** to reduce impacts on these species would be implemented during the construction and operational phases of the Project within the Mānā Plain.

Construction of the PV Solar Array and the Project Substation would occur in an area designated as NWI Freshwater Emergent Wetlands. However, these wetlands were drained in a large land reclamation project in the early 1900s by the Mānā Plain Storm Drainage System for the expansion of agriculture, specifically sugar cane. as are where the PV Solar Array and Project

Substation would be constructed is actively drained through current operations of the Mānā Plain Storm Drainage System via gravity flow and pumping. Also, these lands are zoned for agricultural use and agriculture has dominated the area since the early 1900s. The Applicant is undertaking a wetlands delineation study and currently consulting with the USACE to determine if this area would be considered wetlands and jurisdictional. If it is determined that the area is wetlands and jurisdictional, the Applicant would coordinate with USACE to determine what mitigation would be required.

Following construction, a compatible agricultural use would be located within the PV Solar Array. Areas that have been temporarily disturbed would be revegetated for soil stabilization and erosion control purposes. It is anticipated that revegetation would involve application of hydroseeding, with a suitable mix of native and/or non-invasive grass species. Any species used for revegetation would also be considered in terms of compatibility with potential onsite compatible agricultural activities.

Installation of the new West Kauaʻi Energy Project Interconnection Line and fiber optic line would be within the cleared edges of the existing dirt roads and would not involve vegetation clearing or grading. Construction would involve installation of approximately 35 new poles approximately 80 feet in height. Poles would be drilled in place using an auger to an approximate depth of 10 to 12 feet.

Once construction is completed (overhead lines are hung on poles), the West Kauaʻi Energy Project Interconnection Line would be owned and operated by KIUC as part of their island-wide electrical grid system and would be covered under KIUC's HCP as discussed in **Section 4.1.2.17**. KIUC's overhead electrical lines that are greater than 30 feet in height have been shown to impact three species of threatened and endangered seabirds including Newell's shearwater, Hawaiian Petrel, and band-rumped storm petrel, and five threatened and endangered species of waterbirds including Hawaiian goose, Hawaiian duck, Hawaiian coot, Hawaiian stilt, and Hawaiian common gallinule. Potential impacts to threatened and endangered seabirds and waterbirds associated with the new West Kauaʻi Interconnect Line and that cannot be minimized or avoided would also be mitigated through KIUC's HCP mitigation plan.

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur. Vegetation clearing along the Kōkeʻe Ditch Irrigation System is an ongoing activity under the current ADC management and presumably would continue, which represents no change from existing conditions, or stop operations. All three reservoirs would either need to be rehabilitated to continue operations or be decommissioned, either of which would likely involve some vegetation removal, the extent of which is unknown.

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur and there would be negligible changes and impacts to fauna. The Kōkeʻe Ditch Irrigation System would remain under the management of ADC, and Puʻu Lua Reservoir would remain under the management of DLNR. If this were to result in the closure of the Kōkeʻe Ditch Irrigation System and decommissioning of Puʻu Lua Reservoir, there would be loss of habitat and water resources for waterbirds and land-based fauna in those areas.

Under the No-Action Alternative, no construction associated with the Proposed Action would occur and there would be no construction-related impacts to the Freshwater Emergent Wetlands. However, under a No-Action Alternative, Puʻu Lua Reservoir would remain under management of DLNR, Puʻu ʻŌpae Reservoir would remain with DHHL, and Mānā Reservoir would remain with ADC. All three reservoirs require improvements to comply with Hawaiʻi State Dam Safety Standards and remain operational. Puʻu ʻŌpae and Mānā Reservoir are currently drained and are therefore not active freshwater ponds. Decommissioning of the three reservoirs would eliminate potential for freshwater ponds in the area.

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur and there would be no associated changes for stream habitats from current conditions and current diversion operations. The Phase One IIFS as outlined in the Waimea Mediation Agreement would remain in effect. KIUC's Kōkeʻe Diversion Modification Project would be completed as a separate and independent Project, which would involve modifications to the four Kōkeʻe diversions for implementation of the Phase One IIFS. Responsibility for the operation and ongoing maintenance of the Kōkeʻe Ditch Irrigation System would remain with ADC, as would long-term maintenance and compliance with the Phase One IIFS. This could result in the continuance of reduced operations or closure of the system which would mean no diversions from the four associated streams. If the Kōkeʻe Ditch Irrigation System was not operational, the Kekaha Ditch System would remain the only source of irrigation for agricultural activities on the Mānā Plain, there would be no source of water for DHHL's Puʻu ʻŌpae lands or ADC's mauka lands, and Puʻu Lua Reservoir would not have a source of fresh water other than rainfall.

5.3.2.2 Operation

Proposed Action

Operation of the Proposed Action would include maintenance activities that would include minimal vegetation management in already cleared areas around Project facilities to maintain adequate site access. The current floristic conditions in the study area are a result of more than 100 years of impacts from use and management of the ditch systems and access roads. As a result, these areas are already heavily invaded by nonnative plant species. Any changes to plant species composition that may result from increases or decreases in flow regime due to water diversion would be expected to be insignificant, compared with the conversion from native to invaded forest that occurred over the course of over a century or more. Therefore, the Proposed Action would not be expected to significantly impact the flora of the study area.

One of the Proposed Actions is the diversion of water from streams into ditches by the existing ditch system infrastructure. This action in and of itself would have no impact on terrestrial habitats and threatened or endangered species above the locations of the diversions.

The Proposed Action would initiate the Phase Two IIFS as outlined in the Waimea Mediation Agreement and involve diversion of water from streams in the upper reaches of the Waimea River watershed for DHHL's water reservation, hydroelectric generation, and other irrigation and consumptive uses in the Project area. These diversions would reduce the amount of water left in the stream downstream of each diversion and on the Waimea River. However, the Proposed

Action would ensure that the Phase Two IIFS would remain in the streams through the use of automated intakes at each of the diversion locations. The automation of the system would provide real time flow adjustments and compliance with the Phase Two IIFS set by CWRM. The IIFS is "a quantity or flow of water or depth of water which is required to be present at a specific location in a stream system at certain specified times of year to protect fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses" (HAR Chapter 174C-3). The completion of the implementation of the Phase Two IIFS would improve habitat suitability.

In addition to the Phase Two IIFS implementation, groundwater contributions on the Waiahulu Stream downstream of the four Kōkeʻe Ditch Irrigation System diversions would increase natural stream flows available for habitat and aquatic life. The streams in the headwater of the Waimea River system are relatively unique in comparison to most Hawaiian streams. They drain a high elevation swamp, are much further inland, and drop into an arid canyon environment. To confirm the success of the IIFS flow restoration in improving native stream animal populations, additional surveys focused in the Poʻomau and Waiahulu streams should be conducted over time and used to help adaptively manage minimum flows as needed (Trutta Environmental Solutions, 2018).

The location of the diversions associated with the Kōkeʻe Ditch Irrigation System in the upper regions of the Waimea River watershed minimizes the overall effect of these diversions on native stream animal habitat. The area supporting the majority of habitat in the watershed is downstream of the Waiahulu diversion on the Kekaha Ditch Irrigation System, which is not within the Project area. Specifically, results from the HSHEP model suggest that the majority of native stream animal habitat (89%) is located downstream of the Waiahulu diversion on the Kekaha Ditch system. Only opae kalaʻole (*Atyoida bisulcata*) had suitable habitat above the Kōkeʻe diversions, amounting to only 3% of its suitable habitat in the entire Waimea River system. As a result of the migratory life history of these animals, impacts found lower in the watershed level have a greater effect than those found further upstream (Trutta Environmental Solutions, 2018).

Overall, the combination of field surveys and habitat modeling supported the Phase Two IIFS flow restoration scenario as improving instream habitat conditions for native amphidromous stream animals compared to current conditions (further described in **Section 5.3** and **Appendix G**).

During operations of the Proposed Action, the average diversion volume leaving each stream would be higher than current operations, but instream flow standards would be maintained. The results of West Kauaʻi Energy Project operations compared to current status would be an increase of flow immediately downstream of each diversion, but an overall average decrease of flow remaining in each stream channel. As such, the aquatic environments immediately below the diversions would potentially be enhanced by the Project, with relatively minor changes to streamside vegetation anticipated further downstream. It is important to note that the flora species in the low-elevation areas where downstream impacts to streamside vegetation would take place have already been impacted by human presence and consist of common invasive species. For this reason, any changes in stream flow associated with the use of the diversions would be very unlikely to decrease habitat for special-status or native species.

The location of the diversions associated with the Kōkeʻe Ditch Irrigation System in the upper regions of the Waimea River watershed minimizes the overall effect of these diversions on native stream animal habitat. The area supporting the majority of habitat in the watershed is downstream of the Waiahulu diversion on the Kekaha Ditch Irrigation System, which is not within the Project area.

The completion and ongoing maintenance of roads within the Project area may result in a reduction of mosquito breeding habitat due to the removal of existing areas of stagnant water within ruts and puddles in the dirt roads. During the operation phase, the ditch and reservoirs will maintain a constant flow through as part of standard operations and will not result in standing water. Throughout the life of the Project, there are likely to be repairs on the ditch system or at the reservoirs that would involve draining the infrastructure so the work can be completed. Draining ditches and reservoirs would alleviate the potential for standing water during repairs. Kōkeʻe Ditch is a gravity-based system and water in the ditch, including rainwater, flows down ditch. Standard ditch maintenance would involve the removal of sediment and rock build up that would limit downstream flow and cause pooling. Implementing these road upgrades and following the guidance to reduce mosquito breeding habitat outlined in **Section 5.3.3** would ensure that there is a net decrease in available mosquito breeding habitat within the Project area.

Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe Diversions

Vegetation maintenance along the Kōkeʻe Ditch Irrigation System is ongoing; therefore, there would be little to no impacts to flora from vegetation maintenance along the Kōkeʻe Ditch Irrigation System, including at the diversions to maintain the existing cleared areas for access.

Some limited trimming of vegetation that is overhanging or extending into some access roadways may be required during the operation to maintain sufficient access to the site for maintenance activities. Measures outlined in **Section 5.3.3** would be implemented to minimize impacts to biological resources.

Puʻu Lua Reservoir

Vegetation clearing around the Puʻu Lua Reservoir and access roads would be minimal and limited to that amount necessary for safe operation of the Proposed Action. However, vegetation clearing would occur on the dam embankment to prevent shrubs and trees from growing since root systems damage the integrity of the embankment.

The capacity of Puʻu Lua Reservoir would increase from approximately 60 MG to approximately 200 MG. This increase would provide additional habitat for waterbirds. It would also enhance the fishing and recreational resources at Puʻu Lua Reservoir. In addition, the reservoir rehabilitation would provide water for firefighting activities, which would benefit flora and fauna by increasing firefighting capabilities.

Puʻu ʻŌpae Reservoir would be lined and then fenced for both public safety reasons and to protect the liner from ungulate damage, which would prevent land-based wildlife from accessing these facilities. The reservoir is currently dry or except when rain water accumulates during rain events, and is therefore an unreliable source of water for wildlife.

Puʻu Lua Reservoir is classified as a freshwater pond by the NWI and would be beneficially impacted by the Proposed Action due to freshwater reservoir levels being expanded from currently reduced levels.

Upper Penstock

The current western branch of the Kōkeʻe Ditch that runs between Puʻu Moe Divide and Puʻu ʻŌpae Reservoir would be left in place but no longer be used. The Upper Penstock would operationally replace this section of open ditch, which would eliminate water loss due to saturation. The remaining 10.6 miles of open ditch associated with the Proposed Action above Puʻu Moe Divide, plus the 2.9-mile southern segment below Puʻu Moe Divide and Puʻu Lua Reservoir would remain as open ditch and provide viable sources of water for land-based wildlife.

The Upper Penstock would be buried and up to a 60-foot-wide corridor would be maintained over the penstock alignments. Trees and shrubs would be removed during construction, but the area would be reseeded with native grasses. After construction, a 60-foot corridor would be maintained during operations to prevent growth of trees and shrubs over the penstock. As a buried feature, the penstock would not be accessible to wildlife. Screening at the entrance to the Upper Penstock would prevent animals from entering the penstock. As such, operation of the Upper Penstock is not expected to have a long-term impact to biological resources with minimization measures.

Puʻu ʻŌpae Reservoir, Powerhouse and Facility Substation

Vegetation clearing around the Puʻu ʻŌpae Reservoir and access roads would be minimal and limited to that amount necessary for safe operation of the Proposed Action. However, vegetation clearing would occur on the dam embankment to prevent shrubs and trees from growing since root systems damage the integrity of the embankment. The storage capacity of Puʻu ʻŌpae Reservoir would increase from the historic capacity of 88 MG to 100 MG. The rehabilitation of this reservoir would provide habitat for waterbirds. In addition, the reservoir rehabilitation would provide water for firefighting activities, which would benefit flora and fauna by increasing firefighting capabilities.

Puʻu ʻŌpae Reservoir is classified as a freshwater pond by the NWI and would be beneficially impacted by the Proposed Action due to freshwater reservoir levels being expanded from currently being dewatered.

Puʻu ʻŌpae Powerhouse and Facility Substation would be fenced which would isolate it from fauna resulting in negligible impacts. Vegetation clearing around the Puʻu ʻŌpae Powerhouse and access roads would be minimal and limited to that amount necessary for safe operation of the Proposed Action.

Lower Penstock

The Lower Penstock would be buried and up to a 60-foot-wide corridor would be maintained over the penstock alignments. Trees and shrubs would be removed during construction, but the area would be reseeded with native grasses. After construction, and a 60-foot corridor would be maintained during operations to prevent growth of trees and shrubs over the penstock. As a buried feature, the penstock would not be accessible to wildlife. Screening at the entrance to the Lower Penstock would prevent animals from entering the penstock. The Lower Penstock traverses agricultural fields, and after construction would not impede agricultural activities along the penstock alignment. As such, operation of the Lower Penstock is not expected to have a long-term impact to biological resources with minimization measures and would be inaccessible to land-based wildlife.

Mānā Reservoir, Powerhouse, Pumpstation, and Facility Substation

Vegetation clearing around the Mānā Reservoir and access roads would be minimal and limited to that amount necessary for safe operation of the Proposed Action. However, vegetation clearing would occur on the dam embankment to prevent shrubs and trees from growing since root systems damage the integrity of the embankment. The storage capacity of Mānā Reservoir would increase from the historic capacity of 44 MG to 80 MG. The rehabilitation of this reservoir would provide habitat for waterbirds. In addition, the reservoir rehabilitation would provide water for firefighting activities, which would benefit flora and fauna by increasing firefighting capabilities.

The Mānā Reservoir is classified as a freshwater pond by the NWI and would be beneficially impacted by the Proposed Action due to freshwater reservoir levels being expanded from being completely dewatered.

Operation of Mānā Powerhouse, Pumphouse and Facility Substation would be contained and isolated from fauna resulting in negligible impacts. Vegetation clearing around the Mānā Powerhouse, Pumphouse and Facility Substation and access roads would be minimal and limited to that amount necessary for safe operation of the Proposed Action.

PV Solar Array, Project Substation, and Interconnection Line

Native waterbirds are likely to occur within the vicinity of the proposed PV Solar Array and Project Substation as the immediate area is adjacent to fallow agricultural fields that are prone to flooding. In addition, the DOFAW-managed Kawaiʻele State Waterbird Sanctuary is located approximately 1.75 miles away from the proposed PV Solar Array and Project Substation location, which is similar to the distance between the PMRF solar facility and the Kawaiʻele State Waterbird Sanctuary.

Despite the proximity of the proposed PV Solar Array to known waterbird habitat, there is no evidence that solar arrays impact waterbirds and seabirds in Hawaiʻi. Therefore, in contrast to the precautionary approach concerning the impacts of PV solar arrays on native waterbirds and seabirds in Hawaiʻi proposed by Penniman and Duffy (2021), there is no current evidence to warrant minimization measures for these native species due to the Proposed Action. For example, no special-status fauna or MBTA bird species have been recorded at any of KIUC's six PV solar facilities during the past 10 years of operation, including at the PMRF solar array where systematic biological monitoring has occurred since 2019 (Dawn Huff, Joule Group LLC, pers. comm.). The remaining four facilities have ongoing vegetation management under and around the solar arrays, either through sheep grazing or mowing, and are regularly visited by KIUC staff who are aware of downed-wildlife protocols. This suggests that these solar arrays do not impact native waterbirds or seabirds. To date, the only special-status or MBTA species that has been recorded dead near a PV solar array in the state was a Hawaiian coot. This bird was located immediately below powerlines outside the boundary of a solar array and was reported through KIUC's Habitat Conservation Program reporting system as the result of a powerline collision, which was consistent with the injuries present on the downed bird.

Based on several meta-analyses of avian monitoring and mortality data at PV array sites on the U.S. mainland (Kosciuch et al. 2020; Smith and Dwyer 2016; Walston et al. 2016), it is hypothesized that waterbirds are attracted to solar arrays as they could potentially simulate the surface of waterbodies, creating a hypothesized "lake effect". Birds that do attempt to land within the solar arrays may be at risk of injury or mortality due to collision or become stranded as a result of unsuitable surfaces on which to take off, according to the analyses. However, to date, no experimental research has been undertaken to quantitatively test this hypothesis. Therefore, it is difficult to fully determine the effects of the proposed PV Solar Array on native waterbirds that may occur within the vicinity of the Project site. However, based on the design of the proposed PV Solar Array, and the limited evidence that PV facilities impact avifauna in Hawaiʻi, the proposed PV Solar Array is not expected to pose a threat to waterbirds.

The layout of the single-axis tracking mounts and panels of some of the PV arrays reported in Walston et al. (2016) and Kosciuch et al. (2020) differs from those that would be used in the proposed Project. For example, many of the study sites contained fixed panels spaced approximately six feet apart, as measured on Google Earth, without white cell borders. By contrast, the rows of PV panels in the Proposed Action would be spaced between 20 and 30 feet apart (approximately) to allow access for maintenance vehicles and growing of agricultural crops, thereby reducing the likelihood that avifauna would mistake the arrays for waterbodies. In addition, the studies to date have been conducted in dry, desert environments that greatly differ from those that are present at the proposed Project site. As cautioned by Kosciuch et al. (2020), extrapolating the published evaluation of bird mortality at PV utility-scale solar facilities to sites in drastically different environments such as the Proposed Action would be subject to great uncertainty and at risk of producing meaningless results (Korsciuch et al. 2020).

The potential effects of the proposed PV Solar Array on native forest birds and MBTA-protected passerine species are likely to be negligible due to the location of the proposed PV Solar Array within agricultural lands and the distance of the nearest areas of native and exotic forest (the nearest exotic forest is approximately 3,000 feet [0.6 mile] to the northeast). Because there is no evidence that solar arrays impact waterbirds and seabirds in Hawaiʻi, it is not necessary to implement a downed wildlife monitoring program during the operational phase of the Proposed Action.

There are no expected impacts from the Project Substation on waterbirds, seabirds, native forest birds and MBTA-protected passerine species.

The operation of the proposed PV Solar Array on the Mānā Plain is not expected to impact Freshwater Emergent Wetlands as these lands are currently zoned for agricultural use and are drained by the existing storm drainage system that drains the Mānā Plain. The Applicant is currently undertaking a wetlands delineation study and consulting with the USACE to determine if the area is wetlands and would be jurisdictional. If the area is determined to be wetlands and would be jurisdictional, the Applicant would coordinate with USACE to determine what mitigation would be required.

The proposed Interconnection Line has the potential to impact three species of threatened and endangered seabirds including Newell's shearwater, Hawaiian Petrel, and band-rumped storm petrel, and five threatened and endangered species of waterbirds including Hawaiian goose, Hawaiian duck, Hawaiian coot, Hawaiian stilt, and Hawaiian common gallinule. As noted in **Section 4.1.2.17**, once construction is completed the new Interconnection Line would be owned and operated by KIUC as part of its island-wide electrical grid system and would be covered under KIUC's Habitat Conservation Plan (HCP). Minimization and avoidance measures for potential impacts to threatened and endangered seabirds and waterbirds associated with the new Interconnect Line would be implemented according the KIUC's HCP. Any potential impacts that cannot be minimized or avoided would be mitigated through KIUC's HCP mitigation plan. Minimization and avoidance measures would include the following:

- Removal of approximately 2 miles of existing overhead powerlines between PMRF and Polihale State Park thus completely removing potential impacts associated with this section of electrical line.
- Limiting the height of lines to the extent possible while still complying with applicable safety codes and federal and PUC guidelines.
- Limiting the number of layers on poles to the extent possible while still complying with applicable safety codes and federal and PUC guidelines, meaning lines are configured on the horizontal plane rather than vertical.
- Installing reflective or LED diverters.

In addition, the new Interconnection Line would be monitored specifically as a new line on KIUC's system, and long-term as part of KIUC's electrical overhead transmission system. Initial monitoring would be for the purpose of determining the level of risk introduced by the new overhead line, if the minimization is effective, and whether other minimization methods may be appropriate.

No-Action Alternative

Under the No-Action Alternative, the Phase One IIFS as outlined in the Waimea Mediation Agreement would remain in effect. KIUC's Kōkeʻe Diversion Modification Project would be completed as a separate and independent Project, which would involve modifications to the four Kōkeʻe Ditch Irrigation System diversions for implementation of the Phase One IIFS. Responsibility for the operation and ongoing maintenance of the Kōkeʻe Ditch Irrigation System would remain with ADC, as would long-term maintenance and compliance with the Phase One IIFS. This could result in the continuance of reduced operations or closure of the system which would result in no diversions from the four associated streams. If the Kōkeʻe Ditch Irrigation System was not operational, the Kekaha Ditch System would remain the only source of irrigation for agricultural activities on Mānā Plain, there would be no source of irrigation for DHHL's Puʻu ʻŌpae lands or ADC's mauka lands, and Puʻu Lua Reservoir would not have a source fresh water. If the Kōkeʻe Ditch Irrigation System were to be closed and diversion structures were removed or modified resulting in all flow being retained in the stream, there would be beneficial impacts to other native and invasive stream biota downstream of the diversions. There would be no impacts to terrestrial biological resources.

Under the No-Action Alternative, the Kōkeʻe Ditch Irrigation System would remain under ADC management, Puʻu Lua Reservoir would remain under management of DLNR, Puʻu ʻŌpae Reservoir would remain with DHHL, and Mānā Reservoir would remain with ADC. All three reservoirs require improvements in order to comply with Hawaiʻi State Dam Safety Standards and remain operational. Puʻu ʻŌpae and Mānā Reservoir are currently drained and are therefore not active freshwater ponds. Decommissioning of the reservoirs would result in loss of habitat for waterbirds and land-based fauna at the Puʻu Lua Reservoir. Vegetation clearing along the Kōkeʻe Ditch Irrigation System would continue and represents no change from existing conditions.

Under the No-Action Alternative, the Phase One IIFS as outlined in the Waimea Mediation Agreement would remain in effect. KIUC's Kōkeʻe Diversion Modification Project would be completed as a separate and independent Project, which would involve modifications to the four Kōkeʻe Ditch Irrigation System diversions for implementation of the Phase One IIFS. Responsibility for the operation and ongoing maintenance of the Kōkeʻe Ditch Irrigation System would remain with ADC, as would long-term maintenance and compliance with the Phase One IIFS. This could result in the continuance of reduced operations or closure of the system which would result in no diversions from the four associated streams. If the Kōkeʻe Ditch Irrigation System was not operational, the Kekaha Ditch System would remain the only source of irrigation for agricultural activities on Mānā Plain, there would be no source of irrigation for DHHL's Puʻu ʻŌpae lands or ADC's mauka lands, and Puʻu Lua Reservoir would not have a source fresh water. If the Kōkeʻe Ditch Irrigation System were to be closed and diversion structures were removed or modified resulting in all flow being retained in the stream, there would be beneficial impacts to other native and invasive stream biota downstream of the diversions. There would be no impacts to terrestrial biological resources.

The potential impacts to suitable habitat downstream of Waiahulu Diversion for aquatic species of concern would be entirely dependent on Kekaha Ditch operations. An IIFS has been set for the Kekaha Ditch diversions and Waimea River below Kekaha Ditch diversions, the values of which are the same value both prior to West Kauaʻi Energy Project operation and post West Kauaʻi Energy Project operation. Therefore, the current IIFS for Kekaha Ditch diversions and Waimea River below Kekaha Ditch would remain the same in the absence of West Kauaʻi Energy Project. Under the No-Action Alternative, current average flow in Waiahulu Stream is expected to continue unless there is a change in water needs along the Kōkeʻe Ditch Irrigation System.

5.3.3 Avoidance and Minimization Measures – Biological Resources

The following measures would be implemented in areas of critical habitat to minimize potential impacts to special-status plant species:

- A pre-construction (i.e., prior to vegetation removal) survey would be performed by a qualified biologist throughout the Project sites within critical habitat.
    - If any special-status species are recorded during the survey, the location of the plants would be noted with flagging, a GPS point recorded, and the Project contractors and DOFAW would be notified of the location(s).
    - Work would cease at the specific site until guidance is sought from the appropriate regulatory agency (e.g., DOFAW, USFWS).
- The botanist would possess the following qualifications:
    - Familiarity with the plants of the area, including special-status species.

  - Familiarity with natural communities of the area, including special-status natural communities.
  - Experience conducting floristic field surveys.
  - Experience with analyzing impacts of development of native plant species and natural communities.
- A biological monitor (botanist) would be present during construction within areas of the site where special-status plant species occur.
- No vegetation removal is planned for the portions of the Project located within the Hawaiian picture-wing fly designated critical habitat. However, if vegetation removal of the suspected host plants takes place in the critical habitat areas, a pre-removal survey for eggs and larvae should be conducted on those plants. The eggs or larvae are identified, those host plants should be left in place until the flies have developed into adults and flown away.

The following measures would be implemented to minimize potential impacts to native flora and manage invasive species at areas of vegetation clearing which include the Waiakōali and Kawaikōī Diversions, Puʻu Lua and Puʻu ʻŌpae Reservoirs, and within forested sections of the Upper and Lower Penstocks:

- A biological monitor would survey the area of vegetation to be removed prior to clearance.
- Every effort would be made to limit the total area of native vegetation removed during construction, including felling trees, pushing or dumping vegetation, and piling spoils outside the footprint of the construction area.
- All plant material that is removed would be left to break down at locations where this material would not enter water bodies.
- Wood from removed trees would be saved and made available to DOFAW and/or wood workers on Kauaʻi.
- A qualified biologist would monitor the sites between six months and one year after the clearance of vegetation to determine if highly invasive plant species have established.
  - The species that meet the criteria of highly invasive would be determined through consultation with DOFAW Kauaʻi Branch and the Kauaʻi Invasive Species Committee.
  - If highly invasive species colonize the construction sites, a control plan would be developed for their management.

The following actions were determined in consultation with KHHA and other community members as a means of minimizing the community impact of the Koa tree removal from the northwest corner of Puʻu ʻŌpae Reservoir:

- Harvesting seeds from this specific tree and using them to replant multiple new Koa in the areas adjacent to and immediately south of Puʻu ʻŌpae Reservoir.

- Saving the usable timber from the trunk of the removed tree and giving that wood to KHHA for use in future Farm Plan buildings at Puʻu ʻŌpae, perhaps in an entryway or other prominent and visible area.

The following measures identified during consultation with DOFAW would be implemented to minimize potential impacts to terrestrial and aquatic biological resources:

- A pre-construction survey of the Project sites would be undertaken by a DOFAW Kauaʻi biologist and a representative of KIUC or a suitably qualified subcontractor in areas where special-status species have the potential to occur.
- Regular on-site staff would be trained to identify special-status species with the potential to occur on-site as well as the appropriate measures to be taken if they are present.
- A post-construction report would be submitted to DOFAW Kauaʻi Branch within 30 days of completion of construction. The report would include the following:
  - All wildlife surveys, observations, and monitoring reports;
  - Wildlife incidents, including date, time, and location of the incident; and
  - Photographs of the site before, during, and after Project construction is completed.
- All sick, injured, or dead special-status and MBTA-covered wildlife that are encountered at the Project sites during the construction and operational phases would be reported to the appropriate wildlife agencies.
- All Project construction-related materials and equipment to be placed or used in an aquatic environment would be inspected for pollutants including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use.
- Fueling of Project-related vehicles and equipment would take place away from the aquatic environment. A contingency plan for accidental spills of petroleum products would be developed and retained on-site. Absorbent pads and containment booms would be stored on-site to facilitate clean-up of accidental petroleum releases.
- Project construction-related materials would not be stockpiled in or in close proximity to aquatic habitats and would be protected from erosion to prevent materials from being carried into waters by wind or rain.
- Regular on-site staff would be trained to identify special status species with the potential to occur within the Project area, as well as know the appropriate measures to be taken if a special status species is identified.

The following measures would be implemented to minimize potential impacts to the Hawaiian goose:

- A biologist familiar with waterbird biology would conduct a Hawaiian waterbird nest survey where appropriate habitat occurs two weeks prior to construction. Surveys would be repeated after any subsequent delay of work of three or more days.

- Project personnel and contractors would be informed about the potential presence of endangered species on site.
- Project personnel and contractors would not approach, feed, or disturb Hawaiian geese.
- If Hawaiian geese are observed loafing or foraging within the Project area during the breeding season (September through April), a biologist familiar with the nesting behavior of Hawaiian geese would survey for nests in and around the Project area prior to the resumption of any work where the observation occurred. Surveys would be repeated after any subsequent delay of work of three or more days.
- All work in the immediate vicinity would immediately cease and the USFWS would be contacted for further guidance if a nest is discovered within a 150-foot radius of proposed work, or if a previously undiscovered nest is found within a 150-foot radius after work has begun.
- In areas where Hawaiian geese are known to be present, signs would be posted, reduced speed limits would be implemented, and personnel would be notified of their presence.

Pre-construction planning and post-construction monitoring would be undertaken at the proposed PV Solar Array to ensure that the Hawaiian goose is not impacted by the installation.

The following measures would be implemented to minimize potential impacts to Hawaiian waterbirds:

- A biologist familiar with waterbird biology would conduct a Hawaiian waterbird nest survey where appropriate habitat occurs two weeks prior to construction. Surveys would be repeated after any subsequent delay of work of three or more days. If a nest or active brood is found:
  - The USFWS would be notified within 24 hours for further guidance.
  - A 100-foot buffer would be established and maintained around all active nests and/or broods until the chicks/ducklings have fledged.
  - A biological monitor familiar with waterbird biology would be present on the Project site during all construction or earth-moving activities until the chicks/ducklings have fledged.
- In areas where waterbirds are known to be present, signs would be posted, reduced speed limits would be implemented, and Project personnel would be educated regarding the presence of these species.
- BMPs regarding work in aquatic environments, including avian mortality avoidance measures, would be incorporated into the Project design.
- A qualified wildlife biologist knowledgeable in Hawaiian fauna would be present during construction activities for the proposed PV Solar Array and Interconnection Line on Mānā Plain.

The following measures would be implemented to minimize potential impacts to Hawaiian seabirds:

- No nighttime construction is planned during the course of the Project, and there is no nighttime lighting planned for the operational phase of the Project. The measures below concerning lighting are provided as general guidance:
  - Nighttime construction would be avoided during the seabird fledging season (September 15 to December 15).
  - Nighttime construction, if required, between December 16 and September 14 would utilize fully shielded and downward facing construction lights.
  - All outdoor lights would be fully shielded so the bulb can only be seen from below bulb height and only used when necessary.
  - Automatic motion sensor switches and controls would be installed on all outdoor lights, and/or lights would be turned off when human activity is not occurring in the lighted area.
- Power lines, connections, and poles would be designed to minimize the likelihood of collisions from Hawaiian seabirds.

The following measures would be implemented to minimize potential impacts to forest birds:

- Pre-construction surveys would be undertaken for native Hawaiian forest birds and MBTA-covered species in critical habitat areas for the Akekeʻe and ʻAkikiki and other forested habitats, specifically in the upperwatershed areas (all four diversion sites, Puʻu Lua Reservoir, Puʻu Moe Divide and the Upper Penstock, of the Project area within one week of the commencement of construction.
- No vegetation clearing is proposed for the designated critical habitat areas for the Akekeʻe and ʻAkikiki.
- A qualified wildlife biologist experienced at identifying Hawaiian forest bird species and their nests would be present to monitor construction in forested habitat. If an active nest is located within the footprint of the active work site, the following measures would be implemented:
  - The location of the nest would be recorded with a GPS unit;
  - The area would be flagged and communicated to the project manager and crew; and
  - No work would occur within 30 feet of the nest until the nestlings have fledged.
- Construction and installation phases should occur during the special-status forest bird non-nesting season (approximately October 1 through January 31).
- If tree removal and trimming occur between January and September in areas where native Hawaiian forest birds or MBTA-covered species may be present, a qualified biologist would survey trees for active nests prior to any felling and trimming operations.
- If a downed tree must be removed from a road, trail, or other passageway, it would be inspected for the presence of active bird nests. The measures listed above would be implemented.

- During construction and operational phases, every effort would be made to reduce areas of human-made standing water to minimize the potential for mosquito breeding sites. To accomplish this, the following measures would be undertaken:
  - Remove tire ruts in roads and tracks;
  - Empty open water tanks;
  - Turn over water-collecting containers; and
  - Do not allow water to collect in tarps.
- During the operational phase of the Project, contractors that undertake vegetation maintenance would be informed about the importance or searching for and avoiding bird nests during the nesting season. If contractors do encounter bird nests within maintenance corridors, they should avoid any disturbance of vegetation in which the nest occurs and not undertake maintenance within 30 feet of the nest site.

The following measures would be implemented to minimize potential impacts to the Hawaiian hoary bat:

- Hawaiian hoary bat has been previously recorded at or near sections of the study area; therefore, it should be assumed that bats are present within areas of forest within the Project footprint.
- There would be no disturbance, removal, or trimming of woody plants greater than 15-feet-tall during the bat birthing and pup rearing season (June 1 through September 15).
- Barbless wire would be used for all fence construction to avoid entanglement of Hawaiian hoary bat.

The following measures would be implemented to minimize potential impacts to the picture-wing fly:

- There is no vegetation clearing proposed in critical habitat areas for the picture-wing fly.
- Pre-construction surveys with a focus on picture-wing fly host plants would be conducted prior to construction in the critical habitat areas, if vegetation clearing occurs within the critical habitat area or within 200 feet of a site potentially occupied by picture-wing fly.
- Trained staff would be onsite during construction to identify picture-wing fly host plants and take appropriate measures.
- Clearing of forest vegetation within 200 feet of a site potentially occupied by picture-wing fly would be avoided. Vegetation clearing at Kōkeʻe Diversion would be avoided by delivering equipment and materials to the site via helicopter.
- Construction equipment would be restricted to existing roads and trails.

The following measures would be implemented to minimize the spread of ROD:

- A survey of any locations where tree cutting may occur would be conducted within two weeks prior to tree cutting to determine if there are infected ʻōhiʻa trees. If infected trees are identified, the following measures would be implemented:
    - The USFWS, University of Hawaiʻi Cooperative Extension Service, U.S. Department of Agriculture (USDA) Forest Service, and USDA Agricultural Research Service would be contacted for further guidance.
- Both prior to cutting and after the Project is complete, the following measures would be implemented:
    - Tools used for cutting infected ʻōhiʻa trees would be cleaned with a 70% rubbing alcohol solution or a freshly-prepared 10% solution of chlorine bleach and water as long as the tools are oiled afterwards. Chainsaw blades would be brushed clean.
    - Vehicles used off-road in infected areas would be thoroughly cleaned and tires and the undercarriage would be pressure washed with detergent.
    - Shoes and clothing worn in infected areas would be cleaned by dipping shoe soles in 70% rubbing alcohol and washing clothing in hot water with detergent.
    - All cut wood would be left on-site to avoid spreading ROD.

The following measures would be implemented during operations and ditch maintenance to minimize impacts to native species and habitats:

- Vegetation maintenance would be undertaken by qualified and reputable contractors who are experienced in safely conducting vegetation maintenance within remote areas.
- BMPs concerning limiting the spread of invasive species would be followed at all times.
- Vegetation maintenance crews would prevent trimmed stems, branches, and logs from entering waterways.
- If herbicides are required to manage vegetation, they would be used sparingly and by certified pesticide applicators who are experienced in working in areas of native vegetation in Hawaiʻi.
- If introduced grasses are to be used for erosion control following construction, the grass seed would be purchased from a Hawaiʻi Department of Agriculture-certified source to ensure that invasive species are not present within the seed lot.

The following measures would be implemented to minimize potential impacts to streams and wetlands:

- Implementation of the Phase Two IIFS would ensure mauka to makai stream connectivity and provide adequate streamflow for aquatic species. Implementation of the Phase Two IIFS would also minimize potential impacts to stream related cultural resources associated with traditional cultural practices.

- To the extent practicable, performance of this work to the diversions and around streams would be scheduled to coincide with the drier summer months and would be temporarily suspended in the event of high streamflow or precipitation events.
- Implementation of the Phase Two IIFS through fully automated gates at each diversion would minimize the downstream impacts of water diversion operations.
- New concrete weirs would be designed and constructed to facilitate passage of the migratory native stream animals. Implementation of the Phase Two IIFS would ensure a wetted pathway for the animals to pass over control structure and to avoid “air gaps” (i.e., where the water is not in contact with the streambed) as the migratory species “climb” while in contact with the bottom and not jump over barriers like salmon.
- Construction plans and specifications would include comprehensive BMPs to minimize erosion at the applicable Project sites during and after construction, as well as measures to contain runoff on-site during construction. BMPs may include, but not be limited to, the following:
    - Turbidity and siltation from Project-related work would be minimized and contained within the Project area by silt containment devices, which would be maintained for the life of the construction period and until the Project area is stabilized.
    - No work would occur during adverse weather conditions or flooding.
    - All Project construction-related debris and sediment containment devices would be removed and disposed of at an approved site.
    - All Project construction-related materials and equipment to be placed or used in an aquatic environment would be inspected for pollutants including, but not limited to, grease, oil, etc., and cleaned to remove pollutants prior to use.
    - Fueling of Project-related vehicles and equipment would take place away from the aquatic environment. A contingency plan for accidental spills of petroleum products would be developed and retained on-site. Absorbent pads and containment booms would be stored on-site to facilitate clean-up of accidental petroleum releases.
    - Project construction-related materials would not be stockpiled in or in close proximity to aquatic habitats and would be protected from erosion to prevent materials from being carried into waters by wind or rain.
    - All deliberately exposed soil or under-layer materials used near water would be protected from erosion and stabilized as soon as possible with geotextile, filter fabric, vegetation matting, or hydroseeding.
- Temporary erosion control measures would be used during construction to prevent soil loss and to minimize surface runoff into adjacent wetlands and streams.

5.4 Traditional Cultural Practices and Resources

5.4.1 Affected Environment – Traditional Cultural Practices and Resources

The Project area contains a diversity of cultural, archaeological, and historic resources from both pre-contact (1778) and post-contact (1778 to present) periods. Much of the cultural and historic resources are related to the landing of Captain James Cook at Waimea Bay on January 20, 1778, and the subsequent colonial settlement of the area. In 1878, the Waimea Sugar Mill Company was founded, and sugarcane cultivation became the primary industry in the area. The Waimea Sugar Mill ceased operations in 1945.

A Cultural Impact Assessment (CIA), *Cultural Impact Assessment Report for the Kauaʻi Island Utility Cooperative's Puʻu Ōpae/West Kauaʻi Energy Project, Waimea Ahupuaʻa, Waimea District, Kauaʻi*, provided in **Appendix I**, was prepared pursuant to Act 50[12] (House Bill No. 2895, signed into law on April 26, 2000), and in accordance with the Office of Environmental Quality Control's (OEQC) *Guidelines for Assessing Cultural Impact* (adopted by the State of Hawaiʻi Environmental Council on November 19, 1997. The CIA was also prepared in accordance with HRS Chapter 343, which serves to "...ensure that environmental concerns are given appropriate consideration in decision making..." (HRS Section 343-1). The scope of work for the CIA included the following:

- Examination of cultural and historic resources, including Land Commission documents, historic maps, and previous research reports 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.
- Review of previous archaeological work at and near the subject parcel that may be relevant to reconstructions of traditional land use activities and to the identification and description of cultural resources, practices, and beliefs associated with the parcel.
- Preparation of a report that summarizes the results of these research activities and provides recommendations based on findings.

5.4.1.1 Archival Research

The CIA includes archival research centered on Hawaiian activities including kaʻao (legends), wahi pana (storied places), ʻōlelo noʻeau (proverbs), oli (chants), mele (songs), traditional moʻolelo, traditional subsistence and gathering methods, ritual and ceremonial practices, and more. Background research focused on land transformation, development, and population changes beginning with the early post-contact era to the present day, which has been documented in **Section 5.5**. Cultural documents, primary and secondary cultural and historical sources, historic maps, historic photographs, and Land Commission Awards were reviewed for information

[12] Section 1 of Act 50 states that the preparation of environmental assessments…should identify and address effects on Hawaiʻi's culture, and traditional customary rights and notes that native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the 'aloha spirit' in Hawaiʻi. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on governmental agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups."

pertaining to the study area. Background research for this study yielded the following results which are presented in approximate chronological order:

- Waimea Ahupuaʻa is by far the largest on the island, comprising 92,646 acres and accounting for more than a quarter of the total land area of Kauaʻi. It encompasses all of the Waimea River Canyon area, the uplands of Kōkeʻe, the high swampy plateau of Alakaʻi, and the northwestern coastal valleys of Nuʻalolo and Miloliʻi (Gray 1875:140-146).
- Rain in the Waimea Ahupuaʻa varies greatly depending on location – highland mauka (inland) locations of Waimea receive large rainfall amounts while coastal ridges and plains of the Kekaha-Mānā area receives some of the lowest rainfall on the island. The Kapaʻahoa rain was associated with Waimea town while the Alakaʻi Valley is said to have Nahae rain meaning "to shed". The wind associated with Waimea was Waipao, which means "wind-scooped" according to Kent (1986:443) or "the cool breeze" according to Nakuina (1992:140).
- Hawaiian legends concerning Waimea speak of the Menehune people who according to Thrum (1908:110-111) were summoned by: "Pi the chief of Waimea who gets the Menehune to construct for him a dam across the Waimea River."
- The story Kanaka-nunui-moe, or "the sleeping giant," mentions Kōkeʻe, Waimea Canyon, and Mānā. This story tells of a giant's efforts to help village people construct a heiau (place of worship).
- Waiawa, which is translated to mean "milkfish water" (Soehren 2002:184) or "Place of awa" (Andrews 1922:672); Kekaha understood to mean "land unsuited for taro growth" (Andrews 1922:650); and Mānā understood as "a satisfied condition (Andrews 1922:658)" are all ʻili with Waimea.
- Puʻu-kāpele Peak is positioned at the highest point of Waimea Canyon rim at an elevation of 3,662 feet. The original pronunciation of Puʻu-kāpele is translated to mean "distended hill. The hill is so named because of its resemblance to the characteristic distended bellies of the Menehune, many of whom lived in this area" (Wichman 1998:13).
- Waimea is thought to have first been settled by voyagers from Tahiti, led by Kūalu-nui-kini-akua. In pre-Contact times Waimea was also a site of great significance for poʻe kuhikuhi puʻuone (site experts) and poʻe kilo hoku holo moana (navigators) who traveled to the area to make observations.
- The British vessels Discovery and Resolution, under the command of Captain James Cook, anchored at Waimea Bay on January 20, 1778. Cook's observations during an excursion on shore in 1778 reveal that, "a great crowd assembled at the beach... [with] a brisk trade for pigs, fowls, and roots [occurring]..." (Cook 1821:189).
- Missionary journals and documents recount the events shaping Waimea from the 1820s onwards. In May 1826, kamaʻāina (native born) of the ahupuaʻa (traditional land unit) were struck by two catastrophic events, an influenza epidemic, and a great flood. The flood wreaked havoc upon loʻi (irrigated fields) kalo (taro) and damaged structures built by the missionaries.

- Over 150 kuleana (Native tenant awards) awards were granted in Waimea. Records for Land Commission Awards generated during the Māhele show, interspersed among lo'i, were house sites, small plots of kula (field and/or pastureland) on which were cultivated traditional native dry land crops as well as introduced ones, and also pasture land. In the upper canyon past the Makaweli fork, the degree of settlement thinned out greatly with lo'i and house sites dispersed along the banks of the Waimea River.
- During the last decade of the nineteenth century, the population of Waimea would rebound from the influenza epidemic of 1826, growing from a total of 2,739 persons in 1890 to 4,595 in 1896, and 5,886 in 1900 (Schmitt 1977:13). That growth was attributed to the establishment of commercial sugar cane planting in Waimea and an influx of immigrant labor.
- In the mauka portion of Waimea Ahupua'a, land was divided and preserved by the creation of state parks such as Kōke'e State Park and Waimea Canyon State Park. The development of the parks themselves began in the late 1940s at the instigation of Joseph M. Souza, Jr.
- Previous archaeological studies located within and around the Project area have identified historic sites including pre-Contact habitation terraces, burials, heiau, and cultural deposits.

5.4.1.2 Cultural Consultation

Throughout the CIA process, an effort was made to contact and consult with Native Hawaiian Organizations, agencies, and community members (including descendants of the area) to identify individuals with cultural expertise and/or knowledge of the Project area and the ahupua'a of Waimea. A total of eight individuals and organizations contributed their *Mānā'o* (thought, opinions) and *'ike* (knowledge) of the area. Full written summaries of the interviews are provided in the CIA in **Appendix I**.

The community consultation process for this Project area has identified the importance of water to those residents of Hawaiian Home Lands and the Waimea Ahupua'a. The traditional and cultural practices of the Waimea Ahupua'a in the past, present, and future all depend on the need for continued water sources. In the kama'āina interview with Mr. Eben Manini, Cultural Surveys Hawai'i learned that Project activities may impact the traditional and cultural practice of malama 'aina (Custodial of land) within a native forest located on a small pu'u within a zone the Project area. It is stated in his interview that KIUC is planning to run a section of pipeline (the Upper Penstock) within this zone of the Project area. Mr. Manini and his son walk this pu'u for the past 10 years to care for the native forest. He offered a consideration to re-route a section of the pipeline to an area where there are more eucalyptus trees so that they can continue to practice mālama 'āina and preserve what is still native in this forested pu'u. As one of the avoidance and minimization measures identified below in **Section 5.4.3**, adjustments have been made to the Upper Penstock alignment and the associated construction area to minimize and avoid potential impacts to these practices in this area.

The following traditional and cultural practices were identified within the Project area and the Waimea Ahupua'a during community consultation and kama'āina interviews:

- Hula (Traditional Hawaiian dance)
- Haku mele (Composing song/chant)
- Mahi ʻai (Traditional cultivation of loʻi kalo and dry land kalo, ʻuala)
- Mālama i ka wai (Caring for water and their ecosystems)
- Mālama ʻāina (Custodial land)
- Aloha ʻāina (Love of the land)
- Lawaiʻa (Fishing)
- Gathering of natural resources
- Umu hau pōhaku (stone wall dry stacking)
- Mālama i nā iwi kūpuna (Ancestral remains)
- Nā mea hoʻohana (Tool making practices, poi pounders, adz)
- Pule (Prayer)
- Oli (Chant)
- Laulima (Group of people working together)
- Pono (Maintaining balance)

Several cultural sites and resources relating to ongoing traditional and cultural practices were identified during the community consultation and interview process within the vicinity of the Project area and the Waimea Ahupuaʻa. These are presented in **Table 5-10**.

Table 5-10. Traditional Cultural Practices Identified Within the Vicinity of the Proposed Action

Traditional Cultural Practice	Resource
Cultural Sites and Resources	• Alakaʻi Swamp • Heiau (Temple/Shrine) • Nā Ala Hele (Trails) • Pōhaku hānau (Birth stone) • Pōhaku Manu (Famed Stone) • Puʻu ʻŌpae (Cultural Site) • Wai
Native Hawaiian Plants	• Hala pepe • Hōʻawa • Hoi kuahiwi • ʻIliahi • Kalia • Kalo • Kauila • Koa • Koaiʻe • Kokiʻo keʻokeʻo • Lauaʻe • Loulu • Maile (General maile) • Maili lau liʻiliʻi (Small leaf maile) • Māmaki • Mokihana • Niu • ʻOhai • ʻOhe kikoʻola • ʻŌhiʻa ha • ʻŌhiʻa lehua • Olopua • Palapalai • Pāʻū o Hiʻiaka • Pili • Pūkiawe • ʻUlaʻula • Ulu
Native Hawaiian Birds	• ʻAkikiki • ʻAninaniau • ʻApapane • ʻElepaio

5.4.1.3 Ka Paʻakai Analysis

The Ka Paʻakai Analysis involves a three-prong test that includes the following:

1. the identity and scope of "valued cultural, historical, or natural resources" in the petition area, including the extent to which traditional and customary native Hawaiian rights are exercised in the petition area;
2. the extent to which those resources including traditional and customary native Hawaiian rights will be affected or impaired by the proposed action; and
3. the feasible action, if any, to be taken by the approving agency to reasonably protect native Hawaiian rights if they are found to exist.

A Ka Paʻakai Analysis will be conducted for the Project to support state and county permit applications including the Kauaʻi County Use Permit and Class IV Permit, State Special Permit, Conservation District Use Permit, and Department of Health Section 401 Water Quality Certification. Information from the EA including the Cultural Impact Assessment will be used to inform the Ka Paʻakai Analysis in conjunction with community consultation.

5.4.2 Potential Impacts – Traditional Cultural Practices and Resources

5.4.2.1 Construction

Proposed Action

The findings in the CIA indicate that there are Native Hawaiian cultural resources, beliefs, and ongoing practices associated within the proposed Project area and immediate vicinity, including cultural sites and resources, native Hawaiian plants, and native Hawaiian birds (see **Table 5-10**). Construction activities associated with the Proposed Action would be short-term and temporary. The noise and concentrated human activity in the construction area could be disruptive to cultural practitioners utilizing the area, but this would be temporary and would be limited to the smallest possible area. The Applicant would work directly with potential affected community members including cultural practitioners prior to and during construction in an effort to minimize or avoid potential disruption of their activities. Therefore, it is expected that construction of the Proposed Action would have less than significant impacts on traditional and cultural practices and resources.

