VOL. 5

Proposed Lease (Water Lease) for the Nāhiku, Keʻanae, Honomanū, and Huelo License Areas

Corrected Final Environmental Impact Statement

September 2021 (Corrected)

Prepared For

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East Maui Irrigation Company, Ltd.

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APPENDIX O:

East Maui Watershed Partnership
Management Plan (Amended July 2018)

EAST MAUI WATERSHED PARTNERSHIP

MANAGEMENT PLAN

Prepared by:
East Maui Watershed Partnership
July 2009
Amended July 2018

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EXECUTIVE SUMMARY

On November 23, 1991, county, state, federal and private landowners officially formed the East Maui Watershed Partnership (EMWP). The members, the major landowners and land managers of the windward slope of East Maui, include the County of Maui, East Maui Irrigation Company Ltd. (EMI), Haleakalā National Park (HNP), Haleakala Ranch Company, the State of Hawai‘i Department of Land and Natural Resources/Division of Forestry and Wildlife (DLNR/DOFAW) and The Nature Conservancy of Hawai‘i (TNC).

Although the members of the Partnership have different priorities, mandates and constituencies, all share a common commitment – the long-term protection of the East Maui Watershed.

In June 1993, a management plan was prepared that presented the combined interests and goals of the partners. The plan did not prioritize amongst or within programs and recognized the numerous “users” and values attached to the watershed. It is still important to the success of this cooperative management effort that comparisons of values not be made and that the parties remain focused on initiating activities of common good and commitment.

Since 1993, EMWP has made great strides to protect native forested areas and promote watershed protection within the community. Highlights of the last 25 years include:

- Constructed over 6 miles of fence to enclose a 12,000-acre core area project site. Management of the 12,000 acre area, which includes Waikamoi Preserve, EMI lands and portions of Ko‘olau Forest Reserve, is divided between EMWP and TNC.
- Constructed over 6 miles of fence to enclose an over 3,000 acre project site above the community of Hāna including Waiho‘i Valley. Management of the 3,300 acre area, which includes parts of Ko‘olau Forest Reserve, Hanawī Natural Area Reserve, and Upper Hāna Forest Reserve, is divided between DOFAW and EMWP.
- Worked collaboratively with Haleakala Ranch, Leeward Haleakalā Watershed Restoration Partnership and others to protect and initiate restoration the watershed at the 1,200 acre Pu‘u Pahu Reserve project site.
- Implemented a zero-tolerance management approach to ungulates and began mapping and controlling priority invasive plants in the fenced project sites.
- Developed and implemented a public outreach and education program that includes classroom presentations, interpretive hikes, and volunteer trips to encourage youth to become future stewards of Maui’s natural resources.
- Worked closely with key decision makers in Maui County and throughout the State to affect policies and forward the goals of the Partnership.
- Supported the development of new conservation techniques and applications related to vegetation resource mapping, biocontrol research, and animal control.
- Raised millions of dollars to implement watershed management and protection programs.
- Developed Five Year Weed Management Plan (Appendix G)
- Collaborated with stakeholders to increase access by public hunters to remove feral animals in lower portions of Ko‘olau Forest Reserve.

This revised management plan will detail the accomplishments by EMWP since the initial management efforts in 1993, and will further outline the purpose, objectives and budget for EMWP’s activities in five program areas as identified by Partners through a strategic planning process. These programs include: 1) Ungulate management, 2) Vegetation management, 3) Watershed resource monitoring, 4) Outreach and education, and 5) Management infrastructure.

EMWP will continue implementing a watershed protection program aimed at reducing threats to native ecosystems and increasing public awareness and support of watershed issues. Project staff will continue intensive management efforts in the existing EMWP core area and expand efforts to protect unique bog systems and other high value watershed areas in the vicinity of Waihoʻi valley in the upper portion of Hāna Forest Reserve where ungulate removal and monitoring has begun, and is ongoing above the fence. EMWP staff will assist Haleakala Ranch with resource management efforts on approximately 1,500 acres of sub-alpine shrubland in the fully fenced Puʻu Pahu Reserve. EMWP will also work closely with DLNR/DOFAW to plan future watershed protection projects on State owned land in east Maui with high conservation value and other high value watershed areas as opportunities arise.

EMWP will also continue to support partner resource management programs when time permits or as dictated by financial constraints.

Annual project needs are estimated to be between approximately $715,000 and $910,000 over the next 5 years.

INTRODUCTION

EMWP History

In 1991, the County of Maui, along with federal, state and private landowners signed a Master Cooperative Agreement to coordinate watershed management efforts on the windward slope of Haleakalā. Referred to as the East Maui Watershed Partnership (EMWP), the signatories included:

- County of Maui
- East Maui Irrigation Company, Ltd
- Haleakalā National Park
- Haleakala Ranch Company
- Hana Ranch Partners, LLC
- State of Hawai‘i Department of Land and Natural Resources
- The Nature Conservancy of Hawai‘i

Although the members of the Partnership have different priorities, mandates and constituencies, all share a common commitment – the long term protection of the East Maui Watershed. In this spirit, EMWP's mission statement was drafted:

"The East Maui Watershed Partnership recognizes
that the watershed on the windward slopes of Haleakalā
is an invaluable resource for the island of Maui that must be preserved and protected.

It is an integral component of the present and future water supply
for the island of Maui. Proper management of this forested watershed area
and its native ecosystems is needed to protect the usefulness and value
of the watershed into perpetuity."

After the 1993 EMWP management plan was written, EMI and DLNR/DOFAW entered into a right-of-entry agreement, permitting public hunters to utilize access roads throughout the Forest Reserve. This significantly increased public hunter access and control of feral animals in Ko‘olau Forest Reserve. According to data from DOFAW check-in stations, public hunters removed an average of over 280 pigs per year in these areas between 2000 and 2014. The program continues today and is administered by DLNR/DOFAW with assistance provided by the Ko‘olau Volunteer Hunter Group.

In 1996, the Partners drafted an Environmental Assessment (EA) outlining a fencing strategy to preserve and protect a 12,000-acre core area. In addition to the EA, the partners developed a monitoring plan that proposed specific actions to implement over a 10-year period.

Between 1996 and 2001, partner agencies and cooperators carried out the objectives identified in EMWP management and monitoring plans. Partner resource management agencies assumed primary responsibility for actions involving fence construction and threat abatement and private landowners assisted with access and liability concerns

In 2002, professional staff was hired to assume responsibility for fence construction and threat abatement above partnership fences. In 2003, a public outreach and education program was launched. This program works cooperatively with all partners and interested parties.

During a 2004 strategic retreat, the partners drafted a revised mission statement:

"We the landowners of the forested watershed area of East Maui participate together to protect East Maui's native rainforest and primary water source in perpetuity. We do this to ensure the goods and services of the watershed are provided to the island's communities and the continued health of East Maui's unique native plants and animals. We pledge to do this with fiscal responsibility, efficient completion of work promised, and proper education and reporting."