The CIA states that the Proposed Action would not affect or impact any or impair any traditional and customary Native Hawaiian rights exercised in the ahupuaʻa. However, the CIA notes that water was identified as a primary concern during the consultation process and recommends that the Applicant continue working with the community regarding concerns around water and water diversion. The information provided in the CIA indicates that the Proposed Action would not have any adverse effect on traditional and customary Native Hawaiian rights within the Waimea ahupuaʻa, and provides recommendations for continued community engagement.

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur. Vegetation clearing along the Kōkeʻe Ditch System is an ongoing activity that would continue and represents no change from existing conditions. Therefore, there would be no changes in the current condition and associated impacts to traditional and cultural practices and resources.

5.4.2.2 Operation

Proposed Action

The information on the potential impacts from operation of the Proposed Action to ongoing traditional cultural practices and traditional and cultural resources were gathered based on the data collected during the community consultation process and kamaʻāina interviews. During this process, the impact of water diversion was identified as a "major concern of impacts to the continued life source and sustainability to all ongoing cultural practices, traditional cultural rights and traditional cultural resources are of great concern within the vicinity of the Project area as well as the entire ahupuaʻa" (CSH, 2019). Although consultation efforts identified ongoing traditional and cultural practices and cultural resources within the vicinity of the Proposed Action and the Waimea Ahupuaʻa, only one traditional and cultural practice was found within the Project area. Operation of the Proposed Action may impact the traditional and cultural practice of malama ʻāina within a native forest due to the removal of native vegetation for the Upper Penstock and mauka section of the Lower Penstock.

No-Action Alternative

Under the No-Action Alternative, the existing Kōkeʻe Ditch Irrigation System would remain under management of ADC and any repairs and ongoing operations would fall to ADC. This could potentially result in the continuance of reduced operations or closure of the system. Reduced operations or closure of the ditch system could lead to reduced opportunities for taro cultivation at Puʻu ʻŌpae Reservoir. However, under the No-Action Alternative, there would be no impact to the traditional and cultural practice of malama ʻāina.

5.4.3 Avoidance and Minimization Measures – Traditional Cultural Practices and Resources

The following measures would be implemented to minimize potential impacts to cultural resources:

- The Applicant would continue to work with community members throughout construction and operation of the Proposed Action to minimize any potential impacts to cultural practices and resources within the Project area and in the vicinity of the Proposed Action.
- All staff engaged with the Proposed Action would be provided cultural sensitivity training including the identification of any known culturally sensitive locations and sites in the vicinity of the Proposed Action.
- If human remains or burials are identified, all earth-moving activities in the area would stop, the area would be cordoned off, and SHPD, DHHL, and the Police Department would be notified pursuant to HAR Section 13-300-40.
- If any potential historic properties are identified during construction activities, all activities would cease and SHPD would be notified pursuant to HAR Section 13-280-3.

- Measures to minimize potential impacts to stream related cultural resources associated with traditional cultural practices versus non-traditional practices of extraction and utilization as discussed in **Section 5.3.3**.
- The Applicant is in current discussions with the cultural practitioners of mālama ʻāina within a native forest located on a small puʻu, and adjustments have been made to the Upper Penstock alignment and the associated construction area to minimize and avoid potential impacts to these practices in this area.
- All equipment and vehicles arriving from outside all portions of the Project area located near designated critical habitat would be washed and inspected offsite prior to any maintenance or construction activities to avoid the unintentional introduction or transport of new invasive plant species.

5.5 Archaeological and Historic Resources

5.5.1 Affected Environment – Archaeological and Historic Resources

5.5.1.1 Literature Review and Field Inspection

An Archaeological Literature Review and Field Inspection (LRFI), *Archaeological Literature Review and Field Inspection for the Kauaʻi Island Utility Cooperative's Puʻu Ōpae/West Kauaʻi Energy Project, Waimea Ahupuaʻa, Waimea District, Kauaʻi*, provided in **Appendix J**, was prepared to determine the likelihood that archaeological and historic resources may be affected by the Project and based on findings, consider management recommendations. The study area for the LRFI comprised approximately 1,015 acres.

The LRFI was conducted through detailed historic, cultural, and archaeological background research and a field inspection of the study area. Background research included a review of previous archaeological studies, documents, historic photographs and maps, and Māhele records. The fieldwork included a pedestrian inspection of the study area, GPS data collection, photography, and brief field notes.

Background research of wahi pana, the early historic period, and previous archaeological research conducted for the Waimea area found an Emergence of a settlement pattern in the area. Permanent habitation areas were mainly among the mauka foothills, at the bases of shore facing cliffs, and agricultural areas that previously extended up the gulches watered by rainfall and intermittent streams. Near the base of foothills, multiple agricultural complexes, mounds, terraces, and stacked walls were recorded along with four heiau (Kahelu, Makahoe, Hoʻoneʻenuʻu, and one unknown), and Kaunalewa Ridge burial caves. Modern sites include the Old and New Government Roads with associated structural remnants and multiple agricultural features related to the transportation of water. In addition, multiple pre-Contact house sites were recorded along with two heiau (Polihale and Kapāʻula), pre-Contact burials, and cultural deposits makai of the foothills. Multiple house sites were also recorded in the mauka area atop the ridge along with a pre-Contact agricultural complex, heiau (Ahulolu Heiau), an ʻulu maika (game similar to bowling) court, and burials.

However, background research in the LRFI has found that much of the physical evidence of any pre- and/or post-contact sites has been destroyed by nearly 100 years of commercial agriculture and other operations. In addition, mauka and foothill areas have been overtaken by sugarcane and livestock, and the beach areas have been disturbed by shoreline stabilization Projects.

During the field inspection, 14 potential historic properties and features were documented. These potential historic properties and associated features include historic ranching walls, possible hearths, ditches and associated infrastructure including reservoirs, ditch intakes, diversions, and concrete structures. Many of the potential historic properties are related to former plantation irrigation systems. These historic properties are summarized in **Table 5-11**.

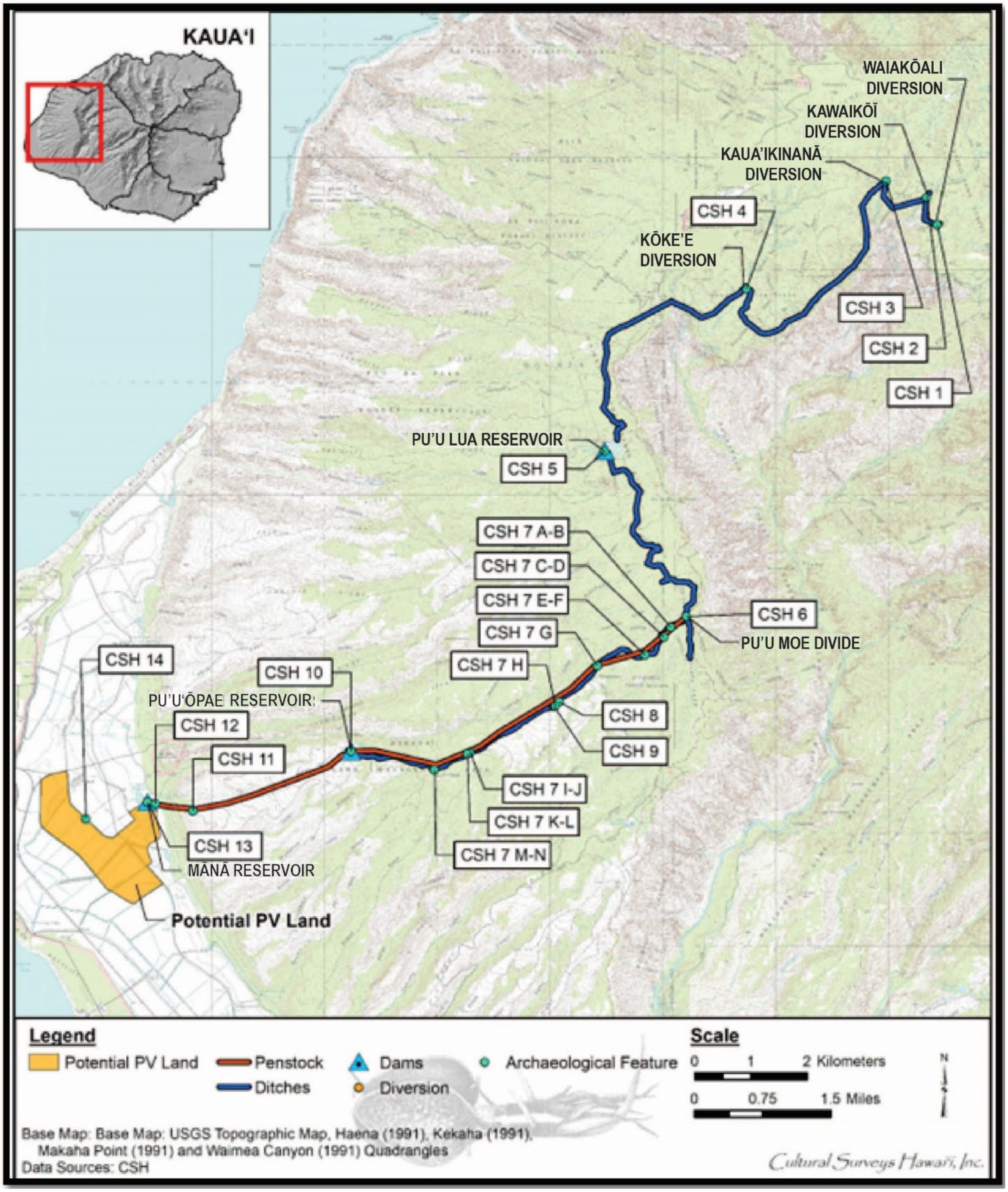
Table 5-11. Historic Properties Identified Within the Study Area

ID	Historic Property	Description
CSH 01	Waiakōali Diversion	• Associated features have multiple stages of construction with basalt and mortar pre-dating concrete masonry areas. • Inscription reading 1989 located on the west portion of the diversion. • Part of the Kōke'e Ditch Irrigation System and was established between 1923 and 1926.
CSH 02	Kawaikōī Diversion	• Associated features have multiple stages of construction with basalt and mortar pre-dating concrete masonry areas. • Inscription with no legible date located on the northern portion of the diversion. • Part of the Kōke'e Ditch Irrigation System and was established between 1923 and 1926.
CSH 03	Kaua'ikinanā Diversion	• Associated features have multiple stages of construction with basalt and mortar pre-dating concrete masonry areas. • Part of the Kōke'e Ditch Irrigation System and was established between 1923 and 1926.
CSH 04	Kōke'e Diversion	• Associated features have multiple stages of construction with basalt and mortar pre-dating concrete masonry areas. • Inscription reading 1924 located on the southern wall of the ditch. • Inscription reading MA on the wall in the western portion of the diversion. • Part of the Kōke'e Ditch Irrigation System and was established between 1923 and 1926.
CSH 05	Pu'u Lua Reservoir	• Associated features have multiple stages of construction with basalt and mortar pre-dating concrete masonry areas. • Some areas modified more recently due to wear and tear and erosion. • Part of the Kōke'e Ditch Irrigation System and was completed in 1972.
CSH 06	Pu'u Moe Divide	• Associated features have multiple stages of construction with basalt and mortar pre-dating concrete masonry areas. • Inscription with illegible writing likely reading 5/26/61 on concrete surface near sluice gate. • Part of the Kōke'e Ditch Irrigation System and was established between 1923 and 1926.

Table 5-11. Historic Properties Identified Within the Study Area (Cont.)

ID	Historic Property	Description
CSH 07	Kōkeʻe Ditch	• Associated features have multiple stages of construction with basalt and mortar pre-dating concrete masonry areas. • Multiple inscriptions on the concrete surface • The western branch is considered a part of the Kōkeʻe Ditch Irrigation System and was established between 1923 and 1926.
CSH 08	Abandoned Cane Haul Road 1	• Date of initial construction unknown. • Likely utilized during plantation era from the late 1800s to as recent as 2003.
	Abandoned Cane Haul Road 2	• Date of initial construction unknown. • Likely utilized during the plantation era from the late 1800s with modifications over the years. • Still in use at the present day.
CSH 09	Possible Hearths	• Three possible hearths with fire-affected basalt rocks and abundant charcoal pieces. • Ground disturbance associated with the installation of the Upper Penstock would be in the vicinity with no direct effect to CSH 09.
CSH 10	Puʻu ʻŌpae Reservoir	• Part of the Kōkeʻe Ditch Irrigation System and was established between 1923 and 1926.
CSH 11	Concrete Remnants	• Date of initial construction unknown, but location and construction style likely related to WWII era. • Ground disturbances for the installation of the Lower Penstock would be in the vicinity with no direct effect to CSH 11.
CSH 12	Stacked Basalt Wall	• Date of initial construction unknown, but location and construction style are likely related to the ranching era. • Ground disturbances for the installation of the Lower Penstock would be in the vicinity with no direct effect to CSH 12.
CSH 13	Mānā Reservoir	• Date of initial construction unknown but shown on a 1960s USGS topographic map.
CSH 14	Access Road Ditch	• Steel road bridge with concrete abutments atop of an earthen drain ditch • Ground disturbances for the PV Solar Array would be in the vicinity with no direct effect to CSH 14.

Figure 5.13. Historic Properties Identified in the Vicinity of the Proposed Action



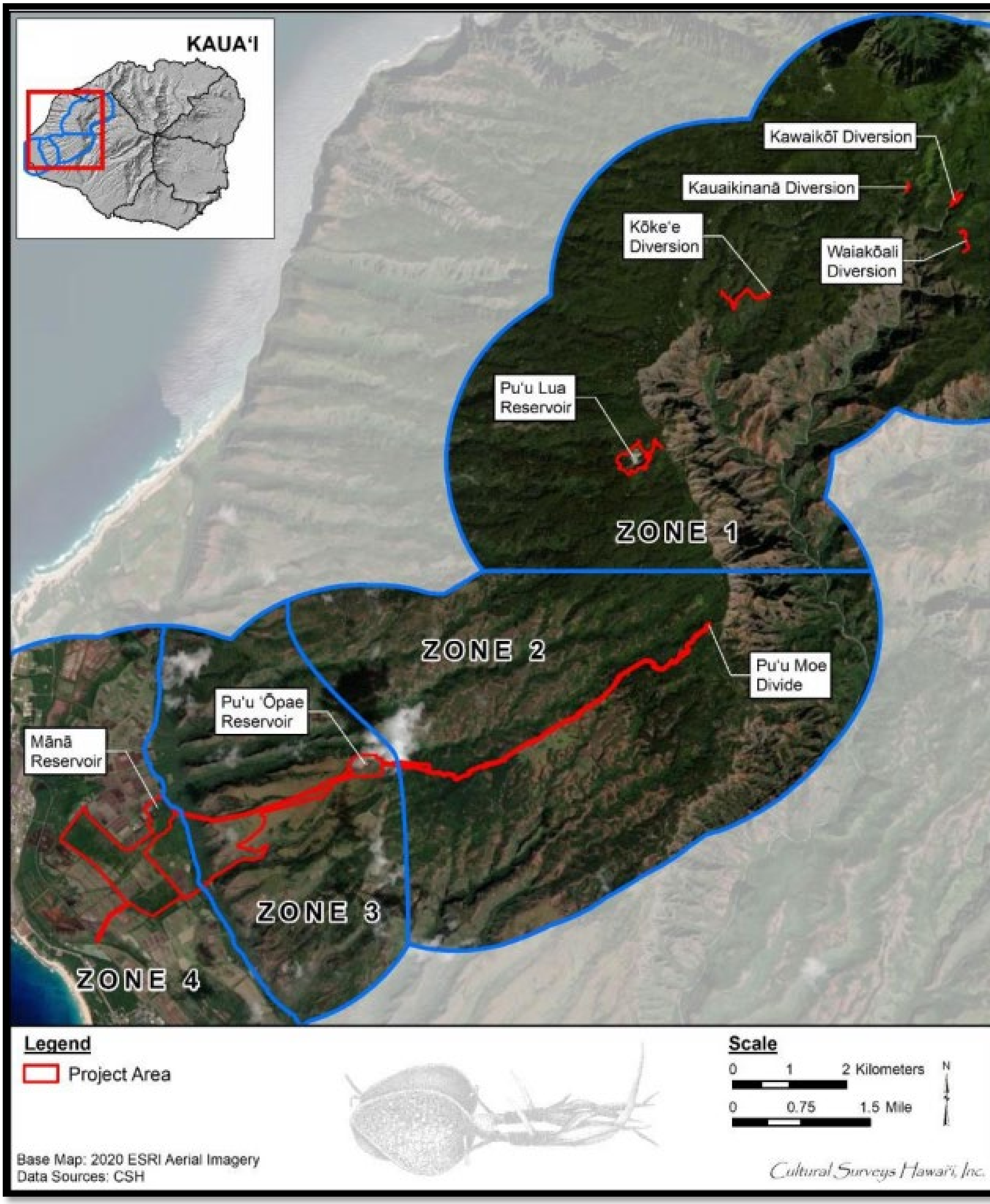
5.5.1.2 Archaeological Inventory Survey

An Archaeological Inventory Survey (AIS) was conducted by Cultural Surveys Hawaiʻi to identify, document, and assess significance of any surface historic properties that may be present in the Project area. The draft report, *Archaeological Inventory Survey for the West Kauaʻi Energy Project, Waimea Ahupuaʻa, Waimea District, Kauaʻi* was prepared to support the environmental review under HRS Chapter 343 and to support any Project-related historic preservation consultation with stakeholders. It was also designed to comply with both federal and Hawaiʻi State historic preservation review. The fieldwork included 100% pedestrian inspection of the Project area, subsurface testing and GPS data collection. The draft AIS report is provided in **Appendix K**.

The pedestrian survey area covered 100% of the Project area and is generally along a narrow discontinuous corridor approximately 18-miles-long extending northeast from Mānā Plain to Alakaʻi Swamp, as well as the area proposed for the PV Solar Array on the Mānā Plain. The survey area is divided into four zones as shown on **Figure 5.14**. Archaeologists undertook a 100%-coverage pedestrian inspection of the survey area. This was accomplished through systematic sweeps of three archaeologists spaced approximately five to 15 meters apart based on ground visibility. General characteristics of the area, including vegetation, were recorded and photographed. Only minimal vegetation clearance was attempted for the purpose of feature documentation and photography. When potential historic resources were identified, the locations were documented using GPS data collection. All surface features visible within the survey area were photographed with a scale and generally described (e.g., dimensions, shape, materials, method of construction, integrity, general condition, evidence of age of the feature). Additionally, interconnected complexes of historic properties that were slightly outside the survey area were documented.

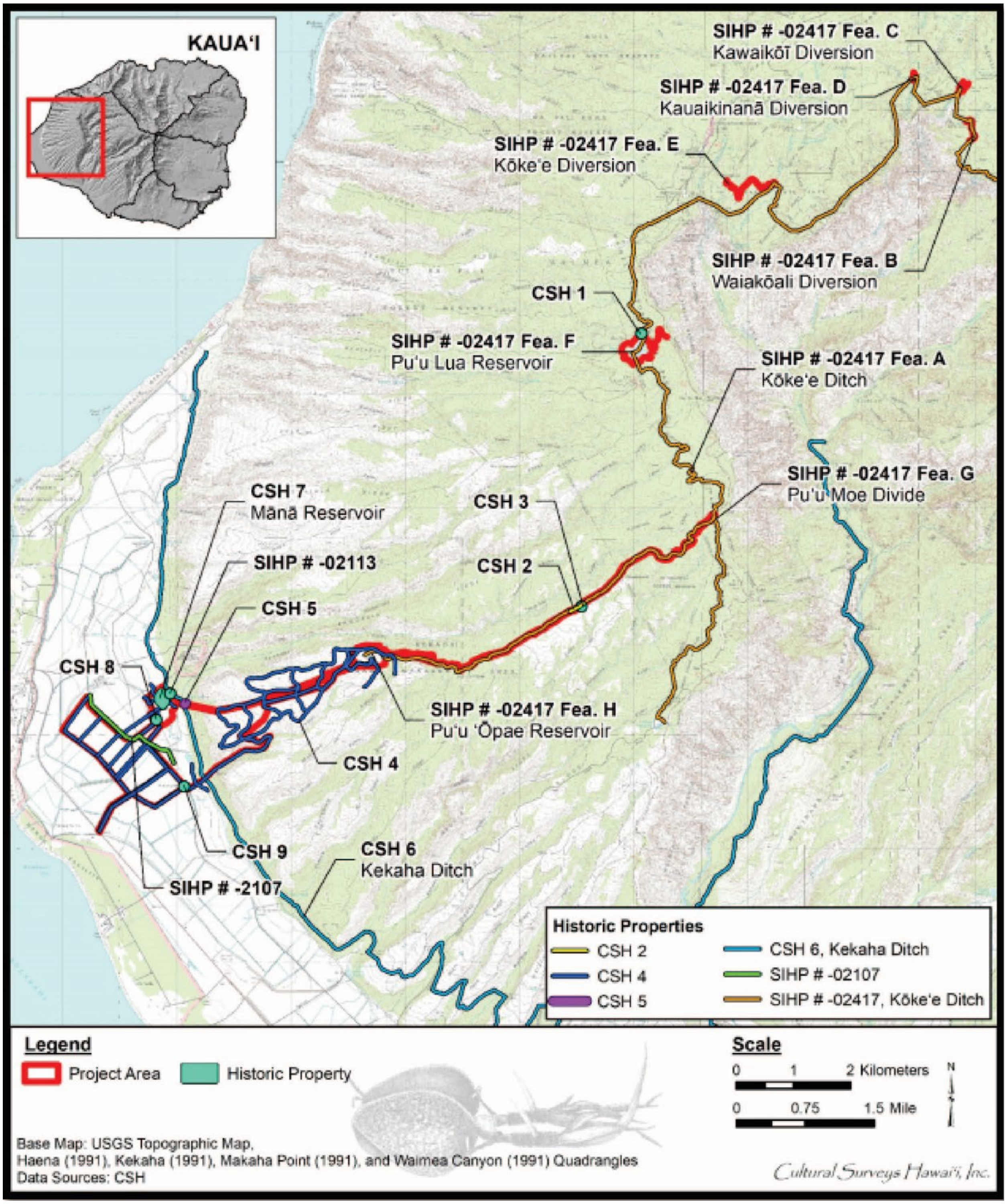
Twelve historic properties were identified during the AIS pedestrian inspection and assessed for significance. Locations of these 12 properties are shown on **Figure 5.15**. Descriptions and assessment of significance is provided in **Table 5-12**.

Figure 5.14. Archaeological Inventory Survey Area



Source: CSH, 2022

Figure 5.15. Locations of Historic Properties Identified During AIS Pedestrian Inspection



Source: CSH, 2022

Table 5-12. Historic Properties Identified During AIS Pedestrian Inspection and Historic Property Significance

ID	Historic Property	Assessment of Historic Property Significance[1]
SIHP #50-30-02-2417	Kōkeʻe Ditch Irrigation System	Assessed as significant per HAR §13-284-6 under Criterion a, Criterion c, and Criterion d. It retains diminished, but sufficient, integrity of location, design, setting, materials, workmanship, feeling and association for which it is significant.
SIHP #50-30-05-2107	Historic road alignments	Was previously evaluated using the National Register of Historic Places (NRHP) and Hawaiʻi Register of Historic Places (HRHP) significance criteria under Criterion D for its information potential although it is not listed on either register. Assessed as significant under Criterion d pursuant to HAR §13-284-6. The roads retain sufficient integrity of location, design, materials, workmanship, and setting.
SIHP #50-30-05-2113	House site	Was previously evaluated using the NRHP and HRHP significance criteria under Criterion D for its information potential although it is not listed on either register. Assessed as significant under Criterion d pursuant to HAR §13-284-6. The house site retains sufficient integrity of location and setting and diminished integrity of design, materials, and workmanship.
CSH 1	Kekaha Sugar Company Puʻu Lua structures	Architectural historic property eligible under Criterion A/a for its association with the Kekaha Sugar Company and its irrigation and reservoir system.
CSH 2	Abandoned road	Assess significant under Criterion d pursuant to HAR §13-284-6. The road retains diminished integrity of location, design, materials, and setting.
CSH 3	Hearths	Unknown age but assumed to be historic. If historic would be assess as significant under Criterion d pursuant to HAR §13-284-6. The hearths retain sufficient integrity of location, design, materials, workmanship, and setting.
CSH 4	Kekaha Sugar Company field infrastructure	Assessed as significant under Criterion d pursuant to HAR §13-284-6. The field infrastructure retains sufficient integrity of location, design, location, materials, workmanship, and setting.
CSH 5	Basalt wall	Assessed as significant under Criterion d pursuant to HAR §13-284-6. The basalt wall retains sufficient integrity of location, design, location, materials, workmanship, and setting.

Table 5-12. Historic Properties Identified During AIS Pedestrian Inspection and Historic Property Significance (Cont.)

ID	Historic Property	Assessment of Historic Property Significance[1]
CSH 6	Kekaha Ditch Irrigation System	Assessed as significant under Criterion a and Criterion d pursuant to HAR §13-284-6. It retains sufficient integrity of location, design, setting, materials, workmanship, feeling, and association although modern modification of the ditch has slightly diminished its integrity.
CSH 7	Mānā Reservoir	Assessed as significant under Criterion a and Criterion d pursuant to HAR §13-284-6. It retains sufficient integrity of location, design, materials, and workmanship. The recent abandonment of the reservoir has diminished its integrity and the reservoir can no longer function.
CSH 8	Concrete slab	Assessed as not significant under Criterion d pursuant to HAR §13-284-6. It does not retain sufficient integrity.
CSH 9	Pump house	Architectural historic property eligible under Criterion A/a for its association with the Kekaha Sugar Company and its irrigation and reservoir system.

[1] *Criterion a: Be associated with events that have made an important contribution to the broad patterns of our history*

Criterion b: Be associated with the lives of persons important in our past

Criterion c: Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, or possess high artistic value

Criterion d: Have yielded, or is likely to yield, information important for research on prehistory or history

5.5.1.3 Archaeological Inventory Survey Subsurface Testing

An Archaeological Inventory Survey (AIS) Testing Strategy was prepared by Cultural Surveys Hawaiʻi and approved by SHPD in May 2022 and from May 30 to June 10, 2022, Cultural Surveys Hawaiʻi conducted a combination of 13 backhoe-assisted test excavations and 20 shovel test pits (STP). Results of the subsurface testing is included in the AIS in **Appendix K**.

Six backhoe-assisted test excavations (T-1 through T-6) were conducted in Zone 4, and seven were conducted in Zone 3 (T-7 through T-13). One STP (STP-1) was conducted in Zone 4, one STP (STP-2) was conducted in Zone 3, and 18 STPs (STP-3 through STP-20) were conducted in Zone 2. The backhoe-assisted test excavations were rectangular measuring approximately 3.0 m long by 0.9 m wide, while the shovel test pits were hand excavated measuring approximately 0.5 m long by 0.5 m wide. The base of excavation for the backhoe-assisted test excavations were determined by reaching sterile natural deposits with a maximum depth of 2 meters, while the base for the shovel test pits were 60 cmbs and excavated to sterile soils. No subsurface testing was proposed for the four diversions and Puʻu Lua Reservoir in Zone 1. **Figure 5.16, Figure 5.17,** and **Figure 5.18** show the locations of the excavations and test pits.

With the exception of black plastic tubing, sporadic charcoal, and broken irrigation parts, no cultural material was observed in any of the backhoe-assisted test excavations (T-1 through T-13). The tubing, charcoal and irrigation parts are commonly found on the surface and within the plow zone of former sugar cane fields. No cultural material was observed in any of the shovel test pits (STP-1 through STP-20). No historic properties were identified in the backhoe-assisted test excavations or the shovel test pits.

Table 5-13 summarizes the results of each of the backhoe-assisted test excavations and shovel test pits. The details and results of the subsurface testing is included in the Draft Archaeological Inventory Survey Report included in **Appendix K**.

Figure 5.16. Locations of Subsurface Test Sites T-1 through T-6, and STP-1

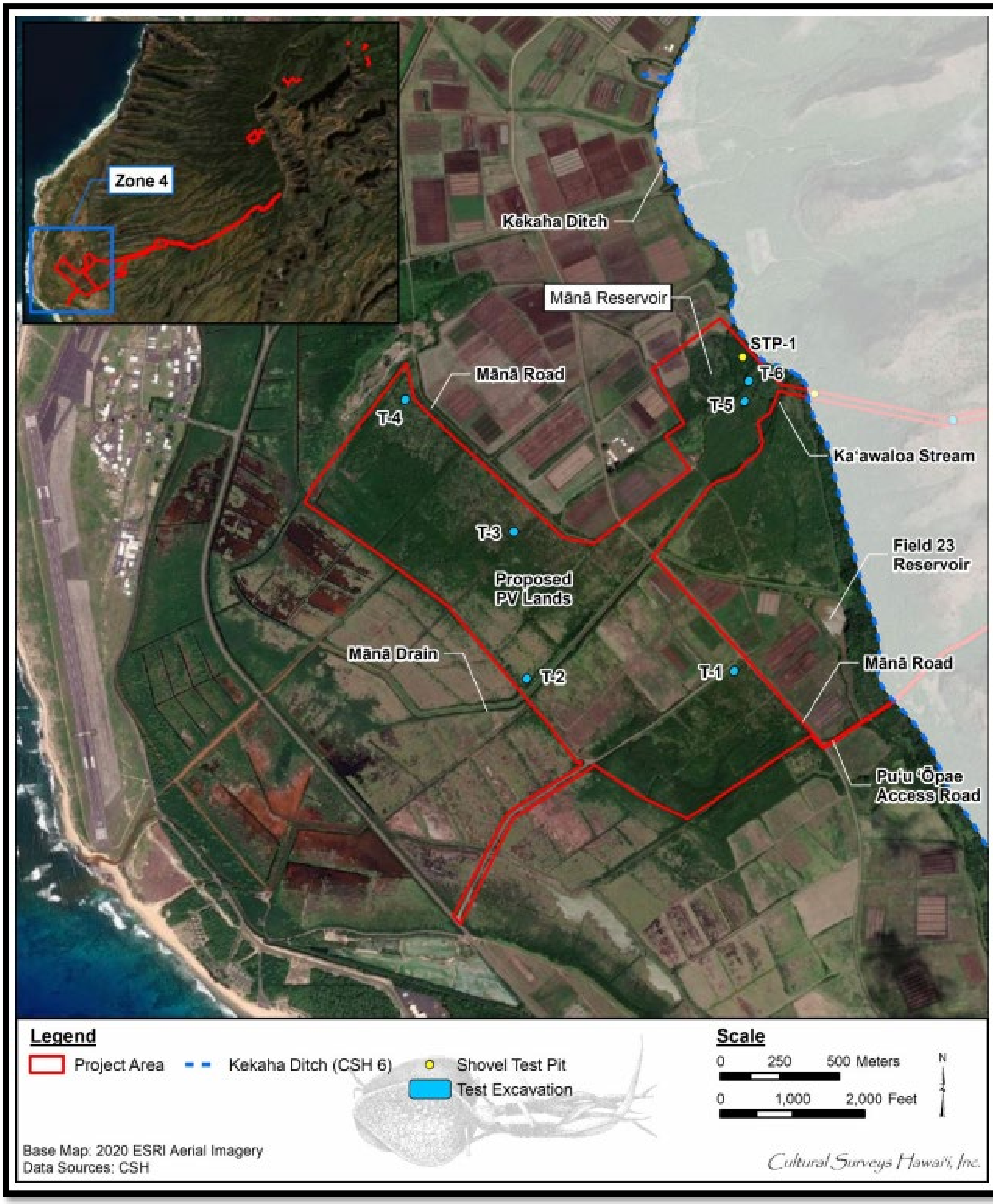


Figure 5.17. Locations of Subsurface Test Sites T-7 through T-13, and STP-2

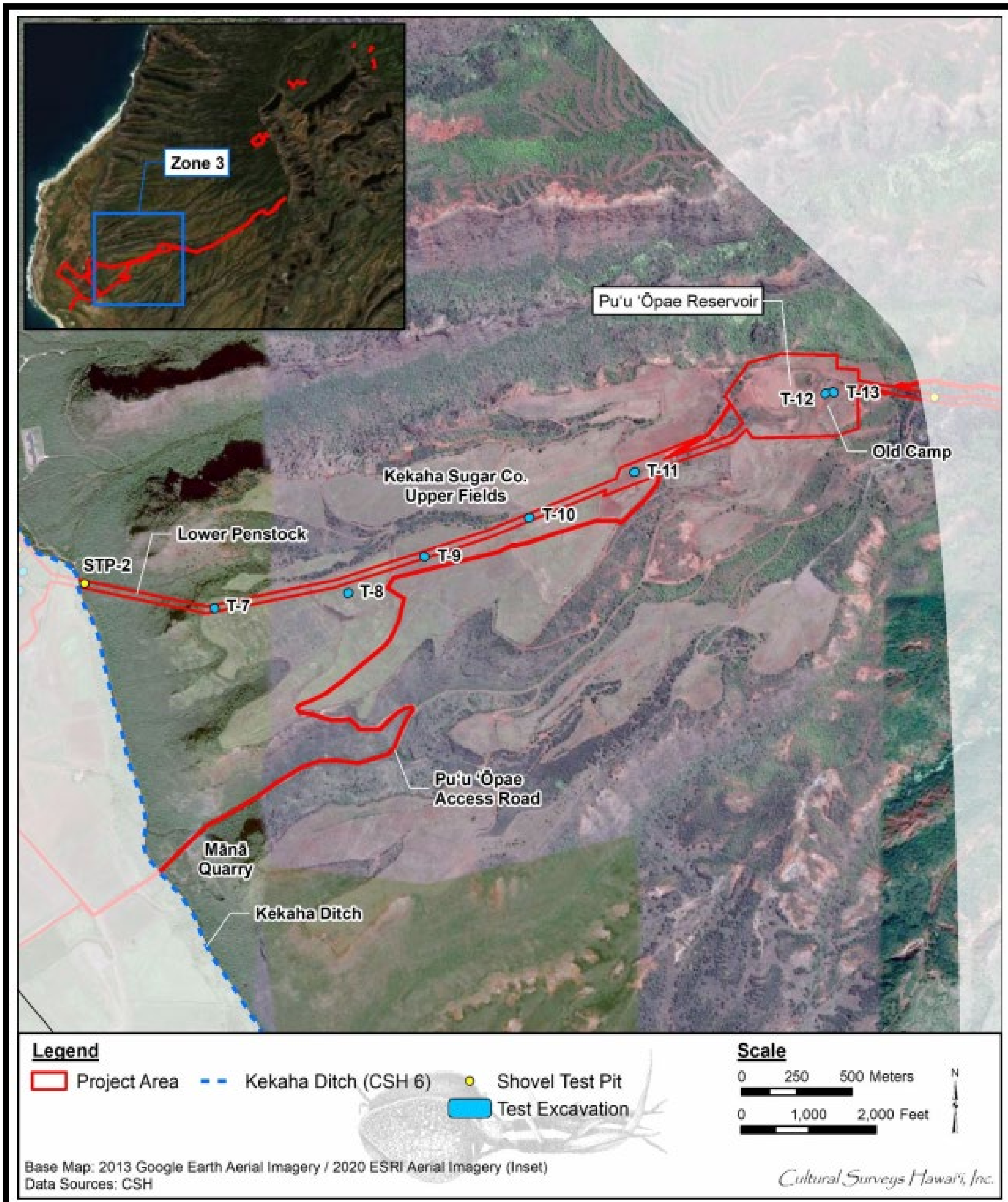


Figure 5.18. Locations of Subsurface Test Sites STP-3 through STP-20

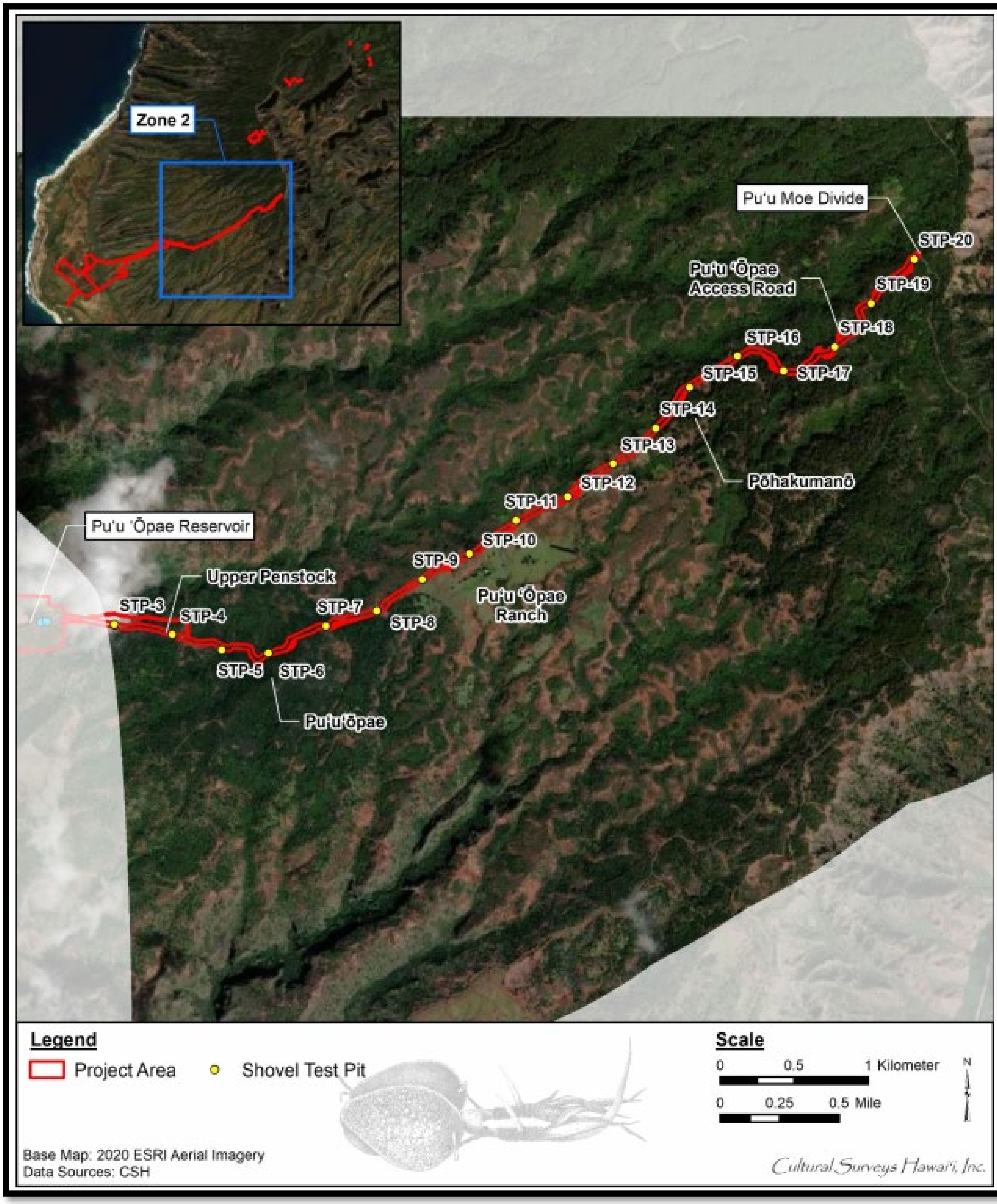


Table 5-13. Subsurface Testing Summary of Findings

Excavation/ Test Pit Site	Summary of Findings
T-1	Within former sugarcane field in the area proposed for the PV Solar Array (Zone 4). Stratigraphy consisted of silty clay plow zone overlying a silty clay locally procured fill. With the exception of black plastic tubing, no cultural material was observed. No historic properties were identified.
T-2	Within former sugarcane field in the area proposed for the PV Solar Array (Zone 4). Stratigraphy consisted of silty clay plow zone overlying a naturally deposited loamy sand and silty clay. Several layers of salt concentrations were observed within some of the layers – possible result of continual flooding and drying out of the area. With the exception of black plastic tubing within the plow zone, no cultural material was observed. No historic properties were identified.
T-3	Within former sugarcane field in the area proposed for the PV Solar Array (Zone 4). Stratigraphy consisted of silty clay plow zone overlying a silty clay plow zone overlying a silty clay locally procured fill. With the exception of black plastic tubing and charcoal, no cultural material was observed. No historic properties were identified.
T-4	Within former sugarcane field in the area proposed for the PV Solar Array (Zone 4). Stratigraphy consisted of silty clay plow zone overlying a silty clay plow zone overlying a silty clay locally procured fill. With the exception of black plastic tubing and charcoal, no cultural material was observed. No historic properties were identified.
T-5	Within former sugarcane field in the area proposed for the substation and staging (Zone 4). Stratigraphy consisted of silty clay plow zone overlying silty clay locally procured fill. With the exception of black plastic tubing, no cultural material was observed. No historic properties were identified.
T-6	Within former pasture lands in the area proposed for the lower penstock (Zone 4). Stratigraphy consisted of stony silty clay plow zone overlying a naturally deposited extremely stony silty clay. No cultural material was observed and no historic properties were identified.
T-7	Within a former sugarcane field in the area proposed for the lower penstock (Zone 3). Stratigraphy consisted of silty clay plow zone overlying a naturally deposited silty clay. With the exception of black plastic tubing within the plow zone, no cultural material was observed. No historic properties were identified.
T-8	Within a former sugarcane field to the south of the proposed location of the lower penstock (Zone 3). Stratigraphy consisted of silty clay plow zone overlying a naturally deposited silty clay. With the exception of black plastic tubing within the plow zone, no cultural material was observed. No historic properties were identified.
T-9	Within a former sugarcane field in the area proposed for the lower penstock (Zone 3). Stratigraphy consisted of silty clay plow zone overlying a naturally deposited silty clay and stony silty clay. With the exception of black plastic tubing within the plow zone, no cultural material was observed. No historic properties were identified.
T-10	Within a former sugarcane field in the area proposed for the lower penstock (Zone 3). Stratigraphy consisted of silty clay plow zone overlying a naturally deposited silty clay and stony silty clay. With the exception of black plastic tubing within the plow zone, no cultural material was observed. No historic properties were identified.

Table 5-13. Subsurface Testing Summary of Findings (Cont.)

Excavation/	Summary of Findings
T-11	Within a former sugarcane field in the area proposed for the lower penstock (Zone 3). Stratigraphy consisted of a silty clay plow zone overlying a naturally deposited silty clay. With the exception of black plastic tubing within the plow zone, no cultural material was observed. No historic properties were identified.
T-12	Within a former sugarcane field at the location of "Old Camp" (Zone 3). Stratigraphy consisted of silty clay plow zone overlying a naturally deposited silty clay. With the exception of black plastic tubing within the plow zone, no cultural material was observed. No historic properties were identified.
T-13	Within a former sugarcane field at the location of "Old Camp" (Zone 3). Stratigraphy consisted of silty clay plow zone overlying a naturally deposited silty clay. With the exception of black plastic tubing within the plow zone, no cultural material was observed. No historic properties were identified.
STP 1 & 2	Within former pastureland near Kekaha Ditch (SIHP #-2429). STP-1 is within an area of proposed improvements for the Mānā Reservoir. STP-2 is mauka of Kekaha Ditch (SIHP #-2429) and south of CSH 5 in Zone 3 within the area proposed for the lower penstock. Stratigraphy of STP-1 and STP-2 consisted of gravelly silty clay loam. No cultural material was observed, and no historic properties were identified in both STP-1 and STP-2.
STP-3 through STP-20	STP-3 through STP-20 were excavated within the proposed upper penstock in Zone 2. STP-3 through STP-8 are on the north slope of Puʻu ʻŌpae, STP-9 through STP-13 is near Puʻu ʻŌpae Ranch, and STP-14 through STP-20 are between Puʻu Moe Divide and DHHL lands. The stratigraphy of STP-3 through STP-20 varied (see **Appendix L** for full details). No cultural material was observed, and no historic properties were identified within STP-3 through STP-20.

5.5.1.4 Historic Architecture Reconnaissance Level Survey

A Reconnaissance Level Survey (RLS) of architectural properties, *Reconnaissance Level Survey, West Kauaʻi Energy Project Environmental Assessment, Mānā, Kauaʻi, Hawaiʻi,* was prepared by Mason Architects, Inc. (MASON) to fulfill historic property identification and significance evaluation requirements for HRS Section 6E-42 reviews undertaken by SHPD and for compliance with HRS Chapter 343 (see **Appendix L**). MASON developed a list of properties (see **Table 5-14**) to survey and evaluate based on the information provided in the LRFI (see **Section 5.5.1.1**).

All but three of the sites were visited in February 2022 to develop the historical context and evaluate effects to the historic properties against criteria in 36 CFR Section 800.5 and HAR Section 13-284-6 Criteria a-d. The three properties not visited (Kekaha Sugar Company Puʻu Lua Structures Grouping, Undeveloped Land, and Pump House) were researched to develop the historical context and evaluate effects. The significance criteria are as follows:

- **Criterion A/a:** Be associated with events that have made an important contribution to the broad patterns of our history.
- **Criterion B/b:** Be associated with the lives of persons important in our past.
- **Criterion C/c:** Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value.

- **Criterion D/d:** Have yielded, or is likely to yield, information important for research on prehistory or history.

As shown in **Table 5-14**, 12 of the 13 resources surveyed were evaluated as historically significant under Criterion A/a for their association with the development of the sugar industry on Kauaʻi, particularly in relation to the Kekaha Sugar Company. The Undeveloped Land was evaluated as not historically significant.

Table 5-14. RLS Inventory Survey Significance Evaluations

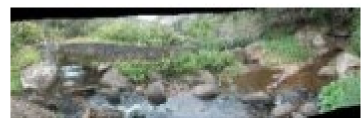
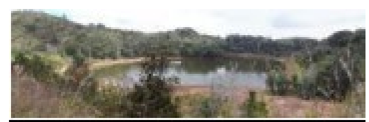
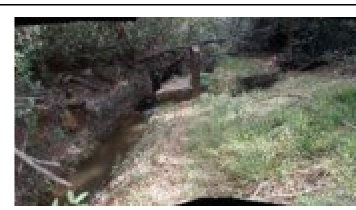
Name	Year Built	NRHP and HRHP Significance Evaluations	Representative Photo
Kōkeʻe Diversion	1924	Eligible under Criterion A/a for its association with the development of the sugar industry on Kauaʻi. As part of the Kōkeʻe Ditch Irrigation System, it enabled Kekaha Sugar Company to achieve record yields.	
Puʻu Lua Reservoir	1927	Eligible under Criterion A/a for its association with the development of the sugar industry on Kauaʻi. As part of the Kōkeʻe Ditch Irrigation System, it enabled Kekaha Sugar Company to achieve record yields.	
Kekaha Sugar Company Puʻu Lua Structures Grouping	ca. 1930s	Eligible under Criterion A/a for its association with the Kekaha Sugar Company and its irrigation and reservoir system.	
Puʻu Moe Divide	1930	Eligible under Criterion A/a for its association with the development of the sugar industry on Kauaʻi. As part of the Kōkeʻe Ditch Irrigation System, it enabled Kekaha Sugar Company to achieve record yields.	
Puʻu ʻŌpae Reservoir	1930	Eligible under Criterion A/a for its association with the development of the sugar industry on Kauaʻi. As part of the Kōkeʻe Ditch Irrigation System, it enabled Kekaha Sugar Company to achieve record yields.	

Table 5-14. RLS Inventory Survey Significance Evaluations (Cont.)

Name	Year Built	NRHP and HRHP Significance Evaluations	Representative Photo
Mānā Reservoir	1905	Eligible under Criterion A/a for its association with the development of the sugar industry on Kauaʻi. As part of irrigation system of Kekaha Sugar Company, it enabled the plantation to achieve record yields.	
Undeveloped Land (Proposed site of the PV Solar Array)	N/A	Not eligible. Although some of this site was formerly planted in sugarcane under Kekaha Sugar Company, it also served other agricultural uses. The 343-acre parcel does not appear to warrant nomination to the Hawaiʻi or National Register of Historic Places (HRHP/NRHP) as an individual resource. It does not appear to meet HAR Section 13-275-6 or HAR Section 13-284-6 significance criteria. While integrity of Location and Setting are somewhat retained, there are a few features or built resources remaining on the site from the historic period that would illustrate the Plantation Era.	
Pump House	ca. 1930s	Eligible under Criterion A/a for its association with the agricultural infrastructure of Kekaha Sugar Company.	
Kekaha Ditch	ca. 1930s	Eligible under Criterion A/a for its association with the development of the sugar industry on Kauaʻi.	

5.5.1.5 Status of HRS 6E Review

A summary of the HRS 6E process to date for the Proposed Action is outlined below:

- An *Archaeological Literature Review and Field Inspection Report for the Kauaʻi Island Utility Cooperative's Puʻu ʻŌpae/West Kauaʻi Energy Project, Waimea Ahupuaʻa, Waimea District, Kauaʻi, TMKs: [4] 1-2-001, 1-2-002, and 1-4-001* (Enanoria et al. 2020) was conducted and submitted to SHPD on 9/17/2021.
- A consultation meeting with SHPD was conducted on 10 August 2021.
- An AIS pedestrian inspection strategy for the West Kauaʻi Energy Project (AES Clean Energy 2021) was submitted to the SHPD for comment on 28 September 2021.
- CSH conducted the AIS pedestrian inspection between 8 November 2021 and 3 December 2021.
- DLNR initiated HRS 6E review with SHPD on 21 March 2021.
- The results of the AIS pedestrian inspection, as well as a proposed AIS testing strategy were presented to SHPD on 19 April 2022.
- An *Archaeological Inventory Survey Testing Strategy for the West Kauaʻi Energy Project, Waimea Ahupuaʻa, Waimea District, Kauaʻi, Portions of TMKs: [4] 1-2-001:003, 007; 1-2-002:001, 016, 018, 019, 020, 023; 1-4-001:002, 003, 013, 014; 1-4-002:008, 035, 036, 048, 066, 067, 068, 085* was submitted to SHPD on 25 April 2022.
- A Reconnaissance Level Survey, West Kauaʻi Energy Project Environmental Assessment, Mānā, Kauaʻi, Hawaiʻi was prepared by MASON. The RLS was submitted to SHPD on 4 May 2022.
- The SHPD approved the AIS testing strategy on 27 May 2022 via HICRIS and requested to review the preliminary AIS results following completion of the subsurface testing to assess if additional testing is warranted.
- Subsurface Testing was conducted between 30 May 2022 and 10 June 2022.
- The results of subsurface testing, historic properties identified during the AIS, and mitigation recommendations were presented to SHPD in a meeting on 10 August 2022. SHPD requested additional testing.
- Additional subsurface testing was conducted on 12 August 2022 and resulted in negative findings.
- State Inventory of Historic Places (SIHP #s) were requested from SHPD on 21 September 2022.