In April 2006, fence construction of the 12,000-acre project site was completed. A distinct portion of the project site is managed by TNC and another distinct portion is managed by EMWP staff. That same year EMWP and TNC developed and launched a 3-year plan for accelerated ungulate removal, adopting a zero-tolerance approach to ungulate activity. The plan, referred to as "Go Deep", was developed to:

"dramatically reduce ungulates throughout the 12,000-acre focal area to achieve near zero damage and activity levels within 3 years and set up an ongoing 'no tolerance' management program that will maintain near zero damage and activity levels."

The Go Deep project was an extremely successful program. Nearly all ungulates have been removed from the 12,000-acre area and a well-developed management infrastructure consisting of trails, transects, camps and landing zones has been installed. Ungulate management at the site has largely shifted to maintenance of existing infrastructure and monitoring.

In June 2007, DLNR approved an Environmental Assessment to expand watershed protection efforts in the East Maui Watershed. This EA discussed construction of over 20 miles of fences in Hanawī NAR, Hāna Forest Reserve and Kīpahulu Forest Reserve. Construction took place in seven phases from 2008-2017 and is now complete.

EMWP held a strategic retreat in the fall of 2008 to identify goals, objectives and, most importantly, specific management actions for the next 5 five years. One of the products of the retreat was a revised overarching goal of EMWP:

"Continue protecting East Maui's primary water source, including, but not limited to, the native forested watershed by significantly reducing targeted threats."

Another product of the 2008 retreat was a refined mission statement in recognition of the importance of the community's role in accomplishing EMWP's goal:

"We the landowners of the forested watershed area of East Maui participate together to protect East Maui's native rainforest and primary water source in perpetuity. We do this to ensure the goods and services of the watershed are provided to the island's communities and the continued health of East Maui's unique native plants and animals. We pledge to do this with fiscal responsibility, efficient completion of work promised, proper education and reporting, and engaging community participation."

In January, 2009 EMWP began watershed protection efforts on approximately 3,000 acres of upper Hāna Forest Reserve. This area includes the headwaters of Kawaipapa, Waihonu, Papahawahawa and several other major east Maui streams as well as the native forested lands

adjacent to the southwest boundary Hanawī NAR. Threat abatement and long-term management of the area began after completing construction of a 6 mile ungulate-proof fence in 2014. EMWP and DOFAW continue to work collaboratively on management of the area.

In 2013 EMWP drafted and approved the East Maui Watershed Partnership Updated 5 Year Weed Management Plan FY2014-19. The Plan takes into account work being carried out by neighboring land managers including Maui Invasive Species Committee and The Nature Conservancy in an attempt to best allocate EMWP's available resources.

In 2014 EMWP began to place a substantial amount of staff field time towards invasive plant control. Control of Himalayan ginger is a current top priority. EMWP's management activities continue to evolve and the program seeks to adapt and respond to the most immediate threats to the watershed.

Protected Lands and Ownership

The lands under the jurisdiction of the East Maui Watershed partners span over 100,000 acres of the Makawao and Hāna Districts of Maui **(Figure 1)**.

Elevations range from sea level along the windward coast to over 10,000 feet in the National Park. At its northwestern end, the watershed includes the mauka lands of Haleakala Ranch, the state-owned Waihou and Makawao Forest Reserves, and the forests of EMI (those owned in fee by EMI and under lease from the State). A portion of both Haleakala Ranch and EMI lands are under separate conservation easements to TNC for the Waikamoi Preserve, which together encompasses 8,951 acres and extends from Makawao Forest Reserve in the west eastward into the central watershed.

The central region of the watershed, mauka of the Hāna Highway, is dominated by the state-owned Koʻolau Forest Reserve and the Hanawī Natural Area Reserve. Haleakalā National Park includes the entire summit region as well as Kīpahulu Valley and Kaʻapahu. At the southwestern end, the watershed is bounded by the state-owned Kīpahulu Forest Reserve.

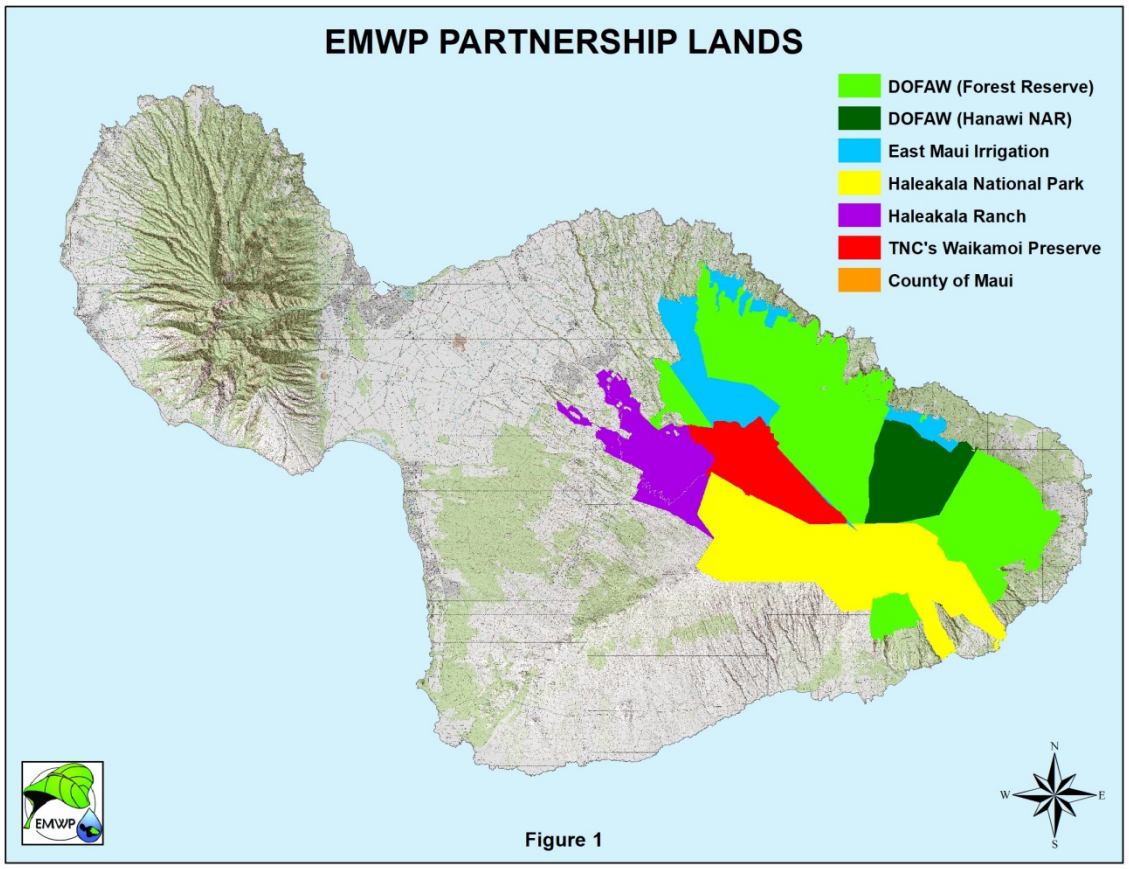


Figure 1

Watershed Resources

East Maui is known for its physical beauty, pristine resources, Hawaiian history and culture and communities dedicated to protecting these resources and maintaining their lifestyle. The watershed is home to native forests, indigenous and endemic plant and animal species, diversified agriculture, numerous streams and at the summit, Haleakalā crater. The landscape includes many legends and oral histories of significance to the Hawaiian culture.

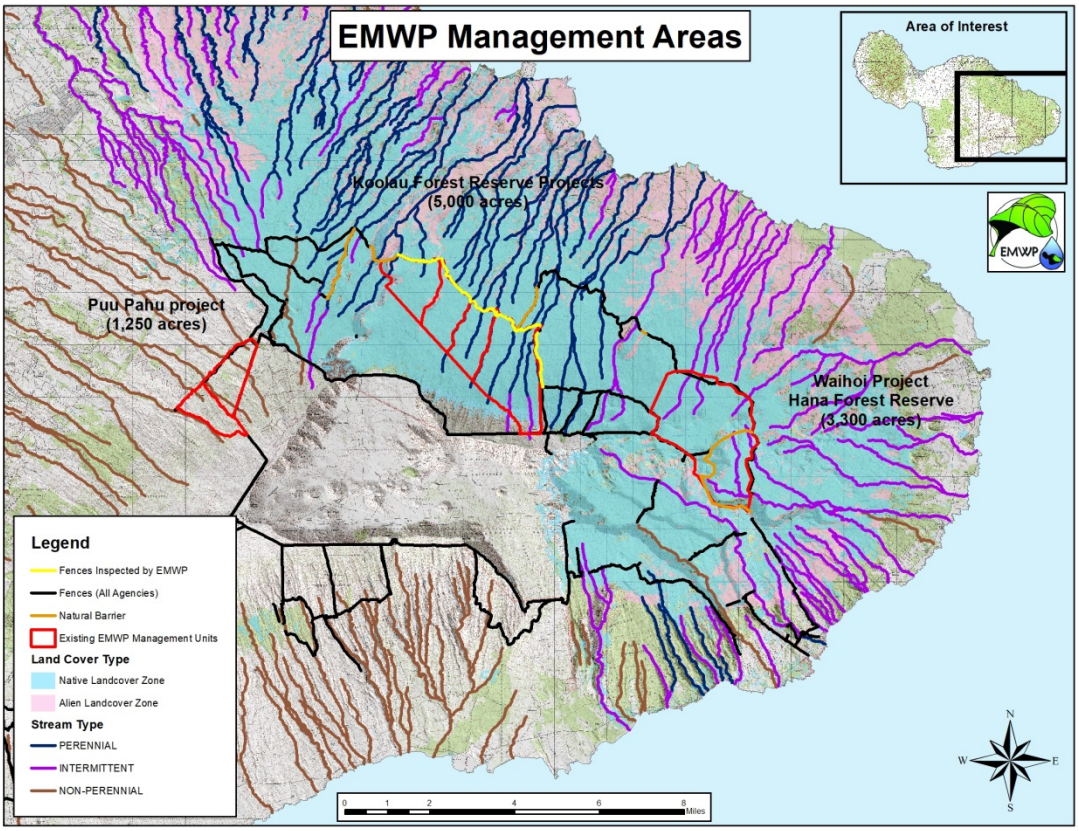
EMWP believes that protecting the native ecosystems and component parts is essential to maintaining a healthy watershed. Forested watersheds perform four basic functions. The plants located throughout the forest canopy intercept rain before it reaches the ground, reducing the rain's erosive capacity and increasing infiltration of rain water into the ground. The increase in percolation recharges underground aquifers and supplies a more consistent flow of surface waters. In addition, fog that condenses on vegetation increases total water flow. Forested watersheds anchor soil. The roots of trees and other vegetation prevent soil from entering streams, thereby decreasing erosion and sedimentation in streams and in near-shore areas. Forested areas also serve as a sponge, soaking rainfall into vegetation and soils that slowly release water when the ground is fully saturated. A consistent and dependable source of fresh water is delivered, well after rainfall events have ended. Lastly, in the forested watersheds, evapotranspiration is suppressed, allowing most rainfall and condensed fog to infiltrate into the ground.

The value of the goods and services provided by Hawaii's forested watersheds has been estimated to be in the billions of dollars. These goods and services include but are not limited to ground and surface water quality, in-stream uses, species habitat, biodiversity, subsistence, hunting, aesthetic values, commercial harvests, ecotourism, and climate control. Replacing any of these goods and services would cost billions of dollars and cripple the State's economy.

Water Resources: The topography and windward aspect of the East Maui Watershed leads to extensive rainfall (115 inches to over 400 inches annually) across the region. Twelve perennial streams originate in the area as well as dozens of intermittent waterways. **(Figure 2)** East Maui's watershed provides the largest harvested source of surface water in the State of Hawaii. The collection, storage and transmission system to collect this surface water is extensive. Surface water is collected from over 50,000 acres of the East Maui Watershed and supplies diversified agriculture in central Maui as well as municipal water for Upcountry residents and farmers, from Haʻikū to Kanaio. Extensive aquifers exist below much of the area feeding numerous wells which produce water for public and private use. The management activities outlined in this management plan are intended to help maintain the quality and quantity of surface and ground water in the region in order to protect the resource for all users and for future generations.

On Maui, the Department of Water Supply (DWS) provides services to Central Maui, UpCountry Maui, East Maui, and West Maui. DWS treats and tests the quality of water it delivers to ensure compliance with all state and federal water quality standards. The DWS Water Quality Laboratory is accredited by the Hawaii State Department of Health, the National Environmental Laboratory Accreditation Program, and the Field Sampling and Monitoring Organization.