Remaining steps include the following:

- Incorporating SIHP #s into the AIS report when received from SHPD.
- AIS submittal to SHPD for HRS 6E review and comment.
- Preparation, submittal and SHDP review and acceptance of any mitigation plans that may be determined necessary.

5.5.2 Potential Impacts – Archaeological and Historic Resources

Per HAR Chapter 11-200.1-2, a ""significant effect" or "significant impact" means the sum of effects on the quality of the environment including actions that irrevocably commit a natural resource, curtail the range of beneficial uses of the environment, are contrary to the State's environmental policies or long-term environmental goals and guidelines as established by law, adversely affect the economic welfare, social welfare, or cultural practices of the community and State, or are otherwise set forth in section 11-200.1-13."

Under HAR Chapter 13-284 "Rules Governing Procedures for Historic Preservation Review to Comment on Section 6E-42, HRS, Projects", which is applicable to this Project, SHPD's criteria on determining effects to significant historic properties are defined under HAR Chapter 13-284-7, where one of the following effect determinations must be established for a Project: "(1) "No historic properties affected." The Project will have no effect on significant historic properties; or (2) "Effect, with agreed upon mitigation commitments." As further described, effects may include, but are not limited to, "partial or total destruction or alteration of the historic property, detrimental alteration of the properties' surrounding environment, detrimental visual, spatial, noise or atmospheric impingement, increasing access with the chances of resulting damage, and neglect resulting in deterioration or destruction. If it is determined that "effects" or impacts may occur to historical properties during the implementation of a Project, then a mitigation commitment(s) may be proposed to be undertaken for each historic property affected. Per HAR Chapter 13-284-8, mitigation may occur in the following five forms: preservation, architectural recordation, archaeological data recovery, historical data recovery, or ethnographic documentation.

The following section identifies the anticipated effect determinations, and if applicable, the proposed mitigation measures or commitments for affected historic properties. While some of the identified effects result in the partial or full demolition or alteration of historic properties, which may be perceived as an irrevocable commitment of resources, the historic preservation review process as enumerated under HAR 13-284 does require SHPD to determine the adequacy of the mitigation commitments being proposed by the applicant relative to the specific criterion of significance. Per HAR 13-284-10, once SHPD agrees that 1) adequate procedures have been taken to determine if historic properties are present and, 2) a detailed mitigation plan to handle an effect to significant historic properties has been approved and fully executed, then the historic preservation review process ends. Accordingly, in the event where a historic property may be altered or demolished and is deemed significant under Criterion D (yielding information for research on history), the completion of adequate and reasonable amount of documentation in consultation with SHPD and other stakeholders typically results in the historic property no longer possessing significance. Accordingly, there would be no irrevocable commitment of a significant historic resource.

Mitigation commitments proposed may include preservation (primarily through actions of avoidance, protection, rehabilitation, and reconstruction), architectural recordation, and/or archaeological data recovery to ensure that information important for history research is sufficiently documented as outlined in HAR Chapter 13-284-8. Although historic properties within the Project area may be affected, demolished, and/or altered, the proper utilization of applicable mitigation commitments through consultation and agreement with SHPD (and other stakeholders) should mitigate the effect.

5.5.2.1 Construction

Proposed Action

The AIS identified the following historic properties with the potential to be affected by construction of the Proposed Action: Kōkeʻe Ditch Irrigation System (SIHP #50-30-02-2417), house site (SIHP #50-30-05-2113), abandoned road (CSH 2), hearths (CSH 3), Kekaha Sugar Company field infrastructure (CSH 4), basalt wall (CSH 5), and Mānā Reservoir (CSH 7). The following historic properties would not be affected by construction of the Proposed Action: historic road alignments (SIHP #50-30-05-2107), Kekaha Sugar Company Puʻu Lua structures (CSH 1), and pump house (CSH6). A single effect determination is required for the Project as a whole, which will be an "Effect, with proposed mitigation commitments." Below is presentation of each project segment, the applicable elements of historical integrity, and evaluation of significance.

- The work at **Waiakōali Diversion** would result in an "Effect, with proposed mitigation commitments" evaluation under HRS Section 6E-42. The new gate would require excavation and demolition of a portion of the ditch, diminishing the integrity of the design, materials, and workmanship of the resource. Integrity of location, setting, and feeling would be slightly diminished, while the integrity of association would be impaired. Waiakōali Diversion is a feature on SIHP #50-30-02-2417, Kōkeʻe Ditch Irrigation System. Wherein feasible, preservation relative to the stabilization, rehabilitation, and reconstruction of the diversion system would be applied. Additionally, architectural recordation would be completed for those portions of Waiakōali Diversion to be altered and/or demolished.
- The work at **Kawaikōī Diversion** contributes to the "Effect, with proposed mitigation commitments" evaluation under HRS Section 6E-42. The new gate would require excavation and demolition of a portion of the ditch, diminishing the integrity of the design, materials, and workmanship of the resource. The construction of the new weir would diminish integrity of design. Integrity of setting and feeling would be slightly diminished, and integrity of association would be impaired. Kawaikōī Diversion is a feature on SIHP #50-30-02-2417, Kōkeʻe Ditch Irrigation System. Wherein feasible, preservation relative to the stabilization, rehabilitation, and reconstruction of the diversion system would be applied. Additionally, architectural recordation would be completed for those portions of Kawaikōī Diversion to be altered and/or demolished.
- The work at **Kauaʻikinanā Diversion** contributes to the "Effect, with proposed mitigation commitments" evaluation under HRS Section 6E-42. The new gate would require excavation and demolition of a portion of the ditch, diminishing the integrity of the design, materials, and workmanship of the resource. Integrity of setting and feeling would be diminished, and integrity of association would be impaired. Kauaʻikinanā Diversion is a feature on SIHP #50-30-02-2417, Kōkeʻe Ditch Irrigation System. Wherein feasible, preservation relative to the stabilization, rehabilitation, and reconstruction of the diversion system would be applied. Additionally, architectural recordation would be completed for those portions of Kauaʻikinanā Diversion to be altered and/or demolished.

- The work at **Kōkeʻe Diversion** contributes to the "Effect, with proposed mitigation commitments" evaluation under HRS Section 6E-42. The new gate would require excavation and demolition of a portion of the ditch, diminishing the integrity of the design, materials, and workmanship of the resource. The construction of the new weir would diminish integrity of design. Integrity of setting and feeling would be diminished, and integrity of association would be impaired. Kōkeʻe Diversion is a feature on SIHP #50-30-02-2417, Kōkeʻe Ditch Irrigation System. Wherein feasible, preservation relative to the stabilization, rehabilitation, and reconstruction of the diversion system would be applied. Additionally, architectural recordation would be completed for those portions of Kōkeʻe Diversion to be altered and/or demolished.
- The **Kekaha Sugar Company Puʻu Lua Structure Grouping (CSH 1)** includes three structures (a wooden garage or workshop, a wooded house, and a wooden shed) clustered near the northeast corner of the Puʻu Lua Reservoir. The garage/workshop and house are outside the proposed disturbance area. The wooden shed is partially within the proposed area of temporary disturbance and would be avoided during construction. Mitigation would include preservation (avoidance and protection). All three structures would be retained in place with no further changes proposed.
- The work at **Puʻu Lua Reservoir** contributes to the "Effect, with proposed mitigation commitments" evaluation under HRS Section 6E-42. The excavation of the reservoir and removal of existing outlet works would diminish the integrity of design, materials, and workmanship of the resource. Integrity of setting and feeling would be diminished, and integrity of association would be impaired. Wherein feasible, preservation relative to the stabilization, rehabilitation, and reconstruction of the diversion system would be applied. Additionally, architectural recordation would be completed for those portions of the reservoir to be altered and/or demolished.
- The work on the **Kōkeʻe Ditch** just above the Puʻu Moe Divide contributes to the "Effect, with proposed mitigation commitments" evaluation under HRS Section 6E-42. The new regulatory structure would require excavation and demolition of a portion of the existing ditch, diminishing the integrity of the design of the resource. In this area, the Kōkeʻe Ditch has naturally excavated earthen banks, so it is not apparent there is any potential change to the level of the integrity of materials and workmanship. Integrity of setting and feeling would be diminished, and integrity of association would be impaired. Kōkeʻe Ditch is a feature on SIHP #50-30-02-2417, Kōkeʻe Ditch Irrigation System. Wherein feasible, preservation relative to the stabilization, rehabilitation, and reconstruction of the diversion system would be applied. Additionally, architectural recordation would be completed for those portions of the reservoir to be altered and/or demolished.
- An **abandoned road (CSH 2)** is located on the northwest side of Kōkeʻe Ditch near Puʻu ʻŌpae Ranch. The road is in remnant condition. CSH 2 would be impacted by construction of the Upper Penstock. The road is significant only for its information potential. The AIS has collected sufficient information. No further work is recommended for the site.

- There are also **four hearths of unknown age and origin (CSH 3)** that are assumed historic located along the Upper Penstock alignment near Puʻu ʻŌpae Ranch. Two of these hearths are just outside the proposed disturbance area, and two are on the margins of the proposed area of temporary disturbance. Depending on confirmation of their age, the hearths are potentially significant for their information potential. Until the age of the hearths can be confirmed, it is recommended that interim protection measures of preservation (avoidance) for the hearths be developed and implemented to prevent accidental disturbance.
- The work at **Puʻu ʻŌpae Reservoir** contributes to the "Effect, with proposed mitigation commitments" evaluation under HRS Section 6E-42. Upon demolition of the reservoir and its rebuilding and lining, it would no longer retain any of the aspects of integrity.
- A **basalt wall (CSH 5)** extends mauka-makai on the talus slope just above Kekaha Ditch on the margins of the proposed Lower Penstock alignment. The function of the wall is unknown. CSH 5 is assessed as a significant historic property, and it is recommended that interim protection measures of preservation (avoidance) be developed and implemented. Should avoidance not be possible, archaeological or architectural data recovery is recommended prior to demolition.
- **SIHP #50-30-05-2113, a former house site**, is located mauka of Mānā Reservoir and consists of various terraces and retaining walls, a concrete foundation, a corral, a cesspool, and two earthen ditches. The makai portion of the site appears to be within the area of impact for the Mānā Reservoir rehabilitation. The AIS has collected sufficient information. No further work is recommended for the site.
- The work at **Mānā Reservoir (CSH 7)** contributes to the "Effect, with proposed mitigation commitments" evaluation under HRS Section 6E-42. Upon demolition of the reservoir and its rebuilding and lining, it would no longer retain any of the aspects of integrity. Construction of the Proposed Action would significantly alter the historic property. HAER documentation would be completed for Kōkeʻe Diversion to mitigate the effect on the historic property.
- **SIHP #50-30-05-2107 consists of a portion of Mānā Road** and its associated bridges and culverts. The features within the Project area are not likely to be affected by construction of the Proposed Action. No interim preservation measures are anticipated so no further work is recommended for the portion of SIHP #50-30-05-2107 within the Project area.
- **CSH 4, the Kekaha Sugar Company field infrastructure**, would be impacted by construction of the proposed PV Solar Array. CSH 4 is significant only for its information potential. The AIS has collected sufficient information. No further work is recommended for the site.
- A **remnant pump house (CSH 6)** is located at the east corner of the proposed PV Solar Array. No changes are proposed to the pump house, and it would be retained in place.

The Proposed Action would result in an "Effect, with agreed upon mitigation commitments" under HAR Section 13-275-7 and HAR Section 13-284-7, and an "Adverse effect" under 36 CFR

Section 800.5(1) for nine of the 12 properties evaluated as historically significant in the RLS. The effects are due to various changes proposed at each resource, which in some cases results in partial or full demolitions or other alterations that affect historic integrity.

It is recommended that archaeological monitoring be conducted during construction of the Upper Penstock as well as along the Lower Penstock between the crest of Niu Ridge and Kekaha Ditch. There remains a possibility for additional cultural materials, deposits, and unidentified sites to be present within these portions of the Project area. Archaeological monitoring is recommended due to the traditional and historical land use of the area. Other portions of the Project area have seen substantial land alteration by former sugarcane operations and associated infrastructure. During construction of the Proposed Action, it is unlikely that additional significant historic properties or features would be encountered in these areas.

BMPs to minimize and mitigate potential impacts to unidentified human remains, burials, or historic properties would be followed prior and during construction activities, as documented in **Section 5.5.3**.

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur and there would be no associated potential direct impacts to archaeological and historic resources. However, there could be impacts to the three reservoirs if they were to be decommissioned.

5.5.2.2 Operation

Proposed Action

Operation of the Proposed Action is not anticipated to impact any of the known archaeological sites or burial sites near the Project area. The existing infrastructure that is considered historic properties would be maintained for the life of the Project, therefore limiting degradation due to disrepair. Per HAR 13-284-7(b) a harmful effect to a historic property can include neglect resulting in deterioration or destruction. This Proposed Action prevents further deterioration of existing infrastructure through a commitment of resources to the rehabilitation and reconstruction of select historic properties.

No-Action Alternative

Under the No-Action Alternative, the existing Kōkeʻe Ditch Irrigation System would remain under management of ADC and any repairs and ongoing operations would fall to ADC. This could potentially result in the continuance of reduced operations or closure of the system. The Puʻu Lua Reservoir would remain under the management of DLNR, the Puʻu Ōpae Reservoir would remain under management of DHHL, and Mānā Reservoir would remain under management of ADC. This could result in State-funded repairs to bring the reservoirs into compliance with Hawaiʻi Dam Safety requirements or decommissioning of the reservoirs. Per HAR 13-284-7(b) a harmful effect to a historic property can include neglect resulting in deterioration or destruction. This Proposed Action prevents further deterioration of existing infrastructure through a commitment of resources to the rehabilitation and reconstruction of select historic properties.

5.5.3 Avoidance and Minimization Measures – Archaeological and Historic Resources

As a part of this Final EA process, a LRFI, AIS, and RLS was prepared to identify the possible historic properties within the Project area, as well as to better understand the historical landscape of the area. While a substantial effort was made to identify possible historical properties within the Project area, there is still the potential to discover unknown historic and archaeological resources. During construction of the Proposed Action, the following measures would be implemented to minimize potential impacts to unknown historic and archaeological resources:

- If human remains or burials are identified, all earth-moving activities in the area would stop, the area would be cordoned off, and SHPD, DHHL, and the Police Department would be notified pursuant to HAR Section 13-300-40. Burials found on DHHL lands would be further subject to the Native American Graves Protection and Repatriation Act.
- If any potential historic properties are identified during construction activities, all activities would cease and SHPD would be notified pursuant to HAR Section 13-280-3.

When effects to historic properties occur, Project proponents must consult with the SHPD to mitigate them, as part of the HRS 6E processes. HAR Section 13-275-8 and HAR Section 13-284-8 explain that mitigation may take the form of one or more of the following:

- **Preservation:** May include avoidance of the effect and protection (conservation), stabilization, rehabilitation, restoration, reconstruction, interpretation or appropriate cultural use.
- **Architectural Recordation:** Involves the photographic documentation and possibly the measured drawing of a building, structure, or object prior to its alteration. Architectural recordation plans and photos shall meet the minimal standards as provided by Historic American Building Survey (HABS).
- **Historical Data Recovery:** Involves researching historical source materials to document an adequate and reasonable amount of information about the property when a property will be altered or destroyed.
- **Ethnographic Documentation:** Consists of interviewing knowledgeable individuals and researching historical materials to document an adequate and reasonable amount of information about the property.

Common mitigation undertaken for “Effect, with agreed upon mitigation commitments” findings for Hawaiʻi’s historic irrigation systems include architectural recordation in the form of HABS/HAER/HALS reports, with large-scale photography, or historic context studies. However, other types of mitigation may also be found appropriate in consultation with the SHPD, such as the development of educational materials or submittal of National Register Nomination forms. Ultimately, the proposed Project mitigation commitments must be developed in consultation with SHPD and other stakeholders and must be deemed as adequate prior to their acceptance by SHPD.

With SHPD's agreement to their adequacy, the following measures would be implemented to mitigate impacts to historic properties identified during the AIS pedestrian inspection:

- Prepare a HAER for the Kōkeʻe Ditch Irrigation System (SIHP #50-30-02-2417) including multiple ditch features and Mānā Reservoir (CSH 7).
- The four hearths (CSH 3) and basalt wall (CSH 5) would be avoided (i.e., Preservation). If avoidance is not possible, then data recovery would be performed.
- The information provided in the AIS for the house site (SIHP #50-30-05-2113), abandoned road (CSH 2), and the Kekaha Sugar Company field infrastructure (CSH 4) is sufficient to mitigate effects on the historic properties.
- Archaeological monitoring would be conducted for Zone 2 and a portion of Zone 3 during construction. HAR 13-279-3 defines archaeological monitoring as an "identification, mitigation, or post-mitigation measure."

5.6 Recreational Resources

5.6.1 Affected Environment – Recreational Resources

The upper portion of the Project area is located within Kōkeʻe State Park. There are lookouts, hiking trails, picnic areas, and campgrounds along the Kōkeʻe Ditch Irrigation System, as shown on **Figure 5.19** and in **Table 5-15**.

Trutta Environmental Solutions, LLC surveyed the Puʻu Lua Reservoir in February 2018 to document conditions within the reservoir by gathering bathymetric date and collecting vertical water quality profiles. The deepest depth recorded was 54.53 ft with an average depth of 19.04 ft and volume of 7,749,107 ft. Fourteen vertical water quality profiles were established as part of the survey. In general, there was very little difference among the measured parameters throughout the vertical water column. This suggests the reservoir is well mixed, with conditions suitable for rainbow trout throughout the reservoir. Trutta used the length/weight data for individual trout to calculate their relative condition. The relative condition statistic was 1.47 for 233 trout sampled between 2016 and 2018. This suggests the trout are in relatively good condition in the reservoir.

Overall, the conditions throughout Puʻu Lua Reservoir were suitable for rainbow trout survival. Water temperature and dissolved oxygen values were suitable, and fish were observed in all sections of the reservoir and at all depths. With respect to potential impacts related to raising the water level and increasing ditch water flow through the reservoir, it is unlikely that these changes will negatively impact the suitability of the reservoir for rainbow trout. Rather, increased area, volume and depth all will provide more habitat for the trout. Increased water flow from the ditch will add more cool, highly oxygenated water to the reservoir and this should be good for rainbow trout. Thus, the proposed changes associated with the West Kauaʻi Energy Project are unlikely to decrease the suitability of the reservoir for trout, but are likely to improve suitability.

Figure 5.19. Recreation Areas

Table 5-15. Recreational Facilities Within the Vicinity of the Proposed Action

Facility Type	Facility Name	Nearest Project Facility
Camping Area	Sugi Grove Camp	Kawaikōī Diversion
	Kawaikōī Camp	Kawaikōī Diversion
Picnic Area	Waiakōali Picnic Area	Waiakōali Diversion
	Alakaʻi Picnic Area	Kauaʻikinanā Diversion
	Kaʻana Picnic Area	Puʻu Lua Reservoir
	Lapa Picnic Area	Puʻu Lua Reservoir
Scenic Lookout	Poʻomau Canyon Lookout	Waiakōali Diversion
	Kumuwela View Point	Kōkeʻe Diversion
	Cliff Trail View Point	Kōkeʻe Diversion
	Waimea Canyon Lookout	Puʻu Moe Divide
Fishing	Puʻu Lua Reservoir	Puʻu Lua Reservoir

Puʻu Lua Reservoir is stocked with rainbow trout and is a popular and locally prized public fishing area with an annual season with varying dates between mid-June and the end of September. Each person fishing must have a valid State of Hawaiʻi freshwater game fishing license, which may be obtained at DLNR-DAR office, license agents, or purchased online. Catch-and-release fishing is prohibited; all trout caught must be retained and count towards the annual bag limit.

The Upper Penstock is located within the Kekaha Game Management Area, which is located on DHHL land and is managed by DOFAW under an agreement between DHHL and DOFAW. This area is open for hunting feral pigs, feral goats, black-tailed deer, and game birds during specified periods throughout the year. DHHL has been in discussion with DOFAW about amending the area available to DOFAW for hunting.

5.6.2 Potential Impacts – Recreational Resources

5.6.2.1 Construction

Proposed Action

Access to trails and camping areas in Kōkeʻe State Park would be mostly unaffected during the construction period. Specific impacts to recreational resources at each Project facility are described in the following subsections.

Waiakōali Diversion

Across the road from Waiakōali Diversion is Waiakōali Campground, which is frequently used by locals and tourists for recreational camping and has a shelter and a composting toilet. Work at this site would not impact public access to Waiakōali Campground.

Camping also occurs occasionally at Waiakōali Diversion as demonstrated by the fire ring in the parking area of the diversion. This area would be used for parking vehicles and as a staging area for equipment. Public access would be restricted from this area during construction. The proposed construction work at Waiakōali Diversion is estimated to take up to four weeks and is expected to occur during the dry season when streamflows are low. The dewatering associated with construction is expected to occur for a period of three weeks.

Kawaikōī Diversion

Kawaikōī Campground is located across the road and upstream of the diversion, and Sugi Grove Campground is located directly across the stream from the diversion structure. Kawaikōī Campground has a cleared area for camping, a rustic shelter, a table, non-potable water, trash can, and a composting toilet. Sugi Grove Campground is equipped with a picnic shelter and a composting toilet. The existing USGS Kawaikōī gaging station is accessed via the Pihea Trail extending from the back of Kawaikōī campground. Sugi Grove Campground is equipped with a picnic shelter and a composting toilet.

There are a number of recreational trails accessible at Kawaikōī including the Kawaikōī Stream Trail that starts across the road from Sugi Grove Campground and the Pihea Trail.

For grout work on the existing diversion, vehicles would access the site using an existing road that extends from Mōhihi-Camp 10 Road into the Sugi Grove Campground. A staging area within Sugi Grove Campground would be created by temporarily relocating a shelter, picnic table, and fire pit to allow a trailer mounted concrete line pump to position in a manner to pump the grout into place. Once the grout work is completed the picnic table and fire pit would be relocated back into their original location.

During construction, public access to the staging areas and active work sites would be restricted. This includes the Kawaikōī Diversion, the existing spur access road, and the existing footpath to the diversion. The Sugi Grove Campground (including the picnic area) would remain open throughout construction. However, the shelter, picnic table, and fire pit would be out of commission for approximately one week during the construction period. Work at this site would not impact public access along Mōhihi-Camp 10 Road or Kawaikōī Campground and trailheads within the vicinity. Construction at this site is anticipated to require five weeks and is expected to happen in the dry season when stream flows are low. The dewatering associated with construction is expected to occur for a period of four weeks.

Kauaʻikinanā Diversion

The Kauaʻikinanā Diversion is located on Mōhihi-Camp 10 Road approximately 2.26 miles from the entrance off Waimea Canyon Drive. The Poʻomau Canyon Ditch trailhead is located approximately 275 feet from the diversion access spur road. People frequently park at a cleared area adjacent to Kauaʻikinanā Diversion to hike the trail or hunt in the area. This area would be used for personnel parking, staging equipment, and construction operations. The upstream construction area for installing the new gaging weir is adjacent to the Poʻomau Canyon Ditch trailhead.

Public access would be restricted from staging areas and active work sites during construction which would include the cleared parking area, the existing foot path, and the diversion site. Construction and dewatering associated with construction at this site is estimated to require 4 weeks and is expected to occur during the dry season when stream flows are low.

Kōkeʻe Diversion

Kōkeʻe Diversion is located off a series of dirt roads and is a little less frequented by the public than the other three diversions. However, the area is used by tourists and locals for recreational purposes. Kōkeʻe Diversion is accessed by the existing Halemanu Road, the entrance to which is near mile marker 14 on Waimea Canyon Drive (Hwy 550). Halemanu Road provides access to a number of recreational trails as well as cabins and hunting spots including the popular Waipoʻo Falls trail, Black Pipe Trail Loop, and Waimea Canyon Trail. Also, near the entrance to Halemanu there are two popular overlooks on either side of Kōkeʻe Road (Hwy 550).

Some limited construction equipment and personnel would gain access to the site using the existing Halemanu Road from Highway 550 and existing side roads off Halemanu Road. A temporary staging area would be established and used for personnel parking, staging equipment, and construction operations in the existing cleared parking area at the diversion site. Personnel would access the diversion area using an existing footpath.

Public access would be restricted from staging areas and active work sites including the existing parking area, the foot path to the diversion, and the diversion site. Public access along Halemanu Road and trail heads in the vicinity would not be impacted. The proposed construction and associated dewatering at Kōkeʻe Diversion is expected to require five weeks to complete and would be conducted during the dry season when stream flows are low.

Puʻu Lua Reservoir

Puʻu Lua Reservoir is currently managed by DLNR as a recreational and sport fishing (trout) site, but also still provides some limited storage for irrigation. DAR, a division of DLNR, manages the trout population in the reservoir and maintains a fingerling holding pen.

Rehabilitation of Puʻu Lua Reservoir would involve draining and completely reconstructing the dam. This work would take place during the dry part of the year for one summer and would mean that the trout fishing program would need to be suspended for one or two seasons. The construction scheduling and execution would be carefully coordinated with DLNR and DAR to minimize the impacts to the trout management and public fishing as much as possible.

Puʻu Moe Divide

There are no specific recreational areas at Puʻu Moe Divide. Access to the Puʻu Moe Divide would be from the existing Trail 1 Road. During construction, the existing parking area at Puʻu Moe Divide would provide a staging area for equipment and materials required to complete construction of the new regulating structure. This area would also provide parking for maintenance staff during Project operations.

Kōkeʻe Ditch Between Diversions and Puʻu Lua Reservoir and Puʻu Moe Divide

Construction of the Proposed Action between Puʻu Lua Reservoir and the Puʻu Moe Divide are within the vicinity of hunting areas. These hunting areas are currently only open during the weekends and are closed during weekdays. The construction work in these areas could be scheduled to occur only during the week, so that hunting activities could continue as normal during the weekends. The scheduling of work in the Kekaha Game Management Area would be coordinated with DHHL and DOFAW to ensure construction worker safety while trying to minimize impacts to available hunting days.

The construction work site and staging areas would be restricted from public access. Construction at Puʻu Moe Divide is estimated to require 4 months.

Upper Penstock

Construction of the Proposed Action along the Upper Penstock alignment toward the DHHL boundary are within the vicinity of hunting areas. These hunting areas are currently only open during the weekends and are closed during weekdays. The construction work in these areas could be scheduled to occur only during the week so that hunting activities could continue as normal during the weekends. The scheduling of work in the Kekaha Game Management Area would be coordinated with DHHL and DOFAW to ensure construction worker safety while trying to minimize impacts to available hunting days.

There would be no impacts to recreation between the DHHL boundary along the Upper Penstock and the Puʻu ʻŌpae Powerhouse since this area is located within a gated area.

Puʻu ʻŌpae Reservoir, Powerhouse and Facility Substation

There would be no impacts to recreation due to construction of Puʻu ʻŌpae Reservoir, Powerhouse and Facility Substation since this area is located within a gated area and are not accessible to the general public.

Lower Penstock

There would be no impacts to recreation due to construction of the Lower Penstock since this area is located within a gated area and are not accessible to the public.

Mānā Reservoir, Powerhouse, Pumphouse and Facility Substation

There would be no impacts to recreation due to construction of Mānā Reservoir, Powerhouse, Pumphouse and Facility Substation since this area is located within a gated area and is not accessible to the public.

PV Solar Array, West Kauaʻi Energy Project Substation, and Interconnection Line

There would be no impacts to recreation due to construction of the proposed PV Solar Array, Project Substation and Interconnection Line since this area is located within a gated area, is not accessible to the public, and is an active agriculture area.

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur. Therefore, there would be no impacts to recreation nor would the benefits to recreation be realized. The Kōkeʻe Ditch Irrigation System would remain under management of ADC and associated public recreation considerations around the ditch system would remain with ADC. Repairs and maintenance of the public access roads would remain with the State. Puʻu Lua Reservoir would remain under management of DLNR, and the necessary repairs to meet Hawaiʻi State Dam Safety Standards or actions required to decommission the reservoir would fall to the State. Decommissioning could result in closure of the trout fishing program.

5.6.2.2 Operation

Proposed Action

Kōkeʻe Ditch Irrigation System

Under the Proposed Action, operation of the upper portion of the Kōkeʻe Ditch Irrigation System within Kōkeʻe State Park and the Kekaha Game Management Area would be of no substantial difference than current operations and would have no impact to the access or the quality of the adjacent recreational areas.

Operation of the portion of the Kōkeʻe Ditch Irrigation System between Puʻu Lua Reservoir and Puʻu Moe Divide would have no impact to recreational areas and trails.

Puʻu Lua Reservoir

The Proposed Action is expected to have beneficial impacts to recreation at Puʻu Lua Reservoir. Specifically, increasing the storage capacity of Puʻu Lua Reservoir and providing increased maintenance to the Puʻu Lua access road would benefit the recreational fishing opportunities by both improving and enlarging habitat for the stocked trout population and by improving safe public access.

Upon completion of the rehabilitation of the Puʻu Lua Reservoir, there would be beneficial opportunities to the popular trout fishing program as the reservoir would be operating at increased water levels which would support increased trout stocking and improved shoreline for fishing access. Public safety would be improved through rehabilitation of the Puʻu Lua Reservoir, which would bring the structure into compliance with Hawaiʻi State Dam Safety Standards. The improvement of the Puʻu Lua Access Road would improve public safety and access to the area.

Upper and Lower Penstock

The Upper and Lower Penstock would be completely buried and would not interfere with the movement of game or any of the permitted hunting activities.

The Upper Penstock would replace the current open ditch and Puʻu ʻŌpae Reservoir would be lined and then fenced for both public safety reasons and to protect the liner from ungulate damage, which would prevent land-based wildlife, including game animals, from accessing these facilities. These areas are currently dry or have very little water and are providing limited water for wildlife. However, the replacement of the open ditch between Puʻu Moe Divide and Puʻu ʻŌpae Reservoir would eliminate water loss due to saturation. The remaining 10.6 miles of open ditch associated with the Proposed Action above Puʻu Moe Divide, plus the 2.9-mile southern segment below Puʻu Moe Divide and Puʻu Lua Reservoir would remain open and viable sources of water for land-based wildlife, including game animals.

Puʻu ʻŌpae Reservoir, Powerhouse and Facility Substation

Operation of Puʻu ʻŌpae Reservoir, Powerhouse and Facility Substation would have no impact to recreational areas and trails since this area is located within a gated area and is not accessible to the general public.

Mānā Reservoir, Powerhouse, Pumphouse and Facility Substation

Operation of Mānā Reservoir, Powerhouse, Pumphouse and Facility Substation would have no impact to recreational areas and trails since this area is located within a gated area and is not accessible to the public.

PV Solar Array and Interconnection Line

There would be no impacts to recreation due to operation of the proposed PV Solar Array since this area is located within a gated area, is not accessible to the public, and is an active agriculture area.

No-Action Alternative

Under the No-Action Alternative, the Kōkeʻe Ditch Irrigation System and associated public recreation and public safety considerations would remain under management of ADC. Repairs and maintenance of the public access roads would remain with the State. Puʻu Lua Reservoir would remain under management of DLNR, and the necessary repairs to meet Hawaiʻi State Dam Safety Standards or actions required to decommission the reservoir would fall to the State. Decommissioning could result in closure of the trout fishing program.

5.6.3 Avoidance and Minimization Measures – Recreational Resources

No avoidance or minimization measures are proposed beyond the construction schedule coordination with DHHL, DLNR, and DAR to minimize impacts to fishing and hunting during specific construction activities.

5.7 Visual Resources

5.7.1 Affected Environment – Visual Resources

The island of Kauaʻi is known for its beauty and variety of landscapes. The Proposed Action would cross a variety of landscapes with a variety of visual resources. There are several scenic lookouts and viewpoints within the vicinity of the Proposed Action, as summarized in **Table 5-16** and shown on **Figure 5.20**. This includes the Poʻomau Canyon Lookout, Kumuwela View Point, Cliff Trail View Point, and Waimea Canyon Lookout.

Table 5-16. Scenic Lookouts and Viewpoints in the Vicinity of the Proposed Action

Scenic Lookout or View Point	Location Relative to Proposed Action	Description
Poʻomau Canyon Lookout	South of Waiakōali Intake	• End of Poʻomau Canyon Lookout Trail • Offers views of Poʻomau Canyon and Waimea Canyon.
Kumuwela View Point	Kōkeʻe Ditch south-southeast of Kōkeʻe Intake	• End of Canyon Trail • Offers views of Waimea Canyon and Waipoʻo Falls • Picnic table at viewpoint
Cliff Trail View Point	Kōkeʻe Ditch west of Kōkeʻe Intake	• Along Cliff Trail • Offers views of Waimea Canyon
Waimea Canyon Lookout	Kōkeʻe Road north of Puʻu Moe Divide	• Off Kōkeʻe Road • Offers views of Waimea Canyon

Figure 5.20. Scenic Lookouts and Viewpoints Within the Vicinity of the Proposed Action

5.7.2 Potential Impacts – Visual Resources

5.7.2.1 Construction

Proposed Action

During construction, there would be minimal impacts to the existing scenic and visual resources. Short-term construction impacts to visual resources include the presence and staging of construction equipment within the Project areas. However, the construction sites are primarily located in gated areas or areas that are not visible from public viewpoints. Therefore, the impacts would not substantially impact visual resources or viewplanes.

Construction activities proposed for the upper portions of the Proposed Action up ditch of Puʻu Lua Reservoir and below Puʻu Lua Reservoir to Puʻu Moe would consist primarily of maintenance and repairs of the existing Kōkeʻe Ditch Irrigation System and would have negligible visual impacts and would not impact visual resources or viewplanes.

Kōkeʻe Ditch Irrigation System

Construction activities proposed for the Kōkeʻe Ditch Irrigation System would consist primarily of maintenance and repairs of the existing Kōkeʻe Ditch Irrigation System and would not add new facilities into the viewplane. Visual impacts would be limited to the presence and staging of construction equipment at the various Project sites.

Puʻu Lua Reservoir

Puʻu Lua Reservoir is currently operating at fractional capacity and is kept partially drained for dam safety reasons. Rehabilitation of Puʻu Lua Reservoir would involve significant earth moving and grading activities in the immediate area of the dam and the reservoir. These activities would significantly alter the appearance of the reservoir during the six- to twelve-month construction period. This change of appearance would be temporary. In addition, Puʻu Lua Reservoir would be closed during construction. Upon completion of construction, the entire reservoir site would be cleaned, graded, and either seeded, mulched, or rip-rapped along with other BMPs to restore the ground and protect against erosion.

Upper Penstock

Construction of the Upper Penstock would require a maximum 60-foot-wide construction area for the entire length of approximately 4.4 miles. Approximately 1.3 miles, the upper portion, of the Upper Penstock construction would occur in forested areas and would result in tree removal. The lower sections of the Upper Penstock traverse areas generally more open, but still may require some limited tree removal. Upon completion, this buried pipeline segment would be restored in the same manner as the rest of the pipeline and would blend with the surrounding terrain. For these reasons, the temporary construction activities would have negligible visual impacts to the visual resources or viewplanes in the vicinity.

Puʻu ʻŌpae Reservoir, Powerhouse and Facility Substation

The existing Puʻu ʻŌpae Reservoir would be completely rebuilt to Hawaiʻi State Dam Safety Standards. Similar to construction at Puʻu Lua Reservoir, there would be significant earth moving and grading activities in the immediate area of the dam and the reservoir. These activities would be temporary, and the area would be fully restored using appropriate BMPs around the new fully lined and fenced reservoir within twelve months of beginning construction. This reservoir is visible from the surrounding, gated Puʻu ʻŌpae lands and would be visible to tenants and guests of tenants.

The Puʻu ʻŌpae Powerhouse and Facility Substation would be a new facility located on the eastern edge of the Puʻu ʻŌpae Reservoir that would be similar in size to a large house and have an appearance similar to an agricultural storage building. All the generating equipment would be housed within the powerhouse structure and adjoining facility substation. Puʻu ʻŌpae Reservoir, Powerhouse and Facility Substation are within a gated DHHL area, and the construction activities would not be visible from any non-gated or public areas and would be low profile enough to not obstruct the viewplane in the general area.

Lower Penstock

The proposed Lower Penstock would be constructed along an alignment that crosses fields between Puʻu ʻŌpae Reservoir and the edge of Niu Ridge bluff. The area is within DHHL's gated lands at an elevation of 750 to 1,500 feet msl and is not visible from non-gated public areas. The segment of proposed pipeline that extends from the edge of Niu Ridge to the Mānā Reservoir would be buried. Construction activities on the slope below the bluff would be visible from the highway located two miles to the west during the two to three months required to complete this section. Upon completion, this buried pipeline segment would be restored in the same manner as the rest of the pipeline and would blend with the surrounding terrain. For these reasons, the temporary construction activities would have negligible visual impacts to the visual resources or viewplanes in the vicinity.

Mānā Reservoir, Powerhouse, Pumphouse and Facility Substation

The existing Mānā Reservoir would be completely rebuilt to Hawaiʻi State Dam Safety Standards. Similar to construction at Puʻu ʻŌpae Reservoir, there would be significant earth moving and grading activities in the immediate area of the dam and the reservoir. These activities would be temporary, and the area would be fully restored using appropriate BMPs around the new fully lined and fenced reservoir within twelve months of beginning construction. This reservoir is visible from the gated Mānā agricultural area and would be visible to tenants and guests of tenants.

The proposed Mānā Powerhouse, Pumphouse and Facility Substation would be located at the base of Niu Ridge on the southeast edge of Mānā Reservoir within the gated Mānā agricultural area. Co-located with the proposed powerhouse would be the Pumphouse and Facility Substation. These structures would not be visible from public areas and would have no impact on visual resources.

PV Solar Array, West Kauaʻi Energy Project Substation, and Interconnection Line

The proposed PV Solar Array on approximately 350 acres of agricultural lands and West Kauaʻi Energy Project Substation on approximately 7.47 acres would be located on agricultural lands on the Mānā Plain. It is anticipated that the proposed construction of these new facilities on the landscape at the lower portion of the Project area on the Mānā Plain would be visible from the highway two miles to the west but would have no substantial impact to visual resources or to the mauka to makai viewplane as activities would be at ground level and would be short-term.

The Interconnection Line would be constructed on Mānā Plain on ADC land and would follow the alignment of existing dirt roads that extend between Mānā Reservoir and Kaumualiʻi Highway. The new Interconnection Line would be approximately two miles in length. Installation of the new West Kauaʻi Energy Project Interconnection Line would be within the cleared edges of the existing dirt roads and would not involve vegetation clearing or grading. Construction would involve installation of approximately 35 new poles approximately 80 feet in height. Construction activities would be visible from the highway but would have no substantial impact to visual resources or to the mauka to makai viewplane as activities would be at ground level and would be short-term.

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur, and the Kōkeʻe Ditch Irrigation System would remain under management of ADC. Repairs and maintenance of the public access roads would remain with the State. Puʻu Lua Reservoir would remain under management of DLNR, and the necessary repairs to meet Hawaiʻi State Dam Safety Standards or actions required to decommission the reservoir would fall to the State. Decommissioning could result in closure of the trout fishing program. Impacts to visual resources or viewplanes associated with the No-Action Alternative would depend on decisions for future improvements and maintenance of existing infrastructure.

5.7.2.2 Operation

Proposed Action

Operation of the Proposed Action could impact Waipoʻo Falls only during high streamflow events at Kōkeʻe Stream. However, the primary impact to Waipoʻo Falls is actually a result of the Waimea Mediation Agreement, the establishment of an IIFS for each stream, and the resultant change of operational parameters on the Kōkeʻe Ditch System. Kōkeʻe Stream is the natural source of Waipoʻo Falls. Historically and currently, Waipoʻo Falls was/is augmented by diverted water from Waiakōali, Kawaikōī, and Kauaʻikinanā Streams that is discharged into Kōkeʻe Stream at Kōkeʻe Diversion rather than remaining in the stream of origin or being used along the ditch system. The IIFS for each stream is required to be implemented at the point of diversion rather than being returned to the watershed through another stream.

The Phase One IIFS for Kōkeʻe Stream is 100% natural flow and the volume of Waipoʻo Falls will be derived entirely from Kōkeʻe Stream after implementation of the Phase One IIFS structural modifications. The Phase Two IIFS for Kōkeʻe Stream is 1.2 MGD. There are no USGS gaging records for Kōkeʻe Stream. However, the hydrology analysis for the Project estimated typical stream flows for Kōkeʻe to range from 0.6 to 3.2 MGD with flood events up to 430 MGD. CWRM's hydrology analysis included in the Waimea IFSAR estimated a Q50 total flow range of 1.8 to 2.1 MGD and a Q50 base flow range of 1.7 to 1.9 MGD. It is expected that the Proposed Action would only be able to divert water from Kōkeʻe Stream during higher flow events and therefore have minimal impact on Waipoʻo Falls. At all times at least 1.2 MGD would remain in the Kōkeʻe

Stream, and an estimated average of 86% of total streamflow would remain in the stream after diversion at Kōkeʻe Stream during West Kauaʻi Energy Project operations.

Kōkeʻe Ditch Irrigation System

Operation of the upper portion of the Project area would have no impact to visual resources. The repairs and rehabilitation of the existing diversions would not result in a significant change in appearance of the structures, and the construction of the two new concrete weirs would be low impact and blend in with the existing infrastructure at each site.

The proposed intake structure at Puʻu Moe Divide would be a compact and largely buried regulating structure along the existing ditch path in the woods near Kōkeʻe Highway. This new structure would likely not be visible from the public roadway.

Puʻu Lua Reservoir

The repairs and continued maintenance of Puʻu Lua Reservoir would be beneficial to the visual environment of these areas as the current reservoirs are either operating at lower water levels or are drained and unused.

Upper and Lower Penstock

The new Upper Penstock would generally follow the route of the existing Camp 1 road and the existing open ditch. To facilitate construction, there would be removal of some trees along portions of the Upper Penstock alignment, Camp 1 road, and the existing ditch. The uppermost segment of this vegetation removal may be visible from the public roadway as vehicles pass by the Camp 1 road turnoff near Puʻu Moe Divide. The cleared areas would be restored to grass areas which would be kept mown for the life of the Proposed Action to facilitate pipeline inspection and serve as a firebreak. The penstock pipe would be fully buried and not visible once construction is completed.

The Lower Penstock alignment would be visible from the gated Mānā agricultural area and would be visible to tenants and guests of tenants. The Lower Penstock alignment may also be visible from Kaumualiʻi Highway but would not block any viewplanes.

The Upper and Lower Penstock alignments would be maintained by cutting of vegetation and would not blend into natural surroundings. The Upper Penstock would be visible from the Puʻu ʻŌpae Reservoir and Powerhouse, which are located on gated lands. Therefore, the Upper Penstock alignment would be visible to tenants and guests of tenants but would not block any viewplanes.

Puʻu ʻŌpae Reservoir, Powerhouse and Facility Substation

The new Puʻu ʻŌpae Powerhouse and Facility Substation would be located on the eastern edge of the Puʻu ʻŌpae Reservoir that would be similar in size to a large house and have an appearance similar to an agricultural storage building. All the generating equipment would be housed within the powerhouse structure. Puʻu ʻŌpae Reservoir, Powerhouse and Facility Substation are within a gated DHHL area and would not be visible from any non-gated or public areas and would be low profile enough to not obstruct the viewplane in the general area.

Mānā Reservoir, Powerhouse, Pumphouse and Facility Substation

The Mānā Powerhouse would be of similar height to the existing trees mauka of the reservoir, would be painted a light earth tone color to blend into the existing environment, and may be visible from Kaumualiʻi Highway. The co-located Pumphouse and Facility Substation would be lesser height and would not likely be visible from Kaumualiʻi Highway. Significant visual impacts are not anticipated to occur as these facilities would either not be visible or would blend into the existing environment.

PV Solar Array, West Kauaʻi Energy Project Substation, and Interconnection Line

The PV Solar Array maintains a low profile but may be visible when panels are at a certain angle. However, generally the PV Solar Array is not expected to be visible from public areas because the maximum panel height is approximately 15 feet tall and portions of the PV Solar Array would be blocked by surrounding existing vegetation. The PV Solar Array would be located approximately one mile from Kaumualiʻi Highway to the west. The PV Solar Array and the substation would not obstruct mauka to makai viewplanes.

The Project Substation is also relatively low in profile and is not likely to be visible from Kaumualiʻi Highway due to the presence of dense vegetation along the highway.

The new West Kauaʻi Energy Project Interconnection Line would replace an approximate two-mile section of existing transmission and distribution lines extending from PMRF to Polihale State Park. These existing sections of transmission and distribution lines between PMRF and Polihale State Park would be completely removed so no overhead lines would be present in their current location, thus removing all potential impacts associated with those overhead lines. The portion of the new overhead line visible from the highway would have the same visual impact as the lines being replaced.

No-Action Alternative

Under the No-Action Alternative, the Kōkeʻe Ditch Irrigation System would remain under management of ADC. Repairs and maintenance of the public access roads would remain with the State. Puʻu Lua Reservoir would remain under management of DLNR, and the necessary repairs to meet Hawaiʻi Dam Safety requirements or actions required to decommission the reservoir would fall to the State. Decommissioning would result in closure of the reservoir and the trout fishing program. Impacts to visual resources or viewplanes associated with the No-Action Alternative would depend on decisions for future improvements and maintenance of existing infrastructure.

5.7.3 Avoidance and Minimization Measures – Visual Resources

The following measures would be implemented to minimize impacts to visual resources:

- The Puʻu Lua Reservoir site would be cleaned, graded, and either seeded, mulched, or rip-rapped along with other BMPs to restore the ground and protect against erosion
- Cleared areas along the Upper and Lower Penstock would be restored to graded, grass areas which would be kept mown for the life of the Proposed Action
- The Upper and Lower Penstock pipe would be fully buried, and not visible once construction is completed

5.8 Roadways and Traffic

5.8.1 Affected Environment – Roadways and Traffic

A traffic study was conducted by Austin, Tsutsumi & Associates Inc. in January 2022 to assess the potential traffic impacts that may result from construction and operation of the Proposed Action. The study addressed the following:

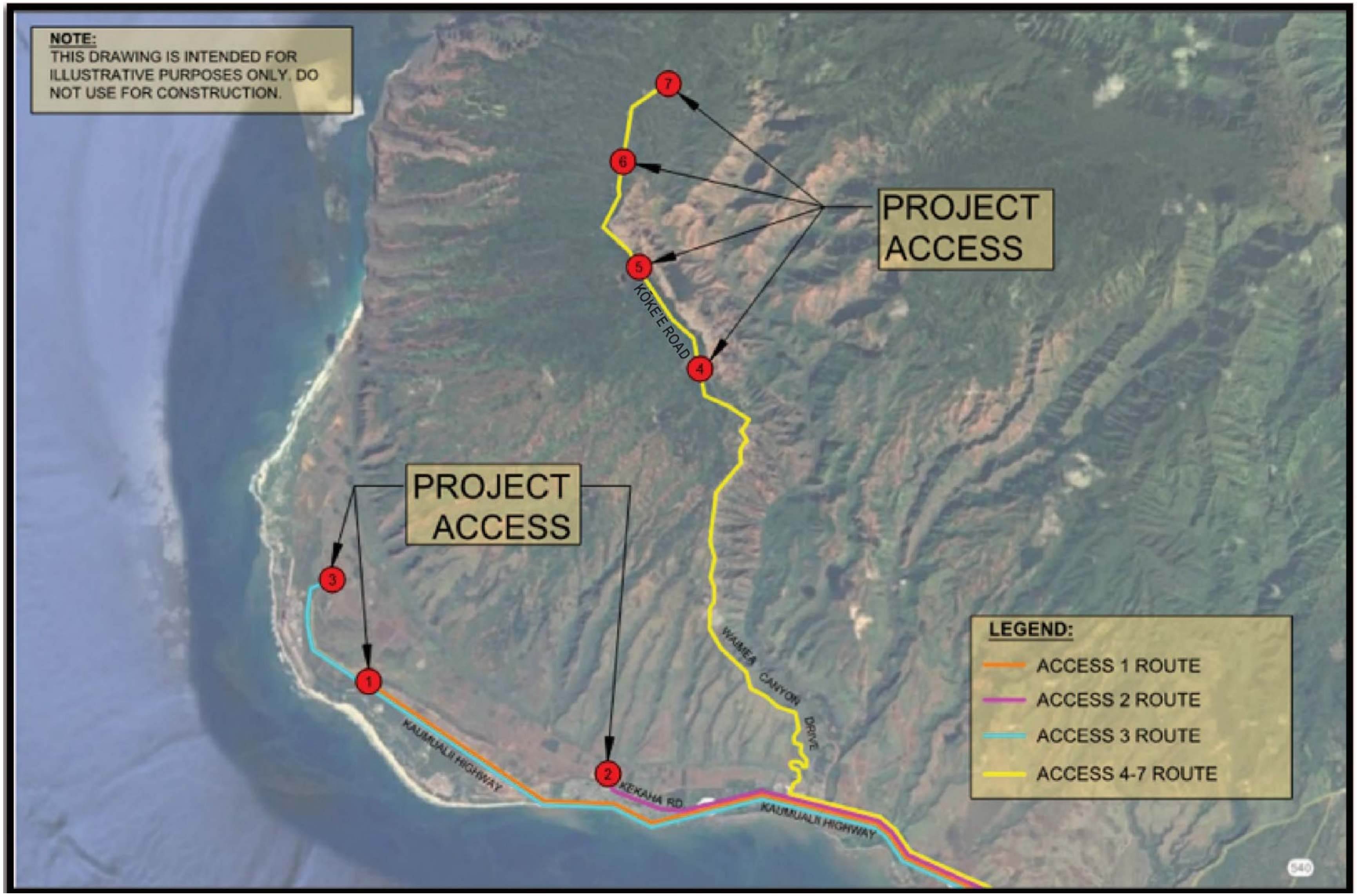
- Existing traffic operating conditions at key intersections during the weekday morning (AM) and afternoon (PM) peak hours of traffic within the study area.
- Traffic Projections for Year 2025 without the Proposed Action. The Year 2025 was selected to reflect the completion year of the Proposed Action. Traffic Projections included traffic generated by other known developments in the vicinity of the Proposed Action in addition to an ambient growth rate, including those associated with PMRF Barking Sands and improvements to Waimea Canyon Road.
- Trip generation and traffic assignment characteristics during construction for the Proposed Action.
- Traffic Projections for Year 2025 during construction of the Proposed Action, which includes Year 2025 without the Proposed Action traffic volumes in addition to traffic volumes generated during construction.
- Recommendations as needed to mitigate any impacts that may result from Year 2025 conditions during construction of the Proposed Action.