Figure 2



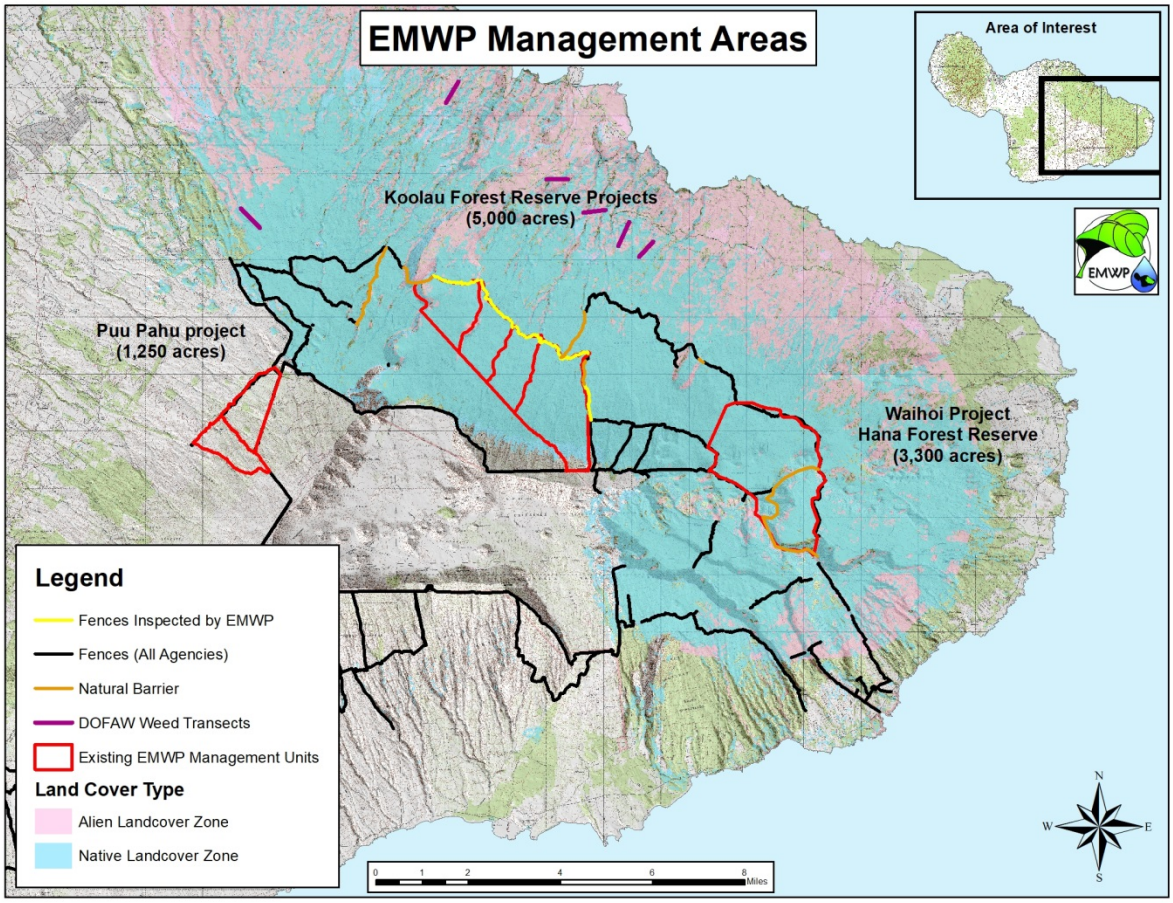
Cultural/Physical Resources: In February 1998, The Trust for Public Land prepared an East Maui Resource Inventory for the National Park Services' Rivers, Trails, and Conservation Assistance Program. Intended to be a reference document for the East Maui community in making decisions and choices, the inventory includes a chronological narrative of events significant to East Maui, a description of each traditional district, land use and preservation, and resource management tools (Trust for Public Land, East Maui Resource Inventory, 1998).

East Maui's landscape includes many legends and oral histories, battles, sites and events that represent the region's distinctive history and culture. Two collections of traditions and oral histories have been compiled for land within the East Maui Watershed (*Wai O Ke Ola: He Wahi Mo'olelo No Maui Hikina*, Kumu Pono Associates, 2002) and The Nature Conservancy's Waikamoi Preserve, owned by Haleakala Ranch Company (*He Mo'olelo No Maui Hikina – Kalialinui I Uka A Me Na Aina O Lalo*, Kumu Pono Associates, LLC (2006).

Native Flora and Fauna Resources: East Maui's forested watershed also serves as a home to myriad native plants and animals. Extensive information on rare plants, vertebrates, invertebrates, and natural vegetation communities is provided in Biological Summary and Land Use History of the East Maui Watershed (TNC, 1996). As reported by the Hawai'i Natural Heritage Program, more than 25 native natural communities are represented in the East Maui Watershed area. Of these, 13 are considered rare. Sixty-three rare plants have also been identified from a variety of locations throughout the watershed area, primarily in areas such as Haleakalā National Park and Waikamoi Preserve. Thirteen rare vertebrates and five rare invertebrate species have been reported as well, with most of the rare vertebrates being

endangered forest birds. Additional funding would be required to continue enhanced surveys for rare plants and animals occurring in Makawao, Koʻolau, Hāna and Kīpahulu Forest Reserves. The approximate distribution of native vs alien, or non-native plant cover is depicted in **Figure 3**.

Figure 3 Land Cover



Recreational Resources The watershed serves the island community by providing plants, animals, forestry products, hiking, and other recreational opportunities of importance to the local island culture and visiting population. The State of Hawai‘i DLNR is tasked to manage and balance these desired levels of activity on DOFAW-managed lands; over 50% of the land under the jurisdiction of the EMWP is located within the State Forest Reserve system.

DLNR/DOFAW formulates and uses a consistent philosophy for management priorities and actions, and periodically updates location specific management guidelines. DOFAW generally bases these guidelines on the overall goal of ensuring the perpetuity of native habitats. DOFAW determines appropriate levels of intensity and use within much of the east Maui watershed. These uses include outdoor recreation, forest products, and game management. DOFAW is currently in the process of updating the Management Guidelines. Those guidelines, when finalized, will be incorporated into a future revision of this management plan.

Hunting is a popular activity in the lower, more accessible portions of the watershed. Feral pigs (*Sus scrofa*), goats (*Capra hir*cus) and axis deer (*Axis axis*) represent a valuable resource to the hunting community and hunting of feral ungulates is a popular sport, source of food and tradition passed down from generation to generation. The forest reserves in East Maui are designated as public hunting areas and DOFAW works with EMI to provide access to the areas where hunting is permitted in the Ko‘olau Forest Reserve. A vehicular access agreement between EMI and DLNR enables members of the Ko‘olau Volunteer Hunters Group (KVHG) to utilize roads, significantly increasing public access. **Figures 4 and 5** depict hunting units in the forest reserves within the lands of the East Maui Watershed Partnership.

Figure 4. Hunting Units

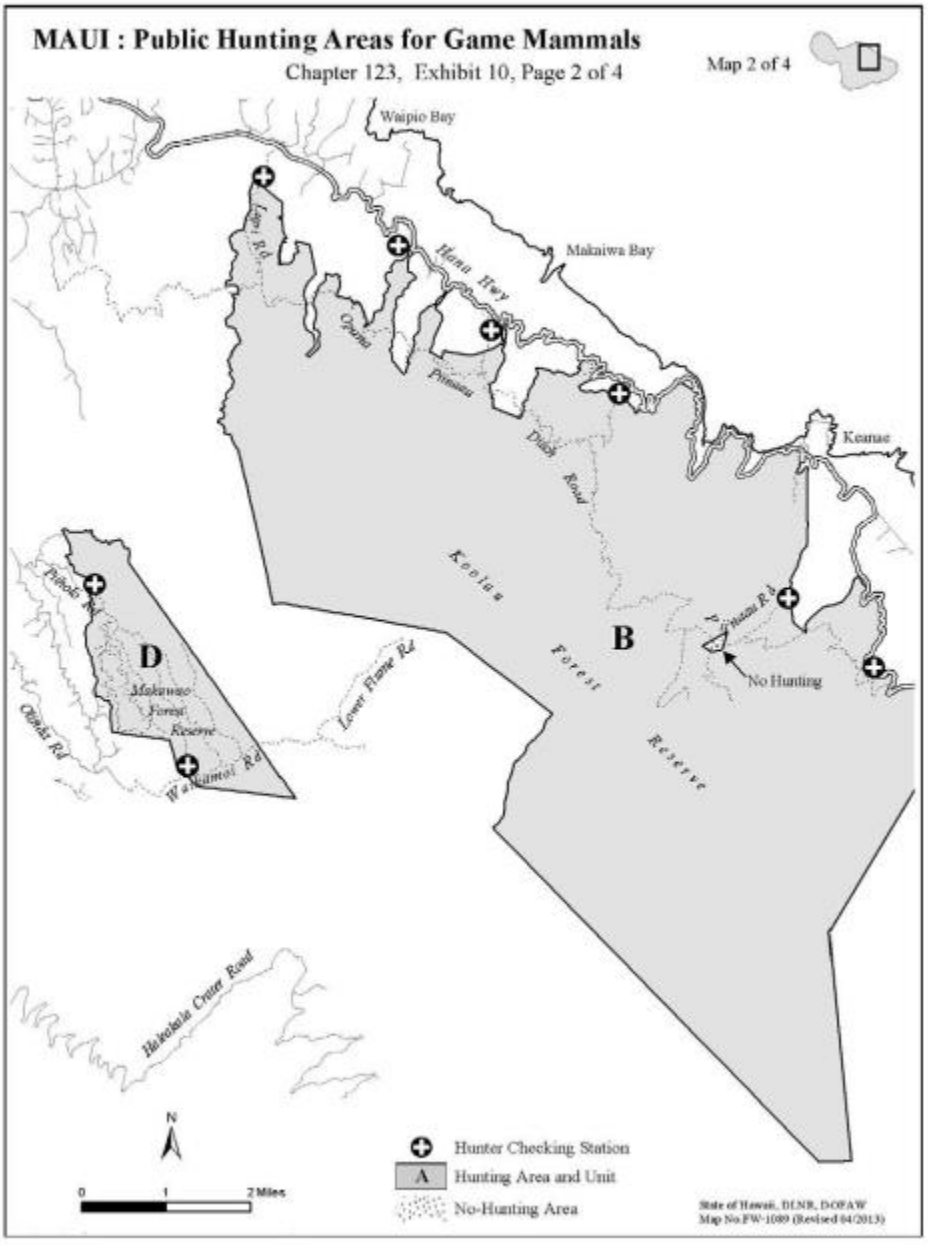
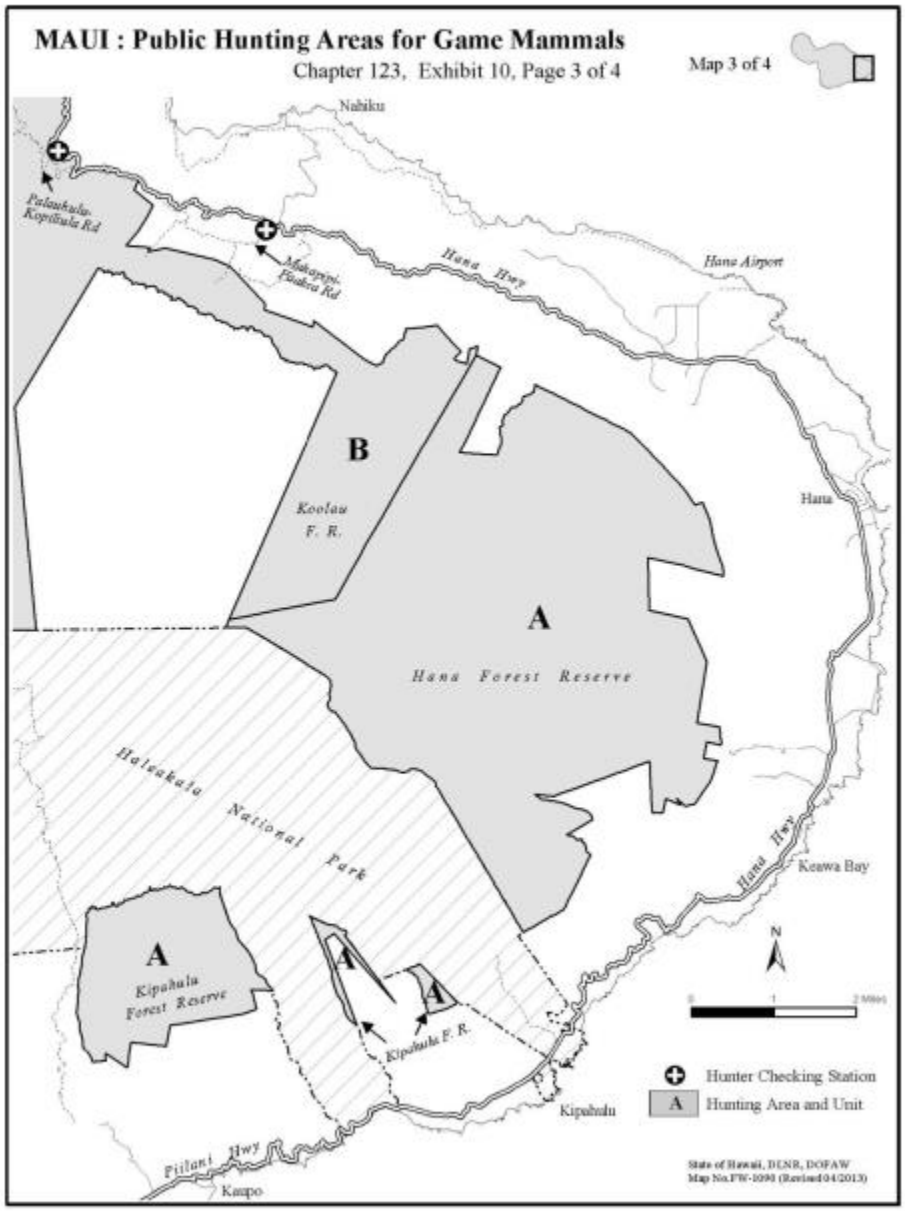


Figure 5. Hunting Units



Watershed Threats

Feral animals and invasive plant species are the most significant threats to the East Maui Watershed. Pigs, goats, feral cattle and axis deer either damage native vegetation or root up soil, increasing erosion of sediments and other pollutants into streams and coastal areas. In areas damaged by feral animals, the likelihood of invasive plant species becoming established greatly increases. Such species out compete native species, and in some places, especially at lower elevations, completely displace the native vegetation and habitat for native animals that rely on such resources. Since many weeds gain a foothold in the forest by sprouting in areas opened by feral animals, feral animal control is a necessary starting point for threat abatement and control programs.