Level of Service (LOS) is a qualitative measure used to describe the conditions of traffic flow at intersections. Values range from free-flow conditions (LOS A) to congested conditions (LOS F). Analyses for the study intersections were performed using the traffic analysis software, SYNCHRO, which prepares reports that contain control delay forecast results based on intersection lane geometry, signal timing, and hourly traffic volumes. Based on the vehicular delay at each intersection, a LOS is assigned to each approach and intersection movement as a qualitative measure of performance. Intersection analysis within the Project study area was performed at the seven construction accesses shown in **Figure 5.21**.

Historical traffic count data from 2016 was provided by the Hawaiʻi Department of Transportation (HDOT). The Kauaʻi Long-Range Transportation Model was used to approximate traffic growth along Kaumualiʻi Highway and Kōkeʻe Road between 2016 and 2022. A growth rate between 0.31% and 0.76% per year was applied to the 2016 data for Kaumualiʻi Highway and 1.87% per year to the 2016 data for Waimea Canyon Drive. Based on the traffic count data, the weekday AM and PM peak hours were identified as 6:30 AM to 7:30 AM and 4:00 PM to 5:00 PM, respectively.

The traffic impact assessment report (TIAR), *Traffic Impact Analysis Report, West Kauaʻi Energy, Waimea, Kauaʻi, Hawaiʻi* is provided in **Appendix M**.

Figure 5.21. Project Access Locations



Source: Austin Tsutsumi & Associates, 2022

5.8.1.1 Existing Traffic Conditions

There are two primary roadways within the vicinity of the Proposed Action:

- **Kaumualiʻi Highway:** A two-way, two-lane, east-west State roadway (State Route 50) that provides regional connectivity between west Kauaʻi and Līhuʻe. Within the study area, the posted speed limit varies between 35 miles per hour (mph) and 50 mph.
- **Kōkeʻe Road:** A two-way, two-lane roadway that begins to the south at its intersection with Kekaha Road near Alae Road and extends mauka until it terminates at the Puʻu O Kila Lookout near mile marker 19. The posted speed limit is 25 mph.

Due to low traffic volumes, all movements at all construction accesses operate at LOS A. Existing lane configuration, volumes, and LOS can be seen in **Figure 5.22**.

Project access would be via existing roadways off Waimea Canyon Drive/Highway 550 as listed in **Table 5-17**.

5.8.1.2 Base Year 2025 Traffic Conditions

It is anticipated that volumes will increase by approximately one to six vehicles in each direction in peak hour over the existing conditions discussed in **Section 5.8.1.1**. All movements at all construction accesses are expected to continue to operate at LOS A. Base Year 2025 lane configuration, volumes, and LOS can be seen in **Figure 5.23**.

5.8.2 Potential Impacts – Roadways and Traffic

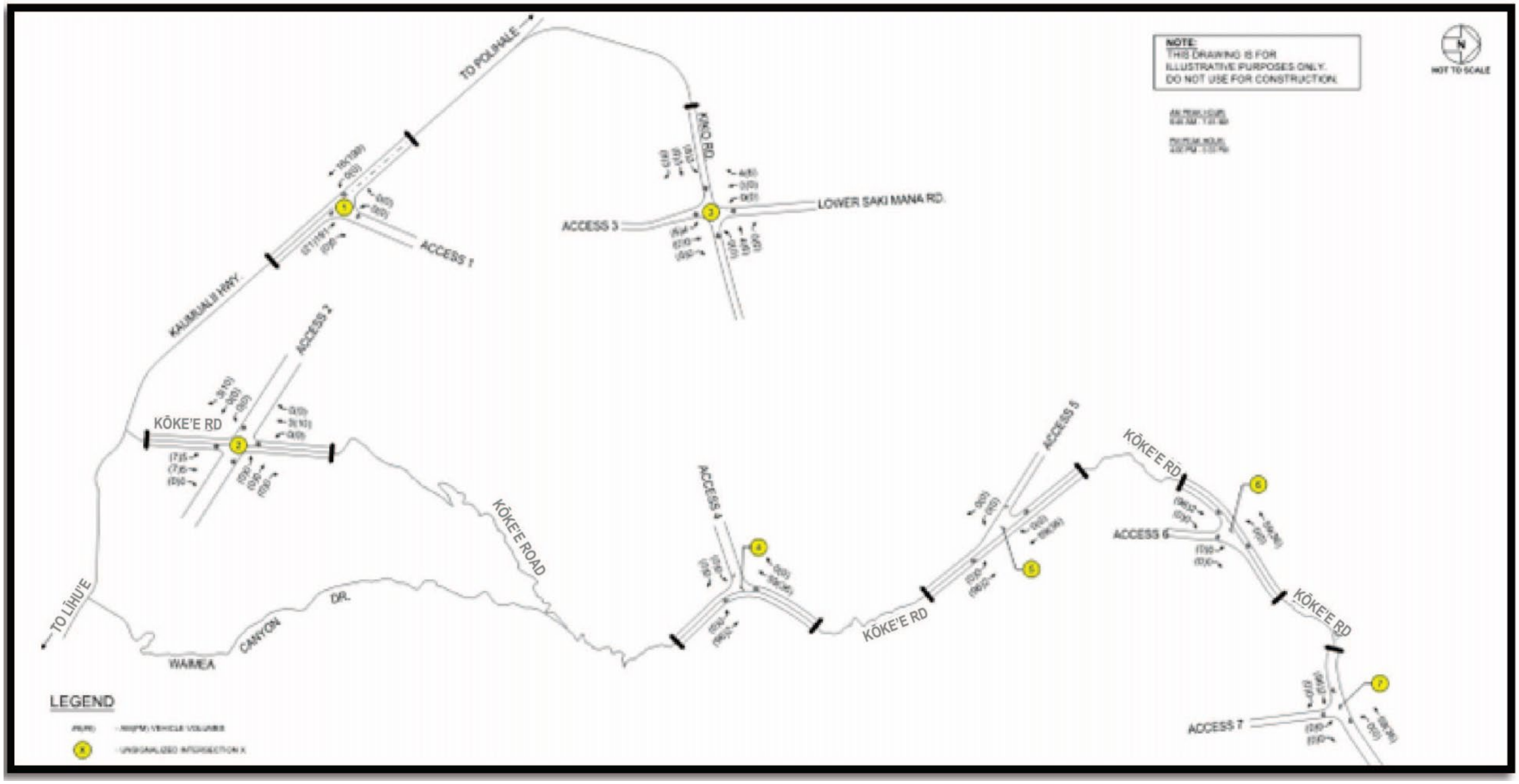
5.8.2.1 Construction

Proposed Action

During construction, the Proposed Action would be accessed via a total of seven accesses from Kaumualiʻi Highway and Kōkeʻe Road as shown on **Figure 5.21.** Construction is anticipated to last approximately 22 months.

Construction-related trip generation is expected to generate five tractor trailer truck trips and 91 construction worker vehicle trips for a total of 96 trips during the AM and PM peak hours. Construction-related trip generation at each access is detailed in **Table 5-18**. With traffic generated from construction of the Proposed Action, all movements at all accesses are anticipated to continue to operate acceptably at LOS B or better across both peak hours.

Figure 5.22. Existing Conditions at Construction Access Points

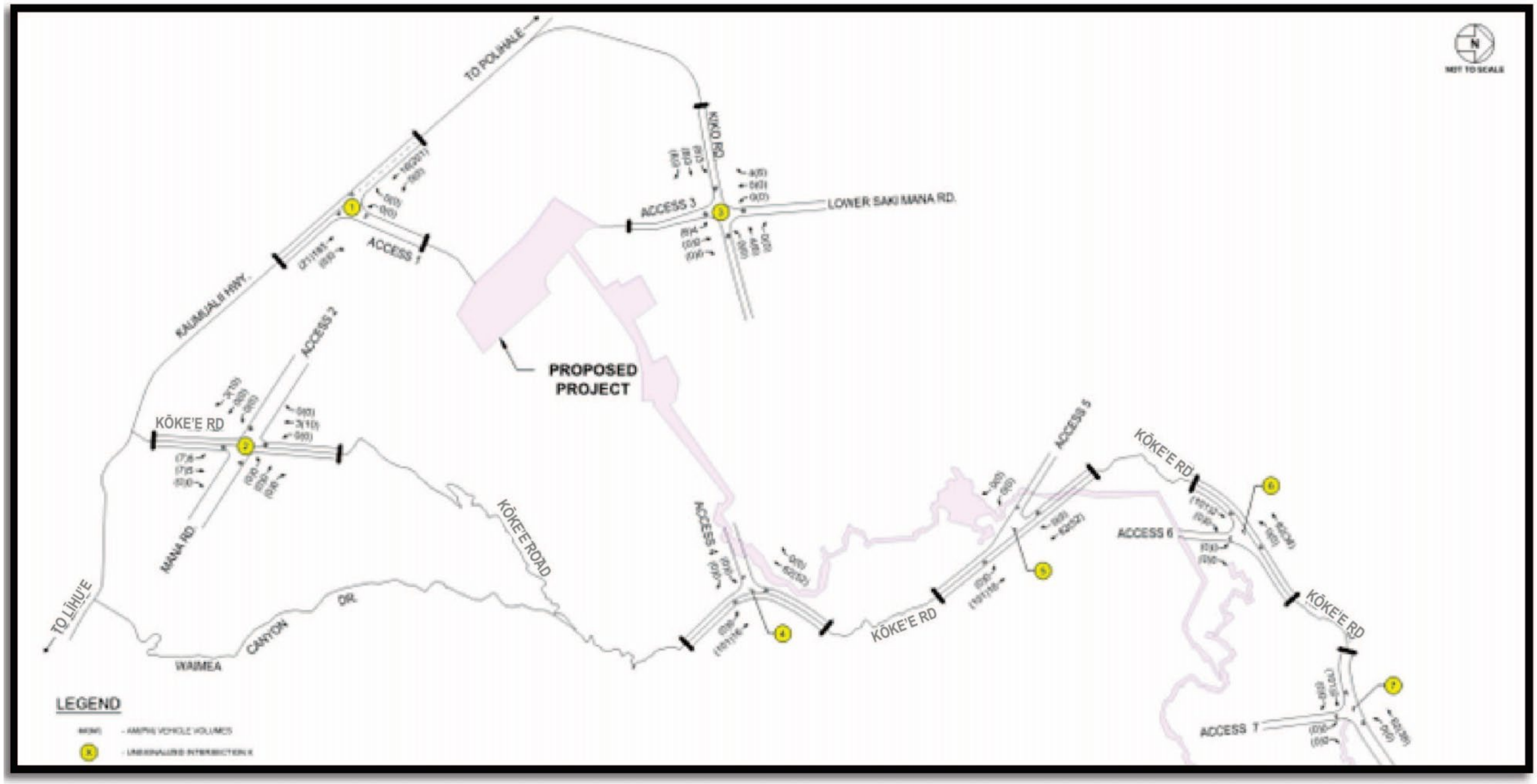


Source: Austin Tsutsumi & Associates, 2022

Table 5-17. Project Access Roads

Access Road	Project Facility(ies)	Proposed Improvements
Mōhihi-Camp 10 Road	Kōkeʻe Ditch Irrigation System Waiakōali Diversion Kawaikōī Diversion Kauaʻikinanā Diversion	Possible light scraping, resurfacing, and trimming of overhanging branches. All work would be within the existing roadway footprint.
Spur Road off Mōhihi-Camp 10 Road	Waiakōali Diversion	Possible light scraping, resurfacing, and trimming of overhanging branches. All work would be within the existing roadway footprint.
Spur Road off Mōhihi-Camp 10 Road	Kawaikōī Diversion	Possible scraping to level rutted areas, application of gravel, and trimming of overhanging branches. All work would be within the existing roadway footprint.
Spur Road off Mōhihi-Camp 10 Road to Sugi Campground	Kawaikōī Diversion	No improvements.
Spur Road off Mōhihi-Camp 10 Road	Kauaʻikinanā Diversion	No improvements.
Halemanu Road	Kōkeʻe Diversion	No improvements.
Puʻu Lua Access Road	Puʻu Lua Reservoir	Regrading and resurfacing with rock the portion of the road on the south abutment of the dam. The existing road that traverses the dam embankment would be resurfaced and regraded after dam modifications are complete. All work would be within the existing roadway footprint.
Trail 1 Road	Puʻu Moe Divide Upper Penstock	Improvements would involve scraping, leveling, and gravel placement. All work would be within the existing roadway footprint.
Puʻu ʻŌpae Access Road off Mānā Plain	Puʻu ʻŌpae Reservoir Puʻu ʻŌpae Powerhouse Lower Penstock	Improvements to the lower section may include drainage improvements, culvert replacement, and paving. Improvements to the upper section may include scraping and gravel resurfacing.
Existing roads on the Mānā Plain	Mānā Reservoir Mānā Powerhouse	Improved as needed with gravel. The existing embankment road that circles the perimeter of the reservoir would be regraded and resurfaced with gravel.
Mānā Road	PV Solar Array	No improvements.

Figure 5.23. Base Year 2025 Traffic Conditions at Construction Access Points



Source: Austin Tsutsumi & Associates, 2022

Table 5-18. Trip Generation During Construction

Access No.	Tractor Trailer Deliveries				Construction Workers				Vehicle Totals			
	AM		PM		AM		PM		AM		PM	
	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit
1	0	0	0	0	30	0	0	30	30	0	0	30
2	4	0	0	4	11	0	0	11	15	0	0	15
3	0	0	0	0	15	0	0	15	15	0	0	15
4	0	0	0	0	20	0	0	20	20	0	0	20
5	1	0	0	1	9	0	0	9	10	0	0	10
6	0	0	0	0	3	0	0	3	3	0	0	3
7	0	0	0	0	3	0	0	3	3	0	0	3
TOTAL	**5**	**0**	**0**	**5**	**91**	**0**	**0**	**91**	**96**	**0**	**0**	**96**

In addition to the trips shown in **Table 5-18**, special vehicles would be needed for delivery of the following:

- 3 – Substation GSU transformers (wide load and 100,000 pounds each)
- 1 - Control building in two pieces
- 1 – Transformer (KIUC)
- 1 – Generator at Mānā Road
- 1 – Turbine at Mānā Road
- 1 – Generator at Pu'u 'Ōpae

It is assumed that the special transport items would be done outside of daily peak hours and would have no effect on commuter traffic. Overall, it is anticipated that the Proposed Action would have no significant impact on traffic in the area during construction.

The solar equipment would be transported to Nāwiliwili Harbor via a freight shipping company and offloaded to standard transportation trucks. The trucks would deliver the equipment to the solar field area via existing state and county roadways. It is anticipated that a total of approximately 1,500 tractor trailer loads would be required to transport the solar equipment over the course of the construction phase. Oversized trucks would be required for delivery of substation transformers.

No roadway improvements or other construction is expected to be required to accommodate the equipment transport. A Traffic Impact Analysis Report (TIAR) concluded that neither construction nor operation of the solar array would significantly impact traffic on surrounding roadways.

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur. Repairs and maintenance of the public access roads would remain with the State.

5.8.2.2 Operation

Proposed Action

Operation of the Proposed Action would have minimal impacts to roadways and traffic since the Proposed Action would be operated automatically and monitored remotely around the clock by means of a SCADA system and a combination of West Kauaʻi Energy Project employees and KIUC dispatchers. Integrated adjustment of the West Kauaʻi Energy Project from the diversion intake gates, the reservoirs, and both hydroelectric powerhouses, along with the battery and PV Solar Array, would be performed automatically according to predefined operating parameters and commands from KIUC's dispatch.

Routine Project maintenance of the Kōkeʻe Ditch Irrigation System and associated facilities would include periodically checking the automated system, gates and trash racks, overflow weirs, gaging sensors, and diversion structure to ensure everything is operating properly and to implement any repairs or maintenance actions as needed.

Project access roads that would be maintained through the life of the Proposed Action include Puʻu Lua Access Road and Dam Embankment Road, Trail 1 Road to access the Upper Penstock, and the Puʻu ʻŌpae Access Road. This would be a beneficial impact for access throughout the publicly available areas or licensees who have access to DHHL's Puʻu ʻŌpae lands.

No-Action Alternative

Under the No-Action Alternative, Project access roads would not be maintained by the Applicant. Repairs and maintenance of these roads would remain with the State.

5.8.3 Avoidance and Minimization Measures – Traffic and Transportation

The following measures would be implemented to minimize traffic impacts:

- To the extent possible, construction-related deliveries and vehicular ingress or egress during the weekday morning and afternoon peak hours (6:30 AM to 7:30 AM and 4:00 PM to 5:00 PM) would be avoided. If night work occurs, appropriate permitting and monitoring, as well as development of administrative and engineering controls, would be employed.
- Workers would be encouraged to carpool from an off-site location to the extent possible.
- All loading and unloading activities would be coordinated to ensure all construction vehicles can be accommodated on site to minimize construction vehicle queues on adjacent roadways.
- Heavy equipment transportation and truck traffic would be limited as much as possible to weekdays and during daytime hours. If heavy equipment and truck traffic occur after normal working hours, appropriate permitting would be employed.

5.9 Municipal Services

5.9.1 Affected Environment – Municipal Services

The discussion on municipal services relates to services such as electric, gas, telephone, sanitary sewer, domestic water and solid waste management. Utility services provided within the County of Kauaʻi include electricity, telecommunications, domestic water and wastewater, and solid waste management.

Electricity and Telecommunications

There are currently no electric distribution lines or telecommunications that service the Project area.

Water and Wastewater

Domestic water is provided by the County of Kauaʻi Department of Water. The County of Kauaʻi Public Works – Wastewater Management Division operates Kauaʻi's wastewater infrastructure. Neither the County water nor the County wastewater systems currently service the Project area.

Solid Waste

Solid waste on Kauaʻi is handled at the Kekaha Landfill. The Applicant is aware of the limited capacity at this landfill, however it is up to the county to determine when a new landfill is necessary and where that landfill would be established.

5.9.2 Potential Impacts and Mitigation Measures

Electricity and Telecommunications

WKEP would require minimal municipal services. The project would require electricity, phone and fiber to service the Mana powerhouse. However, the phone would likely extend from where the existing lines terminate adjacent to the Mana Powerhouse location, and the fiber would be delivered along the same route as the New Interconnection Line. A fiber optic line would be buried along the Lower Penstock route from the Mana Powerhouse up to the Puʻu ʻŌpae Powerhouse providing communication link between the two powerhouse structures. A fiber optic line would also be routed to Puʻu Moe Regulating Structure and Puʻu Lua Reservoir from existing lines along the highway and providing full communication and control link throughout the Project site.

Electricity and Telecommunication services for the Project would all be within the Project footprint and either connect to existing service lines or be delivered along the same route as the new Project Interconnection Line. There would be no impacts associated with these new connections.

Water and Wastewater

The Proposed Action does not require connection to domestic water systems or wastewater infrastructure.

As discussed in Section 4.1.2.13, restroom facilities may be needed adjacent to Mānā Powerhouse. These facilities would not require municipal services. The wastewater would be captured in a 2,000 gallon holding tank with a level alarm that would be serviced on a regular basis by a private contractor. Non-potable utility water would be provided off the penstock with a pressure reduction facility to lower pressures to utility use. A standard filter would be used on the utility water to remove suspended materials. The utility water would be used for the sinks and toilet in the powerhouse. The only potable water at the Mānā Powerhouse would be located in the self-contained emergency eyewash station and total approximately 7 gallons. Drinking water would be provided from standard 5 gallon water tanks delivered to the site. There would be no bathroom at the Pu‘u ‘Ōpae powerhouse, but a similar system eyewash station would be installed. There are no expected impacts due to waste and wastewater handling as a result of the Project.

Solid Waste

Solid waste would be generated during construction and operations of the Proposed Action. Recycling at a local recycling facility would be implemented to the extent possible. Any solid waste that cannot be recycled would be removed from the site and disposed of at the Kekaha Landfill.

Trash stored outdoors will be stored in trash cans or dumpsters with lids. The Applicant will contract for trash removal from the Project area and will not rely on municipal services.

5.10 Socioeconomics

5.10.1 Affected Environment – Socioeconomics

Hawai‘i’s is geographically isolated from sources of crude oil, natural gas, coal, and petroleum reserves which makes it the nation’s most dependent state for imported fossil fuels. This dependence comes with the highest import costs in nation; therefore, it is important to be able to generate electricity that is not "petroleum-dependent" for long term energy resiliency and cost control.

On Kaua‘i, electricity is supplied to members and customers of KIUC. KIUC is a not-for-profit electric cooperative that is governed by a locally elected nine-member board of directors that is accountable to the cooperative’s membership. KIUC provides electricity to 34,000 member-owners on the island of Kaua‘i. The electricity is generated either through burning fossil fuels (e.g., diesel) or renewable energy such as solar, hydro, and biomass. Before recent renewable energy Project development, Hawai‘i was heavily dependent on imported petroleum. Moreover, each island had to build its power plants and grids to generate electricity to meet local demand since there are no transmission lines between islands. Research has shown that the consistently high price of oil combined with the high fixed price on infrastructure has led to record high electricity prices in Hawai‘i.

KIUC strives to transform Kaua‘i from a heavily petroleum-dependent to a renewable energy-based island by investing in different types of renewable energy Projects. Kaua‘i has gradually become less dependent on imported petroleum over the years. KIUC has successfully pushed to increase renewable production from 9% in 2009 to 69% in 2021. In 2015, the State of Hawai‘i established a mandate of reaching 100% renewable electric generation by 2045.

KIUC spends millions of dollars annually purchasing fossil fuel commodities (e.g., diesel fuel and naphtha) for electricity generation. **Table 5-19** shows KIUC’s operating revenue and expenses from 2017 through 2020. Fossil fuel cost has declined significantly since 2018 where it peaked at 29.1% of power cost to 2020 where fossil fuel cost accounted for only 14.4% of power cost. This is due to KIUC’s efforts to implement renewable energy Projects.

Table 5-19. KIUC Operating Revenue and Expenses, 2017-2020

	2017	%	2018	%	2019	%	2020	%
Operating Revenue	$147,800,000	--	$162,600,000	--	$154,900,000	--	$145,100,000	--
Power Cost:	$76,031,389	51.4%	$90,182,164	55.5%	$85,048,216	54.9%	$71,564,840	49.3%
Fossil Fuel	$36,211,000	24.5%	$47,316,600	29.1%	$33,613,300	21.7%	$20,894,400	14.4%
Hydro	$4,434,000	3.0%	$4,715,400	2.9%	$9,294,000	6.0%	$10,882,500	7.5%
Solar	$7,833,400	5.3%	$8,780,400	5.4%	$12,701,800	8.2%	$13,494,300	9.3%
Biomass	$12,119,600	8.2%	$13,333,200	8.2%	$13,166,500	8.5%	$12,188,400	8.4%
Production O&M	$15,371,200	10.4%	$15,934,800	9.8%	$16,264,500	10.5%	$14,074,700	9.7%

Source: KIUC, 2017 to 2020 Annual Reports

Once completed, the Proposed Action could provide as much as 110 GWh of electricity and a storage of 428 million gallons of water for use in Kauaʻi annually. The 110 GWh of electricity would amount to 20-25% of KIUC's annual generation and is a substantial investment for KIUC. To lower the risk of the Project for its members and to optimize the use of tax credits (which result in a lower cost of energy), KIUC has signed a long-term Purchase Power Agreement (PPA) with AES West Kauaʻi Energy Project, LLC. Under the PPA, KIUC conservatively expects to receive an annual total of 110 GWh (110,000 MWh), resulting in an average annual cost of $156.44 ($0.16 per kWh) with the State of Hawaiʻi Refundable Tax Credit.

5.10.2 Potential Impacts – Socioeconomics

An Economic Impact Assessment, *Economic Impact Assessment for the West Kauaʻi Energy Project,* was conducted in October 2020 for the Proposed Action and is provided in **Appendix N**. The economic analysis shows that the Proposed Action would have direct effects, indirect effects, and induced effects, as defined below.

- **Direct Effects:** Primary effect associated with the creation of jobs, earnings, and taxes that are created in industries that are directly associated with the Proposed Action.
- **Indirect Effects:** Secondary effect associated with jobs, earnings, and taxes that are created in businesses that supply goods and services to industries that are directly associated with the Proposed Action.
- **Induced Effects:** Secondary effect associated with jobs, earnings, and taxes that are created as workers re-spend their income on goods and services due to the change in jobs and earning induced by the direct and indirect effects of the Proposed Action.

In this analysis, the 2012 Hawaiʻi Inter-County Input-Output model was used to estimate the economic impacts of the Proposed Action. The economic analysis was conducted with the following assumptions:

The PPA is not a permanent agreement. For purposes of this analysis, the duration of the PPA is set for 40 years.

a. With PPA: Savings = (Fossil fuel expenditures offset) – (Expenditures for purchasing electricity)
b. When PPA Ends: Savings = (Fossil fuel expenditures offset) – (Operation and maintenance expenditures) – (Rental payment)

Estimating savings and fossil fuel expenditures offset requires forecasting the future prices of diesel fuel and naphtha. For this analysis, it was assumed that future expectations do not change significantly over time.

1. Petroleum-fired electricity generation requires diesel fuel and naphtha as inputs. For this analysis, a 1:1 ratio for diesel fuel and naphtha was assumed.
2. The life of the Proposed Action is expected to last 63 years. Job multipliers in the model only go through 2022; therefore, the 2022 multipliers were adopted as surrogates for the analysis.

5.10.2.1Construction

Proposed Action

Total construction expenditures for the Proposed Action include pre-construction/development cost and construction cost, which was estimated at $230 million.

Under the PPA between 2010 to 2064, construction and operation and maintenance would produce 1,867 person-years (i.e., the number of full-time equivalent jobs generated each year) of employment or about 34 new jobs. Jobs created by construction would be mostly confined to the construction trades and would be short term, existing only for the duration of the construction phase. Construction schedule estimates have changed since the study was done and is currently set at 2025. AES would bear the construction expenditures, which mitigates risk to the 34,000 KIUC member-owners.

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur and no socioeconomic benefits would occur.

5.10.2.2Operation

Proposed Action

As discussed in **Section 2.2**, KIUC signed a development agreement with AES and filed a PPA with the PUC in late-2020. The PPA would provide estimated savings to KIUC and its members/customers of between $157 and $172 million (net present value using a 5% discount rate over the 25-year PPA term). The PPA would also provide pricing stability. Specifically, the energy rate and capacity charges under the subject PPA would not increase and are intended to remain fixed or stable for their applicable terms (25 years for the energy rate, 40 years for the PSH Monthly Capacity Charge, and 50 years for the Hydropower-only Monthly Capacity Charge). This would provide stability for KIUC's members and is materially lower that the forecasted cost of oil generation that the PPA would replace, thereby resulting in savings and lower effective rates for KIUC's members/customers. Specifically, the Proposed Action would replace over eight million gallons of imported oil annually, saving ratepayers an estimated average of $20 per month over the first 25 years.

The Project would have no impact on residential solar curtailment. The solar portion of the Project is primarily for the purpose of powering the pumps, and the pump and battery storage capacity would be sized to either use all the solar energy or store it.

The Project has been designed to have the ability to deliver solar power direct to KIUC’s grid, but through operational parameters this would occur only if it will offset fossil fuel generation. In certain situations such as during low-solar irradiance periods (cloudy days) existing available solar PV, including residential solar PV, would not meet electrical demand. Under these circumstances of low-solar irradiance periods, fossil fuels are currently used to provide the additional generation not provided by existing solar PV and residential solar PV to meet electrical demand. WKEP solar PV direct to grid would provide additional solar PV generation as a replacement to the fossil fuel currently used. WKEP store and release hydro generation could be combined with solar PV direct to grid during these same kinds of circumstances to offset fossil fuel use. If existing solar PV and residential solar PV meet electrical demand, WKEP solar PV generation would not be directly imported to the grid.

The Project footprint spans lands owned and managed by DLNR, DHHL, and ADC. AES would be maintaining the infrastructure for the State. This provides a benefit to the State by offsetting the long-term cost of infrastructure maintenance and improvement. The Proposed Action would bring the State-owned reservoirs into compliance with the Hawai‘i State Dam Safety Standards and make lease payments to the State for use of the required lands. The rehabilitation and long-term maintenance of these reservoirs would offer numerous benefits to the State, the local communities of Kekaha and Waimea, and the island of Kaua‘i. Since these improvements and upgrades, along with their ongoing maintenance, is 100% necessary for the production of renewable energy from the Proposed Action, these ancillary enhanced benefits to the State, the local communities of Kekaha and Waimea, and the island of Kaua‘i would come at no additional cost to the members/customers of KIUC.

Most importantly, the Proposed Action would help Kaua‘i become less reliant on fossil fuels, which is an important milestone to reaching 100% renewable energy by 2045 as mandated by State law. Instead of spending millions of dollars on imported fuel costs each year, KIUC would spend less money for the locally generated clean energy created by the Proposed Action, saving the Kaua‘i rate payers money by shifting those expenditures so that more of the dollars are retained locally.

The Proposed Action would be one of the most efficient and modern generation facilities in Hawai‘i. The hydroelectric equipment would have an overall efficiency of 85%. The total elevational drop of the Proposed Action’s hydroelectric system is almost 3,000 feet from Pu‘u Moe Divide to Mānā Reservoir, making this the highest head hydroelectric facility in Hawai‘i. This high head allows the facility to generate over 75,000 kWh from each MGD of water that passes through it, considerably more power per gallon of water than any other hydroelectric facility in Hawai‘i. Additionally, the Proposed Action’s reservoirs would provide a combined total as much as 1,500 MWh of bulk energy storage at a significantly lower cost than any battery based alternative.

The Proposed Action would support diversified agriculture through subsidized irrigation delivery to lands owned by DHHL and ADC, as well as the agricultural fields on the Mānā Plain that are managed by KAA. This would provide an increased agricultural potential for thousands of acres of public lands on the west side of Kauaʻi. It would also bring financial resources to DHHL and ADC via lease rent payments for use of State-owned lands. In addition, it would provide a reliable source of water for fire protection on DLNR, DOFAW, and DHHL lands in the Kōkeʻe area during drought seasons. In addition, the Proposed Action would further the purposes of the HHCA.

Lastly, the partnership between the State and the Applicant would enable the State to provide proper stewardship for the Waimea River through the modernization of the plantation-era stream diversions and ongoing operation of systems that will maintain the IIFS and track instream flow releases at the involved headwater tributaries of the Waimea River.

Overall, the Proposed Action would allow KIUC to spend less money to provide electricity to the island at a more fixed and stable pricing structure for foreseeable future. The Proposed Action would produce locally generated clean, firm, and dispatchable energy. This would provide various grid and reliability benefits and numerous other environmental and public interest benefits to KIUC, its members/customers, the Kauaʻi community, the public, and the State at large as previously discussed in **Section 2.3**.

Jobs directly related to construction and operation of the Proposed Action would be considered “green jobs.” which are generally defined as jobs related to preserving or restoring the environment (U.S. Bureau of Labor Statistics, 2020).

Employment

The savings derived from the Proposed Action are equivalent to 12,430 person-years of employment or about 230 new jobs that would be created if savings were added to the consumer expenditure account each year. “Person-years” is the number of full-time equivalent jobs generated each year. The savings were estimated by using the fuel expenditure offset due to the Proposed Action minus the expenditure of purchasing electricity from AES. The total fuel expenditures offset amounts to $2 billion between 2024 and 2064. The expenditure of purchasing electricity amounts to $599.2 million between 2024 and 2064. Therefore, there is a savings of $1.4 billion under the PPA to businesses and residents on Kauaʻi.

When the PPA ends in 2064, KIUC would take on the responsibilities of operation and maintenance. The operation and maintenance expenditures, rental payment, and savings together would produce 18,775 person-years of employment. The Proposed Action, during and after the PPA, would create a total of 33,113 person-years of employment or 425 jobs per year between 2010 and 2088. Jobs created by operation and maintenance expenditures and rental payments would vary but would be concentrated in the utility, engineering, and public administration fields. These would likely be long-term jobs. The types of jobs created from savings would vary as the value of savings are spread across Kauaʻi’s economy.

Earnings

Under the PPA, the construction, long-term operation and maintenance, and rental payments associated with the Proposed Action would amount to positive personal consumption expenditure earnings of $58.9 million whereas the value of savings amounts to $350 million in personal consumption expenditure earnings (i.e., more money in the pockets of KIUC ratepayers). The estimated total earnings created by the Proposed Action is estimated at $410.6 million between 2010 and 2064.

When the PPA ends in 2064, KIUC would take over the responsibility of operation and maintenance by hiring labor from the local market to manage and operate the facilities. Payroll for these positions would generate $27.4 million in earnings. The savings would generate $513.9 million of earnings. The estimated total earnings generated by the payroll of the Proposed Action would amount to $951.9 million over 78 years (2010 to 2088), or $12.2 million per year.

Fiscal Impacts

The Proposed Action would have a positive impact on State and County taxes. Under the PPA, construction and operations and maintenance expenditures would add an estimated $13.3 million to State tax revenues and $314,481 to County tax revenues between 2010 and 2064. During the same period, the savings would generate an estimated $94.6 million in State tax revenues and $2.2 million in County tax revenues. The fiscal impacts under the PPA would amount to an estimated $108.3 million and $2.6 million in State and County tax revenues, respectively.

When the PPA ends in 2064, KIUC would take over all necessary operations and maintenance. The operations and maintenance expenditures and savings would create an estimated additional $143.3 million State tax revenues and $3.4 million in County tax revenues in 23 years. Together, they would contribute to the State and County tax base at $251.6 million and $6 million, respectively. This is equivalent to adding $3.2 million to State tax revenues and $76,403 to County tax revenues annually.

No-Action Alternative

Under the No-Action Alternative, the savings from the PPA would not be realized and KIUC member-owners would continue to be subject to the volatile cost of imported fossil fuels for the electricity that the Proposed Action would have delivered. The Kōkeʻe Ditch Irrigation System and the cost of any repairs and maintenance would remain with ADC. If the Kōkeʻe Ditch Irrigation System continued reduced operations or was closed, there would be associated reduced agricultural potential on the west side of Kauaʻi. The cost of repairs and maintenance of the public access roads would remain with the State. Puʻu Lua Reservoir would remain under management of DLNR, and the cost for necessary repairs to meet Hawaiʻi State Dam Safety Standards or actions required to decommission the reservoir would fall to the State. In addition, the cost and practical implementation of delivery of water, repair of roads, and installation of an electrical power line to DHHL mauka lands would fall to DHHL, which is not part of DHHL's 20-year plan leaving the lands not viable for the foreseeable future.

Under the No-Action Alternative, there would be significant limitations on renewable energy options for Kauaʻi resulting in difficulty in reaching the State mandate of 100% renewable energy. As was discussed in **Section 4.3.1.2**, this is because hydroelectric and solar are the only two cost-effective, near-term renewable energy options for Kauaʻi. With respect to hydroelectric, there are no other feasible hydroelectric power Projects on Kauaʻi. Unlike pumped storage hydro, battery technology does not provide inexpensive bulk energy storage.

5.10.3 Avoidance and Minimization Measures – Socioeconomics

No avoidance or minimization measures are proposed or expected to be required since the Proposed Action would result in a net economic benefit.

5.11 Noise

Noise is defined as unwanted sound and is one of the most common environmental issues of concern to the public. A number of factors affect sound as it is perceived by the human ear. These include the actual level of the sound (i.e., noise), the frequencies involved, the period of exposure to the noise, and changes or fluctuations in the noise levels (HAR Chapter 12-200.1 – Occupational Noise Exposure).

The State of Hawaiʻi Community Noise Control Rule (HAR Chapter 11-46) defines three classes of zoning districts and specifies corresponding maximum permissible sound levels due to stationary noise sources such as air-conditioning units, exhaust systems, and generators. The accepted unit of measure for noise levels is the decibel (dB). The Community Noise Control Rule does not address most moving sources, such as vehicular traffic noise, air traffic noise, or rail traffic noise. However, the Community Noise Control Rule does regulate noise related to construction activities, which may not be stationary.

The State of Hawaiʻi regulates noise exposure in the following statutes and rules:

- HRS Chapter 342F – Noise Pollution
- HAR Chapter 11-46 – Community Noise Control

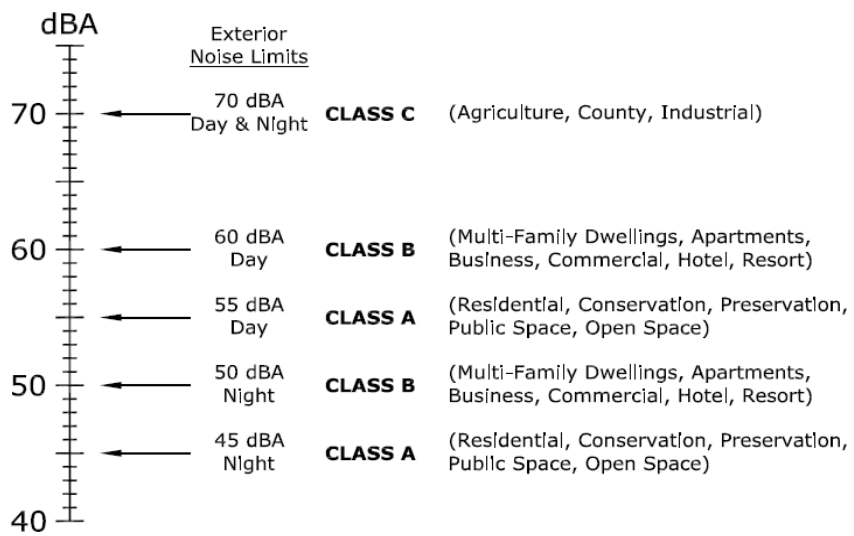
The maximum permissible noise levels are enforced by the DOH for any location at or beyond the property line and shall not be exceeded for more than 10% of the time during any 20-minute period. The specified noise limits which apply are a function of the zoning and time of day as shown in **Figure 5.24.**

With respect to mixed zoning districts, the rule specifies that the primary land use designation shall be used to determine the applicable zoning district class and the maximum permissible sound level. In determining the maximum permissible sound level, the background noise level is taken into account by the DOH.

As discussed in **Section 6.3.3**, the Proposed Action is located through several zoning designations, which include Conservation, Open, Agriculture, and areas of No Zoning. This puts most of the Project Area from the upper Kōkeʻe Ditch Irrigation System towards the Mānā Reservoir in a Class A Zoning District which has a maximum permissible sound level during daytime hours (7 AM to 10 PM) of 55 dBA and a maximum permissible sound level of 45 dBA during nighttime hours (10 PM to 7 AM). The Project Area west from the Mānā Reservoir towards the proposed PV Solar Array would be in a Class C Zoning District with a maximum permissible sound level of 70 dBA during both daytime (7 AM to 10 PM) and nighttime hours (10 PM to 7 AM). Therefore, a Community Noise Permit may be required from the Indoor and Radiological Health Branch of the DOH.

Figure 5.24. Hawaiʻi Maximum Permissible Sound Levels for Various Zoning Districts

Zoning District	Day Hours (7 AM to 10 PM)	Night Hours (10 PM to 7 AM)
CLASS A Residential, Conservation, Preservation, Public Space, Open Space	55 dBA (Exterior)	45 dBA (Exterior)
CLASS B Multi-Family Dwellings, Apartments, Business, Commercial, Hotel, Resort	60 dBA (Exterior)	50 dBA (Exterior)
CLASS C Agriculture, Country, Industrial	70 dBA (Exterior)	70 dBA (Exterior)



5.11.1 Affected Environment – Noise

The Proposed Action is located in forested and grassland areas on the west side of Kauaʻi in a relatively undeveloped area. There are no adjacent noise producers to the Project area, which creates a very quiet noise environment. Noise in the area is limited to the sound of the river, wind blowing through trees, birds, and other fauna. Since there are no sensitive receptors in the area, noise impacts aren't expected.

5.11.2 Potential Impacts – Noise

5.11.2.1 Construction

Proposed Action

Noise generated during construction of the Proposed Action would be short-term and limited to the areas of construction. Noise would be generated by construction equipment employed to implement the Proposed Action. Construction equipment would include excavators, trucks, and other heavy equipment. Earthmoving equipment (e.g., an excavator) would probably be the loudest piece of equipment used during construction. Typical noise emission levels for construction equipment are provided in **Table 5-20**.

The proposed rehabilitation of the existing Kōkeʻe Ditch Irrigation System, Puʻu Lua Reservoir, and the jeep access roads located in Kōkeʻe State Park, which is a highly utilized area for recreation (see **Section 5.6**), would have short-term and temporary noise impacts. Noise from construction may reduce the enjoyment for recreationists in the vicinity of construction. Specific noise impacts would be limited to recreation areas discussed in **Section 5.6**. However, these impacts would be short-term and temporary, and there are ample recreation opportunities throughout Kōkeʻe State Park that would not be impacted by construction noise.

Construction-generated noise in the areas west of the Puʻu Moe Divide and Kōkeʻe State Park are located in undeveloped Open Space and Agriculture lands away from residential and major population centers. Therefore, noise impacts associated with construction of the Proposed Action would be less than significant.

Table 5-20. Typical Noise Emission Levels for Construction Equipment

Type of Equipment	Noise Level at 50 feet (dBA)
Air Compressor	81
Backhoe	80
Bulldozer	82
Chain Saw	85
Concrete/Grout Pumps	82
Crawler Service Crane (100-ton)	83
Dump Truck	88
Excavator	85
Front End Loader	80
Generator	81
Jackhammer (compressed air)	85
Lift Booms	85
Pick-Up Truck	55
Power-Actuated Hammer	88
Water Pump	76
Water Truck	55

Source: FHWA, 2015

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur and there would be no noise impacts.

5.11.2.2 Operation

Proposed Action

The operation of the reservoirs, ditches, and water control infrastructure would have no noise increase from the existing noise environment.

Noise generated from the operation of the powerhouses would be contained largely within the powerhouses; however, some steady noise from rotating machinery and building ventilation fans would be present when the powerhouses were operating. The renewable energy created by the Proposed Action would offset energy that would otherwise be produced by loud existing legacy fossil generation units at either Port Allen or Kapaia, resulting in a net decrease in noise emissions for Kauaʻi's electricity generation.

The operation of the PV Solar Array, West Kauaʻi Energy Project Substation, and Interconnection Line would have no noise increase from the existing noise environment. The renewable energy created by the Proposed Action would offset energy that would otherwise be produced by loud existing legacy fossil generation units at either Port Allen or Kapaia, resulting in a net decrease in noise emissions for Kauaʻi's electricity generation.

Operation of the Proposed Action would provide positive regional noise impacts, minimal noise impacts in the immediate area of the powerhouses, and negligible noise impacts across most of the Project footprint.

No-Action Alternative

Under the No-Action Alternative, the Kōkeʻe Ditch Irrigation System would remain with ADC, which may result in a continuance of reduced operations or closure of the system. The maintenance of the public access roads would remain with the State. Puʻu Lua Reservoir would remain under management of DLNR, and the necessary repairs to meet Hawaiʻi State Dam Safety Standards or actions required to decommission the reservoir would fall to the State. Noise related to existing conditions around the existing infrastructure would remain unchanged. However, under the No-Action Alternative, there would not be an offset of energy production at the existing legacy fossil generation units at Port Allen and Kapaia, resulting in ongoing regional noise impacts.

5.11.3 Avoidance and Minimization Measures – Noise

Noise generated from short-term construction activities and the use of machinery would be minimized by requiring contractors to adhere to State and County noise regulations, including HRS Chapter 342F; HAR Title 11, Chapter 46; and Kauaʻi County Code Section 22-14. To reduce noise exposure, construction activities are generally planned to be conducted on weekdays and in daytime hours. In the event that work occurs after normal working hours (i.e., at night or on weekends), or if permissible noise levels are exceeded, appropriate permitting and monitoring, as well as development of administrative and engineering controls, would be employed.

No minimization measures are proposed for noise created during plant operations since it would be confined to the areas immediately surrounding the powerhouses.

5.12 Air Quality and GHG Emissions

5.12.1 Affected Environment – Air Quality and GHG Emissions

5.12.1.1 Air Quality

The Clean Air Act of 1972 and its 1990 Amendments and subsequent legislation regulate air emissions from area, stationary, and mobile sources. Both the U.S. Environmental Protection Agency and the State of Hawaiʻi have instituted Ambient Air Quality Standards (AAQS) to maintain air quality in the interest of public health and secondary public welfare.

At the present time, seven parameters are regulated: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. The Hawaiʻi AAQS are in some cases considerably more stringent than the comparable National Ambient Air Quality Standards (NAAQS). In particular, the Hawaiʻi 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit. **Table 5-21** illustrates the NAAQS and State AAQS and the units of measure (micrograms per cubic meter [$\mu g/m^3$] and parts per million [ppm]).

In addition to the NAAQS and the State AAQS, the DOH regulates fugitive dust. HAR Chapter 11-60.1-33, Fugitive Dust, states that no person shall cause or permit visible fugitive dust to become airborne without taking reasonable precautions, and no person shall cause or permit the discharge of visible fugitive dust beyond the property lot line on which the fugitive dust originates (DOH, 2014). This rule applies to construction Projects and would, therefore, be applicable to the Proposed Action.

There are no air quality monitoring stations on the west side of Kauaʻi. The only air quality monitoring station on the island is in Niumalu, which is a “Special Purpose Monitoring Station” that monitors source impacts from cruise ships ($PM_{2.5}$, SO_2, and NO_2) (DOH, 2021). From a qualitative perspective, air quality on the west side of Kauaʻi is affected by pollutants from natural, vehicular, agricultural, and military sources. Air quality in the vicinity of the Proposed Action is likely considered to be good due to the low density of development in the area and relatively few point source air pollutants.

Table 5-21. State of Hawai‘i and National Ambient Air Quality Standards

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawai‘i
Particulate Matter <10 microns (PM_{10})	µg/m^3	Annual 24 Hours	- 150[a]	- 150[a]	50 150[b]
Particulate Matter <2.5 microns ($PM_{2.5}$)	µg/m^3	Annual 24 Hours	12[c] 35[d]	15[c] 35[d]	- -
Sulfur Dioxide (SO_2)	ppm	Annual 24 Hours 3 Hours 1 Hour	- - - 0.075[e]	- - 0.5[b] -	0.03 0.14[b] 0.5[b] -
Nitrogen Dioxide (NO_2)	ppm	Annual 1 Hour	0.053 0.100[f]	0.053 -	0.04 -
Carbon Monoxide (CO)	ppm	8 Hours 1 Hour	9[b] 35[b]	- -	4.4[b] 9[b]
Ozone (O_3)	ppm	8 Hours	0.070[g]	0.070[g]	0.08[g]
Lead	µg/m^3	3 Months Quarter	0.15[h] 1.5[i]	0.15[h] 1.5[i]	- 1.5[i]
Hydrogen Sulfide	ppb	1 Hour	-	-	25[b]

a Not to be exceeded more than once per year on average over three years.

b Not to be exceeded more than once per year.

c Three-year average of the weighted annual arithmetic mean.

d 98th percentile value averaged over three years.

eThree-year average of fourth-highest daily 1-hour maximum.

f 98th percentile value of the daily 1-hour maximum averaged over three years.

g Three-year average of annual fourth-highest daily 8-hour maximum.

h Rolling 3-month average.

i Quarterly average.

Source: DOH, 2015

5.12.1.2 GHG Emissions

Act 234 enacted in 2007 established the foundation for Hawai‘i's GHG Program, which aimed to reduce emissions in the State to 1990 levels by 2020, excluding aviation emissions. Parts of Act 234 were codified in HRS Chapter 342B, and in 2014 HAR Section 11-60.1 was amended to adopt the GHG Program. The most recent GHG emissions report, *Hawai‘i Greenhouse Gas Emissions Report for 2017* (ICF and UHERO, 2021), indicates that the State is on target to meet the GHG reduction goals; however, goal attainment is dependent on the continued reduction of emissions from the energy sector, which includes both transportation and stationary combustion sources.

The 2017 GHG emissions report also indicates that the energy sector accounted for 86% of Hawai'i's emissions, which was estimated at 17.7 million metric tons (MMT) ±0.21 standard deviation CO_2e with 8.89 MMT coming from stationary combustion sources.

In 2018, Act 15 established Hawai'i's zero emissions clean economy target. Act 15 was codified in HRS Section 225P-5, which set a statewide target to sequester more atmospheric carbon and GHG than emitted within the State as quickly as practicable, but no later than 2045.

While the most recent publicly available State-wide GHG data is for 2017, KIUC confirms that its 2020 GHG emissions of 120,000 metric tons were already well below its 1990 GHG emissions of 224,000 metric tons.

5.12.2 Potential Impacts – Air Quality and GHG Emissions

5.12.2.1 Construction

Proposed Action

Air Quality

Construction-related impacts to air quality are anticipated with the implementation of the Proposed Action. During the short-term and temporary construction period, potential emission sources that may affect air quality at the construction sites include the following:

- Diesel and/or gasoline-powered construction equipment and motor vehicles would contribute to additional CO and CO2 in the air.
- Fugitive dust emissions resulting from excavation to rehabilitate the reservoirs, bury the proposed upper and lower penstocks and electric power lines, and repair the unpaved access roads.

Because levels of criteria pollutants in Hawai'i are consistently below Federal and State AAQS, and because the prevailing trade winds rapidly carry pollutants offshore limiting the effect on receptors, increases in levels of criteria pollutants at the Project sites and adjacent areas, including the Kawai'ele Waterbird Sanctuary, from construction activities are not expected to be significant. It is not anticipated that Federal or State AAQS would be exceeded during construction activities.

GHG Emissions

A GHG emissions study was prepared by McMillen Jacobs Associates in December 2020 to present an estimate of the anticipated carbon dioxide emissions (CO_2e) that would occur during construction, operation, and decommissioning of the Proposed Action.[13] Three phases of the Proposed Action were identified and analyzed as part of the study:

- **Construction:** Eighteen months of field construction activities using a variety of construction equipment and installation of materials.

[13] Exhibit 5 of the PUC Application (Docket No. 2020-0218); https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A21A05B22519H00102

- **Operation:** Twenty-five years of operation and maintenance.
- **Decommissioning:** Nine months of field construction activities using a variety of construction equipment.

Each phase considered three emission categories:

- **Construction Equipment Operation:** Off-highway heavy equipment used primarily for accomplishing each component of the Proposed Action.
- **Transportation Equipment Operation:** On-highway vehicles used to transport employees, equipment, and materials to and from the Project site.
- **Construction Materials Manufacturing:** Materials required to construct each component of the Proposed Action and the emissions required to manufacture these materials.

The study was prepared for the first 25 years of the PPA (i.e., for the Solar Term) and not for the additional terms of the Pumped Storage Hydropower and Hydropower-only components of the Project. The reason is that essentially all (i.e., approximately 99.9%) of the GHG emissions from the Project would come from the construction of the Proposed Action, including the manufacturing of the PV panels and the BESS, and then from the decommissioning of the PV/BESS Facility. To attempt to provide a GHG analysis beyond said 25-year period would be unreliable and unduly speculative. For example, at the end of the 25-year Solar Term for the PV/BESS Facility, the Solar Term may be further extended. At that time, if the components of the PV/BESS Facility remain operational, then any additional GHG impacts resulting from the extension would be negligible or minimal; the only difference would be that the decommissioning of the PV/BESS Facility, and the resulting GHG impacts from the decommissioning, would occur at a later date. However, if components of the PV/BESS Facility must be replaced, then there would be additional GHG impacts associated with the work to replace such components. In any event, if the 25-year Solar Term of the PV/BESS Facility was extended, KIUC would seek any approvals from the PUC that may be required for the extension at that time and would provide any GHG-related information in support of that extension in compliance with any applicable requirements imposed by the PUC and/or by law. The study was later revised in May 2021 to increase the solar PV panels manufacturing component from 72% to 73% and was submitted in response to information request CA/KIUC-IR-32[14] from the PUC's Division of Consumer Advocacy.

The study initially provided an estimate of approximately 79,726.43 metric tons of CO_2e that would occur during construction of the Proposed Action and the decommissioning of the PV/BESS Facility, as shown in **Table 5-22**.

Furthermore, the Applicant provided a revised and updated operational and lifecycle GHG emissions analysis that was submitted to the PUC as Attachment PUC-KIUC-IR-107 (Part 1).[15] The revised analysis quantified CO_2, CH_4, and N_2O listed in units of CO_2e, and included the potential

[14] https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A21E12B55350J01850; https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A21E12B55356B01853

[15] https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A21E28A84215G02176

GHGs from transporting Project equipment off-island for disposal or recycling. The results of this analysis is summarized in **Table 5-23** and **Table 5-24**. The revised/updated lifecycle GHG emissions estimate for the Proposed Action are 182,308 MT CO_2e. Although this is higher than the CO_2 values provided in the initial analysis, it is still far below the total lifecycle GHG emissions of 2,691,185 MT CO_2e that would be avoided if the Proposed Action is operated for 25 years.

Table 5-22. Estimated CO_2 Emissions During Construction and PV/BESS Decommissioning

Activity	Estimated CO_2 Emissions (metric tons)	% of Total CO_2 Emissions
Construction of the Proposed Action		
Construction Equipment Operation	5,780.726	7.251%
Transportation Equipment Operation	345.160	0.433%
Construction Materials Manufacturing	73,252.025	91.879%
Total	**79,377.911**	**99.563%**
Decommissioning of the PV/BESS Facility		
Construction Equipment Operation	334.824	0.420%
Transportation Equipment Operation	13.695	0.017%
Construction Materials Manufacturing	0.000	0.000%
Total	**348.519**	**0.437%**

Source: McMillen, 2022

Table 5-23. Total Estimated GHG Emissions for Project Operations and Lifecycle

Project Stage		GHG Intensity (kg CO_2e/MWh)	GHG Emissions (MT CO_2e)
Upstream	Raw Materials Extraction & Manufacturing	61.18	168,235
	Transportation	0.31	840
	Construction	2.88	7,914
Project Operations	Operations and Maintenance	0.45	1,225
Downstream	Transportation	0.08	233
	Decommissioning and Disposal	1.40	3,861
Total Project Operations		**0.45**	**1225**
Total Project Lifecycle		**66.29**	**182,308**

Source: KIUC, 2022

Table 5-24. Net Avoided Emissions

Total Project Offset During Operations	**734**	**2,018,487**
Total Project Offset For Lifecycle	**912**	**2,508,877**

Source: KIUC, 2022

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur; therefore, there would be no air quality impacts associated with construction of the Proposed Action.

5.12.2.2 Operation

Proposed Action

Air Quality

The proposed rehabilitation of existing State infrastructure would allow for continued operation of the upper Kōkeʻe Ditch Irrigation System, reservoirs, and access roads in the long-term with no adverse impact to air quality. The operation of the Proposed Action with energy generated from both solar and hydroelectric would have a beneficial effect on air quality by reducing fossil-fuel energy generation and the associated air emissions.

GHG Emissions

The Applicant estimates that the Proposed Action would result in KIUC using approximately 7.8 million less gallons of naphtha fuel and 775,000 less gallons of ultra-low sulfur diesel fuel during a full year of production, which would result in an estimated annual reduction of about 80,000 tons of CO_2e. As a result, after only one year of operation, the Applicant would have caused enough of a reduction in GHG emissions from its lower fuel consumption to offset the GHG emissions from the construction, first 25 years of operation of the Proposed Action, and decommissioning of the PV/BESS Facility.

Hydroelectric power generation and pumping of water for agricultural purposes does not create noxious emissions. The Proposed Action would provide an estimated 30 GWh of hydroelectric generation annually and up to 80 GWh of firmed solar generation. Like noise emissions, this increase in generation of renewable energy from the Proposed Action would decrease the required generation of electricity from fossil fuel sources and the resultant GHG emissions. The Proposed Action would produce up to 110,000 MWh of renewable energy, which would reduce the need for fossil fuels that would equate to the reduction of 80,000 metric tons of GHG emissions (CO_2 equivalent) ($MTCO_2e$) each year, or an estimated net reduction in GHG emissions of approximately 2,018,487 $MTCO_2e$ for the Proposed Action's operation stage and 2,508,877 $MTCO_2e$ for the Proposed Action's lifecycle over 25 years. By displacing fossil fuel power generation and reducing GHG emissions, the Proposed Action would have a beneficial impact on air quality elsewhere in Hawaiʻi.

No-Action Alternative

Under the No-Action Alternative, without improvements to the Kōkeʻe Ditch Irrigation System or the reservoirs and without construction of the integrated renewable energy and irrigation project, there would be significant limitations on renewable energy options for Kauaʻi. Rehabilitation and ongoing maintenance of existing reservoirs and the Kōkeʻe Ditch Irrigation System would remain the responsibility of the State, which could lead to reservoirs being decommissioned and closure of the Kōkeʻe Ditch Irrigation System, significantly limiting the use of the resources for potential renewable energy projects in the future. If a No-Action Alternative takes place, the island would continue to rely on energy generated from fossil fuels which would continue to contribute GHG emissions that affect local and statewide air quality. The estimated GHGs for fossil fuel generation under the No-Action Alternative are summarized in **Table 5-25**.

Table 5-25. Fossil Fuel Emissions under the No Action Alternative

Estimated During Fossil Fuel Operations	**734**	**2,019,712**
Estimated During Fossil Fuel Lifecycle	**979**	**2,691,185**

Source: KIUC, 2022

5.12.3 Avoidance and Minimization Measures – Air Quality and GHG Emissions

A dust control plan would be developed and implemented to minimize fugitive dust during construction, to be approved by the DOH. The plan would include some or all of the following measures:

- Watering of active work areas and Project access roads, as needed
- Screening piles of materials from wind, if appropriate
- Installing dust screens or wind barriers around construction sites, if appropriate
- Covering open trucks carrying construction materials
- Limiting areas to be disturbed at any given time
- Mulching or chemically stabilizing inactive areas that have been disturbed

Additionally, contractors would be required to maintain equipment with emissions controls.

5.13 Natural Hazards

5.13.1 Affected Environment – Natural Hazards

5.13.1.1 Floods and Tsunami

As shown in **Figure 5.25**, all of the proposed facilities except the PV Solar Array are located in Flood Zone X, which is not considered a flood hazard area and outside of the tsunami evacuation zone. A portion of the PV Solar Array is located on the Mānā Plain in Flood Hazard Zone A, which is an area subject to inundation by the 1% annual chance flood event, and the tsunami evacuation zone. These facilities would be designed to be compatible with being located in a Flood Hazard Zone given the solar panels would be elevated several feet off the ground so as not to be impacted by flood waters. As an unmanned facility, there would be no public safety issues associated with being in the Flood Hazard Zone or the tsunami evacuation zone.

The Mānā Plain is protected by an extensive series of channels and pumps that were installed by the Kekaha Sugar Company in 1923 to drain the low terrain to provide land for agriculture. The drainage system consists of approximately 34 miles of interceptor, side, and arterial ditches. Its primary functions are (1) to support agricultural production during the growing season by maintaining the water table below the root zone, and (2) to divert storm runoff from the adjacent uplands away from farmland. These channels and pumps are managed as part of the long-term agricultural operations on the Mānā Plain. Additional information about the Mānā Plain Ditch System is provided in **Section 1.1.6.3**.

5.13.1.2 Earthquakes

Strong earthquakes endanger people and property by shaking structures and by causing ground cracks, ground settling, and landslides. The size of an earthquake is commonly expressed by its magnitude on the Richter scale, which is a measure of the relative size of the earthquake wave recorded on seismographs. Thousands of earthquakes occur every year in Hawaiʻi, most on and around the Island of Hawaiʻi. Many of these earthquakes are directly related to volcanic activity. The entire island of Kauaʻi is rated Seismic Hazard Zone A. Zone A is defined as having a “very small probability of experiencing damaging earthquake effects” (USGS, 2017).

5.13.1.3 Hurricanes and Tropical Storms

The Hawaiian Islands are seasonally affected by Pacific hurricanes from June through November. On average, there are between four and five tropical cyclones observed in the Central Pacific every year. The State has been affected by significant hurricanes and tropical storms over the years. These include Hiki (1950), Nina (1957), Dot (1959), ʻIwa (1982), ʻIniki (1992), Iselle (2014), Lane (2018), and Olivia (2018). Hurricane ʻIniki in 1992 passed directly over the island of Kauaʻi as a category 4 hurricane and was the strongest hurricane to ever hit the Hawaiian Islands. According to a report presented at the International Union of Conservation of Nature World Conservation Congress, global climate change could mean that Hawaiʻi may experience more frequent and more severe hurricanes in the future (HNN, 2016).

Figure 5.25. Flood Hazard Zones

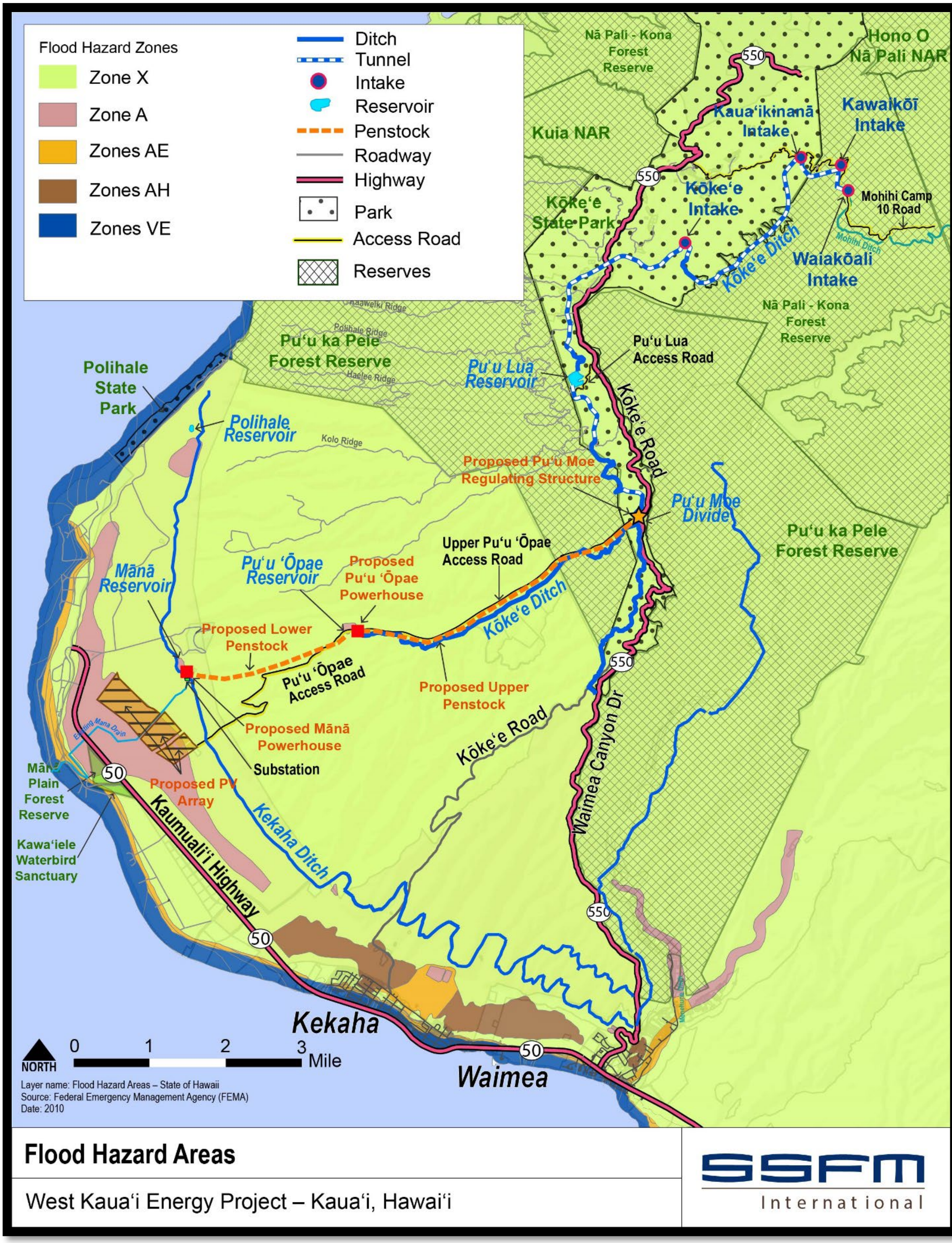
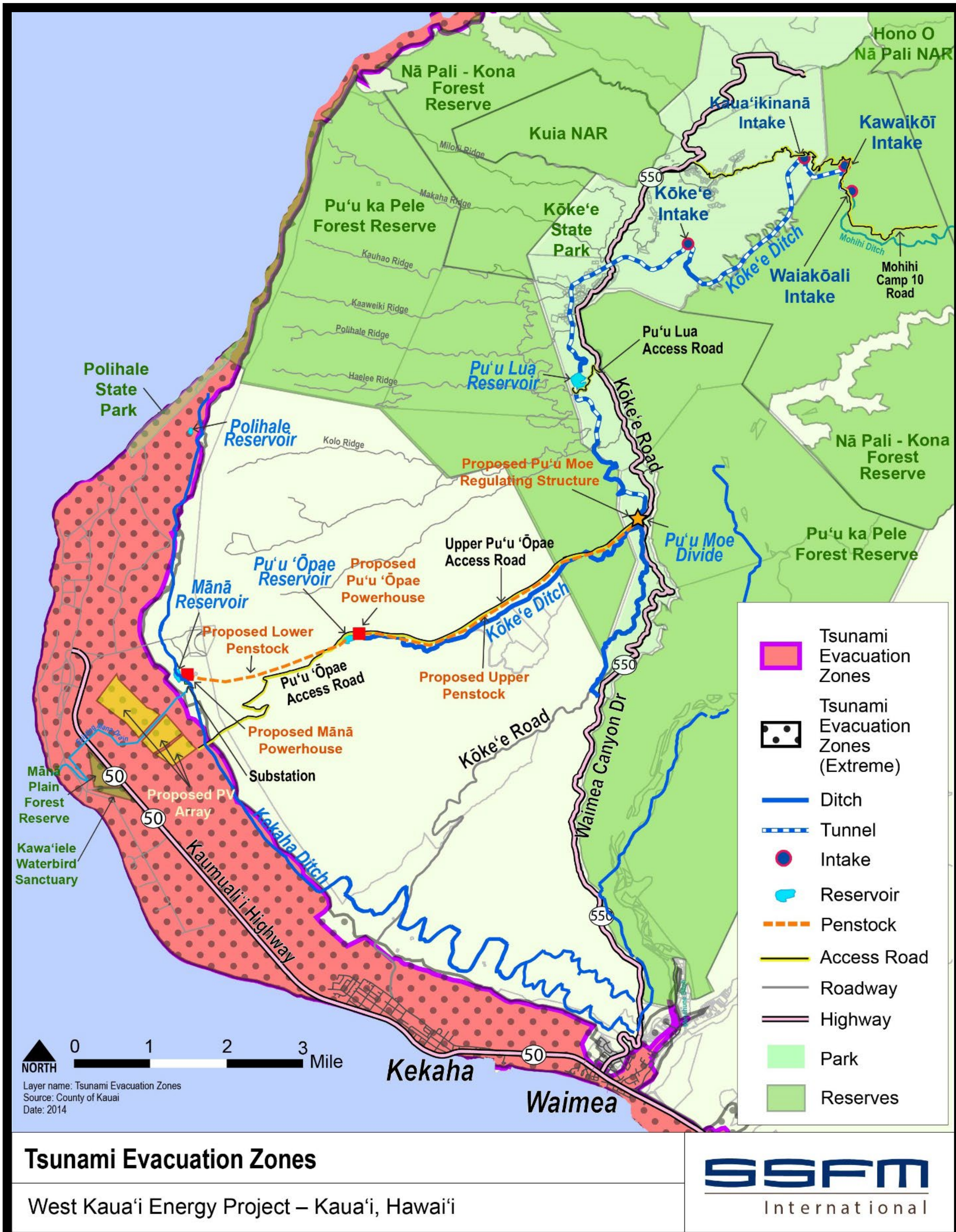


Figure 5.26. Tsunami Evacuation Zones



5.13.1.4 Wildfire

Steep slopes, rough terrain, difficult access, and a large percentage of highly ignitable invasive grasses and numerous threatened and endangered native species characterize the Kauaʻi landscape. Coupled with warm weather, recurring drought conditions, changes in land use, and a history of human-caused fires puts the area at increased risk of wildfire. The proximity of development to fire-prone wildlands present hazardous conditions that now threaten Kauaʻi communities and natural resources. Overgrown vegetation close to homes, pockets of open space within subdivisions, and an increase of non-native high fire-intensity plants around developed areas and native forests pose increasing threats to commercial, community, environmental, and residential resources. Together, these factors create the fire environment that puts Kauaʻi at risk of wildfire.

The wildland-urban interface area where developed areas, roads, and community infrastructure abuts undeveloped land is where the majority of wildfire ignitions occur. Most wildfires on Kauaʻi are caused by human error or arson, especially near developments, power line rights-of-way, and along roadsides. Wildfires in lesser developed areas, fallow agricultural lands, and in the higher elevations also spread and threaten natural areas, and the native and protected species they may contain (HWMO, 2016).

5.13.2 Potential Impacts – Natural Hazards

5.13.2.1 Construction

Proposed Action

Short-term construction under the Proposed Action would not create conditions that would exacerbate natural hazards. The Kauaʻi Emergency management Agency coordinates and integrates efforts among all levels of government and the private sector to mitigate against, prepare for, respond to, and recover from natural disasters, acts of terrorism, and other threats and hazards. Construction personnel would respond to any Emergency messages or alerts, as appropriate, to ensure their safety during construction.

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur, and no conditions would exist that exacerbate natural hazards.

5.13.2.2 Operation

Proposed Action

The existing upper Kōkeʻe Ditch Irrigation System, Puʻu Moe Regulating Structure and Upper Penstock, reservoirs, and access roads have been operational for decades, without significant damage from natural hazards. These facilities were built to withstand their natural environment, and it is expected that they will continue to do so. The rehabilitation of these existing infrastructures would increase the stability and integrity of the structures for the long-term against future natural hazards. Specifically, the Proposed Action would rehabilitate old plantation irrigation ditches, reservoirs, and access roads, which would in turn improve public safety and increase the stability and integrity of the structures for the long-term against future natural hazards.

The repairs to the Puʻu Lua Reservoir, Puʻu ʻŌpae Reservoir, and Mānā Reservoir would bring the reservoirs into compliance with Hawaiʻi State Dam Safety Standards, which would greatly decrease the risk of a dam breach and associated resultant downstream flooding. In addition, the automation of the diversions and water level monitoring systems to be installed at each reservoir and flow gages in the streams and ditches would provide information to the control system and allow for responsive diversion flow management as the stream flow changes. In addition, the long-term maintenance and operation of the Puʻu Lua Reservoir and Puʻu ʻŌpae Reservoir would provide reliable sources of water for helicopters during firefighting operations, thereby improving fire protection in these areas.

A hydrology study was performed to delineate flood hazards based on existing conditions at the proposed PV Solar Array location. Based on preliminary design, the critical power infrastructure (such as batteries, inverters, substation, and switchyard) would be sited on the mauka side of the Mānā Plain at higher elevation in FEMA Flood Zone X and where the flood depth of a 100-year flood event ranges from 0.01 to 3.0 feet. Critical infrastructure would be located outside of FEMA Flood Zone A. Based on preliminary design, some portions of the PV Solar Array trackers are located in FEMA Flood Zone A, in areas where the flow depth ranges from 1.0 to 5.0 feet. The height of the panels and other equipment shall be taken into consideration and sited to be compatible with the FEMA Flood Zone A. The design of the proposed PV Solar Array would be compatible with being in the flood hazard zone and SLR-XA and would be able to withstand inundation during the prime lifetime of the facility. The PV panels would be designed to provide a 2-foot clearance above the anticipated 100-year flood depth when the panels are at their lowest position. It is not anticipated that sea level rise would have an impact on the PV array during its anticipated useful life span of 25 to 30 years. In addition, the PV Solar Array is designed to withstand approximately 100 plus mile per hour winds, and the solar array's tracker system has a stow function for high wind and/or extreme weather events. The Applicant has several operating solar projects on the island and across the state in highly corrosive environments. All Project components are designed to withstand corrosion and rust. The steel support piles that hold the mounting system for the solar panels are specifically rated for the environmental conditions. Increased galvanization thickness would be used to address potential corrosiveness from salt, rust, and potential water inundation of the area surrounding the solar PV array.

The series of channels and pumps that make up the Mānā Plain storm drainage system and were installed by the Kekaha Sugar Company in 1923 are managed as part of the long-term agricultural operations on the Mānā Plain and are not part of the Proposed Action. Power for the pumps that drain Mānā Plain is primarily provided by the existing hydropower facilities on Kekaha Ditch (Waimea Mauka and Waiawa), which are managed by KAA. An additional source of power for the pumps is the KIUC electric grid, which provides power to KAA when the Waimea Mauka and Waiawa Hydropower Plants do not generate sufficient power for KAA operations including the drainage pumps. These pumps have been operating successfully since their installation, but there is no backup generator to power pumping during power outages. The Mānā Plain can absorb and handle weeks without pumping during major power outages because flood water flows from Mānā Plain by way of gravity to the ocean at Kinikini.

The Project Substation for the Proposed Action would be designed in accordance with engineering standards for high water level events associated with both flood inundation and tsunami events and would be sited on the mauka side of the Mānā Plain at higher elevation in FEMA Flood Zone X and where the flood depth of a 100-year flood event ranges from 0.01 to 3.0 feet. This new Project Substation would allow for decommissioning of the existing Mānā Substation, which is located in Flood Zone A (an area more prone to flooding); therefore, the Proposed Action may provide enhanced flood protection to KIUC’s system from water inundation.

No-Action Alternative

Under the No-Action Alternative, potential impacts associated with natural hazards would be the same as current conditions.

5.13.3 Avoidance and Minimization Measures – Natural Hazards

All existing and proposed facilities are unmanned, and continuous real-time monitoring of the Project would be performed by the SCADA system. The only time personnel visit the facilities is for inspections and/or maintenance. Personnel would respond to any Emergency messages or alerts, as appropriate, to ensure their safety during these visits to the facilities.

5.14 Climate Change and Sea Level Rise

5.14.1 Affected Environment – Climate Change and Sea Level Rise

5.14.1.1 Climate Change

Climate change is a long-term shift in patterns of temperature, precipitation, humidity, wind, and seasons. Scientific data show that earth’s climate has been warming. This warming is mostly attributable to rising levels of carbon dioxide and other GHG generated by human activity. These changes are already impacting Hawai‘i through rising sea levels, increasing ocean acidity, changing rainfall patterns, decreasing stream flows, and changing wind and wave patterns.

While the earth’s climate experiences natural change and variability over geologic time, the changes that have occurred over the last century due to human input of GHG into the atmosphere are unprecedented (HCCMAC, 2017). The State of Hawai‘i and Kaua‘i have relied heavily on fossil fuels for energy production, which has contributed to global GHG emissions. Over the past 10 years, Kaua‘i has been successful in reducing its GHG emission more than 60% from the electricity generation sector by KIUC’s successful efforts in implementing new renewable generation facilities.

5.14.1.2 Sea Level Rise

Sea levels are rising at increasing rates due to global warming of the atmosphere and oceans and melting of glaciers and ice sheets (HCCMAC, 2017). These rising seas and the Projection for more increased tropical storms in the Pacific Ocean would increase Hawai‘i’s vulnerability from coastal inundation and erosion. According to the Intergovernmental Panel on Climate Change, if global GHG were to continue at a “business as usual” scenario, it is expected that a 3.2-foot sea level rise could occur by the year 2100 and, to some Projections, as early as the year 2060, and would continue to rise in the future. Therefore, the *Hawai‘i Sea Level Rise Vulnerability and Adaptation Report (2017)* adopted by the State of Hawai‘i suggests that planning for a 3.2-foot sea level rise should happen now (HCCMAC, 2017).

As such, the sea level rise exposure area (SLR-XA) has been developed for the State in order to model and determine the potential future exposure of each island to multiple coastal hazards as a result of sea level rise. The SLR-XA is the footprint of three coastal hazards: passive “bathtub” flooding, annual high wave flooding, and coastal erosion. Using the SLR-XA to assess sea level rise impacts and coastal hazard exposure would support efforts to encourage Hawaiʻi’s adaptation to sea level rise. The impacts of sea level rise on the communities of Kauaʻi have the potential to exacerbate existing challenges such as aging infrastructure, planning for future growth, and the lack of affordable housing (HCCMAC, 2017). According to the *Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report (2017),* approximately 5,760 acres of land on Kauaʻi is estimated to be located in the SLR-XA with 3.2-feet of sea level rise by the mid- to latter-half of the century. It is noted that while specific responses to sea level rise would need to be place-based, larger regional issues should also be considered, such as determining whether to armor the coastline or to relocate roads and other critical infrastructure inland (HCCMAC, 2017).

As shown in **Figure 5.27**, a 3.2-foot sea level rise scenario would occur in the area of the proposed PV Solar Array. However, the Mānā Plain is protected by an extensive series of channels and pumps that were installed by the Kekaha Sugar Company in 1923 to drain the low terrain to provide land for agriculture. These channels and pumps are managed as part of the long-term agricultural operations on the Mānā Plain. The pumps are powered by electricity generated at the Waimea Mauka and Waiawa hydropower plants, with backup power provided by the KIUC electric grid. If power outages occur that impact pumping operations, the storm drain system can still drain via gravity flow at Kinikini Ditch for extended periods. The Mānā Plain can absorb and handle water inundation without pumping during power outages because flood water flows from Mānā Plain by way of gravity to the ocean at Kinikini Ditch. Kinikini Ditch is the most northern outlet at Kawaiʻele and is shown on **Figure 4.46** and **Figure 4.49**.

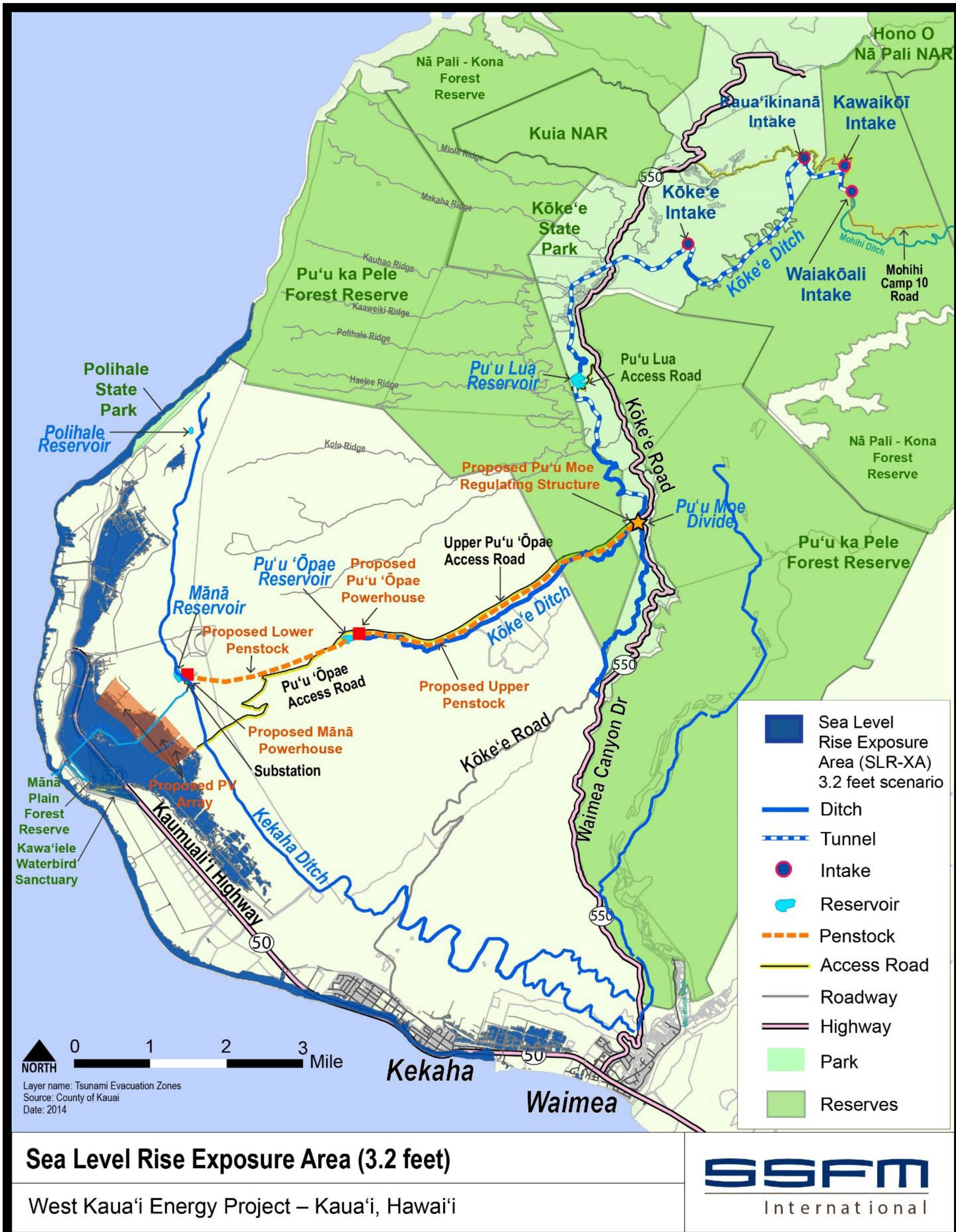
5.14.2 Potential Impacts – Climate Change and Sea Level Rise

5.14.2.1 Construction

Proposed Action

Due to Projections that suggest that a 3.2-foot sea level rise scenario will not occur until as early as mid-century, construction of the Proposed Action is not expected to be impacted. Short-term construction of the Proposed Action is expected to occur way before mid-century. However, increased tropical cyclones in the Pacific due to climate change is occurring and may impact construction of the Proposed Action if construction were to occur during hurricane season. Construction personnel would respond to any County of Kauaʻi Emergency alerts, as appropriate, to ensure safety during construction.

Figure 5.27. Sea Level Rise Exposure Area



Diesel and/or gasoline-powered construction equipment and motor vehicles would contribute to global GHG emissions. However, contractors would be required to maintain construction equipment with emissions controls. As previously stated, the Applicant estimates that the Proposed Action would result in KIUC using approximately 7.8 million less gallons of naphtha fuel and 775,000 less gallons of ultra-low sulfur diesel fuel during a full year of production, which would result in an estimated annual reduction of about 80,000 tons of CO_2e. As a result, after only one year of operation, the Applicant would have caused enough of a reduction in GHG emissions from its lower fuel consumption to offset the GHG emissions from the construction, first 25 years of operation of the Proposed Action, and decommissioning of the PV/BESS Facility.

No-Action Alternative

Under the No-Action Alternative, no construction activities associated with the Proposed Action would occur; therefore, there would be no construction-related emissions that contribute to global climate change.

5.14.2.2 Operation

Proposed Action

Operation of the Proposed Action would not contribute to global GHG emissions and climate change. The operation of the Proposed Action would have substantial beneficial impacts by reducing the State and Kauaʻi's reliance on fossil fuels and their contribution to global climate change by helping to meet the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045. The Proposed Action would produce renewable energy through the proposed hydroelectric and solar energy generating infrastructures and facilities. In addition, the Proposed Action would help KIUC make significant progress toward 100% renewable energy. The Proposed Action would produce up to 110,000 MWh of renewable energy, which would reduce the need for fossil fuels that would equate to the reduction of 80,000 metric tons of GHG emissions (CO_2 equivalent) each year. The Proposed Action would result in a 62% reduction in the use of fossil fuels and save 8.5 million gallons per year.

A future downward trend and reduction in stream flows would have no operational effect on the Proposed Action. Precipitation and resulting streamflow is highly variable and differs considerably from year to year. The diversions and the hydropower facilities are both operated continuously with varying stream flows, floods, and droughts. Any small trends over time would not impact operations. Information on water availability for the Project can be found in **Section 4.1.1.2**.

There would be economic impacts resulting from a downward trend in streamflow since total volume of water that is available for diversion directly correlates to the amount of energy produced by the hydroelectric facility. However, the modeling of water availability for the Project diversion and the energy production estimates both accounted for prolonged periods of drought combined with intermittent high streamflow events.

Outside of the significant global and regional impacts associated with climate change, there are environmental effects specifically related to the Proposed Action and climate change. If natural streamflows decrease for any reason, including long-term climate change related reasons, the balance of diverted water to water left in the stream will shift to favor water being left in the stream. This is because the IIFS, which is the amount left in the stream and not diverted, is a fixed amount and diversion flows are subordinate to the IIFS flow releases. If streamflows decrease, the IIFS remains the same and the diverted volume decreases. Therefore, environmental impacts due to the Proposed Action and long-term decreases in natural streamflow would not occur. Additionally, the Hawaiʻi IFS process is designed to address changing conditions. If there are changes in resource, species, water use, or any other pertinent factor at the site, then CWRM can change the IIFS volume to reflect the changed circumstances.

The operation of the proposed PV Solar Array located on the low-lying Mānā Plain would potentially be impacted by flooding due to sea level rise in the mid- to latter- half of the century. However, the design of the proposed PV Solar Array would be compatible with being in the flood hazard zone and SLR-XA and would be able to withstand inundation during the prime lifetime of the facility. The PV panels would be designed to provide a 2-foot clearance above the anticipated 100-year flood depth when the panels are at their lowest position. It is not anticipated that sea level rise would have a material impact on the PV array during its anticipated useful life span of 25 to 30 years. The Applicant has several operating solar projects on the island and across the state in highly corrosive environments. All Project components are designed to withstand corrosion and rust. The steel support piles that hold the mounting system for the solar panels are specifically rated for the environmental conditions. Increased galvanization thickness would be used to address potential corrosiveness from salt, rust, and potential water inundation of the area surrounding the solar PV array. In addition, the Mānā Plain is protected by an extensive series of channels and pumps that were installed by the Kekaha Sugar Company in 1923 to drain the low terrain to provide land for agriculture. These channels and pumps are managed as part of the long-term agricultural operations on the Mānā Plain and are not part of the Proposed Action.

No-Action Alternative

Under the No-Action Alternative, no hydroelectric or solar energy generating infrastructure that produce renewable energy would be constructed and the State and Kauaʻi would continue to rely heavily for a longer period on energy generated from fossil fuels that contribute to global climate change and would exacerbate coastal hazards due to sea level rise. The State and the County of Kauaʻi would be delayed in meeting their future renewable energy goals, and KIUC would likely have to rely on additional solar plus battery storage to meet the 2045 mandate. This would present significant challenges, such as identifying alternative long-duration storage options and improving grid stability with such a high proportion of intermittent solar resources as discussed in **Section 0**.

5.14.3 Avoidance and Minimization Measures – Climate Change and Sea Level Rise

GHG emissions generated from the use of diesel and/or gasoline-powered construction equipment and motor vehicles for short-term construction activities would be minimized by requiring contractors to maintain equipment with emissions controls. In addition, the PV Solar Array and facilities located in the SLR-XA would be designed to increase flood resiliency to sea level rise and coastal hazards.

No minimization or mitigation measures for climate change are proposed for the operation of the Proposed Action as no GHG emissions would be produced.

5.15 Secondary Impacts and Cumulative Effects

Secondary impacts are those effects that are caused by an action and are later in time or farther removed in distance but are reasonably foreseeable. They may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water or other natural systems. The partnership between the State and the Applicant would enable the State to provide for proper stewardship for the Waimea River and existing State infrastructure, while expanding agriculture, energy production, and DHHL's Kuleana Subsistence Agricultural Lots development on the west side of Kauaʻi. The Proposed Action would not utilize Class A lands or lands designated as Important Agricultural Lands. The Proposed Action would be located in an area that is designated by the State of Hawaiʻi for agricultural land use and would be subject to the requirements of HRS Chapter 205, which specifies the permitted uses in the various State land use districts (see **Section 6.2.2**). Use of Class B agricultural lands on for the PV Solar Array would provide revenue for ADC that would benefit other agricultural activities. Therefore, the Proposed Action would have potential beneficial secondary impacts in terms of the potential expansion of agricultural opportunities and DHHL's Kuleana Subsistence Agricultural Lots development due to delivery of water for irrigation to ADC and DHHL lands, as discussed in **Section 1.4**.

Cumulative effects refer to the impacts on the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant impacts taking place over time. The Proposed Action involves the continued operation of the existing Kōkeʻe Ditch Irrigation System and three existing reservoirs and includes both the rehabilitation of existing State infrastructure as well as new construction of a renewable energy and irrigation Project. There would be no cumulative impacts from construction, repairs, or improvements of the Project facilities. All potential impacts from the construction of new solar, hydroelectric, and irrigation infrastructure and facilities would be short-term and temporary during construction and would be minimized through the implementation of appropriate BMPs. Therefore, construction of the Proposed Action would not result in negative cumulative impacts.

Operation of the Proposed Action could result in beneficial cumulative impacts from improved air quality associated with the reduction of the use of fossil fuels and improved stream health from cumulative years of compliance with the Phase Two IIFS.

The stream water discharged from Mānā Reservoir that would not be used for irrigation, and would be conveyed to the Mānā Plain Storm Drainage System would be clean, filtered water from Kōkeʻe streams. Because the discharge is conveyed through a pipe to the storm drain system, it would not come into contact with agriculture fields and therefore not contain any potential pesticide runoff from those fields. The West Kauaʻi Energy Project discharge would not convey sediment into the storm drain system and is expected to dilute any potential pollutants already present in the system from other sources.

The Proposed Action would assist KIUC in meeting the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045.

Minimization and avoidance measures would be implemented to address one (1) potential negative cumulative impact from Project operations. This involves the diversion at the four streams feeding into the Kōkeʻe Ditch Irrigation System. These diversions are currently active and have been since the early 1900s. As noted in **Section 1.2**, the Waimea Mediation Agreement outlined Phase One and Phase Two IIFS for both the Kōkeʻe and Kekaha Ditch Irrigation Systems and the Waimea River downstream of both ditch systems. The Phase Two IIFS was established and approved on the Kōkeʻe Ditch Irrigation System for the Proposed Action and associated diversion and ditch operations, and with the understanding that the Kekaha Ditch Irrigation System would be operating simultaneously for both irrigation and hydroelectric purposes. The Phase Two IIFS would go into effect upon implementation of the Proposed Action. The Proposed Action would minimize the impact of diversion activities by implementing the Phase Two IIFS, which has been set by CWRM and deemed sufficient to meet the instream needs including stream biota and habitat. During the operation phase of the Proposed Action, all four streams would maintain mauka to makai connectivity and the maintenance and monitoring of the Kōkeʻe Ditch Irrigation System would be improved. The modifications associated with the Proposed Action would increase the reliability, consistency, and longevity of IIFS implementation and increase data collection on the Kōkeʻe Ditch Irrigation System.

According to the stream habitat assessment completed for the Project, the *Puʻu ʻŌpae Hydropower Diversion Assessment using HSHEP Model*, which is provided in **Appendix G**, potential impacts of the Kōkeʻe Ditch diversions are minimized due to the location of the diversions in the upper reaches of the watershed; the instream habitat was in good condition during then current diversion operations that did not provide for implementation of the Phase One IIFS since the necessary modifications were not completed at that time. The assessment also concluded that the implementation of the Phase Two IIFS through the Proposed Action would benefit instream habitat and aquatic biota. Additionally, the Proposed Action would be the only source of irrigation for the mauka lands and has the capacity to provide irrigation for the agricultural fields on the Mānā Plain, thereby reducing the reliance on the Kekaha Ditch Irrigation System and resulting in reduced diversion pressures of streams in the lower reaches of the Waimea River watershed where native species are more prevalent and aquatic habitat needs are higher. This beneficial cumulative impact is aligned with the goals and intentions set forth in the Waimea Mediation Agreement, which was discussed in **Section 1.2**.

Also, the Waimea Mediation Agreement addresses potential cumulative impacts of simultaneous operation of the Proposed Action and the Kekaha Ditch Irrigation System diversions. In Section D, IIFS Numbers, the Waimea Mediation Agreement states:

"If Phase Two goes into operation, the Commission will examine the amounts being diverted at Koaiʻe and at Waiahulu with the goal of increasing the total IIFS numbers for these two streams."

The new Interconnection Line would be owned and operated by KIUC as part of its island-wide electrical grid system. Therefore, the Interconnection Line would be part of a larger and separate operational system outside of WKEP. The new Interconnection Line has the potential to impact three species of threatened and endangered seabirds including Newell's shearwater, Hawaiian Petrel, and band-rumped storm petrel, and five threatened and endangered species of waterbirds including Hawaiian goose, Hawaiian duck, Hawaiian coot, Hawaiian stilt, and Hawaiian common gallinule. As part of KIUC's island-wide electrical grid system, the new Interconnection Line would be covered under KIUC's Habitat Conservation Plan (HCP), and would comply with HCP minimization, avoidance, monitoring and reporting measures included in the HCP. Any potential impacts that cannot be minimized or avoided would be mitigated through KIUC's HCP mitigation strategy.

Potential impacts associated with KIUC's island-wide electrical grid system are currently covered through an agreed upon extension of KIUC's Short Term HCP and early implementation of the longer-term HCP that is currently in development. Even though the Short-Term HCP was limited to a period of five years ending in 2016, KIUC, in coordination with USFWS and DOFAW, continued implementing minimization, avoidance, and mitigation as outlined in the Short-Term HCP beyond the five-year term. In addition, in consultation with USFWS and DOFAW, KIUC expanded minimization, avoidance, and mitigation actions beyond the scope of the Short-Term HCP and consistent with the development of the longer-term HCP. In collaboration with USFWS and DOFAW, KIUC has been developing the new HCP that will likely have a permit term of 30 to 50 years and would address the potential for take through powerline collision of three species of threatened and endangered seabirds including Newell's shearwater, Hawaiian petrel, and band-rumped storm petrel, and five threatened and endangered species of waterbirds including Hawaiian goose, Hawaiian duck, Hawaiian coot, Hawaiian stilt, and Hawaiian common gallinule. The longer-term draft HCP is expected to be ready for submission to the Endangered Species Recovery Committee and for public review in the first quarter of 2023. Because the new HCP is being developed in collaboration with USFWS and DOFAW, a Federal Incidental Take Permit and State Incidental Take License is anticipated as a result of completion and approval of the new HCP.

5.16 Irretrievable and Irreversible Commitment of Resources

The Proposed Action includes the continued operation of the Kōkeʻe Ditch Irrigation System for the diversion of water for hydroelectric energy production and irrigation. The water diverted would be stored in the reservoirs or made available for irrigation purposes to adjacent agricultural lands and for renewable energy generation.

As discussed in **Section 5.1**, the repairs and maintenance of the existing Kōkeʻe Ditch Irrigation System would ensure efficient and reliable water delivery and longevity of the system. The installation of regulating equipment along the existing Kōkeʻe Ditch Irrigation System, penstocks, reservoirs, and irrigation infrastructure, and the continuous real-time monitoring of the Project by the SCADA system would ensure efficient monitoring and controlled flow releases of water resources for the beneficial uses of renewable energy generation and irrigation. This would ensure that instream flow requirements set by CWRM would be met and that diversion practices would not substantially impact natural streams. The operation of the Puʻu Lua Reservoir, Puʻu ʻŌpae Reservoir, and Mānā Reservoir would be coordinated to utilize the storage capacity to the greatest possible extent for energy production, water conservation, and agricultural benefit while ensuring that connectivity in natural stream channels is maintained even during periods of drought.

The Project would rehabilitate old plantation irrigation ditches, reservoirs, and improve road access, which would in turn improve public safety and increase the stability and integrity of the structures for the long-term against future natural hazards. This includes providing increased opportunities for public access and recreational opportunities associated with the Puʻu Lua Reservoir. Without the Project, existing abandoned infrastructure would continue to deteriorate.

The Project would also provide employment opportunities in both the short-term and the long-term, additional tax base to the State and County, and lease revenues to DHHL and ADC. It is estimated that approximately 200 short-term jobs would be created during the construction phase of the Project. As stated in a socioeconomic impact assessment for the Project, "[t]he construction, long-term operation and maintenance expenditures, and the savings from the petroleum offset will create a total of 27,320 person-years of employment over 78 years. The construction and [Operation and Maintenance] payroll will generate a sum of $788.3 million of earnings in Kauaʻi throughout the Project. The Project will also add an estimated $207.4 million and $4.9 million to the State and County tax base, respectively."

As discussed in **Section 5.5** the Project will result in irretrievable and irreversible commitments of resources for historic properties to be affected by construction of the Proposed Action: Kōkeʻe Ditch Irrigation System (SIHP #50-30-02-2417), house site (SIHP #50-30-05-2113), abandoned road (CSH 2), hearths (CSH 3), Kekaha Sugar Company field infrastructure (CSH 4), basalt wall (CSH 5), and Mānā Reservoir (CSH 7). The Proposed Action would result in an "Effect, with agreed upon mitigation commitments" under HAR Section 13-275-7 and HAR Section 13-284-7, and an "Adverse effect" under 36 CFR Section 800.5(1) for nine of the 12 properties evaluated as historically significant in the RLS. The effects are due to various changes proposed at each resource, which in some cases results in partial or full demolitions or other alterations that affect historic integrity. However, mitigation actions recommended by SHPD would be implemented to offset these effects.

It is recommended that archaeological monitoring be conducted during construction of the Upper Penstock as well as along the Lower Penstock between the crest of Niu Ridge and Kekaha Ditch. There remains a possibility for additional cultural materials, deposits, and unidentified sites to be present within these portions of the Project area. Archaeological monitoring is recommended due to the traditional and historical land use of the area. BMPs to minimize and mitigate potential impacts to unidentified human remains, burials, or historic properties would be followed prior and during construction activities, as documented in **Section 5.5.3**.

While some of the identified effects result in the partial or full demolition or alteration of the historic properties, which may be perceived as an irrevocable commitment of the property, none of these effects will be realized without the Project receiving approval by SHPD on the proposed mitigation commitments. Mitigation commitments proposed would include proper data recovery and documentation of the historic property to ensure that all necessary and appropriate information on the property can be preserved and will include the necessary information outlined in HAR Chapter 13-284-8(e). Although historic properties within the Project area may be affected, demolished, and/or altered, the utilization of mitigation measures, commitments, and consultation with the SHPD will ensure that all information on historic properties will be documented and preserved in accordance with the State's Historic Preservation Rules.

Operation of the Puʻu ʻŌpae and Mānā Powerhouse and co-located facilities would not impact or degrade water quality as no foreign objects or chemicals are introduced and no temperature change would be introduced to water as it passes through the powerhouses. KIUC has no plans to make any changes to the existing systems that would create a potential for temperature, chemical, or foreign object introduction into streams or natural waterways and is committed to maintaining that policy for the duration of the Project.

At the end of the Project life, the Project's lands and waters would be available to continue as an energy and/or irrigation Project, or for other purposes as appropriate.