Resource managers with the National Park, TNC and DOFAW utilize a system of fencing, hunting, and trapping to remove pigs from the most pristine upland areas. Most of these areas are too remote to support public hunting and professional staff has had success in controlling pigs in these fenced areas. Public hunting is the primary means to control feral pigs below fenced units. Feral cattle are problems in localized areas on State and EMI lands, and are being removed by aerial shooting and trapping. Goats, once numerous in the summit region, have been greatly reduced in the last several decades via fencing and hunting efforts by the National Park. However, a sizable goat population remains in the south eastern portion of the watershed, near Kīpahulu Valley and Kīpahulu Forest Reserve. Axis deer are expanding their range on Maui and are known from several locations in the East Maui Watershed area. In 2016, Big Island Invasive Species Committee conducted aerial surveys and concluded 6,000 to 10,000 axis deer currently exist on Maui, with most of them currently in central Maui.

Invasive plants displace native vegetation and disrupt the natural function of the watershed while reducing habitat for native fauna. Outlying populations of priority weeds including but not limited to: ginger species, strawberry guava, pine species, Australian tree fern, African tulip and a variety of plants in the family Melastomtaceae are all control targets EMWP. See the East Maui Watershed Partnership Updated 5 Year Weed Management Plan FY2014-19 for more detail regarding invasive plant threats and control strategy.

Feral cats, rats and mongoose are also extremely problematic as they prey upon native bird species. In addition, non-native birds oftentimes out-compete their native counterparts or spread seeds from invasive plants. The Maui Forest Bird Recovery Project and the Maui Invasive Species Committee (MISC) address these threats on a limited scale in portions of the watershed.

The invasive African jackson chameleon (*Chamaeleo jacksonii*) continues to spread in EMWP forested areas. This reptile is known to be a predator on native invertebrates such as tree snails and insects. While no wide-scale management actions are currently planned, site specific control may be implemented on a case by case basis to protect rare invertebrates by the Hawai‘i Invertebrate Program of DOFAW.

Invasive predatory invertebrates (e.g. *Vespula sp.*) are a relatively recent additional threat to EMWP forests. They now remove large quantities of native pollinators for the forest ecosystem and compete with native forest birds for prey items on a landscape scale. Forest structure may be changed as pollination success is reduced through loss of native pollinators. EMWP supports and recognizes the need for research into the management and controlling of predatory insects.

Fungal pathogens are an increasingly acute threat to the native ‘ōhi‘a forests in the East Maui Watershed. Rapid ‘Ōhi‘a Death, caused by the fungi *Ceratocystis huliohia and Ceratocystis lukuohia* is currently decimating an increasingly large portion of the native ‘ōhi‘a forest on Hawai‘i Island. Although there are still many questions to be answered including vectoring potential and wind

dispersal likelihood, the September 2017 discovery of the fungus in the Kohala district of Hawai‘i island increases the probability of wind dispersal to East Maui.

Humans can also serve as vectors of invasive plant seeds. Seeds and plant propagules can easily be dispersed on clothing, foot wear, vehicles, equipment and pets.

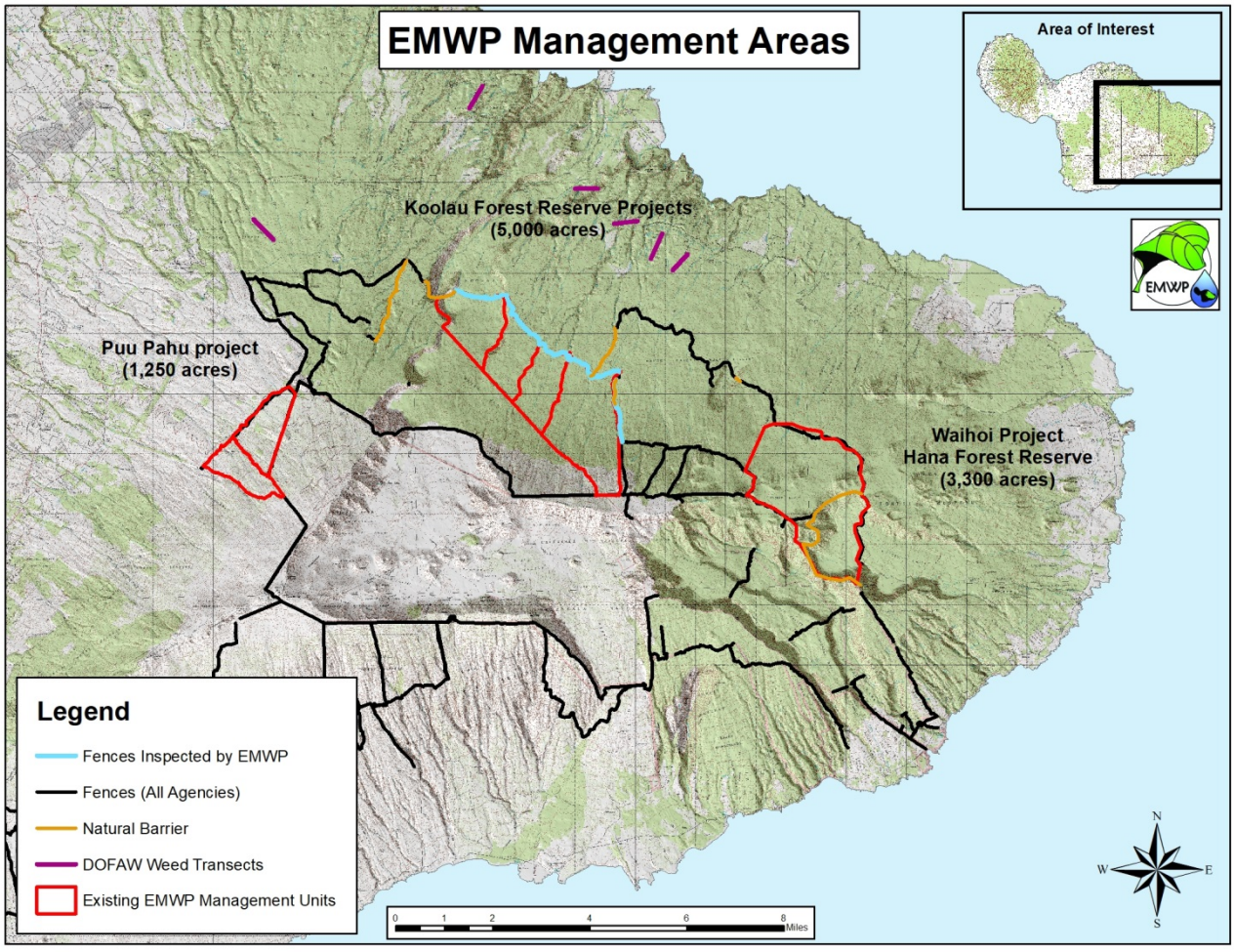
Additional discussions on threats to the East Maui Watershed are provided in TNC’s Biological Summary and Land Use History for the East Maui Watershed Area (1996).

EMWP FIVE-YEAR MANAGEMENT OBJECTIVES AND ACTIONS

This section outlines EMWP's priority management objectives for the next five years. These objectives were originally identified during EMWP's 2008 strategic retreat and were originally written to reflect the collaborative efforts of all Partners to identify key conservation targets, threats, and strategies. The 2018 update to EMWP's management plan further refines those original goals as the partnership accomplishes objectives and continues adaptive management. The 2018 update also restricts the scope of the objectives written in this plan to those carried out by EMWP's professional staff. EMWP's objectives are organized under the following five Programs: Ungulate Management, Vegetation Management, Watershed Resource Monitoring, Outreach and Education, and Management Infrastructure.

A map depicting EMWP's field project sites is included **(Figure 6)**. Specific management actions are bulleted after each objective below. These may be adapted and built upon as management efforts continue.

Figure 6



Ungulate Management

Goals:

- **Implement animal control methods to minimize damage to the watershed.**
- **Utilize public hunting opportunities in accessible areas.**
- **Protect remote or sensitive areas.**

Objective 1. Maintain ungulate damage and activity at near zero levels in existing 12,000-acre management area.

- Animal management activities include regular fence inspections, intensive animal control, transect monitoring, and aerial and on-the-ground scouting.

Objective 2. Expand Zero Tolerance ungulate management areas.

- Determine unfenced areas where new fences could be constructed to protect water source and supply from the threat of feral pigs, goats, deer and cattle.
- Develop action plans for specific areas identified by landowners for priority fencing. Support and contribute to state-wide conservation initiatives including the Aloha Plus Challenge and the Sustainable Hawai‘i Initiative.
- Continue aerial shooting and expand as needed including EMI Halehaku cattle removal project, HRC's Pu‘u Pahu Reserve, Hanawī and Hāna Forest Reserve.
- Support ungulate control at Pu‘u Pahu Reserve.
- Support ungulate control at Hanawī NAR, Hāna Forest Reserve and Ko‘olau Forest Reserve (Loulu, Kūhiwa, and Waiho‘i fenced units).

Objective 3. Maintain and expand animal management programs in lower elevations (below fence) and in new management areas using public hunters and Partnership agency staff.

- Continue EMI Halehaku feral cattle project to reduce cattle populations. Coordinate with EMI as appropriate.
- Continue DOFAW ungulate and vegetation transect monitoring to assess effectiveness of public hunting to keep ungulate numbers and impacts down.
    - Summarize and report on data of these surveys once in the five year project period to gauge effectiveness and progress
- Identify and expand public hunting access into Hāna Forest Reserve and Kīpahulu Forest Reserve.
- Where appropriate, work with public hunters to control animals in management units and other areas.

Objective 4. Support research to help facilitate management of feral animals within the East Maui Watershed.

- Encourage University of Hawai‘i Zoology and Conservation Biology students to conduct feral animal projects on Maui and in other parts of Hawai‘i.
- Utilize new technologies for remote sensing through forest canopy including Forward Looking Infrared Devices, and Unmanned Arial Systems to assist in ungulate monitoring and control efforts.
- Support other research efforts.
- Assist with compiling data and making estimates associated with axis deer surveys

Vegetation Management

Goals:

- **Control existing priority watershed weeds.**
- **Prevent the introduction of new habitat modifying weeds.**
- **Manage threats and assist with recovery efforts of rare and endangered species.**

Objective 1. Prevent the establishment and expansion of top priority weeds (3-5) in existing/future management units.

- Develop, implement, and regularly update comprehensive Weed Control Plan that identifies priority weeds within management units and outlines management strategies and timelines for their control.
- Eliminate populations of top priority weeds in management units.
- Prevent expansion of top priority weeds.
- Increase weed management capacity by hiring additional staff and utilizing volunteers, Maui Invasive Species Committee (MISC) and other agencies.

Objective 2. Support integrated pest management (IPM) research and implementation for top priority weeds in management units and other areas.

- Identify appropriate biocontrol research and release sites and carry out strategic release of approved biocontrol agents.
- Refine herbicide application methods.
- Work with other agencies (USFWS, State DOA, UH College of Tropical Agriculture and Human Resources (CTAHR), etc.) to develop more tools and or techniques for vegetation management.

Objective 3. Continue to support weed management efforts outside of management units.

- Provide staff and funding to MISC as appropriate to control MISC target species.
- Help MISC access lands containing target species.
- Work with others to enforce and update the Interagency Biosecurity Plan and noxious weed law.

Objective 4. Assist PCSU Plant Extinction Prevention Program for managing Rare and Endangered species.

- Work with the Plant Extinction Prevention Program (PEP) and other agencies to locate, inventory and assess the status of Threatened and Endangered species in the watershed.
- Implement threat abatement, monitoring, out-planting and other actions to assist with the recovery of Threatened and Endangered species in the watershed.

Objective 5. Support research to help facilitate management of non-native vegetation within the East Maui Watershed.

- Support research efforts to quantify the hydrologic effects of priority invasive plant species.
- Support other research efforts.
- Utilize new technologies for remote sensing through forest canopy including multispectral imaging, and Unmanned Arial Systems to assist in vegetation monitoring and weed control efforts.

Watershed Resource Monitoring

Goals:

- **Monitor the physical, biological and cultural resources of the watershed.**
- **Identify new and existing threats to the watershed.**
- **Measure the effectiveness of management programs.**

Objective 1. Track changes in quality and quantity of stream flow and rainfall.

- Measure rainfall—Obtain US Geological Survey rain gage information and summarize information annually.
- Measure stream flow—Obtain existing information from State Division of Aquatic Resources and Commission on Water Resource Management and summarize annually.
- Assess the need to install rain gages/Remote Automated Weather Stations in EMWP areas.
- Measure sedimentation and erosion—Obtain guidance from State Department of Health and US Geological Survey.
- Measure biotic stream components—Obtain information from Maui Division Aquatic Resources and other agencies.

Objective 2. Track changes in vegetation (both native and non-native).

- Assess existing remote sensing/mapping of vegetation resources by TNC, Kamehameha Schools, DOFAW (Pacific Disaster Center for fire operations), Haleakalā National Park, Haleakala Ranch, US Forest Service, and US Geological Survey.
- Apply vegetation monitoring protocols outlined in 2009 Monitoring Plan where appropriate and as funding permits.
- Continue monitoring existing vegetation transects.
- Track soil changes related to vegetation composition.
- Continue monitoring changes around landing zones, fences, camps, etc.
- Track health of vegetation (e.g. forest disease, pests, etc.). Coordinate with DOFAW Forest Health Coordinator.
- Support the development of new technologies that may assist with vegetation monitoring and mapping.
- Add additional new transects below existing fence at Wailuanui, Wailuku Iki, Kopiliula. Assess quality of watershed and vegetation cover in those areas.

Objective 3. Track changes in animal populations? (both native and non-native).

- Continue monitoring existing ungulate transects, conducting ground and aerial scouts and animal counts.
- Assist with the Hawai‘i Bird Surveys every 5-6 years if assistance is requested and funding is available.
- Obtain USFWS Bird Survey data and Maui Forest Bird Recovery Project data.
- Support forest bird recovery efforts.
- Continue to collect animal harvest data from DOFAW and EMWP.
- Conduct stream animal surveys.
- Assess threat of axis deer.
- Conduct studies to better understand the ecology of feral animals (movements, habits, home range, etc.) within the watershed.
- Assess and map non-native invertebrate threat to native invertebrates and threat to forest. Support research and management of this predator in EMWP lands.