6 Relationship to Land Use Plans and Policies

6.1 Department of Hawaiian Home Lands Planning Documents

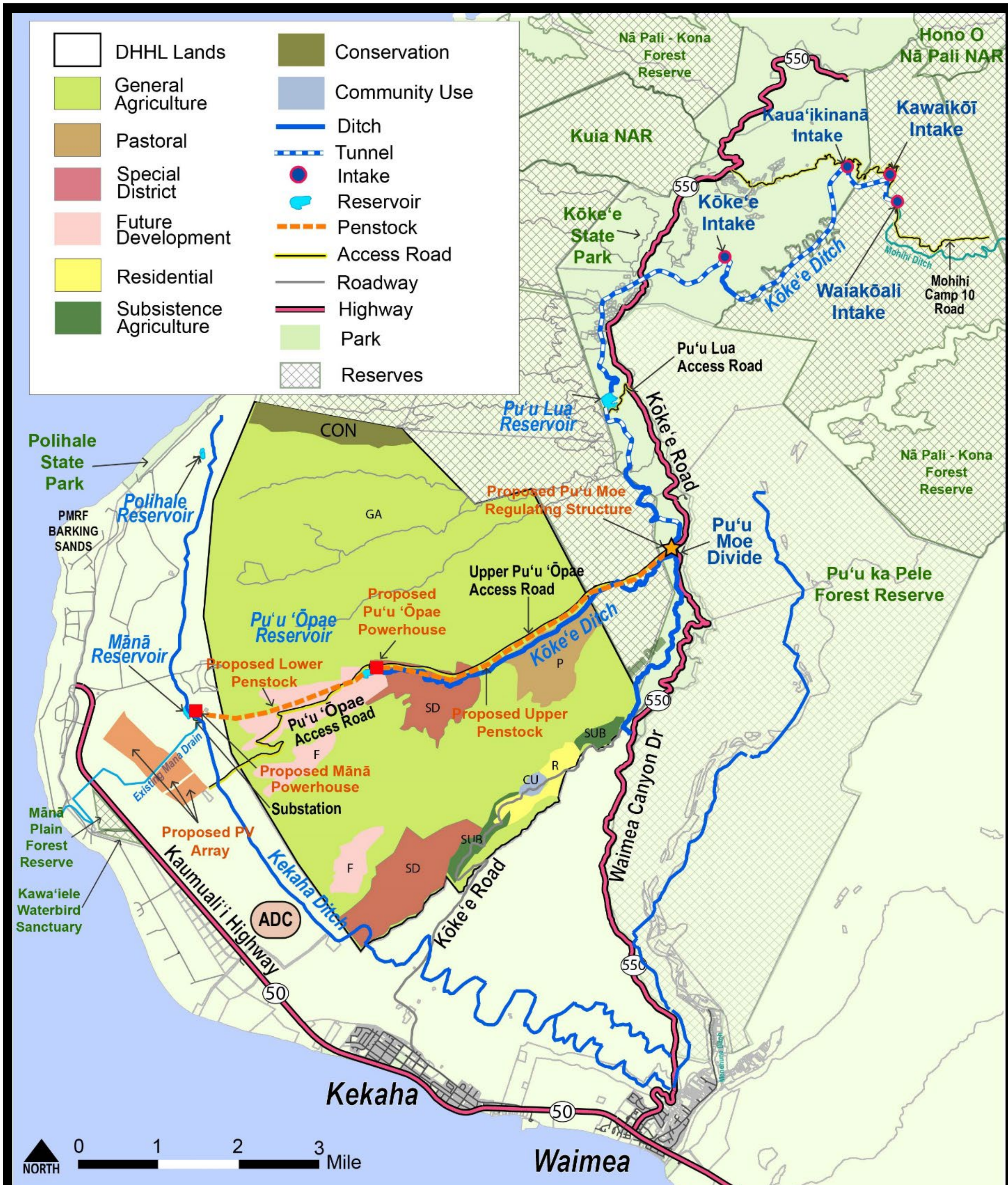
6.1.1 Kauaʻi Island Plan

Island Plans produced by DHHL fall within the second tier under the General Plan (first tier) of the DHHL Planning System. The DHHL's *Kauaʻi Island Plan* published in May 2004 provides recommendations for the future use of DHHL's 20,565 acres on the island of Kauaʻi. The plan was intended to guide overall land use patterns and development on Kauaʻi for the next 20 years by assigning Land Use Designations and identifying specific areas for priority homestead development for all of DHHL's lands.

As shown on **Figure 6.1**, the Project falls within DHHL's Waimea Lands and would traverse through the General Agriculture, Pastoral, Special District, and Future Development Land Use Designations. The *Kauaʻi Island Plan* identifies the current uses such as sugarcane cultivation, diversified agriculture, and DLNR Game management to continue within the General Agricultural Land Use Designation. The Puʻu ʻŌpae Special District and surrounding reservoir area was envisioned to be a Puʻuhonua – a retreat and place of refuge for beneficiaries island-wide – consisting of passive recreation where individuals can hike to take advantage of the scenic views. Beneficiaries would be allowed to operate tour groups, youth or adult camps or other retreat activities as community economic development Projects in the Puʻuhonua.

The Proposed Action would include the construction of Puʻu ʻŌpae Powerhouse, which would be a new building located on the eastern edge of the Puʻu ʻŌpae Reservoir that would be similar in size to a large house and have an appearance similar to an agricultural storage building. All the generating equipment would be housed within the powerhouse structure. Puʻu ʻŌpae Powerhouse and Puʻu ʻŌpae Reservoir are within a gated DHHL area, and the construction activities would not be visible from any non-gated or public areas and would be low profile enough to not obstruct the viewplane in the general area. In addition, diversified agriculture would be supported by irrigation provided by the Project.

Figure 6.1. DHHL Land Uses



DHHL Land Uses

West Kauaʻi Energy Project – Kauaʻi, Hawaiʻi

SSFM International

6.1.2 West Kauaʻi Regional Plan

DHHL regional plans provide the means to solidify visions and partnerships that are essential to effectively manage DHHL trust lands for the betterment of native Hawaiian beneficiaries. Regional plans provide DHHL and the affected homestead communities opportunities to assess land use development factors, identify issues and opportunities, and identify the region's top priority Projects slated for implementation.

West Kauaʻi is the region of the island that includes lands from Hanapepe to Mānā and includes some of the most productive agricultural lands in the State. The DHHL lands in West Kauaʻi are located in three general areas: Hanapēpē, Kekaha, and Waimea uplands.

The *West Kauaʻi Regional Plan* identifies development of the Puʻu ʻŌpae area as a priority Project. This includes providing agricultural leases, maintaining/rehabilitating the existing reservoir and irrigation system, and improvement of access roads. The Proposed Action would improve the existing water infrastructure and provide improved access to water for future DHHL development. In addition, the Proposed Action would improve access roads, which would improve access into areas planned for development. Lastly, the Proposed Action would provide annual lease revenue to DHHL that could be used to support planned development.

6.1.3 Puʻu ʻŌpae Kuleana Homestead Settlement Plan

As discussed previously in **Section 1.4**, DHHL is proposing the Puʻu ʻŌpae Kuleana Homestead Settlement Plan to offer 251 homestead lots (11 Pastoral and 240 Subsistence Agriculture) on 1,421 acres in the Waimea area of West Kauaʻi. The Puʻu ʻŌpae Kuleana Homestead Project is proposing the following DHHL land uses: Subsistence Agriculture, Pastoral, Community Use, and Special District. These land uses are dependent on the completion of the Proposed Action to deliver water to the area, as agreed upon through the Waimea Mediation Agreement. Specifically, the Waimea Mediation Agreement of the Waimea Watershed Area that was approved in 2017 identified that DHHL's water reservation of 6.903 MGD, which was approved by CWRM in a separate action, would be delivered by the Project.

The improvements to the Kōkeʻe Ditch Irrigation System by the Proposed Action would service the Puʻu ʻŌpae Kuleana Homestead Project area. As part of the Proposed Action, one tap would be provided on the Upper Penstock to deliver water to a storage tank located at the mauka DHHL land boundary for use at the five existing Pastoral lots. Two outlets would be provided at the Puʻu ʻŌpae Reservoir to allow water draws directly from the reservoir for use on the adjacent lands.

In addition to improving the existing water infrastructure and providing improved access to water to the Puʻu ʻŌpae Kuleana Homestead Project area, the Proposed Action would provide for road improvements and maintenance for the life of the Project and delivery of electrical service to the Puʻu ʻŌpae area. These combined benefits would support the use of the DHHL Puʻu ʻŌpae lands by the existing licensees and future beneficiaries and the development of the Kuleana leases. Also, the Proposed Action would provide annual lease revenues to DHHL. Overall, the Proposed Action would further the purposes of the HHCA.

6.1.4 Hoʻomaluō Energy Policy

DHHL's *Hoʻomaluō Energy Policy* identifies five objectives to enable native Hawaiians and the community to work together to achieve energy self-sufficiency and sustainability.

- ***Mālama ʻāina.*** Respect and protect our native home lands.
- ***Koʻo*.** Facilitate the use of diverse renewable energy resources.
- ***Kūkulu pono*.** Design and build homes and communities that are energy efficient, self-sufficient and sustainable.
- ***Kōkua nō i nā kahu*.** Provide energy efficiency, self-sufficiency, and sustainability opportunities to existing homesteaders and their communities.
- ***Hoʻonaʻauao*.** Prepare and equip beneficiaries to promote a green, energy efficient lifestyle in and around communities.

The Proposed Action would meet all five objectives identified, as it would service DHHL homestead lands with a sustainable and energy efficient means of receiving water and electricity. The Puʻu ʻŌpae Kuleana Homestead Project area would be serviced by the improvements proposed to the Kōkeʻe Ditch Irrigation System, and improved access to water for future DHHL development would be provided. The Proposed Action would also provide an efficient and reliable source of irrigation to support diversified agricultural lands that are managed by DHHL, ADC, and KAA, which would increase food security and generate employment opportunities for the local community. In addition, the Proposed Action would improve access roads, which would improve access into areas planned for development.

6.2 State of Hawaiʻi Planning Documents

6.2.1 HRS Chapter 226, Hawaiʻi State Plan

The Hawaiʻi State Plan, codified as HRS Chapter 226, provides goals, objectives, policies, and priorities for the State. The Hawaiʻi State Plan also provides a basis for determining priorities, allocating limited resource, and improving coordination of State and County plans, policies, programs, Projects, and regulatory activities. It establishes a set of themes, goals, objectives, and policies that are meant to guide the State's long-range growth and development activities. Applicable sections of HRS Chapter 226 to the Proposed Action are shown in **Table 6-1**.

Table 6-1. Summary of Applicability of HRS Chapter 226 to the Proposed Action

HRS Chapter 226 Hawaiʻi State Planning Act	Applicability to Project
Part I. Overall Theme, Goals, Objectives, and Policies	
§226-5 Objective and policies for population	Not applicable
§226-6 Objectives and policies for the economy--in general	**Applicable**
§226-7 Objectives and policies for the economy-- agriculture	**Applicable**
§226-8 Objective and policies for the economy--visitor industry	Not applicable

Table 6-1. Summary of Applicability of HRS Chapter 226 to the Proposed Action (Cont.)

HRS Chapter 226 Hawaiʻi State Planning Act	Applicability to Project
§226-9 Objective and policies for the economy--federal expenditures	Not applicable
§226-10 Objective and policies for the economy--potential growth and innovative activities	**Applicable**
§226-10.5 Objectives and policies for the economy--information industry	Not applicable
§226-11 Objectives and policies for the physical environment--land-based, shoreline, and marine resources	**Applicable**
§226-12 Objective and policies for the physical environment--scenic, natural beauty, and historic resources	**Applicable**
§226-13 Objectives and policies for the physical environment--land, air, and water quality	**Applicable**
§226-14 Objective and policies for facility systems--in general	**Applicable**
§226-15 Objectives and policies for facility systems--solid and liquid wastes	**Applicable**
§226-16 Objective and policies for facility systems--water	**Applicable**
§226-17 Objectives and policies for facility systems--transportation	Not applicable
§226-18 Objectives and policies for facility systems--energy	**Applicable**
§226-18.5 Objectives and policies for facility systems--telecommunications	Not applicable
§226-19 Objectives and policies for socio-cultural advancement--housing	Not applicable
§226-20 Objectives and policies for socio-cultural advancement--health	Not applicable
§226-21 Objective and policies for socio-cultural advancement--education	Not applicable
§226-22 Objective and policies for socio-cultural advancement--social services	Not applicable
§226-23 Objective and policies for socio-cultural advancement--leisure	**Applicable**
§226-24 Objective and policies for socio-cultural advancement--individual rights and personal well-being	Not applicable
§226-25 Objective and policies for socio-cultural advancement--culture	Not applicable
§226-26 Objective and policies for socio-cultural advancement--public safety	**Applicable**
§226-27 Objective and policies for socio-cultural advancement--government	**Applicable**
Part III. Priority Guidelines	
§226-103 Economic priority guidelines	**Applicable**
§226-104 Population growth and land resources priority guidelines	Not applicable
§226-105 Crime and criminal justice	Not applicable
§226-106 Affordable housing	Not applicable
§226-107 Quality education	Not applicable
§226-108 Sustainability	**Applicable**
§226-109 Climate change adaptation priority guidelines	**Applicable**

Section 226-6. *Objectives and policies for the economy – in general*

(a) Planning for the State's economy in general shall be directed toward achievement of the following objectives:

(1) Increased and diversified employment opportunities to achieve full employment, increased income and job choice, and improving living standards for Hawaiʻi's people, while at the same time stimulating the development and expansion of economic activities capitalizing on defense, dual-use, and science and technology assets, particularly on the neighbor islands where employment opportunities may be limited.

(2) A steadily growing and diversified economic base that is not overly dependent on a few industries, and includes the development and expansion of industries on the neighbor islands.

(b) To achieve the general economic objectives, it shall be the policy of this State to:

(5) Promote innovative activity that may pose initial risks, but ultimately contribute to the economy of Hawaiʻi.

(8) Assure that the basic economic needs of Hawaiʻi's people are maintained in the event of disruptions in overseas transportation.

(19) Promote and protect intangible resources in Hawaiʻi, such as scenic beauty and the aloha spirit, which are vital to a healthy economy.

Discussion: The Proposed Action would generate substantial and positive impacts on the Kauaʻi County economy. The construction, long-term O&M expenditures, and the savings from the petroleum offset would create a total of 27,320 person-years of employment over 78 years. The construction and O&M payroll would generate a sum of $788.3 million of earnings in Kauaʻi throughout the life of the Project.

The economic impacts spring from construction expenditures, long-term O&M expenditures, and savings due to lower fuel costs. Instead of spending millions on offshore fuel costs, the Proposed Action would shift resources back to Kauaʻi.

Overall spending associated with the Proposed Action would have a ripple effect on local industries and sectors that propel Kauaʻi's economy and would offset State expenditures by providing long-term maintenance resources in the area.

The Proposed Action would decrease the required generation of electricity from fossil fuel sources which would reduce dependence of foreign fuel sources that could be impacted if there are disruptions in overseas transportation.

The repairs and continued maintenance of the existing reservoirs would be beneficial to the visual environment of these areas as the current reservoirs are either operating at lower water levels, or drained and unused. Upon completion of the rehabilitation of the Puʻu Lua Reservoir, there would be beneficial opportunities to the popular trout fishing program as the reservoir would be operating at increased water levels which would support increased trout stocking and increased shoreline for fishing access. Public safety would be improved through rehabilitation of the Puʻu Lua Reservoir, which would bring the structure into compliance with Hawaiʻi State Dam

Safety Standards. The improvement of the Puʻu Lua access road would improve public safety and access to the area.

Section 226-7. *Objectives and policies for the economy – agriculture.*

(a) Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:

(20) Continued growth and development of diversified agriculture throughout the State.

(21) An agriculture industry that continues to constitute a dynamic and essential component of Hawaiʻi's strategic, economic, and social well-being.

(b) To achieve the agricultural objectives, it shall be the policy of this State to:

(2) Encourage agriculture by making the best of natural resources/

(6) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.

(10) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.

Discussion: The Proposed Action would help secure non-potable water to DHHL's Kuleana Subsistence Agricultural Lots development, which would contribute to increased food security for lessees/residents. In addition, the Proposed Action is in alignment with the State's objectives to expand economic growth and job opportunities in agricultural activities, thereby helping to diversify and invest in the local economy. Although the Proposed Action would utilize Class B agricultural land for the solar facility, it would be in compliance with HRS 205-4.5(a)(21)(A) which would allow the area occupied by the solar facility to also be made available for compatible agricultural activities. Therefore, the Proposed Action is consistent with the objectives and policies for agriculture.

Section 226-10. *Objective and policies for the economy – potential growth and innovative activities.*

(a) Planning for the State's economy with regard to potential growth and innovative activities shall be directed towards achievement of the objective of development and expansion of potential grown and innovative activities that serve to increase and diversify Hawaiʻi's economic base.

(b) To achieve the potential growth and innovative activity objective, it shall be the policy of this State to:

(1) Facilitate investment and employment growth in economic activities that have the potential to expand and diversity Hawaiʻi's economy, including but not limited to diversified agriculture, aquaculture, renewable energy development, creative media, health care, and science and technology-based sectors.

(8) Accelerate research and development of new energy-related industries based on wind, solar, ocean, underground resources, and solid waste.

Discussion: The Proposed Action would help Kauaʻi become less reliant on fossil fuels, which is an important milestone to reaching 100% renewable energy by 2045 as mandated by State law. Instead of spending millions of dollars on imported fuel costs each year, KIUC would spend less money for the locally-generated clean energy created by the Proposed Action, saving the Kauaʻi rate payers money by shifting those expenditures so that more of the dollars are retained locally.

Less directly, but also of great value, the Proposed Action would support diversified agriculture through subsidized irrigation delivery. It would also bring financial resources to DHHL and ADC via lease rent payments for lands that are currently not in active use. In addition, it would provide a reliable source of water for fire protection on DLNR, DOFAW, and DHHL lands in the Kōkeʻe area during drought seasons.

Section 226-11. *Objectives and policies for the physical environment – land-based, shoreline, and marine resources.*

(a) Planning for the State's physical environment with regard to land-based, shoreline, and marine resources shall be directed towards achievement of the following objectives:

(1) Prudent use of Hawaiʻi's land-based, shoreline, and marine resources.

(2) Effective protection of Hawaiʻi's unique and fragile environmental resources.

(b) To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of this State to:

(1) Exercise an overall conservation ethic in the use of Hawaiʻi's natural resources.

(2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.

(3) Take into account the physical attributes of areas when planning and designing activities and facilities.

(4) manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.

(5) Consider multiple uses in watershed areas, provided such uses do not detrimentally affect water quality and recharge functions.

(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaiʻi.

(9) Pursue compatible relationships among activities, facilities, and natural resources.

(10) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.

Discussion: The Proposed Action would support viable agricultural and recreational uses of the land that would prevent potential development for other activities such as housing or commerce, thereby supporting conservation. During the operation phase of the Proposed Action, all four streams would maintain mauka to makai connectivity and the maintenance and monitoring of the Kōkeʻe Ditch Irrigation System would be improved. The modifications associated with the Proposed Action would increase the reliability, consistency, and longevity of IIFS implementation to be in compliance with the Waimea Mediation Agreement. Additionally, the Proposed Action would be the only source of irrigation for the mauka lands and has the capacity to provide irrigation for the agricultural fields on the Mānā Plain, thereby reducing the reliance on the Kekaha Ditch Irrigation System and resulting in reduced diversion pressures of streams in the lower reaches of the Waimea River watershed where native species are more prevalent and aquatic habitat needs are higher. This beneficial cumulative impact is aligned with the goals and intentions set forth in the Waimea Mediation Agreement.

Hydroelectric power generation and pumping of water for agricultural purposes does not create noxious emissions. The Proposed Action would provide an estimated 30 GWh of hydroelectric generation annually and up to 80 GWh of firmed solar generation. This increase in generation of renewable energy from the Proposed Action would decrease the required generation of electricity from fossil fuel sources and the resultant GHG emissions, which would have a beneficial impact on air quality.

The Proposed Action would implement BMPs to minimize impacts to land-based, shoreline, and marine resources, as discussed in **Sections 5.1.3** and **5.2.3**. Avoidance and minimization measures would be implemented to minimize impacts to special-status species, as discussed in **Section 5.3.3**. Rehabilitation of access roads would improve safe public access to the area and provide for safer recreational opportunities. Upon completion of the rehabilitation of the Puʻu Lua Reservoir, there would be beneficial opportunities to the popular trout fishing program as the reservoir would be operating at increased water levels which would support increased trout stocking and increased shoreline for fishing access. Public safety would be improved through rehabilitation of the Puʻu Lua Reservoir, which would bring the structure into compliance with Hawaiʻi State Dam Safety Standards. The improvement of the Puʻu Lua access road would improve public safety and access to the area.

Therefore, the Proposed Action is consistent with the objectives and policies for land-based, shoreline, and marine resources.

Section 226-12. *Objectives and policies for the physical environment – scenic, natural beauty, and historic resources.*

(a) Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaiʻi's scenic assets, natural beauty, and multi-cultural/historical resources.

(b) To achieve the scenic, natural beauty, and historic resources objective, it shall be the policy of this State to:

(1) Promote the preservation and restoration of significant natural and historic resources.

(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.

(4) Protect those special areas, structures, and elements that are an integral and functional part of Hawaiʻi's ethnic and cultural heritage.

Discussion: Siting of the Proposed Action included early consultation with interested parties to ensure that the Project layout avoided any ethnic or cultural sites or resources.

Operation of the upper portion of the Project area would have no impact to visual resources as rehabilitation of the Kōkeʻe Ditch Irrigation System would not involve constructing new facilities. The modifications associated with the Proposed Action, including rehabilitation of irrigation ditches, restoration of streams, and modifications to diversions, would increase the reliability, consistency, and longevity of IIFS implementation to be in compliance with the Waimea Mediation Agreement. The repairs and continued maintenance of the existing reservoirs would be beneficial to the visual environment of these areas as the current reservoirs are either operating at lower water levels, or drained and unused. Additionally, the rehabilitation and increased storage capacity of the Puʻu Lua Reservoir associated with the Proposed Action would benefit recreational fishing opportunities as the reservoir would operate at increased water levels, which would support increased trout stocking. The Puʻu Lua Access Road would also be improved, which would improve public safety and access to the area.

Construction activities proposed for the upper portions of the Proposed Action up ditch of Puʻu Lua Reservoir and below Puʻu Lua Reservoir would consist primarily of maintenance and repairs of the existing Kōkeʻe Ditch Irrigation System and would have negligible visual impacts and would not affect any viewplanes.

Puʻu Lua Reservoir is currently operating at fractional capacity and is kept partially drained for dam safety reasons. Rehabilitation of Puʻu Lua Reservoir would involve significant earth moving and grading activities in the immediate area of the dam and the reservoir. These activities would significantly alter the appearance of the reservoir during the six- to twelve-month construction period. This change of appearance would be temporary, and the entire reservoir site would be cleaned, graded, and either seeded, mulched, or rip-rapped along with other BMPs to restore the ground and protect against erosion.

The proposed intake structure at Puʻu Moe Divide would be a compact and largely buried regulating structure along the existing ditch path in the woods near Kōkeʻe Highway. This new structure would not be visible from the public roadway. The new Upper Penstock would generally follow the route of the existing Camp 1 access road and the existing open ditch. To facilitate construction, there would be removal of some trees along portions of the upper pipeline alignment, Camp 1 road, and the existing ditch. The uppermost segment of this vegetation removal may be visible from the public roadway as vehicles pass by the Camp 1 road turnoff near Puʻu Moe Divide. The cleared areas would be restored to graded, grass areas which would be kept mown for the life of the Proposed Action to facilitate pipeline inspection and serve as a firebreak. The pipeline would be fully buried and not visible once construction is completed.

The introduction of new facilities into the landscape at the lower portion of the Project area and west of the Puʻu Moe Divide would have no substantial impact to visual resources or to the mauka to makai view plane. The proposed Puʻu ʻŌpae Powerhouse would be a single-story structure located to the east of the existing Puʻu ʻŌpae Reservoir that would be similar in size to a large house and have an appearance similar to an agricultural storage building. All new generating equipment, switchgear, and ancillary systems would be housed within the powerhouse structure. The proposed Mānā Powerhouse located to the southeast of the existing Mānā Reservoir would be 50 feet high and would house the hydroelectric units within the powerhouse. The Mānā Powerhouse would be located at the base of Niu Ridge and would be smaller than the ridge and as similar height as the existing trees surrounding the reservoir. Both proposed powerhouses would not alter natural landforms or significantly block existing mauka to makai view planes.

Pu‘u ‘Ōpae Powerhouse and Pu‘u ‘Ōpae Reservoir are within a gated DHHL area, and the construction activities would not be visible from any non-gated or public areas and would be low profile enough to not obstruct the viewplane in the general area.

The existing Pu‘u ‘Ōpae Reservoir would be completely rebuilt to Hawai‘i State Dam Safety Standards. Similar to construction at Pu‘u Lua Reservoir, there would be significant earth moving and grading activities in the immediate area of the dam and the reservoir. These activities would be temporary, and the area would be fully restored using appropriate BMPs around the new fully lined and fenced reservoir within twelve months of beginning construction. This reservoir is visible from public areas.

The proposed Lower Penstock would be constructed along an alignment that crosses on fields between Pu‘u ‘Ōpae Reservoir and the edge of Niu Ridge bluff. The area is within DHHL’s gated lands at an elevation of 750 to 1,500 feet msl and is not visible from non-gated public areas. The segment of proposed pipeline that extends from the edge of Niu Ridge to the Mānā Reservoir would be buried down the bluff, under the Kekaha ditch, and through scrub vegetation and field to the new Mānā Powerhouse. Construction activities on the slope below the bluff would be visible from the highway located two miles to the west during the two to three months required to complete this section. Upon completion, this buried pipeline segment would be restored in the same manner as the rest of the pipeline and would blend with the surrounding terrain. For these reasons, the temporary construction activities would have negligible visual impacts to the visual resources or viewplanes in the vicinity.

The proposed Mānā Powerhouse located at the base of Niu Ridge on the southeast edge of Mānā Reservoir within the gated Mānā agricultural area. The powerhouse building would be approximately 70-feet by 70-feet in plan and 50-feet-tall and would house the hydroelectric units and ancillary equipment. Connected to the south of the proposed powerhouse would be a buried structure approximately 150-feet by 60-feet in plan that would contain the pumping equipment, the reservoir spillway, and the pipeline surge facilities. These structures would not be visible and would have no impact on visual resources. The Mānā Powerhouse would be of similar height to the existing trees mauka of the reservoir, would be painted a light earth tone color, and would stand out notably from the highway two miles to the west of the Mānā Powerhouse location.

The proposed PV Solar Array would be located on the Mānā Plain on approximately 330 acres of agricultural lands. The design of the PV Solar Array and the substation would not obstruct mauka to makai viewplanes. Additionally, there would be no new overhead lines mauka of the Mānā Reservoir as the new power line would be simultaneously buried alongside the Lower Penstock during construction.

It is anticipated that the proposed construction of these new facilities into the landscape at the lower portion of the Project area on the Mānā Plain would have no substantial impact to visual resources or to the mauka to makai viewplane.

Therefore, the Proposed Action is consistent with the objectives and policies for scenic, natural beauty, and historic resources.

Section 226-13. *Objectives and policies for the physical environment – land, air, and water quality.*

(a) *Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives:*

(1) *Maintenance and pursuit of improved quality in Hawaiʻi's land, air, and water resources.*

(b) *To achieve the land, air, and water quality objectives, it shall be the policy of this State to:*

(4) *Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawaiʻi's people.*

(8) *Foster recognition of the importance and value of the land, air, and water resources to Hawaiʻi's people, their cultures and visitors.*

Discussion: The Proposed Action would implement BMPs to minimize impacts to land-based, shoreline, and marine resources.

The Proposed Action's implementation of the Phase Two IIFS would minimize impacts to diverted streams by maintaining flow volumes in stream channels that have been determined by CWRM sufficient to meet the instream needs including those of aquatic habitat and stream biota. The Proposed Action's design and long-term maintenance would reduce water losses on the Kōkeʻe Ditch Irrigation System and increase water delivery efficiency compared to current conditions. The proposed rehabilitation of existing State infrastructure would allow for continued operation of the upper Kōkeʻe Ditch Irrigation System, reservoirs, Puʻu Moe intake structure and Upper Penstock, and access roads in the long-term with no adverse impact to air quality. The operation of the Proposed Action with energy generated from both solar and hydroelectric would have beneficial effect on air quality by reducing fossil-fueled energy generation and the associated air emissions.

Hydroelectric power generation and pumping of water for agricultural purposes does not create noxious emissions. The Proposed Action would provide an estimated 26 GWh of hydroelectric generation annually and up to 81 GWh of firmed solar generation. This increase in the generation of renewable energy would decrease the required generation of electricity from fossil fuel sources and reduce GHG emissions by 70,000 metric tons annually. By displacing fossil fuel power generation, the Puʻu ʻŌpae Project would have a beneficial impact on air quality elsewhere in Hawaiʻi.

Therefore, the Proposed Action is consistent with the objectives and policies for land, air, and water quality.

Section 226-14. *Objectives and policies for facility systems – in general.*

(a) *Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.*

(b) *To achieve the general facility systems objective, it shall be the policy of this State to:*

(2) Encourage flexibility in design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.

(3) Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.

Discussion: The Proposed Action would assist KIUC in meeting the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045. The Project would produce over 20% of the total energy requirements for Kauaʻi and would provide diversity of renewable energy generation which would stabilize and reduce electricity rates over time.

Repairs and maintenance of the entire length of the Kōkeʻe Ditch Irrigation System between the diversions and the Puʻu Moe Divide would be funded and completed by the Applicant as part of the Proposed Action to improve water delivery efficiency and infrastructure longevity, as well as would ensure that instream flow requirements would remain in the natural stream channels. The Proposed Action would initiate the Phase Two IIFS as outlined in the Waimea Mediation Agreement and involve diversion of water from streams in the upper reaches of the Waimea River watershed for DHHL's water reservation, hydroelectric generation, and other irrigation and consumptive uses in the Project area. These diversions would reduce the amount of water left in the stream downstream of each diversion and on the Waimea River. However, the Proposed Action would ensure that the Phase Two IIFS requirements would remain in the natural stream channels using automated intakes at each of the diversion locations. The automation of the system would provide real time flow adjustments and compliance with the Phase Two IIFS set by CWRM.

The Proposed Action would provide reliable irrigation water supply through upgrades to the ditch and reservoirs and the assumption of long-term operations and maintenance by the Applicant that would support diversified agriculture on the mauka lands managed by DHHL and would provide an efficient reliable source of irrigation for the ADC agricultural fields on the Mānā Plain, which would increase food security and generate employment opportunities for the local community.

To lower the risk of the Project for its members and to optimize the use of tax credits (which result in a lower cost of energy), KIUC has signed a long-term PPA with AES West Kauaʻi Energy Project, LLC. Under the PPA, the energy rate and capacity charges would not increase and are intended to remain fixed or stable for their applicable terms (25 years for the energy rate, 40 years for the PSH Monthly Capacity Charge, and 50 years for the Hydropower-only Monthly Capacity Charge). This would provide rate stability for KIUC's members and is materially lower that the forecasted cost of oil generation that the PPA would replace, thereby resulting in savings and lower effective rates for KIUC's members/customers. Specifically, the Proposed Action would replace over eight million gallons of imported oil annually, saving ratepayers an estimated average of $20 per month over the first 25 years.

Therefore, the Proposed Action is consistent with the objectives and policies for facility systems.

Section 226-16. *Objective and policies for facility systems – water.*

(a) Planning for the State’s facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.

(b) To achieve the facility systems water objective, it shall be the policy of this State to:

(1) Coordinate development of land use activities with existing and potential water supply.

(4) Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.

Discussion: The purpose of the Proposed Action is to provide an integrated renewable energy and irrigation Project designed with the intent of serving four objectives:

1. Renewable energy production via hydroelectric electric generation
2. Renewable energy production via solar PV generation
3. Pumped and battery storage to shift most of the Project’s solar PV energy production for use in the evening peak, nighttime, and morning peak hours (as well as during periods of rainy or cloudy weather) via the release of water and hydroelectric electric energy generation
4. Irrigation delivery to support diversified agriculture on lands adjacent to the Project site including mauka lands managed by DHHL and ADC, and the agricultural fields on the Mānā Plain that are managed by KAA

The partnership between the State and the Applicant would enable the State to provide proper stewardship for the Waimea River and existing State infrastructure, while expanding agriculture, energy production, and DHHL’s Kuleana Subsistence Agricultural Lots development on the west side of Kaua‘i.

During the operation phase of the Proposed Action, all four streams would maintain mauka to makai connectivity and the maintenance and monitoring of the Kōke‘e Ditch Irrigation System would be improved. The modifications associated with the Proposed Action would increase the reliability, consistency, and longevity of IIFS implementation to be in compliance with the Waimea Mediation Agreement. Additionally, the Proposed Action would be the only source of irrigation for the mauka lands and has the capacity to provide irrigation water for the agricultural fields on the Mānā Plain, thereby reducing the reliance on the Kekaha Ditch Irrigation System and resulting in reduced diversion pressures of streams in the lower reaches of the Waimea River watershed where native species are more prevalent and aquatic habitat needs are higher.

The Proposed Action would provide reliable irrigation water supply through upgrades to the ditch and reservoirs and the assumption of long-term operations and maintenance by the Applicant that would support diversified agriculture on the mauka lands managed by DHHL and would provide an efficient reliable source of irrigation for the ADC agricultural fields on the Mānā Plain, which would increase food security and generate employment opportunities for the local community.

Therefore, the Proposed Action is consistent with the objectives and policies for water.

Section 226-18. *Objectives and policies for facility systems – energy.*

(a) Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives, giving due consideration to all:

(1) Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;

(2) Increased energy security and self-sufficiency through the reduction and ultimate elimination of Hawaiʻi's dependence on imported fossil fuels for electrical generation and ground transportation;

(3) Greater diversification of energy generation in the face of threats to Hawaiʻi's energy supplies and systems;

(4) Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use; and

(5) Utility models that make the social and financial interests of Hawaiʻi's utility customers a priority.

(a) To achieve the energy objectives, it shall be the policy of this State to ensure the short- and long-term provision of adequate, reasonably priced, and dependable energy services to accommodate demand.

(b) To further achieve the energy objectives, it shall be the policy of this State to:

(1) Support research and development as well as promote the use of renewable energy sources.

(2) Ensure that the combination of energy supplies and energy-saving systems is sufficient to support the demands of growth.

(8) Support actions that reduce, avoid, or sequester greenhouse gases in utility, transportation, and industrial sector applications.

Discussion: The Proposed Action would assist KIUC in meeting the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045. The Project would produce over 20% of the total energy requirements for Kauaʻi. The Proposed Action would directly eliminate the need to import over 8.2 million gallons of oil to Kauaʻi every year, which would not only provide significant environmental benefits but also provide lower and more stable electric rates. The Proposed Action would also reduce GHG emissions by 70,000 metric tons every year. By adding two renewable sources (hydroelectric and solar) to the electric grid, Kauaʻi will benefit from increased diversification of renewable resources. In addition, hydroelectric and solar are complementary in that when one is not producing much energy, the other one is. The ability to add more low-cost solar to Kauaʻi's power supply mix, firmed with long-duration storage, complemented with hydro, and then delivered to the grid primarily through rotating hydroelectric turbine generators would also increase reliability and enable longer periods of 100% renewable operation of the

Kauaʻi grid. Therefore, the Proposed Action is consistent with the objectives and policies for energy.

Section 226-23. *Objective and policies for socio-cultural advancement – leisure.*

(a) Planning for the State's socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of the adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.

(b) To achieve the leisure objective, it shall be the policy of this State to:

(3) Enhance the enjoyment of recreational experiences through safety and security measures, educational opportunities, and improved facility design and maintenance.

Discussion: Upon completion of the rehabilitation of the Puʻu Lua Reservoir, there would be beneficial opportunities to the popular trout fishing program as the reservoir would be operating at increased water levels which would support increased trout stocking and increased shoreline for fishing access. Public safety would be improved through rehabilitation of the Puʻu Lua Reservoir, which would bring the structure into compliance with Hawaiʻi State Dam Safety Standards. Rehabilitation of access roads would improve safe public access to the area and provide for safer recreational opportunities. Therefore, the Proposed Action is consistent with the objective and policies for leisure.

Section 226-26. *Objectives and policies for socio-cultural advancement – public safety.*

(b) Planning for the State's socio-cultural advancement with regard to public safety shall be directed towards the achievement of the following objectives:

(1) Assurance of public safety and adequate protection of life and property for all people.

(2) Optimum organizational readiness and capability in all phases of Emergency management to maintain the strength, resources, and social and economic well-being in the event of civil disruptions, wars, natural disasters, and other major disturbances.

(b) To further achieve the public safety objectives related to Emergency management, it shall be the policy of this State to:

(1) Ensure that responsible organizations are in a proper state of readiness to respond to major war-related, natural, or technological disasters and civil disturbances at all times.

Discussion: The Proposed Action would provide a reliable source of water for fire protection on DLNR, DOFAW, and DHHL lands in the Kōkeʻe area during drought seasons. It would also rehabilitate and operate three state-owned reservoirs in compliance with current Hawaiʻi State Dam Safety Standards.

The proposed Project would assist KIUC in meeting the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045. The Project would significantly reduce the amount of fossil fuel burned for electricity and produce up to 25% of the total electrical energy requirements for Kauaʻi's grid, thereby allowing KIUC to achieve significant progress toward 100% renewable energy. This would allow the island to be less dependent on imported fossil fuel commodities for electricity generation. By being less dependent on imported fuel, Kauaʻi would be better prepared and in a proper state of readiness to respond to major war-related, natural, or technological disasters and civil disturbances that may impact imports of fuel and thereby the generation of electricity (***Section 226-27).*** *Objectives and policies for sociocultural advancement – government.*

(a) Planning the State's socio-cultural advancement with regard to government shall be directed towards the achievement of the following objectives:

(1) Efficient, effective, and responsive government services at all levels in the State.

(2) Fiscal integrity, responsibility, and efficiency in the state government and county governments.

(b) To achieve the government objectives, it shall be the policy of this State to:

(1) Provide for necessary public goods and services not assumed by the private sector.

(2) Pursue an openness and responsiveness in government that permits the flow of public information, interaction, and response.

Discussion: The Proposed Action would rehabilitate and maintain existing State-owned irrigation ditch features within that are part of the Project. Without the Proposed Action, the responsibility for the operation and ongoing maintenance of existing reservoirs and the Kōkeʻe Ditch Irrigation System would remain the responsibility of the State, which requires significant funding that could be used for other government services.

Section 226-103. *Economic priority guidelines – water use and development.*

(e) Priority guidelines for water use and development.

(3) Encourage the improvement of irrigation technology and promote the use of nonpotable water for agricultural and landscaping purposes.

(f) Priority guidelines for energy use and development:

(1) Encourage the development, demonstration, and commercialization of renewable energy sources.

Discussion: The Proposed Action is an integrated energy and irrigation Project that is designed with the intent of serving four objectives:

1. Renewable energy production via hydroelectric electric generation
2. Renewable energy production via solar PV generation
3. Pumped and battery storage to shift most of the Project's solar PV energy production for use in the evening peak, nighttime, and morning peak hours (as well as during periods of rainy or cloudy weather) via the release of water and hydroelectric electric energy generation

4. Irrigation delivery to support diversified agriculture on lands adjacent to the Project site including mauka lands managed by DHHL and ADC, and the agricultural fields on the Mānā Plain that are managed by KAA

The Project involves utilizing the existing Kōkeʻe Ditch Irrigation System and the Puʻu Lua, Puʻu ʻŌpae, and Mānā Reservoirs, and includes both rehabilitation of existing State infrastructure and new construction.

The partnership between the State and the Applicant would enable the State to provide proper stewardship for the Waimea River and existing State infrastructure, while expanding agriculture, energy production, and DHHL's Kuleana Subsistence Agricultural Lots development on the west side of Kauaʻi.

The Proposed Action would provide reliable irrigation water supply through upgrades to the ditch and reservoirs and the assumption of long-term operations and maintenance by KIUC that would support diversified agriculture on the mauka lands managed by DHHL and would provide an efficient reliable source of irrigation for the ADC agricultural fields on the Mānā Plain, which would increase food security and generate employment opportunities for the local community. The Proposed Action would incorporate a flexible design and modern automation that would actively balance water diversion and storage simultaneously with environmental protection, energy production, and irrigation.

Therefore, the Proposed Action is consistent with the economic priority guidelines for water and energy use and development.

Section 226-108. *Sustainability.*

Priority guidelines and principles to promote sustainability shall include:

(1) Encouraging balanced economic, social, community, and environmental priorities.

(2) Encourage planning that respects and promotes living within the natural resources and limits of the State

(5) Promoting decisions based on meeting the needs of the present without compromising the needs of future generations

Discussion: The purpose of the Proposed Action is to provide an integrated renewable energy and irrigation Project designed with the intent of serving four objectives:

1. Renewable energy production via hydroelectric electric generation
2. Renewable energy production via solar PV generation
3. Pumped and battery storage to shift most of the Project's solar PV energy production for use in the evening peak, nighttime, and morning peak hours (as well as during periods of rainy or cloudy weather) via the release of water and hydroelectric electric energy generation
4. Irrigation delivery to support diversified agriculture on lands adjacent to the Project site including mauka lands managed by DHHL and ADC, and the agricultural fields on the Mānā Plain that are managed by KAA

The Project would significantly reduce the amount of fossil fuel burned for electricity and produce up to 25% of the total electrical energy requirements for Kauaʻi's grid, thereby allowing KIUC to achieve significant progress toward meeting the State's mandate to achieve 100% renewable energy by 2045.

The partnership between the State and the Applicant would enable the State to provide proper stewardship for the Waimea River and existing State infrastructure, while expanding agriculture, energy production, and development of DHHL's Kuleana Subsistence Agricultural Lots on the west side of Kauaʻi.

The Proposed Action would provide reliable irrigation water supply through upgrades to the ditch and reservoirs and the assumption of long-term operations and maintenance by the Applicant that would support diversified agriculture on the mauka lands managed by DHHL and would provide an efficient reliable source of irrigation for the ADC agricultural fields on the Mānā Plain, which would increase food security and generate employment opportunities for the local community.

Therefore, the Proposed Action is consistent with the objectives and policies for facility systems in general.

Section 226-109. *Climate change adaptation priority guidelines.*

> *Priority guidelines to prepare the State to address the impacts of climate change, including impacts to the areas of agriculture; conservation lands; coastal and nearshore marine areas; natural and cultural resources; education; energy; higher education; health; historic preservation; water resources; the built environment, such as housing, recreation, transportation; and the economy shall:*
>
> *(1) Ensure that Hawaiʻi's people are educated, informed, and aware of the impacts climate change may have on their communities;*
>
> *(2) Encourage community stewardship groups and local stakeholders to participate in planning and implementation of climate change policies;*
>
> *(3) Invest in continued monitoring and research of Hawaiʻi's climate and the impacts of climate change on the State;*
>
> *(4) Consider native Hawaiian traditional knowledge and practices in planning for the impacts of climate change;*
>
> *(5) Encourage the preservation and restoration of natural landscape features, such as coral reefs, beaches and dunes, forests, streams, floodplains, and wetlands, that have the inherent capacity to avoid, minimize, or mitigate the impacts of climate change;*
>
> *(6) Explore adaptation strategies that moderate harm or exploit beneficial opportunities in response to actual or expected climate change impacts to the natural and built environments;*
>
> *(7) Promote sector resilience in areas such as water, roads, airports, and public health, by encouraging the identification of climate change threats, assessment of potential consequences, and evaluation of adaptation options;*

(8) Foster cross-jurisdictional collaboration between County, State, and Federal agencies and partnerships between government and private entities and other nongovernmental entities, including nonprofit entities;

(9) Use management and implementation approaches that encourage the continual collection, evaluation, and integration of new information and strategies into new and existing practices, policies, and plans; and

(10) Encourage planning and management of the natural and built environments that effectively integrate climate change policy.

<u>Discussion</u>: Operation of the Proposed Action would not contribute to global GHG emissions and climate change. The operation of the Proposed Action would have substantial beneficial impacts by reducing the State and Kauaʻi's reliance on fossil fuels and their contribution to global climate change by helping to meet the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045. The Proposed Action would produce renewable energy through the proposed hydroelectric and solar energy generating infrastructures and facilities. The Proposed Action would produce over 20% of the total energy requirements for Kauaʻi.

The Proposed Action would directly eliminate the need to import over 8.2 million gallons of oil to Kauaʻi every year, which would not only provide significant environmental benefits but also provide lower and more stable electric rates. The Proposed Action would also reduce GHG emissions by 70,000 metric tons every year. By adding two renewable sources (hydroelectric and solar) to the electric grid, Kauaʻi will benefit from increased diversification of renewable resources. In addition, hydroelectric and solar are complementary in that when one is not producing much energy, the other one is. The ability to add more low-cost solar to Kauaʻi's power supply mix, firmed with long-duration storage, complemented with hydro, and then delivered to the grid primarily through rotating hydroelectric turbine generators would also increase reliability and enable longer periods of 100% renewable operation of the Kauaʻi grid.

The Proposed Action includes repairs to the existing diversions to allow for instream flow releases and the installation of gaging equipment at each diversion location with remote monitoring. Stream gage data would be made available to the public through CWRM.

The following themes of Part I of the Hawaiʻi State Plan are not applicable to the Proposed Action for the following reasons:

- ***Section 226-5.*** *Objective and policies for population.* The Proposed Action would not result in population growth.
- **Section 226-8.** *Objective and policies for the economy – visitor industry.* The Proposed Action does not involve the visitor industry.
- **Section 226-9.** *Objective and policies for the economy – federal expenditures*. The Proposed Action does not include the use of federal funds.
- ***Section 226-10.5.*** *Objective and policies for the economy – information industry.* The Proposed Action does not include nor impact telecommunications or information technology resources.

- **Section 226-15.** *Objective and policies for facility systems – solid and liquid wastes.* The Proposed Action does not include development of solid or liquid waste facilities.
- **Section 226-17.** *Objectives and policies for facility systems – transportation.* The Proposed Action does not include new transportation facilities.
- **Section 226-18.5.** *Objective and policies for facility systems – telecommunications.* The Proposed Action does not include new telecommunication facilities.
- **Section 226-20.** *Objectives and policies for socio-cultural advancement – health.* The Proposed Action does not include health facilities or services.
- **Section 226-21.** *Objectives and policies for socio-cultural advancement – education.* The Proposed Action does not include educational programs or facilities.
- **Section 226-22.** *Objectives and policies for socio-cultural advancement – social services.* The Proposed Action does not include social services or activities.
- **Section 226-24.** *Objectives and policies for socio-cultural advancement – individual rights and personal well-being.* The Proposed Action would have no impact to personal rights and personal well-being.
- **Section 226-25.** *Objectives and policies for socio-cultural advancement – culture.* The Proposed Action would have no impacts to cultural identities, traditions, values, customs, and arts of Hawaiʻi's people.

The themes of Part II of the Hawaiʻi State Plan are not applicable to the Proposed Action since the Proposed Action does not involve the preparation of planning documents.

The following themes of Part III of the Hawaiʻi State Plan are not applicable to the Proposed Action for the following reasons:

- ***Section 226-104.*** *Population growth and land resources priority guidelines.* The Proposed Action would not result in population growth nor any change in land use.
- ***Section 226-105.*** *Crime and criminal justice.* The Proposed Action does not involve the criminal justice system.
- ***Section 226-106.*** *Affordable housing.* The Proposed Action would not provide housing.
- ***Section 226-107.*** *Quality education.* The Proposed Action would have no impact on education opportunities or facilities.

6.2.2 HRS Chapter 205, State Land Use Law

Hawaiʻi was the first of the fifty States to have a State Land Use Law (originally adopted in 1961) and a State Plan. Today, Hawaiʻi remains unique among the fifty states with respect to the extent of control that the State exercises in land use regulation. The State has four classifications: Agricultural, Conservation, Rural, and Urban. The State Land Use Law, HRS Chapter 205, initially set the boundaries for the four classifications. Changes to boundaries for areas less than 15 acres can be approved at the County level; larger modifications must be approved by the Land Use Commission by super-majority vote. Per HRS Chapter 205-5, counties shall govern the zoning within the State Land Use Districts with exception of the Conservation District; the Conservation District shall be governed by the DLNR. For actions taken on Hawaiian Home Lands, those actions require Hawaiian Homes Commission approval. The Applicant has been working cooperatively with the Department of Hawaiian Home Lands and the Hawaiian Homes Commission in that regard.

As shown in **Figure 6.2**, the Proposed Action is located within the Conservation and Agricultural State Land Use Districts. Specifically, the portion of the Project from the intakes to the Puʻu Lua Reservoir, as well as approximately 0.75-mile of the Upper Penstock are located in the Conservation District. All other existing and proposed facilities are located within the Agricultural District.

Permitted uses in the Conservation District are dependent on the Conservation District Subzone. As shown in **Figure 6.3**, the Proposed Action is located within the Resource subzone of the Conservation District. Power generation from renewable sources is an acceptable land use within the Resources subzone of the Conservation District. A Conservation District Use Permit from the BLNR is required, and a management Plan must be prepared and approved simultaneously with the permit.

Permitted uses in the Agricultural land use district is dependent on the agricultural land productivity rating as determined by the LSB. The LSB assigns a rating of A to E to agricultural land, with A being the most productive land and E being the least productive land. As shown in **Figure 6.4**, the Proposed Action would be located on lands designated B, C D, and E. The Proposed Action would be located in an area that is designated by the State of Hawaiʻi for agricultural land use and would be subject to the requirements of HRS Chapter 205, which specifies the permitted uses in the various State land use districts.

Pursuant to HRS Chapter 205-2(d), solar energy facilities are a permitted use within the State agricultural district; however, as further clarified in HRS Chapter 205-4.5, those facilities in areas with Land Study Bureau (LSB) Class B and C soils require a Special Use Permit and must meet certain conditions relating to agricultural activities and decommissioning as described in HRS Chapter 205-4.5(21):

(A) The area occupied by the solar energy facilities is also made available for compatible agricultural activities at a lease rate that is at least fifty per cent below the fair market rent for comparable properties;

(B) Proof of financial security to decommission the facility is provided to the satisfaction of the appropriate county planning commission prior to date of commencement of commercial generation; and

(C) Solar energy facilities shall be decommissioned at the owner's expense according to the following requirements:

i. Removal of all equipment related to the solar energy facility within twelve months of the conclusion of operation or useful life; and

ii. Restoration of the disturbed earth to substantially the same physical condition as existed prior to the development of the solar energy facility.

As shown on **Figure 6.4**, the solar energy facilities would occupy areas with LSB Class B soils. Pursuant to the HRS Chapter 205-4.5, the solar energy facilities would be a permitted use with issuance of a Special Use Permit, assuming compliance with the provisions related to decommissioning, proof of financial security, and making the area available for compatible agricultural activities at a lease rate below fair market rent. The Applicant will seek approval of a Special Use Permit prior to Project construction.

Although the Project will be located partially on the Mānā Plain, neither the Project nor KIUC controls that land or the storm drainage system that drains the area, so the decision to continue drainage and/or maintenance of the agricultural fields is outside of the scope and responsibility of the Project, and is best addressed to the State of Hawaiʻi ADC.

As shown in **Figure 6.5**, portions of the Project would be located on lands designated as Agricultural Lands Important to the State of Hawaiʻi (ALISH), rated as “Prime” and “Other” agricultural lands in the ALISH rating system. The ALISH classification system and criteria was developed by an ad hoc committee comprised of representatives from the U.S. Department of Agriculture’s Soil Conservation Service, the University of Hawaiʻi College of Tropical Agriculture and Human Resources, the State Rural Development Committee, the DOA, DBEDT, and DLNR. The classification categorizes agricultural lands into three classes: Prime, Unique, and Other Important Agricultural Land. Based on the classification system, “Prime” land is defined as land best suited for the production of food, feed, forage, and fiber crops due to the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops when treated and managed according to modern farming methods. “Other” agricultural land is defined as land of statewide or local importance for the production of food, feed, fiber, and forage crops and are not “Prime” or “Unique” land because it may exhibit properties such as seasonal wetness, erodibility, limited rooting zone, slope, flooding, or doughtiness. The ALISH classification system does not in itself constitute a designation of any area to a specific land use, rather, it proves decision makers with an awareness of the long-term implications of various land use options for agricultural production in Hawaiʻi (Baker, 1979).

Figure 6.2. State Land Use Districts

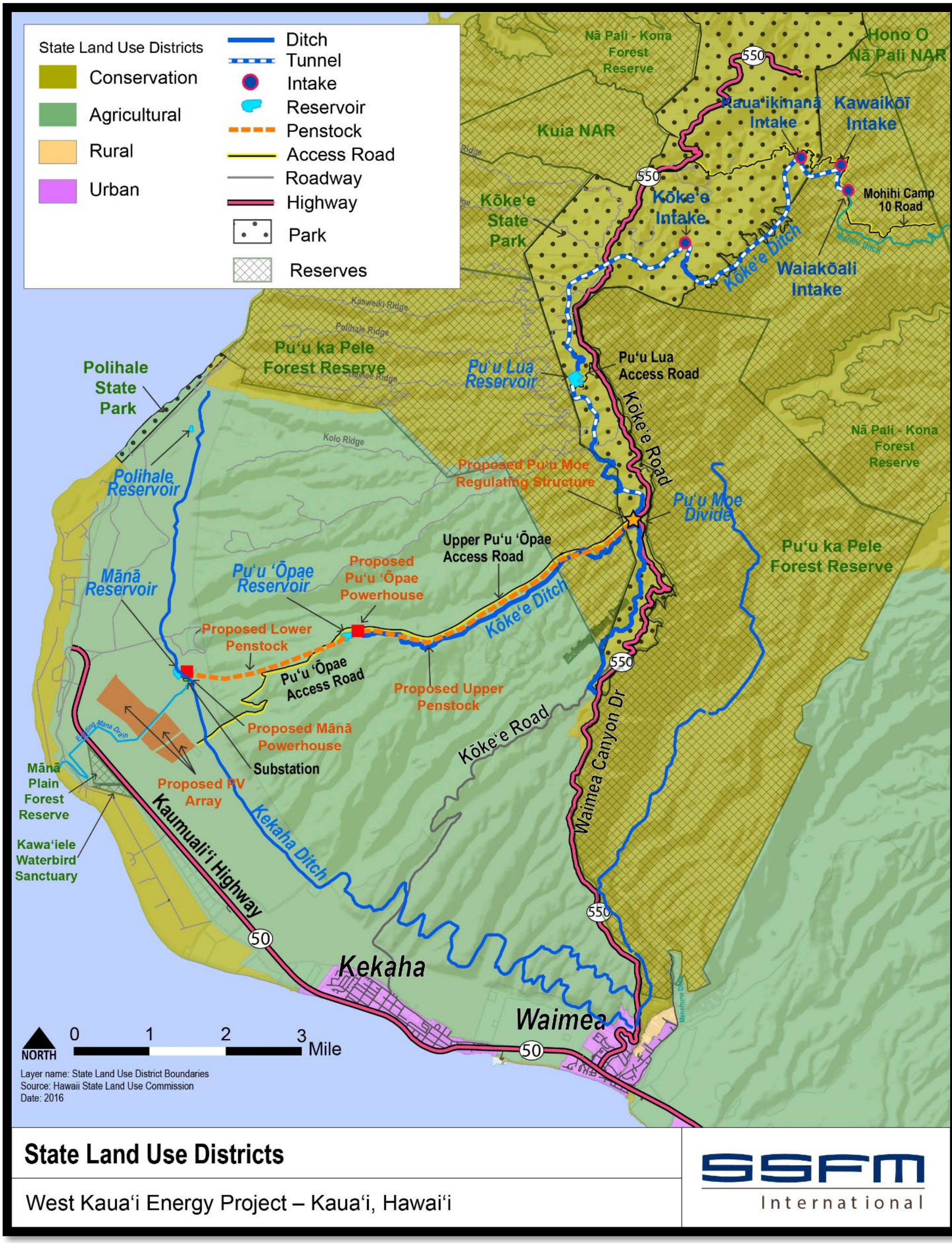


Figure 6.3. Conservation District Subzones

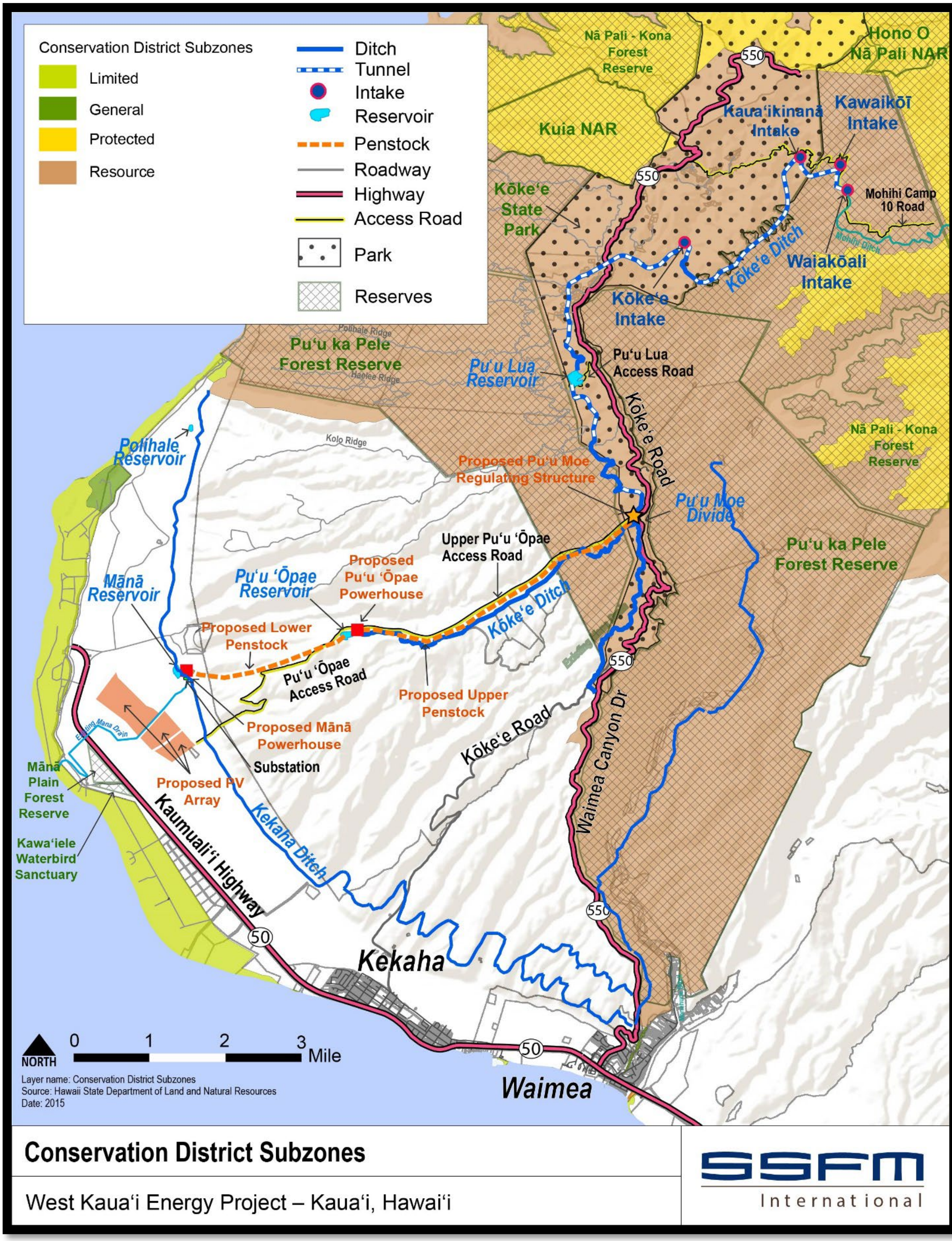


Figure 6.4. Land Study Bureau Map

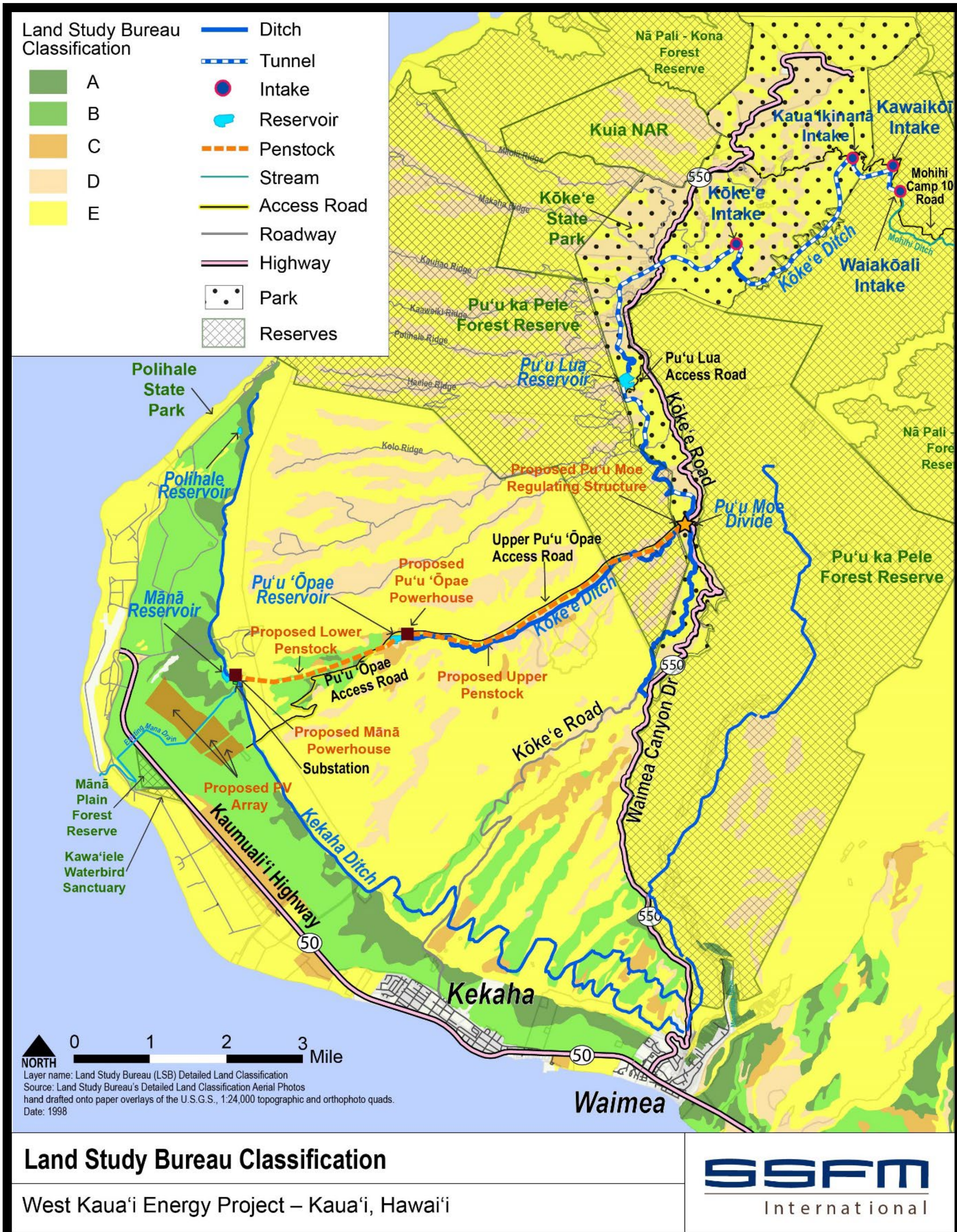
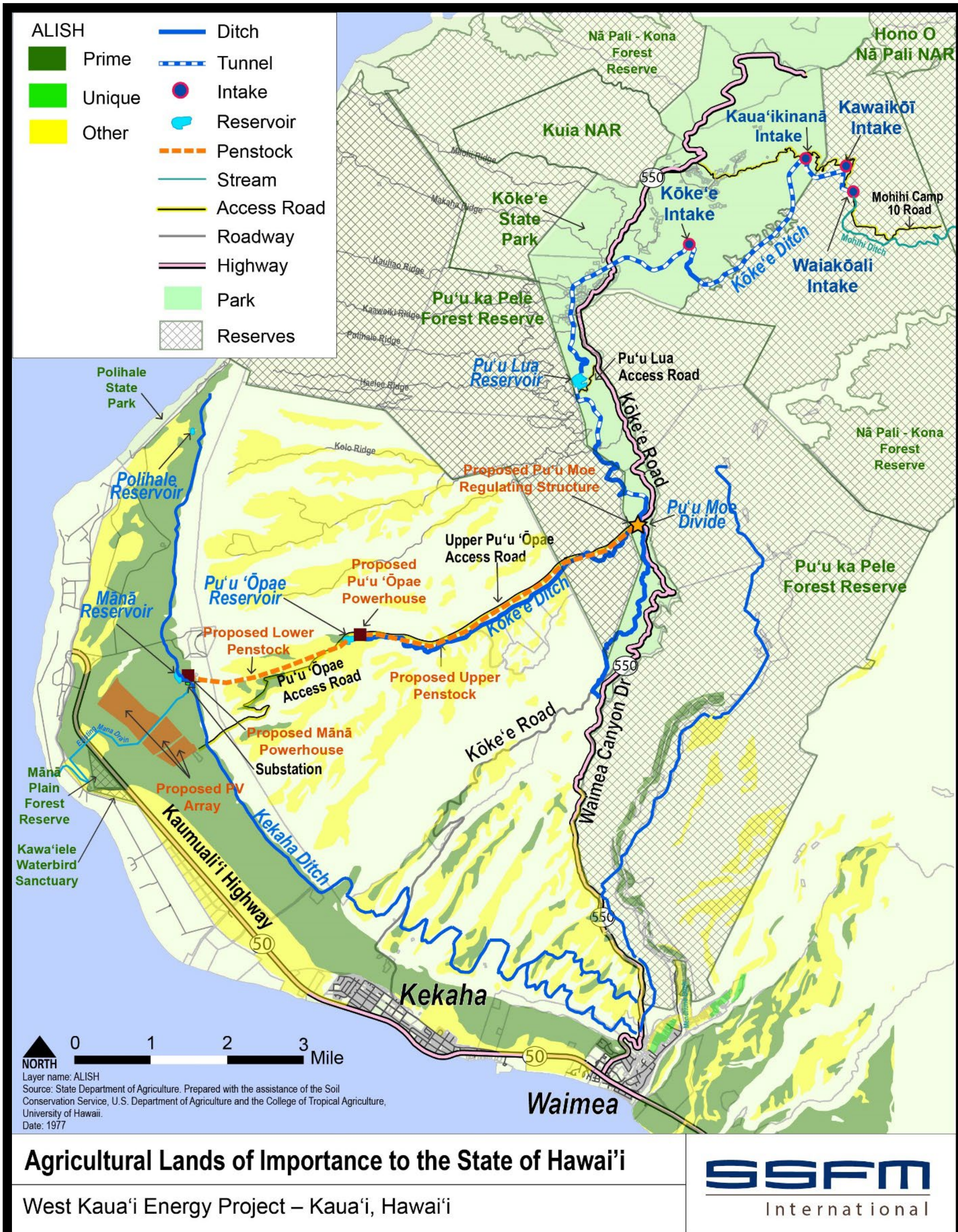


Figure 6.5. Agricultural Lands of Importance to the State of Hawaiʻi



The Proposed Action would benefit agriculture on the west side of Kauaʻi through the rehabilitation and addition of irrigation infrastructure. The repairs to and long-term maintenance of all the reservoirs would enable an increase in active storage for irrigation users on both ADC and DHHL lands during the drier months. The repairs, operation, and maintenance of the Kōkeʻe Ditch Irrigation System would provide reliable water delivery to DHHL and ADC lands for irrigation use, and the cost would be absorbed by the Applicant. In addition, the penstocks, in lieu of open ditch, would provide a more efficient and reliable method of irrigation water delivery in sections of ditch currently not operable. Overall, the Proposed Action would provide ways to complement and increase existing irrigation infrastructure and enables future expansion on lands not currently irrigated.

The Proposed Action would also provide benefits to DHHL by enabling the utilization of Puʻu ʻŌpae mauka lands through the delivery of water, access to the KIUC electrical grid, road improvements, reservoir storage for irrigation, and repairs to reservoir outlet works that will provide irrigation water releases from the reservoir. The repairs to the Puʻu ʻŌpae Reservoir would bring the reservoir into compliance with Hawaiʻi State Dam Safety Standards, offsetting this cost and maintenance from DHHL to KIUC. The Applicant would also bear the cost of the long-term operation and maintenance of the reservoir, thus improving this asset for future DHHL generations. In addition, as part of the Proposed Action, KIUC would install a water storage tank at the upper boundary of DHHL lands and supply the tank from the pressurized pipeline for the five pastoral lots in this location.

The lands proposed for the PV Solar Array are part of a larger segment of land that covers the Mānā Plain and were historically used for the cultivation of sugarcane. Prior to development, these lands were predominantly swamp and estuarine but were converted to agricultural use by draining water into an extensive storm drainage system that ultimately discharges water into the ocean. The land areas identified for the solar field location have been selected in cooperation with farmers currently active on lands in the immediate area. The selected lands are classified as "B" lands and are not "A" class prime agricultural lands. Some of these areas are prone to flooding and water retention that is a result of low elevation, current pumping management policies, and a high percentage of clay in the soil. Other areas are not preferable for farming because of the soil make-up and drainage issues. Lease rent from the Project would provide financial resources to ADC in order to further their agricultural goals.

6.2.3 HRS Chapter 183C and HAR Section 13-5, Conservation District Rules

The Board of Land and Natural Resources (BLNR) administers land use regulations for the Conservation District pursuant to the State Land Use Law, discussed above. As it relates to the State Land Use Law, Conservation is defined as "the protection of watersheds and water supplies; preserving scenic areas; providing park lands; wilderness and beach reserves; conserving endemic plants, fish, and wildlife; preventing floods and soil erosion; forestry; and other related activities" (DLNR, 2017a). The Conservation District has five subzones: Protective, Limited, Resource, General, and Special. The first four subzones are ranked by environmental sensitivity from highest to lowest. The Special subzone defines a unique land use on a specific site.

As shown in **Figure 6.2**, the Proposed Action is located within the Conservation Land Use District, specifically, the portion of the Project from the intakes to the Puʻu Lua Reservoir, as well as approximately 0.75-mile of the Upper Penstock. These portions of the Proposed Action are located within the Resource subzone of the Conservation District. Power generation from renewable sources is an acceptable land use within the Resources subzone of the Conservation District with an approved Conservation District Use Permit pursuant to the Hawaiʻi Administrative Rules (HAR) §13-5-22, P-12 POWER GENERATION FROM RENEWABLE RESOURCES (D-1). Therefore, a Conservation District Use Permit from the BLNR is required, and a management Plan must be prepared and approved simultaneously with the permit.

The use of Conservation District lands is regulated by HAR §13-5 and HRS §183C. In evaluating Projects (i.e., proposed land use) during the permitting process, the BLNR applies eight criteria. The Proposed Action is consistent with the criteria as follows:

(1) The proposed land use is consistent with the purpose of the conservation district.

<u>Discussion</u>: The purpose of the Conservation District is to conserve, protect, and preserve the important natural and cultural resources of the State through appropriate management and use to promote their long-term sustainability and the public health, safety, and welfare. Power generation from renewable sources is an acceptable land use within the Resources subzone of the Conservation District with an approved Conservation District Use Permit. As previously noted in **Section 5.5.3**, mitigation and/or preservation measures would be implemented to mitigate the impacts on historic properties that may be affected by the proposed Project.

(2) The proposed land use is consistent with the objectives of the subzone of the land on which the use will occur.

<u>Discussion</u>: The objective of the Resource subzone is to ensure, with proper management, the sustainable use of the natural resources of those areas. The Project proposes the sustainable use of a natural resource in the form of using water for the purposes of hydroelectric power generation. Power generation from renewable resources inclusive of hydroelectric and solar facilities is an allowable use in the Resource subzone.

(3) The proposed land use complies with provisions and guidelines contained in chapter 205A, HRS, entitled "Coastal Zone management", where applicable.

<u>Discussion</u>: The Proposed Action is consistent with HRS 205A, as discussed in the following subsection.

(4) The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community, or region.

<u>Discussion</u>: Construction of the Proposed Action would have limited short-term impacts to natural resources in the Project vicinity. Based on the significance criteria set forth in HAR 11-200.1 and discussed in **Section 7.1**, it is anticipated that the Proposed Action would not have a significant adverse impact on the environment. No long-term significant impacts to any resource are anticipated with implementation of the Proposed Action. The primary impacts identified would be during the construction phase which would be short-term, temporary and minimized to the extent practicable through the implementation of Best Management Practices (BMPs) and other minimization and avoidance measures.

(5) *The proposed land use, including buildings, structures, and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels.*

Discussion: Rehabilitation of the Kōkeʻe Ditch Irrigation System would not involve constructing new facilities. The repairs and continued maintenance of the existing reservoirs would be beneficial to the visual environment of these areas as the current reservoirs are either operating at lower water levels, or drained and unused. Construction activities proposed for the upper portions of the Proposed Action up ditch of Puʻu Lua Reservoir and below Puʻu Lua Reservoir would consist primarily of maintenance and repairs of the existing Kōkeʻe Ditch Irrigation System and would have negligible visual impacts and would not affect any viewplanes.

Rehabilitation of Puʻu Lua Reservoir would involve significant earth moving and grading activities in the immediate area of the dam and the reservoir. These activities would significantly alter the appearance of the reservoir during the six- to twelve-month construction period. This change of appearance would be temporary, and the entire reservoir site would be cleaned, graded, and either seeded, mulched, or rip-rapped along with other BMPs to restore the ground and protect against erosion.

The proposed intake structure at Puʻu Moe Divide would be a compact and largely buried regulating structure along the existing ditch path in the woods near Kōkeʻe Highway. This new structure would not be visible from the public roadway. The cleared areas would be restored to graded, grass areas which would be kept mown for the life of the Proposed Action to facilitate pipeline inspection and serve as a firebreak. The pipeline would be fully buried and not visible once construction is completed.

The introduction of new facilities into the landscape at the lower portion of the Project area and west of the Puʻu Moe Divide would have no substantial impact to visual resources or to the mauka to makai view plane. The proposed Puʻu ʻŌpae Powerhouse would be a single-story structure located to the east of the existing Puʻu ʻŌpae Reservoir that would be similar in size to a large house and have an appearance similar to an agricultural storage building. All new generating equipment, switchgear, and ancillary systems would be housed within the powerhouse structure. The proposed Mānā Powerhouse located to the southeast of the existing Mānā Reservoir would be 50-feet-high and would house the hydroelectric units within the powerhouse. The Mānā Powerhouse would be located at the base of Niu Ridge and would be smaller than the ridge and as similar height as the existing trees surrounding the reservoir. Both proposed powerhouses would not alter natural landforms or significantly block existing mauka to makai view planes.

Puʻu ʻŌpae Powerhouse and Puʻu ʻŌpae Reservoir are within a gated DHHL area, and the construction activities would not be visible from any non-gated or public areas and would be low profile enough to not obstruct the viewplane in the general area.

The existing Puʻu ʻŌpae Reservoir would be completely rebuilt to Hawaiʻi State Dam Safety Standards. Similar to construction at Puʻu Lua Reservoir, there would be significant earth moving and grading activities in the immediate area of the dam and the reservoir. These activities would be temporary, and the area would be fully restored using appropriate BMPs around the new fully lined and fenced reservoir within twelve months of beginning construction. This reservoir is visible from public areas.

The proposed PV Solar Array would be located on the Mānā Plain on approximately 330 acres of agricultural lands. The design of the PV Solar Array and the substation would not obstruct mauka to makai viewplanes. Additionally, there would be no new overhead lines mauka of the Mānā Reservoir as the new power line would be simultaneously buried alongside the Lower Penstock during construction.

It is anticipated that the proposed construction of these new facilities into the landscape at the lower portion of the Project area on the Mānā Plain would have no substantial impact to visual resources or to the mauka to makai viewplane.

(6) The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable.

Discussion: The Proposed Action is not anticipated to affect the aesthetic and visual character of the surrounding area.

(7) Subdivision of land will not be utilized to increase the intensity of land uses in the conservation district.

Discussion: The Proposed Action does not involve subdivision of land.

(8) The proposed land use will not be materially detrimental to the public health, safety, and welfare.

Discussion: The Proposed Action would have some temporary, minor impacts on air, noise, and water quality during construction however, these impacts would be minimized to the extent practicable by the employment of BMPs and compliance with permit conditions. The Proposed Action would not result in any post-construction or long-term effects on public health. In fact, operation of the Proposed Action would have a beneficial impact on air quality by the reduction of fossil-fueled energy generation and the associated air emissions, expected to result in health benefits from the positive impact on air quality.

6.2.4 HRS Chapter 205A, Coastal Zone management

The National Coastal Zone management (CZM) Program was created with the passage of the Coastal Zone management Act of 1972 (CZMA). Hawaiʻi's CZM Program, established pursuant to HRS Chapter 205A, as amended, is administered by the State of Hawaiʻi Office of Planning and provides for the beneficial use, protection, and development in the State's coastal zone. The objectives and policies of the Hawaiʻi CZM Program encompass a wide array of concerns including impacts to recreational resources, historic and archaeological resources, coastal scenic resources and open space, coastal ecosystems, coastal hazards, and the management of development. The Hawaiʻi CZM area includes all lands within the State and the areas seaward to the extent of the State's management jurisdiction. Therefore, the Proposed Action is located within the CZM area.

The Proposed Action is consistent with the following objectives and policies of the Hawaiʻi CZM Program:

(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 for public recreation;

v. Ensuring public recreational uses 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 nonpoint 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, and county authorities; and crediting such dedication against the requirements of section 46-6.

Discussion: The Proposed Action is not in a coastal area and would have no impacts to 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.

Discussion: Operation of the Proposed Action would not affect or impair any traditional and customary Native Hawaiian rights exercised in the ahupuaʻa in which the Project area is located, and that the information provided in the CIA demonstrates that the Proposed Action would not have any adverse effect on traditional and customary Native Hawaiian rights within the Waimea Ahupuaʻa. Operation of the Proposed Action is not anticipated to adversely impact any of the known archaeological sites or burial sites near the Project area.

(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

(D) scenic resources.

Encourage those developments that are not coastal dependent to locate in inland areas.

Discussion: Under the Proposed Action, operation of the upper portion of the Kōkeʻe Ditch Irrigation System within Kōkeʻe State Park and the Kekaha Game Management Area would be of no substantial difference than current operations and would have no impact to the access or the quality of the adjacent recreational areas.

Construction activities proposed for the upper portions of the Proposed Action up ditch of Puʻu Lua Reservoir and below Puʻu Lua Reservoir would consist primarily of maintenance and repairs of the existing Kōkeʻe Ditch Irrigation System and would have negligible visual impacts and would not affect any viewplanes.

Upon completion of the rehabilitation of the Puʻu Lua Reservoir, there would be beneficial opportunities to the popular trout fishing program as the reservoir would be operating at increased water levels which would support increased trout stocking and increased shoreline for fishing access. Public safety would be improved through rehabilitation of the Puʻu Lua Reservoir, which would bring the structure into compliance with Hawaiʻi State Dam Safety Standards. The improvement of the Puʻu Lua access road would improve public safety and access to the area.

Operation of the portion of the Kōkeʻe Ditch Irrigation System below Puʻu Lua and west of the Puʻu Moe Divide would have no impact to recreational areas and trails as there are none in the vicinity of the Project areas.

Operation of the Proposed Action could impact Waipoʻo Falls. However, the primary impact to Waipoʻo Falls is actually a result of the Waimea Mediation Agreement, the establishment of an IIFS for each stream, and the resultant change of operational parameters on the Kōkeʻe Ditch Irrigation System. Kōkeʻe Stream is the natural source of Waipoʻo Falls. Historically and currently, Waipoʻo Falls was/is augmented by diverted water from Waiakōali, Kawaikōī, and Kauaʻikinanā Streams that is discharged into Kōkeʻe Stream at Kōkeʻe Diversion rather than remaining in the stream of origin or being used along the ditch system. The IIFS for each stream is to be implemented at the point of diversion rather than being returned to the watershed through another stream. The Phase Two IIFS would be implemented during operation of the Proposed Action. The Phase Two IIFS for Kōkeʻe Stream is 1.2 MGD. It is expected that the Proposed Action would only be able to divert water from Kōkeʻe Stream during higher flow events and therefore have minimal impact on Waipoʻo Falls. At all times at least 1.2 MGD would remain in the stream, and an estimated average of 86% of total streamflow would remain in the stream after diversion at Kōkeʻe Stream during West Kauaʻi Energy Project operations.

Puʻu Lua Reservoir is currently operating at fractional capacity and is kept partially drained for dam safety reasons. Rehabilitation of Puʻu Lua Reservoir would involve significant earth moving and grading activities in the immediate area of the dam and the reservoir. These activities would significantly alter the appearance of the reservoir during the six- to twelve-month construction period. This change of appearance would be temporary, and the entire reservoir site would be cleaned, graded, and either seeded, mulched, or rip-rapped along with other BMPs to restore the ground and protect against erosion.

The proposed intake structure at Puʻu Moe Divide would be a compact and largely buried regulating structure along the existing ditch path in the woods near Kōkeʻe Highway. This new structure would not be visible from the public roadway. The new Upper Penstock would generally follow the route of the existing Camp 1 access road and the existing open ditch. To facilitate construction, there would be removal of some trees along portions of the upper pipeline alignment, Camp 1 road, and the existing ditch. The uppermost segment of this vegetation removal may be visible from the public roadway as vehicles pass by the Camp 1 road turnoff near Puʻu Moe Divide. The cleared areas would be restored to graded, grass areas which would be kept mown for the life of the Proposed Action to facilitate pipeline inspection and serve as a firebreak. The pipeline would be fully buried and not visible once construction is completed.

The introduction of new facilities into the landscape at the lower portion of the Project area and west of the Puʻu Moe Divide would have no substantial impact to visual resources or to the mauka to makai view plane. The proposed Puʻu ʻŌpae Powerhouse would be a single-story structure located to the east of the existing Puʻu ʻŌpae Reservoir that would be similar in size to a large house and have an appearance similar to an agricultural storage building. All new generating equipment, switchgear, and ancillary systems would be housed within the powerhouse structure.

The proposed Mānā Powerhouse located to the southeast of the existing Mānā Reservoir would be 50-feet-high and would house the hydroelectric units within the powerhouse. The Mānā Powerhouse would be located at the base of Niu Ridge and would be smaller than the ridge and as similar height as the existing trees surrounding the reservoir. Both proposed powerhouses would not alter natural landforms or significantly block existing mauka to makai view planes.

Puʻu ʻŌpae Powerhouse and Puʻu ʻŌpae Reservoir are within a gated DHHL area, and the construction activities would not be visible from any non-gated or public areas and would be low profile enough to not obstruct the viewplane in the general area.

The existing Puʻu ʻŌpae Reservoir would be completely rebuilt to Hawaiʻi State Dam Safety Standards. Similar to construction at Puʻu Lua Reservoir, there would be significant earth moving and grading activities in the immediate area of the dam and the reservoir. These activities would be temporary, and the area would be fully restored using appropriate BMPs around the new fully lined and fenced reservoir within twelve months of beginning construction. This reservoir is visible from public areas.

The proposed Lower Penstock would be constructed along an alignment that crosses on fields between Puʻu ʻŌpae Reservoir and the edge of Niu Ridge bluff. The area is within DHHL's gated lands at an elevation of 750 to 1,500 feet msl and is not visible from non-gated public areas. The segment of proposed pipeline that extends from the edge of Niu Ridge to the Mānā Reservoir would be buried down the bluff, under the Kekaha ditch, and through scrub vegetation and field to the new Mānā Powerhouse. Construction activities on the slope below the bluff would be visible from the highway located two miles to the west during the two to three months required to complete this section. Upon completion, this buried pipeline segment would be restored in the same manner as the rest of the pipeline and would blend with the surrounding terrain. For these reasons, the temporary construction activities would have negligible visual impacts to the visual resources or viewplanes in the vicinity.

The proposed Mānā Powerhouse located at the base of Niu Ridge on the southeast edge of Mānā Reservoir within the gated Mānā agricultural area. The powerhouse building would be approximately 70-feet by 70-feet in plan and 50-feet-tall and would house the hydroelectric units and ancillary equipment. Connected to the south of the proposed powerhouse would be a buried structure approximately 150-feet by 60-feet in plan that would contain the pumping equipment, the reservoir spillway, and the pipeline surge facilities. These structures would not be visible and would have no impact on visual resources. The Mānā Powerhouse would be of similar height to the existing trees mauka of the reservoir, would be painted a light earth tone color, and would stand out notably from the highway two miles to the west of the Mānā Powerhouse location.

The proposed PV Solar Array would be located on the Mānā Plain on approximately 330 acres of agricultural lands. The design of the PV Solar Array and the substation would not obstruct mauka to makai viewplanes. Additionally, there would be no new overhead lines mauka of the Mānā Reservoir as the new power line would be simultaneously buried alongside the Lower Penstock during construction.

It is anticipated that the proposed construction of these new facilities into the landscape at the lower portion of the Project area on the Mānā Plain would have no substantial impact to visual resources or to the mauka to makai viewplane.

(4) Coastal Ecosystems

OBJECTIVE:

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

POLICIES:

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

(B) Improve the technical basis for natural resource management;

(C) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

(D) 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

(E) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

<u>Discussion</u>: Construction of the Proposed Action may produce sediment from soil erosion during and after excavation and construction at the Project areas near several perennial streams, which may impact water quality at the construction site as well as adjacent watercourses and coastal areas. Contaminants associated with equipment during construction may impact surface water and groundwater. Construction plans and specifications would include BMPs to minimize erosion on the Project site during and after construction, as well as measures to contain runoff on-site during construction. Temporary erosion control measures would be used during construction to prevent soil loss and to minimize surface runoff into adjacent areas and streams, as well as to minimize the likelihood of spills from construction equipment.

Operation of the Proposed Action would not cause water pollution or subsequent impacts to coastal ecosystems as no foreign objects or chemicals are introduced to the water during its passage through the penstocks, pumps, or turbines. Additionally, there is no heat removal or addition to the water as it passes through the powerhouses. The Applicant has no plans to make any changes or have any operation activities that would create a potential for temperature, chemical, or foreign object introduction into the natural stream channels and is committed to maintaining that policy for the duration of the Project.

(5) Economic Uses

OBJECTIVE:

(A) Provide public or private facilities improvements important to the State's economy in suitable locations.

POLICIES:

(A) Concentrate coastal dependent development in appropriate areas;

(B) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry 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.

<u>Discussion</u>: The Proposed Action was designed and the Project footprint was determined to avoid impacts to natural and cultural resources, including coastal areas. The Proposed Action would generate substantial and positive impacts on the Kauaʻi County economy. The construction, long-term O&M expenditures, and the savings from the petroleum offset would create a total of 27,320 person-years of employment over 78 years. The construction and O&M payroll would generate a sum of $788.3 million of earnings in Kauaʻi throughout the life of the Project.

The economic impacts spring from construction expenditures, long-term O&M expenditures, and savings due to lower fuel costs. Instead of spending millions on offshore fuel costs, the Proposed Action would shift resources back to Kauaʻi.

Overall spending associated with the Proposed Action would have a ripple effect on local industries and sectors that propel Kauaʻi's economy and would offset State expenditures by providing long-term maintenance resources in the area. This includes repairing and maintaining the Kōkeʻe Ditch Irrigation System, bringing the reservoirs into compliance with the Hawaiʻi State Dam Safety Standards, supporting food sustainability and diversification through the delivery of water for irrigation, and providing a reliable source of water for fire protection during drought seasons.

Most importantly, the Proposed Action would help Kauaʻi become less dependent on fossil fuels and assist the County in meeting the State of Hawaiʻi's mandate of reaching 100 percent renewable generation by 2045.

(6) Coastal hazards

OBJECTIVE:

(A) 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 source pollution hazards;

(C) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

(D) Prevent coastal flooding from inland projects.

Discussion: Short-term construction under the Proposed Action would not create conditions that would exacerbate coastal hazards. The Kauaʻi Emergency management Agency coordinates and integrates efforts among all levels of government and the private sector to mitigate against, prepare for, respond to, and recover from natural disasters, acts of terrorism, and other threats and hazards. Construction personnel would respond to any Emergency messages or alerts, as appropriate, to ensure their safety during construction. The operation of the new proposed solar, hydroelectric, and irrigation infrastructures and facilities would be constructed to withstand coastal hazards.

All existing and proposed facilities are unmanned, and continuous real-time monitoring of the Project would be performed by the SCADA system. The only time personnel visit the facilities is for inspections and/or maintenance. Personnel would respond to any Emergency messages or alerts, as appropriate, to ensure their safety during these visits to the facilities.

(7) Managing development

OBJECTIVE:

(A) Improve the development review process, communication, and public participation in the management of coastal resources 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 or 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.

Discussion: The Final EA is being provided for public comment and review. To facilitate the agency review process for the required permits for the Proposed Action, the Applicant will meet with the various agencies prior to submitting permit application packages. The permit review process will provide additional opportunities for public involvement.

(8) Public Participation

OBJECTIVE:

(A) Stimulate public awareness, education, and participation in coastal management.

POLICIES:

(A) Promote public involvement in coastal zone management processes;

(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 issues, developments, and government activities; and

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

Discussion: Opportunities for public awareness, education, and participation in coastal management are provided through Federal, State, and County regulatory review process. The Final EA is being provided for public comment and review. Additional opportunities for review will come during the entitlement process.

(9) Beach protection

OBJECTIVE:

Protect beaches for public use and recreation.

POLICIES:

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

Discussion: The Proposed Action is not in a coastal area and would have no impacts to beaches.

(10) Marine resources

OBJECTIVE:

Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

POLICIES:

(A) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial.

Discussion: The Proposed Action is not in a coastal area and would have no impacts to marine resources.

6.2.5 Hawaiʻi Clean Energy Initiative

The Hawaiʻi Clean Energy Initiative (HCEI) was launched in 2008 when the State and the U.S. Department of Energy signed a MOU to establish a long-term partnership to reduce the State's use and reliance on imported fossil fuels. The goal of the HCEI is to achieve 100% clean energy by 2045 by building upon the ongoing work of public and private organizations at the State, County, and grassroots level to achieve the following objectives:

- To define the structural transformation that will need to occur to transition the State to a clean energy dominated economy
- To demonstrate and foster innovation in the use of clean energy technologies, financing methodologies, and enabling policies designed to accelerate social, economic, and political acceptance of a clean energy dominated economy
- To create opportunity at all levels of society that ensures wide-spread distribution of the benefits resulting from the transition to a clean, sustainable energy State
- To establish an "open source" learning model for others seeking to achieve similar goals
- To build the workforce with crosscutting skills to enable and support a clean energy economy.

The Proposed Action is consistent with the HCEI's objectives as it would demonstrate innovation in the use of clean energy technology to provide renewable energy production by way of hydroelectric electric generation and PV generation. The Proposed Action would also provide an efficient and reliable source of irrigation to support diversified agricultural lands that are managed by DHHL, ADC, and KAA, which would increase food security and generate employment opportunities for the local community. In addition, the Proposed Action would provide a reliable source of water for fire protection during drought seasons. The generation of renewable energy from the Project would help to further achieve the State's goal of 100% clean energy by 2045 to lessen the impacts of climate change.

6.2.6 Hawaiʻi 2050 Sustainability Plan

Act 8, Special Session Laws of Hawaiʻi 2005, established the Hawaiʻi Sustainability Task Force to develop a Hawaiʻi 2050 Sustainability Plan in collaboration with the State auditor. The task force was comprised of 25 members of the public and private stakeholders, whom together with the State Auditor created the Hawaiʻi 2050 Sustainability Plan published in 2008. Act 8 also called for the plan to be updated by the State Auditor with the assistance of the State Office of Planning every ten years, and as such the Ten-Year Measurement Update of the Hawaiʻi 2050 Sustainability Plan was published in 2018. The Hawaiʻi 2050 Sustainability Plan identified the following five goals as integrated philosophies to indicate where the State should be headed.

- Sustainability as a Way of Life: Living sustainably is part of our daily practice in Hawaiʻi.
- Sustainable Economy: Our diversified and globally competitive economy enables us to live, work, and play in Hawaiʻi.

- Sustainable Environment and Natural Resources: Our natural resources are responsibly and respectfully used, replenished, and preserved for future generations.
- Sustainably Community and Social Well Being: Our community is strong, healthy, vibrant and nurturing, providing safety nets for those in need.
- Sustaining Kanaka Maoli Culture and Island Values: Our Kanaka Maoli and island cultures and values are thriving and perpetuated.

The Proposed Action would meet the goals of the Hawaiʻi 2050 Sustainability Plan as it would provide renewable energy production and resources to support agricultural production, which would benefit the surrounding communities, the County, and the State. The Proposed Action would also rehabilitate former plantation irrigation ditches and reservoirs improving public safety and increasing the value of State-owned assets, provide additional water resources for fire suppression in areas where they are not currently available, and create jobs through construction and operation of the Proposed Action. The Project would demonstrate responsible and respectful use of water through compliance with the Waimea Mediation Agreement and IIFS. Providing irrigation to support diversified agricultural lands would increase food security and generate employment opportunities for the local community and the County and would also sustain island cultures and values as they relate to agriculture.

6.2.7 HRS Chapter 342B, Air Pollution Control

Act 234 enacted in 2007 established the foundation for Hawaiʻi's GHG Program, which aimed to reduce emissions in the State to 1990 levels by 2020, excluding aviation emissions. Parts of Act 234 were codified in HRS Chapter 342B, and in 2014 HAR Section 11-60.1 was amended to adopt the GHG Program. The most recent GHG emission report indicated that Hawaiʻi is on target to meet GHG reduction goals; however, goal attainment is dependent on continued reduction of emissions from the energy sector, which includes both the transportation and stationary combustion sources. Further, the 2017 GHG emission report, published in April 2021, indicated that the energy sector accounted for 86% of total Hawaiʻi emissions, estimated at 17.7 MMT ± 0.21 standard deviation CO_2e, with 8.98 MMT coming from stationary combustion.

KIUC has already met its 1990 level GHG emissions target and is currently operating at 50% below 1990 levels. Hydroelectric power generation and pumping of water for agricultural purposes does not create noxious emissions. The Proposed Action would provide an estimated 30 GWh of hydroelectric generation annually and up to 80 GWh of firmed solar generation. Like noise emissions, this increase in generation of renewable energy from the Proposed Action would decrease the required generation of electricity from fossil fuel sources and the resultant GHG emissions. The Proposed Action would produce up to 110,000 MWh of renewable energy, which would reduce the need for fossil fuels that would equate to the reduction of 80,000 metric tons of GHG emissions (CO_2 equivalent) ($MTCO_2e$) each year, or an estimated net reduction in GHG emissions of approximately 2,018,487 $MTCO_2e$ for the Proposed Action's operation stage and 2,508,877 $MTCO_2e$ for the Proposed Action's lifecycle over 25 years.

6.2.8 HRS Chapter 225P, Hawaiʻi Climate Change Mitigation and Adaptation Initiative

In 2018, Act 15 established Hawaiʻi's zero emissions clean economy target. Act 15 was codified in HRS Section 225P-5, which set a statewide target to sequester more atmospheric carbon and GHG than emitted within the State as quickly as practicable, but no later than 2045.

The Proposed Action supports Act 15 because it will not emit any GHG as a result of its production of electricity or operations. KIUC intends on meeting the 100% RPS by 2045, which would result in KIUC not emitting any carbon as a result of its production of electricity or operations by that date. Further, the Proposed Action would contribute approximately 23.6% to KIUC's Renewable Portfolio Standards (RPS) in 2024 (year 1) and 18.1% in 2048 (year 25). This would assist KIUC in achieving the State's RPS.

6.2.9 HRS Chapter 174 C, State Water Code

The State Water Code establishes the Hawaiʻi Water Plan as the guide for implementing the policy for comprehensive water resources planning to address the problems of supply and conservation of water in the state. The Hawaiʻi Water Plan consists of five parts:

1. Water Resource Protection Plan (see **Section 6.2.9.1**)
2. Water Quality Plan (see **Section 6.2.9.2**)
3. State Water Projects Plan (see **Section 6.2.9.3**)
4. Agricultural Water Use and Development Plan (see **Section 6.2.9.4**)
5. Water Use and Development Plans prepared by each county (see **Section 6.2.10**)

The Water Resource Protection Plan and the Water Quality Plan provide the overall legal and policy framework that guide the development, conservation, and use of water resources. The State Water Projects Plan and Agricultural Water Use and Development Plan provide information on State and agricultural water needs and development plans. All this information is then integrated into the County Water Use and Development Plans, which set forth the broad allocation of land to water use within each county.

6.2.9.1 Water Resource Protection Plan

The Water Resource Protection Plan is prepared by CWRM. The objective of the plan is to protect and sustain ground and surface water resources, watersheds, and natural stream environments throughout the state. The Water Resource Protection Plan was last updated in 2008. The Water Resource Protection Plan includes policies, program directives, resource inventories, and recommendations of resource management issues. CWRM is responsible for the preparation, implementation, and updating of the Water Resource Protection Plan.

<u>Discussion</u>**:** Under HRS Chapter 174C, State Water Code, CWRM has the responsibility of establishing an IFS on every stream whenever necessary to protect the public interest in waters of the State. As discussed in **Section 1.2**, the Waimea Mediation Agreement was approved by CWRM on April 18, 2017. The Waimea Mediation Agreement establishes IIFS for the Proposed

Action. Therefore, the Proposed Action is consistent with the goals and policies of the Water Resource Protection Plan component of the Hawaiʻi Water Plan.

6.2.9.2 Water Quality Plan

The Water Quality Plan is prepared by DOH and outlines the regulations, standards, and resource management policies that define the quality to be maintained in ground and surface water resources. The Water Quality Plan identifies goals and actions for maintaining water quality throughout the state. DOH is responsible for the implementation of the Water Quality Plan through three programs: Clean Water Branch, Wastewater Branch, and Safe Drinking Water Branch. These programs are responsible for Project review and issuance of permits relative to water quality.

Discussion: The Applicant would obtain all required permits and comply with permit conditions to minimize impacts to water resources. Permits would include:

- NPDES Individual Permit from the Clean Water Branch of the DOH for stormwater discharge associated with construction activities
- NPDES Dewatering Permit from the Clean Water Branch of the DOH for discharges associated with construction activity dewatering
- Section 401, Water Quality Certification from the Clean Water Branch of the DOH
- Section 404, Clean Water Act permit from the USACE

Therefore, the Proposed Action is consistent with the Water Quality Plan component of the Hawaiʻi Water Plan.

6.2.9.3 State Water Projects Plan

The State Water Projects Plan is prepared by the DLNR Engineering Division who has accountability for State Projects. The purpose of the State Water Projects Plan is to provide a framework for planning and implementation of water development programs to meet Projected demands for State Projects. The 2017 update to the State Water Projects Plan only considered DHHL Projects since DHHL possesses one of the largest areas of land of all state agencies and could have significant impact and requirements on water resources. In addition, water needs of DHHL are Public Trust uses of water and have special protection in the water code.

Discussion: The Proposed Action is consistent with the State Water Projects Plan. As discussed in **Section 1.2**, the Waimea Mediation Agreement was approved by CWRM on April 18, 2017. The Waimea Mediation Agreement provides for DHHL's water reservation of 6.903 MGD from the Waiakōali, Kawaikōī, Kauaʻikinanā, and Kōkeʻe Streams for use on Hawaiian Home Lands (Section A.4. of the Waimea Mediation Agreement), and notes that this water reservation will be delivered by the "energy Project" (i.e., the proposed Project) (Section A.6. and F.6. of the Waimea Mediation Agreement).

The Proposed Action is significantly related to the Puʻu ʻŌpae Kuleana Homestead Settlement Plan, a Final EA for which was published in July 2020. Specifically, the ability to successfully implement the Puʻu ʻŌpae Kuleana Homestead Settlement Plan is heavily dependent on and intertwined with the successful implementation of the West Kauaʻi Energy Project. The provision of water delivery to these lands, the availability of electrical power, and the improvement of roads and other infrastructure will allow for the Puʻu ʻŌpae Kuleana Homestead Settlement Plan to move forward and will affect the timing by which Homestead users will be able to fully use the water reservation made for this Project by the CWRM.

The Proposed Action's relationship to the Puʻu ʻŌpae Kuleana Homestead Settlement Plan is further discussed in **Section 6.1.3**. The Proposed Action is consistent with the State Water Projects Plan.

6.2.9.4 Agricultural Water Use and Development Plan

The Agricultural Water Use and Development Plan is prepared by DOA. The Agricultural Water Use and Development Plan was updated in 2019. The objective of the plan is to develop a long-range management plan that assesses state and private agricultural water use, supply, and irrigation water systems. It is intended to be a master irrigation inventory plan that identifies system rehabilitation needs and prioritizes system repair.

The Agricultural Water Use and Development Plan identifies agriculture as an essential component for the state to achieve its goals of sustainability and a diversified economy. The investment into agricultural water systems is key to providing adequate water to continue to grow diversified agriculture in the state. The 2004 inventory of the Kōkeʻe Ditch Irrigation System identified improvements to Puʻu Lua Reservoir and the Puʻu Moe Divide as proposed Capital Improvement Projects. These improvements were put on hold pending the approval of the Waimea Mediation Agreement.

Discussion: Pursuant to the Waimea Mediation Agreement, the Kōkeʻe Ditch Irrigation System can only receive diverted water after instream flows are met at the various Waimea River diversions. The Waimea Mediation Agreement established IIFS for the Proposed Action. The Proposed Action would include modifications to Puʻu Lua Reservoir and Puʻu Moe Divide. Therefore, the Proposed Action is consistent with the Agricultural Water Use and Development Plan.

6.2.10 Kauaʻi Water Use and Development Plan

The Kauaʻi Water Use and Development Plan was prepared by the County of Kauaʻi Department of Water and was adopted by Kauaʻi County ordinance in 1990. The purpose of the plan is to inventory all Projected water demands to ensure that future water needs of the county are met. The plan serves to inform future land use planning and provides guidance to CWRM for decision-making on water allocations and water reservation requests. The plan includes an analysis of needed water developments for municipal, agricultural, private, and military uses.

Discussion: The Kauaʻi Water Use and Development Plan was prepared in 1990 when sugar plantations were still in operation. As such, the plan determined that the sugar plantations have adequate water supply for their irrigation requirements and there was no need for additional water development Projects. Due to the age of the current plan, it is not applicable to the water needs of today. However, the intention of the plan still holds true. The Proposed Action is consistent with the intent of the Kauaʻi Water Use and Development Plan due to its compliance with the Waimea Mediation Agreement. The Proposed Action would deliver irrigation water to support diversified agriculture on lands adjacent to the Project site, including mauka lands managed by the Department of Hawaiian Home Lands (DHHL) and ADC, and the agricultural fields on the Mānā Plain that are managed by Kekaha Agricultural Association (KAA). In addition, the Proposed Action would provide water and electrical power to DHHL lands and improve roads and other infrastructure that will allow for the Puʻu ʻŌpae Kuleana Homestead Settlement Plan to move forward.

6.3 County of Kauaʻi Planning Documents

6.3.1 County of Kauaʻi General Plan

The *County of Kauaʻi General Plan* establishes priorities for managing growth and community development over a 20-year planning timeframe. The General Plan designates land uses and provides policy goals. As shown in **Figure 6.6**, the upper part of the Proposed Action is located in the "Parks and Recreation" land use designation. The lower part of the Proposed Action is located in the "Natural" land use designation. The Mānā Powerhouse, PV Solar Array, and substation are located in the "Agricultural" land use designation.

Areas designated as "Parks and Recreation" include State parks, regional and district parks, stadiums, linear parks, and beach parks. Areas designated as "Natural" have either limited development capacity or are not suitable for development due to various reasons. Areas designated as "Agricultural" are to be held in reserve for agricultural purposes with little residential development.

The Proposed Action is consistent with the following policies of the *County of Kauaʻi General Plan:*

Policy #11: Help agricultural lands be productive

Discussion: The Proposed Action would provide reliable water supply for agricultural use through upgrades to the ditch and reservoirs and the assumption of long-term operations and maintenance by the Applicant that would support diversified agriculture on the mauka lands managed by DHHL and would provide an efficient and reliable source of water for irrigation for the ADC mauka lands and agricultural fields on the Mānā Plain, which would increase food security and generate employment opportunities for the local community. Although the Proposed Action would utilize prime agricultural land for the solar facility, it would be in compliance with HRS 205-4.5(a)(21)(A) which would allow the area occupied by the solar facility to also be made available for compatible agricultural activities. Therefore, the Proposed Action is consistent with the objectives and policies for agriculture.

Policy #13: Complete Kauaʻi's shift to clean energy

Discussion: The purpose of the Proposed Action is to provide an integrated renewable energy and irrigation Project designed with the intent of serving four objectives:

1. Renewable energy production via hydroelectric electric generation
2. Renewable energy production via solar PV generation
3. Pumped and battery storage to shift most of the Project's solar PV energy production for use in the evening peak, nighttime, and morning peak hours (as well as during periods of

rainy or cloudy weather) via the release of water and hydroelectric electric energy generation

4. Irrigation delivery to support diversified agriculture on lands adjacent to the Project site including mauka lands managed by DHHL and ADC, and the agricultural fields on the Mānā Plain that are managed by KAA

The Proposed Action would assist KIUC in meeting the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045. In 2021, Kauaʻi achieved 69% renewable energy production. The Proposed Action would produce over 20% of the total energy requirements for Kauaʻi, and it would allow KIUC to make significant progress toward achieving 100% renewable energy.

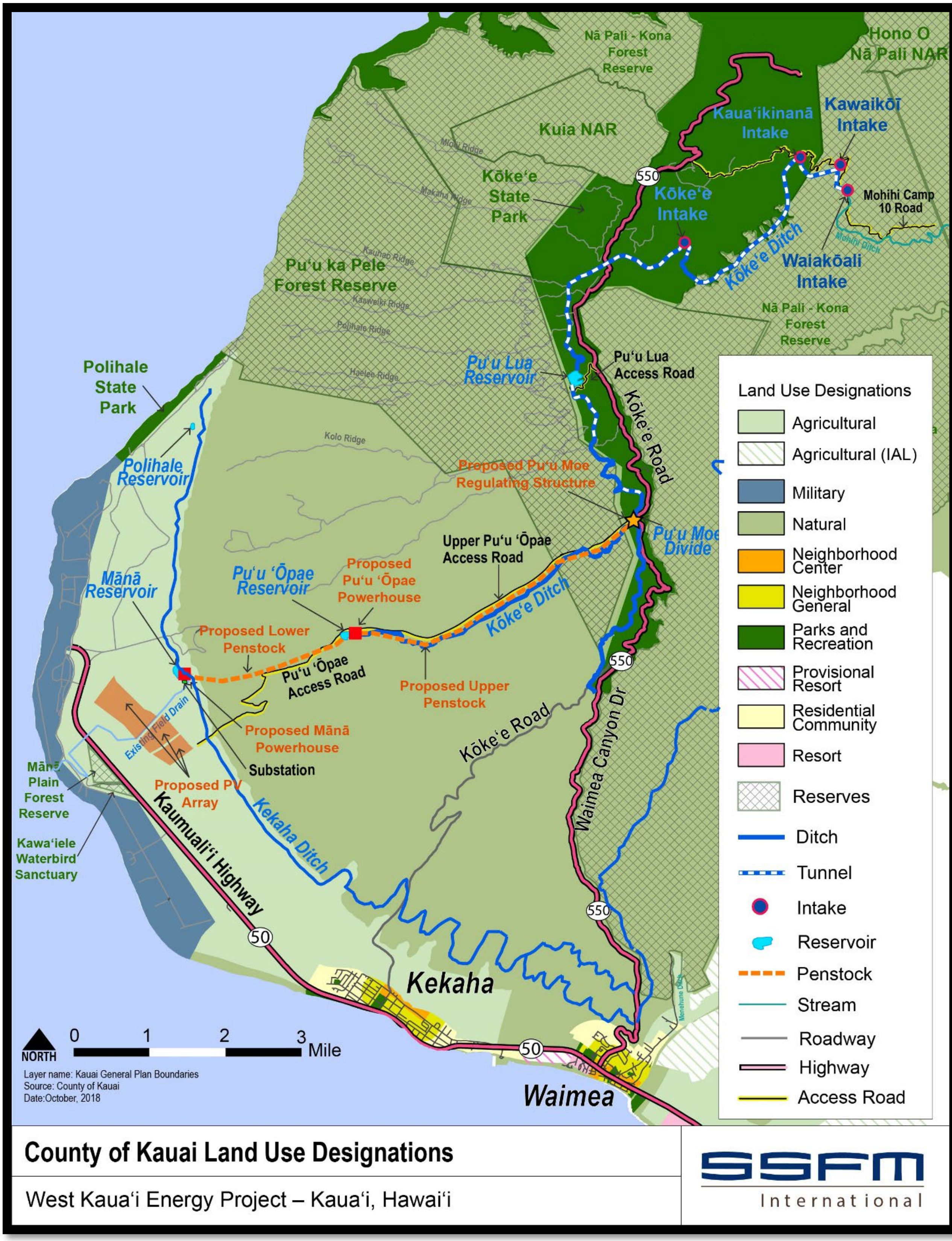
Policy #14: Prepare for Climate Change

Discussion: Operation of the Proposed Action would not contribute to global GHG emissions and climate change. The operation of the Proposed Action would have substantial beneficial impacts by reducing the State and Kauaʻi's reliance on fossil fuels and their contribution to global climate change by meeting the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045. The Proposed Action would produce renewable energy through the proposed hydroelectric and solar energy generating infrastructures and facilities.

Policy #16: Protect access to Kauaʻi's treasured places

Discussion: Rehabilitation of access roads would improve safe public access to Puʻu Lua Reservoir, which is a widely known and valued place for the trout fishing program.

Figure 6.6. County of Kauaʻi Land Use Designations



6.3.2 West Kauaʻi Community Plan

The *West Kauaʻi Community Plan* is one of five community plans of the County that addresses land use policies at the regional level. The plan was formally adopted on December 3, 2020, and the County's Planning Department is currently working on adopting the Council-approved amendments into the plan. Through the public process, six regional policies were identified and prioritized by the community. The Proposed Action is consistent with the following policy of the *West Kauaʻi Community Plan*:

Resiliency Policy #3: Strengthen the resiliency of the region's critical infrastructure and public facilities.

Discussion: The Proposed Action is consistent with this policy as it would provide renewable energy production by way of hydroelectric electric generation and PV generation. In addition, the bulk storage provided by the pumped storage portion of the Proposed Action helps address intermittency issues with solar energy generation. The extra storage capability, plus the ditch-based hydroelectric, provides Kauaʻi with a renewable solution during cloudy and rainy periods which can deplete short duration batteries. The additional storage also provides support in the event of oil-fired generation outages, allowing repair time. The Proposed Action's capabilities would provide Kauaʻi with an important reliability component as the island moves towards 100% renewable generation.

6.3.3 County of Kauaʻi Zoning

The County of Kauaʻi Planning Department Regulatory Planning Division administers the zoning and subdivision ordinances that control land use in Kauaʻi County. The County of Kauaʻi adopted the Comprehensive Zoning Ordinance in 1972 and has approved several amendments to specific provisions since its adoption. However, the ordinance has not been updated in a comprehensive manner since its adoption. The County of Kauaʻi is currently updating the Comprehensive Zoning Ordinance in two phases. In December 2012, the County approved the first phase by adopting Ordinance No. 935, which is the newly adopted zoning code for the County of Kauaʻi and will serve as the official zoning code until the County of Kauaʻi completes the second phase of the update.

As shown in **Figure 6.7**, the Proposed Action traverses lands designated as Conservation, Open, and Agriculture by the County of Kauaʻi. Each zone has a designated purpose and development standards. The Applicant would consult with the County of Kauaʻi Planning Department Regulatory Planning Division to determine any permit needs for development in these districts.

6.3.4 Special Management Area

Pursuant to the Hawaiʻi Coastal Zone management Program, HRS 205A, the counties have enacted ordinances establishing Special management Areas (SMA). Any "development" within the geographically defined SMA with a valuation of greater than $500,000 requires an SMA Use Permit issued by the Planning Commission. As shown in **Figure 6.8,** the Proposed Action would not encroach into the SMA. Therefore, an SMA Use Permit would not be required.

Figure 6.7. County of Kauaʻi Zoning Map

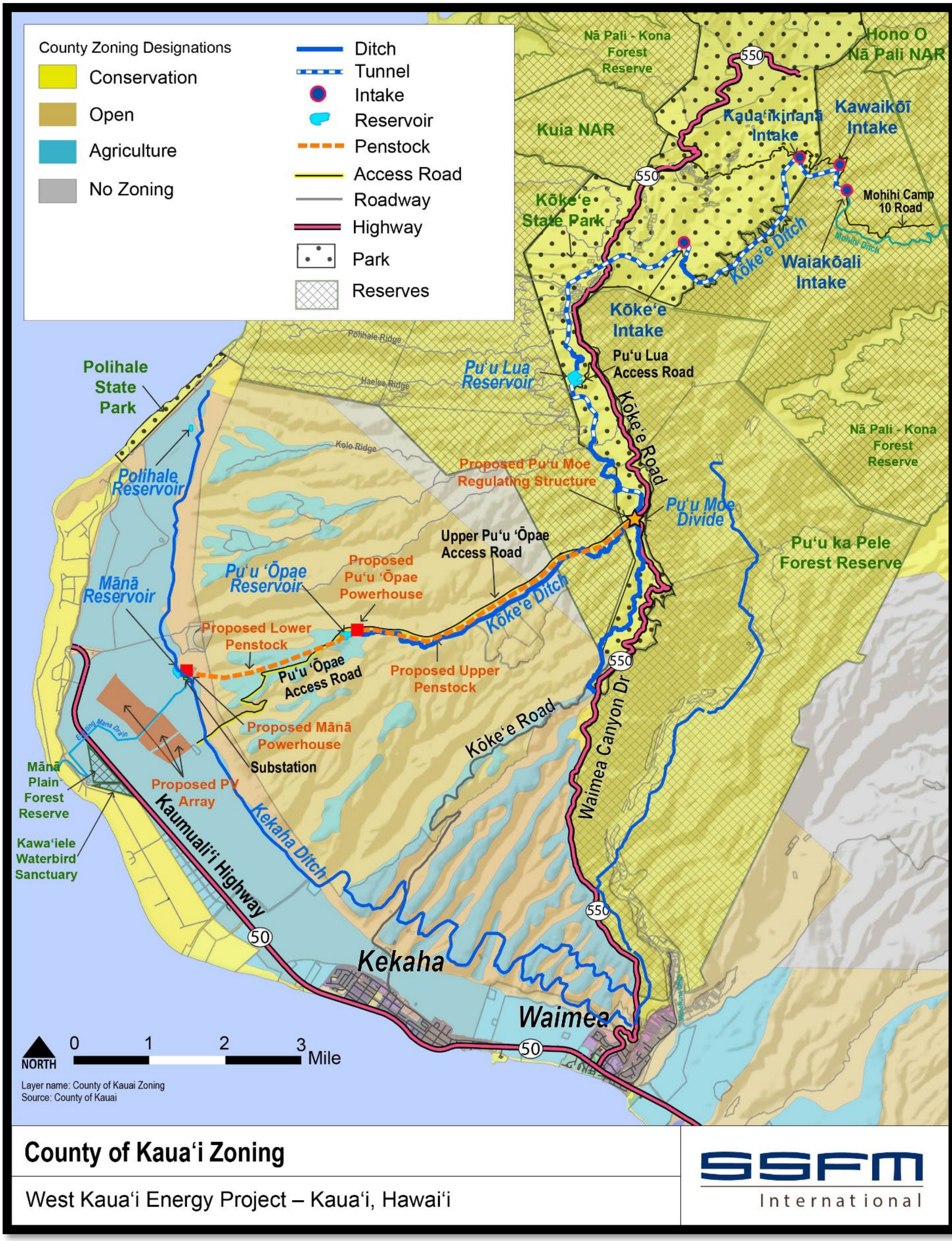
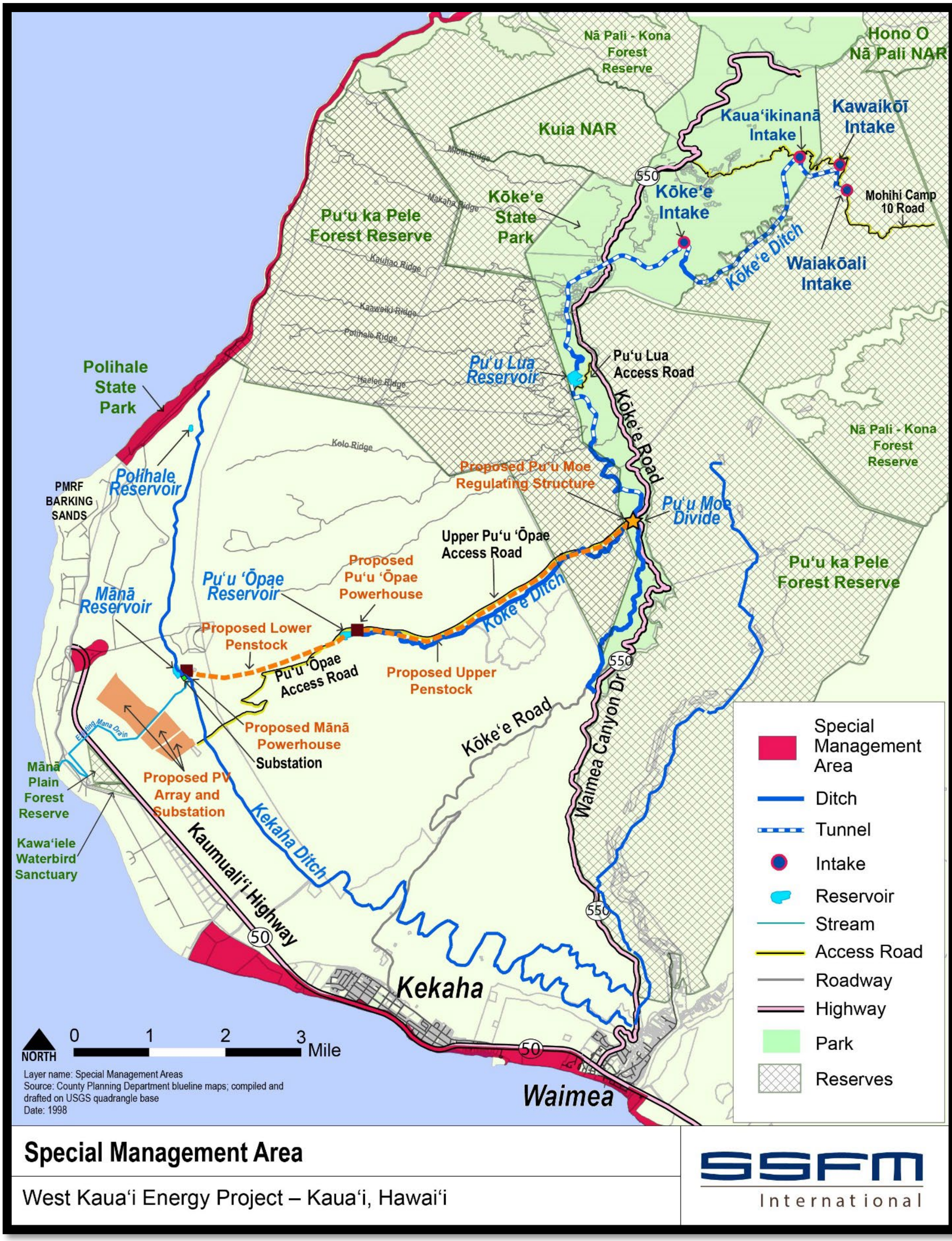


Figure 6.8. Special Management Area



7 Findings and Conclusions

7.1 Significance Criteria

HAR Chapter 11-200.1 provides significance criteria for which all Projects in Hawaiʻi are assessed. These significance criteria and their relationship to the Proposed Action are as follows:

(1) Irrevocably commit a natural, cultural resource, or historic resource.

The Proposed Action was designed, and the Project footprint was determined, to avoid irrevocable impacts to natural and cultural resources to the extent practicable.

The Proposed Action includes the continued operation of the Kōkeʻe Ditch Irrigation System for the diversion of water for hydroelectric energy production and irrigation. Modifications on the Kōkeʻe Ditch Irrigation System necessary for implementation of the Phase Two IIFS are part of the Proposed Action and discussed in more specific detail in **Section 4.1.2**. Phase Two IIFS for the Kōkeʻe Ditch Irrigation System would be implemented and maintained at each of the four diversions at all times during operation of the Proposed Action prior to diversion of water into the Kōkeʻe Ditch Irrigation System for irrigation and hydroelectric generation. As outlined in the Waimea Mediation Agreement, all flows above the Phase Two IIFS flow values may be used by the Proposed Action, but diversion volumes are also limited by the ditch capacity.

The water diverted would be stored in the reservoirs or made available for irrigation purposes to adjacent agricultural lands. During high rain events when Project discharge exceeds what is needed for irrigation on Mānā Plain, Project discharge would be transported through open ditch to fields northwest of Mānā Reservoir where KAA has plans to revert fields to open floodable spaces (fields 425, 324, 326, and 327) or into the existing storm drainage system as discussed in **Section 4.1.2.14**.

Project discharge from Mānā Reservoir would be clean, filtered water and is expected to dilute existing potential pollutants or chemical contaminants that may be present in water from other sources already present in the existing storm drainage system. This would result in an overall improved water quality of water that is discharged from the Mānā Plain. Outflow at Mānā Reservoir would be available to KAA and other farmers on Mānā Plain for the beneficial uses described **Section 2.3** including irrigation on Mānā Plain for loʻi other diversified agriculture, and for the open floodable spaces.

At the end of the Project life, land and the water used for the Project would continue to be available as an energy and/or irrigation use or other purposes as appropriate. The Project could also be decommissioned and the Project area could return to substantially the same condition as existed prior to Project development. In addition, the IIFS can be adjusted by CWRM as necessary.

The AIS identified seven historic properties with the potential to be affected by construction of the Proposed Action, including the Kōkeʻe Ditch Irrigation System (SIHP #50-30-02-2417). The Proposed Action would result in an "Effect, with agreed upon mitigation commitments" under HAR Section 13-275-7 and HAR Section 13-284-7. These historic properties and the effect construction would have on each are outlined below:

- Kōkeʻe Ditch Irrigation System (SIHP #50-30-02-2417): While construction would result in an effect on the historic Kōkeʻe Ditch Irrigation System and its features including the four diversions and the Puʻu Lua and Puʻu ʻŌpae Reservoirs, these historic properties would not be irrevocably committed. The historic property would maintain elements of historical integrity including location, setting, workmanship, feeling and association as it would continue to function as a water ditch system. The ditch and its multiple features would remain in the same locations and continue to function as a ditch system.
- Abandoned road (CSH 2): It is likely this feature will be altered or demolished during construction. The site is considered significant for its information potential and sufficient information has been collected to mitigate the effects on the property and would not be considered irrevocably committed.
- The four hearths (CSH 3): It is anticipated the four hearths can be mitigated through preservation (avoidance and protection) during construction. As a result, the effect on the four hearths would not be an irrevocable commitment.
- The Kekaha Sugar Company field infrastructure (CSH 4): The majority of the identified field infrastructure features such as the ditch network features and many of the culverts would likely remain as is; however, specific sections of culverts and other features may require rehabilitation to carry anticipated roadway loads or may be demolished during construction. The ditches and road network would overall maintain elements of historical integrity including location, setting, workmanship, feeling, and association as most of the system would continue to function as intended. The ditches and road network would remain in the same locations and continue to function as intended. For those CSH 4 features that are considered significant for their information potential under Criterion D. Sufficient information has been collected to mitigate the effects on the property and are not considered irrevocably committed.
- The basalt wall (CSH 5): It is anticipated the basalt wall can be avoided during construction. As a result the basalt wall would not be irrevocably committed. If avoidance is not possible, the basalt wall can be mitigated through preservation (avoidance and protection) during construction. As a result, the effect on the basalt wall would not be an irrevocable commitment.
- House site (SIHP #50-30-05-2113): The foundations of the house are outside the construction area and would not be irrevocably committed. Less significant features of the house site on the makai side of the site such as terraces, a ditch and a cesspool are in the construction area and would likely be buried under the Mānā Reservoir northwest embankment. The site is considered significant for its information potential under Criterion D. Sufficient information has been collected to mitigate the effects on the property and would not considered to be irrevocably committed.

It is recommended that archaeological monitoring be conducted during construction of the Upper Penstock as well as along the Lower Penstock between the crest of Niu Ridge and Kekaha Ditch. There remains a possibility for additional cultural materials, deposits, and unidentified sites to be present within these portions of the Project area. Archaeological monitoring is recommended due to the traditional and historical land use of the area. Other portions of the Project area have seen substantial land alteration by former sugarcane operations and associated infrastructure. During construction of the Proposed Action, it is unlikely that additional significant historic properties or features would be encountered in these areas.

BMPs to minimize and mitigate potential impacts to unidentified human remains, burials, or historic properties would be followed prior and during construction activities, as documented in **Section 5.5.3**.

(2) Curtail the range of beneficial uses of the environment.

The Proposed Action would utilize the existing infrastructure, specifically the Kōkeʻe Ditch Irrigation System and the Puʻu Lua, Puʻu ʻŌpae, and Mānā Reservoirs, for hydroelectric generation and irrigation delivery, and would include both rehabilitation of existing State infrastructure and new construction.

The Proposed Action is an integrated renewable energy and irrigation Project that would divert water for energy production and irrigation. The utilization of the existing Kōkeʻe Ditch Irrigation System and the Puʻu Lua, Puʻu ʻŌpae, and Mānā Reservoirs would allow the Proposed Action to provide the following:

- Renewable energy production via store and release hydroelectric electric generation
- Renewable energy production via solar PV generation
- Pumped hydroelectric and battery storage to shift most of the Project's solar PV energy production for use during the evening peak, nighttime, and morning peak hours (as well as during periods of rainy or cloudy weather) via the release of water and hydroelectric electric energy generation
- Irrigation delivery, including DHHL's water reservation of 6.903 MGD, to support diversified agriculture on lands adjacent to the Puʻu ʻŌpae Reservoir, including mauka lands managed by DHHL and ADC, and the agricultural fields on the Mānā Plain that are owned by ADC and managed by KAA
- Maintenance of three state-owned reservoirs in accordance with Hawaiʻi State Dam Safety Standards
- Compliance with IIFS for Kōkeʻe, Kauaʻikinanā, Kawaikōī, and Waiakōali streams

In multiple ways, the Proposed Action would provide additional beneficial uses of the environment, as discussed in **Section 2.3**. The Applicant would ensure that instream flow requirements would remain in the natural stream channels. The compliance with the Phase Two IIFS set by CWRM would be a benefit to all users of water on the system.

(3) *Conflict with the State's environmental policies or long-term environmental goals established by law.*

HRS 344 states that "It shall be the policy of the State, through its programs, authorities, and resources to:

(1) Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawaii.

(2) Enhance the quality of life by:

(A) Setting population limits so that the interaction between the natural and artificial environments and the population is mutually beneficial;

(B) Creating opportunities for the residents of Hawaiʻi to improve their quality of life through diverse economic activities which are stable and in balance with the physical and social environments;

(C) Establishing communities which provide a sense of identity, wise use of land, efficient transportation, and aesthetic and social satisfaction in harmony with the natural environment which is uniquely Hawaiian; and

(D) Establishing a commitment on the part of each person to protect and enhance Hawaiʻi's environment and reduce the drain on nonrenewable resources."

As discussed in **Chapter 5**, the Proposed Action would have no significant impact on environmental resources. Avoidance and minimization measures would be implemented to further reduce impacts. By displacing fossil fuel power generation, the Proposed Action is consistent with both the long-term environmental policies and goals of the state.

On Kauaʻi, electricity is supplied to members and customers of KIUC. KIUC is a not-for-profit electric cooperative that is governed by a locally elected nine-member board of directors that is accountable to the cooperative's membership. KIUC provides electricity to 34,000 member-owners on the island of Kauaʻi. The electricity is generated either through burning fossil fuels (e.g., diesel) or renewable energy such as solar, hydro, and biomass. Before recent renewable energy Project development, Hawaiʻi was heavily dependent on imported petroleum. Moreover, each island had to build its power plants and grids to generate electricity to meet local demand since there are no transmission lines between islands. Research has shown that the consistently high price of oil combined with the high fixed price on infrastructure has led to record high electricity prices in Hawaiʻi.

The Proposed Action would assist KIUC in meeting the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045. The Project would produce over 20% of the total energy requirements for Kauaʻi and increase Kauaʻi's total energy generated from renewable resources to over 80%. The Proposed Action has characteristics which would make it a unique and valuable part of KIUC's generation portfolio. It would provide significant energy storage (as much as 1,500 MWh) and has the ability to generate energy both day and night and during all weather conditions.

The Proposed Action would provide reliable irrigation water supply through upgrades to the ditch and reservoirs and the assumption of long-term operations and maintenance by the Applicant that would support diversified agriculture on the mauka lands managed by DHHL and would provide an efficient reliable source of irrigation for the ADC agricultural fields on the Mānā Plain, which would increase food security and generate employment opportunities for the local community.

(4) Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community or State.

As discussed in **Section 5.10.2**, the Proposed Action would allow KIUC to spend less money to provide electricity to the island at a more fixed and stable pricing structure. The Proposed Action would produce locally generated clean, firm, and dispatchable energy. This would provide various grid and reliability benefits and numerous other environmental and public interest benefits to KIUC, its members/customers, the Kauaʻi community, the public, and the State at large.

Overall Project spending would have a positive ripple effect on local industries and sectors that propel Kauaʻi's economy. It also offsets State expenditures by providing long-term maintenance resources in the area. In addition, it would bring the reservoirs into compliance with the Hawaiʻi State Dam Safety Standards, diversify and increase agricultural activities and products through irrigation delivery, and provide a reliable source of water for fire protection during drought seasons.

Most importantly, the Proposed Action would help Kauaʻi become less reliant on fossil fuels, which is an important milestone to reaching the State of Hawaiʻi mandate of 100% of renewable energy by 2045. In addition, the partnership between the State and the Applicant would enable the State to provide proper stewardship for the Waimea River and existing State infrastructure, while expanding agriculture opportunities, energy production, DHHL's Kuleana Subsistence Agricultural Lots development on the west side of Kauaʻi, and furthering the purposes of the HHCA.

With regard to cultural practices, as discussed in **Section 5.4**, consultation efforts identified ongoing traditional and cultural practices and cultural resources within the vicinity of the Proposed Action and the Waimea Ahupuaʻa; however, only one traditional and cultural practice was found within the Project area. The Applicant would continue to work with community members throughout construction and operation of the Proposed Action to minimize any potential impacts to cultural practices and resources within the Project area and in the vicinity of the Proposed Action.

(5) Have a substantial adverse effect on public health.

The Proposed Action would have some temporary, minor impacts on air, noise, and water quality during construction (see **Sections 5.12.2, 5.11.2,** and **5.1.2**, respectively); however, these impacts would be minimized to the extent practicable by the employment of BMPs and compliance with permit conditions. The Proposed Action would not result in any post-construction or long-term effects on public health. In fact, operation of the Proposed Action would have a beneficial impact on air quality by the substantial reduction of fossil-fueled energy generation and the associated air emissions, expected to result in health benefits from the positive impact on air quality.

(6) *Involve adverse secondary impacts, such as population changes or effects on public facilities.*

The partnership between the State and the Applicant would enable the State to provide for proper stewardship for the Waimea River and existing State infrastructure, while expanding agriculture, energy production, and DHHL’s Kuleana Subsistence Agricultural Lots development on the west side of Kaua‘i. The Proposed Action would not utilize Class A lands or those designated as Important Agricultural Lands for the solar facility, which would provide revenue for ADC that would benefit other agricultural activities. The Proposed Action would be located in an area that is designated by the State of Hawai‘i for agricultural land use and would be subject to the requirements of HRS Chapter 205, which specifies the permitted uses in the various State land use districts (see **Section 6.2.2**). Therefore, the Proposed Action would have potential beneficial secondary impacts in terms of the potential expansion of agricultural opportunities and DHHL’s Kuleana Subsistence Agricultural Lots development due to irrigation water delivery to ADC and DHHL lands.

Under the Proposed Action, operation of the upper portion of the Kōke‘e Ditch Irrigation System within Kōke‘e State Park and the Kekaha Game Management Area would be of no substantial difference than current operations and would have no impact to the access or the quality of the adjacent recreational areas (e.g., public facilities). Upon completion of the rehabilitation of the Pu‘u Lua Reservoir, there would be beneficial opportunities to the popular trout fishing program as the reservoir would be operating at increased water levels which would support increased trout stocking and increased shoreline for fishing access. Public safety would be improved through rehabilitation of the Pu‘u Lua Reservoir, which would bring the structure into compliance with Hawai‘i State Dam Safety Standards. The improvement of the Pu‘u Lua Access Road would improve public safety and access to the area.

(7) *Involve a substantial degradation of environmental quality.*

As discussed in **Chapter 5**, the Proposed Action would have no significant impacts to environmental quality. Avoidance and minimization measures would be implemented to further reduce any potential impacts. By displacing up to 20% of KIUC’s current fossil fuel power generation and bringing Kaua‘i to more than 80% renewable generation, the Proposed Action would have significant beneficial impacts to air quality and climate change.

(8) *Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions.*

As discussed in **Section 5.15**, construction of the Proposed Action would not result in negative cumulative impacts. Operation of the Proposed Action could result in beneficial cumulative impacts from improved air quality associated with the reduction of the use of fossil fuels, increased stream health from compliance with the IIFS set by CWRM and expanded agricultural production leading to greater food self-sufficiency. The Proposed Action would assist KIUC in meeting the State of Hawaiʻi's mandate to achieve 100% renewable energy by 2045. Under the Proposed Action, water would be retained in the streams and diversions as required by the IFS set by CWRM.

The only potential negative cumulative impact from Project operations is from diversion at the four streams into the Kōkeʻe Ditch Irrigation System. These diversions are currently active and have been since the early 1900s. As noted in **Section 1.2**, the Waimea Mediation Agreement outlined Phase One and Phase Two IIFS for both the Kōkeʻe and Kekaha Ditch Irrigation Systems and the Waimea River downstream of both ditch systems. The Phase Two IIFS was established and approved on the Kōkeʻe Ditch Irrigation System for the Proposed Action and associated diversion and ditch operations, and with the understanding that the Kekaha Ditch Irrigation System would be operating simultaneously for both irrigation and hydroelectric purposes. The Phase Two IIFS would go into effect upon implementation of the Proposed Action. The Proposed Action would minimize the impact of diversion activities by implementing the Phase Two IIFS, which has been set by CWRM and deemed sufficient to meet the instream needs including stream biota and habitat. During the operation phase of the Proposed Action, all four streams would maintain mauka to makai connectivity and the maintenance and monitoring of the Kōkeʻe Ditch Irrigation System would be improved. The modifications associated with the Proposed Action would increase the reliability, consistency, and longevity of IIFS implementation and increase data collection on the Kōkeʻe Ditch Irrigation System.

(9) *Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat.*

There were no special-status plant species found during ground surveys of the study area even though some facilities are located within critical habitat designated for those flora species.

Four special-status fauna species—ʻiʻiwi, Hawaiian duck, Hawaiian goose, and Hawaiian moorhen—were detected during the field surveys. Additionally, there is suitable habitat for the Hawaiian hoary bat and the picture-wing fly.

As discussed in **Section 5.3.1.2** and **Section 5.3.1.5**, there is critical habitat for nine flora species, the akekeʻe, the ʻakikiki, and the picture-wing fly.

Construction of the Proposed Action could have short-term impacts to special status species, which would be minimized or negated through the implementation of minimization and mitigation measures as discussed in **Section 5.3.3**.

As discussed in **Section 5.3.2**, the operation of the proposed PV Solar Array would have minimal impact to forest birds due to the location of the facility in agricultural lands away from natural and forested habitats. The proposed PV Solar Array location is identified as Emergent wetlands and is adjacent to fallow agricultural fields prone to flooding. Waterbirds are generally attracted to areas with standing water and have been seen in fields near the Project area. In addition, the DOFAW managed Mānā Waterbird Refuge is located approximately 1.75 miles away from the proposed PV Solar Array location. There is no evidence to date to indicate any impacts from PV Solar Array to waterbirds in Hawaiʻi including at KIUC's existing solar facilities. Therefore, there are no anticipated impacts to waterbirds.

(10) Have a substantial adverse effect on air and water quality or ambient noise levels.

Short-term construction-related impacts would occur to air quality, noise, and water quality (see **Sections 5.12.2**, **5.11.2**, and **5.1.2**). Avoidance and minimization measures would be implemented to further reduce impacts. By displacing fossil fuel power generation, the Proposed Action would have beneficial impacts to air quality, noise, and climate change.

(11) Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

As discussed in **Section 5.13**, all of the proposed facilities, except a portion of the PV Solar Array, are located in Flood Zone X, which is not considered a flood hazard area, and outside of the tsunami evacuation zone. The existing upper Kōkeʻe Ditch Irrigation System, reservoirs, and access roads have been operational for decades, without significant damage from natural hazards. These facilities were built to withstand their natural environment, and it is expected that they would continue to do so. The rehabilitation of this existing infrastructure would increase the stability and integrity of the structures for the long-term against future natural hazards.

A portion of the PV Solar Array is located on the Mānā Plain in Flood Hazard Zone A, which is an area subject to inundation by the 1% annual chance flood event, and the tsunami evacuation zone. A hydrology study was performed to delineate flood hazards based on existing conditions at the proposed PV Solar Array location. Based on preliminary design, the critical power infrastructure (such as batteries, inverters, substation, and switchyard) would be sited on the mauka side of the Mānā Plain at higher elevation in FEMA Flood Zone X and where the flood depth of a 100-year flood event ranges from 0.01 to 3.0 feet. Based on preliminary design, some portions of the PV Solar Array trackers are located in FEMA Flood Zone A, in areas where the flow depth ranges from 1.0 to 5.0 feet. The height of the panels and other equipment shall be taken into consideration and sited to be compatible with the FEMA Flood Zone A. The design of the proposed PV Solar Array would be compatible with being in the flood hazard zone and would be able to withstand inundation during the prime lifetime of the facility.

The operation of the new proposed solar, hydroelectric, and irrigation infrastructure and facilities would be compatible with its location.

(12) Have a substantial adverse effect on scenic vistas and view planes, day or night, identified in county or State plans or studies.

During construction, there would be minimal impacts to the existing scenic and visual resources. Short-term construction impacts to visual resources include the presence and staging of construction equipment within the Project areas. However, the construction sites are primarily located in gated areas or areas that are not visible from public viewpoints. Therefore, the impacts would not substantially impact visual resources or viewplanes.

Operation of the Proposed Action could impact Waipoʻo Falls. However, the primary impact to Waipoʻo Falls is actually a result of the Waimea Mediation Agreement, the establishment of an IIFS for each stream, and the resultant change of operational parameters on the Kōkeʻe Ditch Irrigation System. Kōkeʻe Stream is the natural source of Waipoʻo Falls. Historically and currently, Waipoʻo Falls was/is augmented by diverted water from Waiakōali, Kawaikōī, and Kauaʻikinanā Streams that is discharged into Kōkeʻe Stream at Kōkeʻe Diversion rather than remaining in the stream of origin or being used along the ditch system. The IIFS for each stream is to be implemented at the point of diversion rather than being returned to the watershed through another stream. The Phase Two IIFS would be implemented during operation of the Proposed Action. The Phase Two IIFS for Kōkeʻe Stream is 1.2 MGD. It is expected that the Proposed Action would only be able to divert water from Kōkeʻe Stream during higher flow events and therefore have minimal impact on Waipoʻo Falls. At all times at least 1.2 MGD would remain in the stream, and an estimated average of 86% of total streamflow would remain in the stream after diversion at Kōkeʻe Stream during West Kauaʻi Energy Project operations.

The repairs and rehabilitation of the existing diversions would not result in a change in appearance of the structures. The repairs and continued maintenance of the existing reservoirs would be beneficial to the visual environment of these areas as the current reservoirs are either operating at lower water levels or are drained and unused.

The Upper and Lower Penstock alignments would be maintained by cutting of vegetation and would not blend into natural surroundings. The Upper Penstock would be visible from the Puʻu ʻŌpae Reservoir and Powerhouse, which are located on gated lands. Therefore, the Upper Penstock alignment would be visible to tenants and guests of tenants but would not block any viewplanes. The Lower Penstock alignment would be visible from the gated Mānā agricultural area and would be visible to tenants and guests of tenants. The Lower Penstock alignment may also be visible from Kaumualiʻi Highway but would not block any viewplanes.

The Mānā Powerhouse building would be approximately 70-feet by 70-feet in plan and 50-feet-tall and would house the hydroelectric units and ancillary equipment. The Mānā Powerhouse would be of similar height to the existing trees mauka of the reservoir, would be painted a light earth tone color, and would not stand out notably from Kaumualiʻi Highway two miles to the west of the Mānā Powerhouse location.

The PV Solar Array would maintain a low profile of only approximately 15-feet-tall but may be visible when panels are at a certain angle. However, generally the PV Solar Array is not expected to be visible from public areas because it would be blocked by existing surrounding vegetation and would be at least .25 miles away from the nearest major road, Kaumualiʻi Highway. The PV Solar Array and the substation would not obstruct mauka to makai viewplanes. Additionally, there would be no new overhead power lines mauka of the Mānā Reservoir as the new power line would be simultaneously buried alongside the Lower Penstock during construction.

(13) Requires substantial energy consumption or emit greenhouse gases.

As discussed in **Section 5.12.2.2**, operation of the Proposed Action would not contribute to global GHG emissions and climate change, but in fact would greatly help reduce GHG emissions and climate change. The Applicant estimates that the Proposed Action would result in KIUC using approximately 7.8 million less gallons of naphtha fuel and 775,000 less gallons of ultra-low sulfur diesel fuel during a full year of production, which would result in an estimated annual reduction of about 80,000 tons of CO_2e. As a result, after only one year of operation, the Applicant would have caused enough of a reduction in GHG emissions from its lower fuel consumption to offset the GHG emissions from the construction, first 25 years of operation of the Proposed Action, and decommissioning of the PV/BESS Facility.

Hydroelectric power generation and pumping of water for agricultural purposes does not create noxious emissions. The Proposed Action would provide an estimated 30 GWh of hydroelectric generation annually and up to 80 GWh of firmed solar generation. Like noise emissions, this increase in generation of renewable energy from the Proposed Action would decrease the required generation of electricity from fossil fuel sources and the resultant GHG emissions. The Proposed Action would produce up to 110,000 MWh of renewable energy, which would reduce the need for fossil fuels that would equate to the reduction of 80,000 metric tons of GHG emissions (CO_2 equivalent) ($MTCO_2e$) each year, or an estimated net reduction in GHG emissions of approximately 2,018,487 $MTCO_2e$ for the Proposed Action's operation stage and 2,508,877 $MTCO_2e$ for the Proposed Action's lifecycle over 25 years. By displacing fossil fuel power generation and reducing GHG emissions, the Proposed Action would have a beneficial impact on air quality elsewhere in Hawaiʻi.

7.2 Anticipated Finding of No Significant Impact

Based on the significance criteria set forth in HAR Chapter 11-200.1 and discussed in **Section 7.1**, it is anticipated that the Proposed Action would not have a significant effect on the environment and that a Finding of No Significant Impact (FONSI) would be filed with the State of Hawaiʻi Office of Planning and Sustainable Development's Environmental Review Program following the public comment period.

8 Agencies and Organizations Consulted

8.1 Pre-Assessment Consultation

The following agencies and organizations were consulted during the preparation of the Draft EA and were provided notice of availability of the publication of the Draft EA. Those who formally replied are indicated by an asterisk (*). All written comments received during the early consultation period of the Draft EA and responses are included in **Appendix O**.

8.1.1 Federal Agencies

- U.S. Army Corps of Engineers *
- U.S. Fish and Wildlife Service *

8.1.2 State of Hawaiʻi Agencies and Elected Officials

- Department of Agriculture *
- Agribusiness Development Corporation *
- Department of Accounting and General Services *
- Department of Business, Economic Development & Tourism
- Hawaiʻi State Energy Office
- Office of Planning *
- Department of Hawaiian Home Lands
- Department of Health (DOH), Clean Water Branch
- DOH, Clean Air Branch
- DOH, Indoor and Radiological Health Branch *
- DOH, Environmental Planning Office
- Department of Land and Natural Resources (DLNR), Land Division

Division of Forestry and Wildlife *

Engineering Division *

Commission on Water Resource Management *

Division of State Parks *

- DLNR, State Historic Preservation Division
- Department of Transportation *
- Office of Hawaiian Affairs
- Senator Ronald D. Kouchi, Senate District 8

- Representative Dee Morikawa, House District 16
- Representative James Kunane Tokioka, House District 15
- Representative Nadine K. Nakamura, House District 14

8.1.3 County of Kauaʻi Agencies and Elected Officials

- Mayor Derek S.K. Kawakami
- Council Chair Arryl Kaneshiro
- Former Council Vice Chair Ross Kagawa
- Councilmember Luke Evslin
- Councilmember Felicia Cowden
- Councilmember Kipu Kai Kualiʻi
- Councilmember Mason K. Chock
- Office of Economic Development
- Department of Parks and Recreation
- Planning Department
- Public Works Department *

8.1.4 Non-Governmental Organizations and Landowners

- Kauaʻi County Farm Bureau
- Grove Farm Company
- General Dynamics Mission Systems
- Pacific Missile Range Facility
- Kauaʻi Visitors Bureau
- Kauaʻi Economic Development Board
- Kauaʻi Chamber of Commerce
- Kekaha Hawaiian Homestead Association
- West Kauaʻi Business and Professional Association
- E Ola Mau Nā Leo O Kekaha
- Kauaʻi Planning and Action Alliance
- Kekaha Agricultural Association
- Earthjustice *
- Kōkeʻe Lodge

- Contractors Association of Kauaʻi *
- West Kauaʻi Homestead Association
- Anahola Hawaiian Homes Association
- Kalalea Anahola Farmer's Hui
- Piʻilani Mai Ke Kai Community Association
- Kūkulu Kumuhana o Anahola
- Kekaha Host Community – Citizens Advisory Committee

8.2 Virtual Community Meeting and Online Open House

A virtual community meeting and online open house was held by KIUC to inform the public of the Project's uses, purpose, size, location, and requirements; and to collect input from the public to be included into the Draft EA. The outreach effort was intended to fulfill commitments made to the public by KIUC to conduct outreach prior to the publication of the Draft EA. The virtual community meeting was held on March 31, 2021, at 6:00 p.m. via Zoom web conference. The interactive online open house website (www.westkauaienergyproject.com) was launched on March 30, 2021 to provide information presented at the virtual community meeting and provide an additional opportunity for the public to submit comments on the Project. The virtual open house comment period closed on April 21, 2021; however, the website has remained active through the EA process and was available to the public to receive updates and provide input on the Draft EA.

A copy of the meeting attendance sheet for the virtual community meeting is provided in **Appendix P** along with a summary of the meeting. Two-hundred and seventy-three (273) individuals pre-registered for the meeting and 154 people attended. The online open house was open for public comment for 22 days and was visited by 172 unique visitors resulting in 701 page views with five (5) written comments submitted. In total, 131 individual comments or questions were submitted by the public through participating at the virtual community meeting or online open house. Major topics of discussion and comments submitted are provided in the list below and detailed comments and responses for each are provided in the meeting summary in **Appendix P**. Major discussion topics included:

1. Project funding, development costs, and timeline
2. Impacts on electricity rates, profits, and savings
3. Environmental impacts on water resources (e.g., stream flow, discharges and sedimentation, water diversions), Agricultural resources and farming, Biological resources, Archaeological and Historic resources, Cultural practices and burials, Use of conservation Lands and DHHL lands
4. Socioeconomic impacts on the West Side communities, benefits to Hawaiians and DHHL Beneficiaries, State and KIUC energy goals, workforce, Environmental Justice (EJ)

5. Proposed Action elements including operations, alternatives, construction impacts, water diversions
6. Community Engagement Process
7. Applicability of Environmental Assessment vs. Environmental Impact Statement
8. Mediated Water Agreement and Power Purchase Agreements
9. Community access and safety considerations

8.3 Review of February 2021 Draft EA and September 2022 Draft EA

The following agencies and organizations were consulted and received notice of availability of the publication of the first Draft EA in August 2021 and the second Draft EA in September 2022. Those who formally replied to the first Draft EA are indicated by a "[1]", and those who replied to the second Draft EA are indicated by a "[2]"All written comments received during the consultation period of the first Draft EA and responses are included in **Appendix Q**. Written comments received during consultation period of the second Draft EA and responses are included in **Appendix R**.

8.3.1 Federal Agencies

- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service[1]

8.3.2 State of Hawaiʻi Agencies

- Department of Agriculture[2]
- Agribusiness Development Corporation[1]
- Department of Accounting and General Services
- Department of Business, Economic Development & Tourism
- Hawaiʻi State Energy Office[1, 2]
- Office of Planning and Sustainable Development[1]
- Department of Hawaiian Home Lands
- Department of Health (DOH), Clean Water Branch[2]
- DOH, Clean Air Branch[1]
- DOH, Indoor and Radiological Health Branch
- DOH, Environmental Planning Office
- Department of Land and Natural Resources (DLNR)

Land Division[1, 2]

Division of Forestry and Wildlife[1]

Engineering Division[1]

Commission on Water Resource Management

Division of State Parks

Office of Conservation and Coastal Lands[1, 2]

Division of Aquatic Resources

- DLNR, State Historic Preservation Division
- Department of Transportation[1]
- Office of Hawaiian Affairs[2]
- Senator Ronald D. Kouchi, Senate District 8
- Representative Dee Morikawa, House District 16
- Representative James Kunane Tokioka, House District 15
- Representative Nadine K. Nakamura, House District 14

8.3.3 County of Kauaʻi Agencies

- Mayor Derek S.K. Kawakami
- Council Chair Arryl Kaneshiro
- Council Vice Chair Mason Chock
- Councilmember Kipukai Kualiʻi
- Councilmember Luke Evslin
- Councilmember Bernard Carvalho, Jr.
- Councilmember Felicia Cowden
- Councilmember Kipukai Kualiʻi
- Councilmember Mason K. Chock
- Office of Economic Development
- Department of Parks and Recreation
- Department of Water
- Planning Department[2]
- Public Works Department[1]

8.3.4 Non-Governmental Organizations and Landowners

- Kauaʻi County Farm Bureau
- Grove Farm Company

- General Dynamics Mission Systems
- Pacific Missile Range Facility
- Kauaʻi Visitors Bureau
- Kauaʻi Economic Development Board
- Kauaʻi Chamber of Commerce
- Kekaha Hawaiian Homestead Association
- Pōʻai Wai Ola
- West Kauaʻi Business and Professional Association
- E Ola Mau Nā Leo O Kekaha
- Kauaʻi Planning and Action Alliance
- Kekaha Agricultural Association
- Earthjustice[2]
- Kōkeʻe Lodge
- Contractors Association of Kauaʻi
- West Kauaʻi Homestead Association
- Anahola Hawaiian Homes Association
- Kalalea Anahola Farmer's Hui
- Piʻilani Mai Ke Kai Community Association
- Kūkulu Kumuhana o Anahola
- Kekaha Host Community – Citizens Advisory Committee

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