Objective 4. Track changes in host cultural resources.

- Inventory existing biological and anthropocentric cultural resources in the watershed.
- Adopt cultural protocol for field work.
- Use Hawaiian terminology where possible.
- Learn moʻolelo/cultural significance of places we work.
- Initiate special effort to reach out to Hawaiian children – hikes, work projects, classroom projects.
- Develop cultural information on EMWP website.
- Compose mele about EMWP.
- Identify plants of cultural significance in the watershed.

Objective 5. Take all steps possible to aid early detection of Rapid ʻŌhiʻa Death (*Ceratocystis huliohia* and *Ceratocystis lukuohia*) into East Maui

- Participate in Maui ROD working group, and stay up to date with developments from the statewide working group.
- Use standardized decontamination protocol in cases where contamination may be present.
- Monitor for dieback during all helicopter operations and facilitate sampling by appointed sample team.

Outreach and Education

Goals:

- **Inform the public of watershed management issues.**
- **Encourage volunteerism to assist with management efforts.**

Objective 1. Maintain and expand support by informing the public regarding watershed issues.

- Continue Existing EMWP outreach programs, including hikes, classroom presentations, community events, volunteer trips, art contest, taro festival, etc.
- Expand opportunities for volunteers.
- Reduce spread of invasive species by adopting weed reduction protocols, particularly for contractors.
- Educate visitors about cleaning gear/vehicles.
- Expand UHERO economic evaluation study for East Maui watershed.
- Continue to inform elected officials regarding threats to watershed issues.
- Update EMWP brochure and website to communicate cultural objectives and specific EMWP research needs.
- Regularly update "ten talking points" fact sheet for Partnership.
- Develop protocols to address "larger" conservation issues such as the Rapid ʻŌhiʻa Death, biocontrol, DOA Interagency Biosecurity Plan, etc.
- Bridge the gap between larger mauka and makai watershed planning initiatives.

Management Infrastructure

Goal:

- **Provide and maintain appropriate infrastructure to allow for effective management.**

Objective 1. Maintain existing funding sources. (County, State, Federal, Private).

- Strengthen Tri-Isle RC&D relationship with PCSU.
- Maintain close relationships with existing funding sources.
- Develop funding proposals as required.
- Explore costs and benefits associated with forming a 501(c)(3) nonprofit organization.

Objective 2. Develop new funding sources.

- Develop capacity by hiring a grant writer and grant manager.
- Solicit donations from the private sector.
- Continue to work with HAWP on long-term sustainable financing initiatives.
- Develop one page project funding needs.
- Create products that are educational and have the ability to generate revenue for watershed protection efforts.
- Continue supporting sales of forest products and services by DOFAW.
- Work with businesses who utilize watershed resources to assist with funding watershed protection efforts.

Objective 3. Maintain and continue well organized and functioning organization.

- Develop performance benchmarks to ensure management is adaptive and efficient.
- Formalize agreement with CTAHR for baseyard facility use.
- Complete and adopt revised management plan by early 2018.
- Maintain partner relationships via quarterly meetings, annual retreats, transparent and constructive information sharing, and good internal communications within partner agencies.
- Develop professional staff by sharing training opportunities, encouraging inter-agency work projects, and providing funds for staff training.

ANTICIPATED PROGRAM COSTS

Table 1. Five-Year Projected EMWP Program Expenses

Ungulate Management						
Q'ty	**Description/Units**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**
36	hours helicopter time (Koʻolau Forest Reserve)	$43,200	$45,000	$46,800	$48,600	$50,400
25	hours helicopter time (Upper Hāna Forest Reserve)	$30,000	$31,250	$32,500	$33,750	$35,000
	Field supplies (EMWP)	$10,000	$10,000	$11,000	$11,000	$11,000
	Field supplies 2k (DOFAW: Aerial Shooting)	$2,000	$2,000	$2,000	$2,000	$2,000
	Total	**$85,200**	**$88,250**	**$92,300**	**$95,350**	**$98,400**

Vegetation Management						
Q'ty	**Description/Units**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**
55	hours helicopter time	$66,000	$68,750	$71,500	$74,250	$77,000
	Remote sensing	$80,000		$80,000		
	Field supplies (EMWP)	$5,000	$5,000	$6,000	$6,000	$6,000
	Total	**$151,000**	**$73,750**	**$157,500**	**$80,250**	**$83,000**

Watershed Resource Monitoring						
Q'ty	**Description/Units**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**
24	hours helicopter time	$28,800	$30,000	$31,200	$32,400	$33,600
	Field supplies (EMWP)	$5,000	$5,000	$5,500	$5,500	$5,500
	Contract: Hydrology Effects non-native plants			$75,000		
	Total	**$33,800**	**$35,000**	**$111,700**	**$37,900**	**$39,100**

Outreach and Education						
Q'ty	**Description/Units**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**
	Mālama Wao Akua: Art Exhibition	$2,000	$2,000	$2,500	$2,500	$2,500
	Outreach/Educational Supplies	$3,000	$3,000	$3,500	$3,500	$3,500
	PR Training/Meetings	$500	$500	$500	$500	$500
	Total	**$5,500**	**$5,500**	**$6,500**	**$6,500**	**$6,500**

Operational Expenses						
Q'ty	**Description/Units**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**
	Office supplies	$1,000	$1,000	$1,000	$1,000	$1,000
	Facilities	$5,000	$5,000	$5,000	$5,000	$5,000
	Utilities	$6,000	$6,000	$6,000	$6,000	$6,000
	Equipment Operating Expenses: fuel, maintenance, repair and insurance costs for vehicles and small equipment	$8,000	$8,000	$9,000	$9,000	$9,000
	Vehicle (purchase FY21)				$65,000	
	Total	**$20,000**	**$20,000**	**$21,000**	**$86,000**	**$21,000**

Management Infrastructure						
Q'ty	**Description/Units**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**
1	Program Manager	$415,000	$421,225	$427,543	$433,957	$440,466
1	Program & Data Assistant @ 60%					
1	Community Outreach and Education Liaison @ 75%					
1	Natural Resource Manager					
1	Field Crew Leader					
3	Field Assistants					
	Travel: Subsistence (backcountry camping)	$13,500	$13,500	$13,500	$13,500	$13,500
	Travel: coordinator's airfare, mileage, etc.	$2,500	$2,500	$2,500	$2,500	$2,500
	Training/Conferences /Meetings for all staff (airfare & other travel expenses included)	$5,000	$5,000	$6,000	$6,000	$6,000
	Total	**$436,000**	**$442,225**	**$449,543**	**$455,957**	**$462,466**

Program Totals						
	Description	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**
	Ungulate Management	$ 43,200	$ 45,000	$ 46,800	$ 48,600	$ 50,400
	Vegetation Management	$ 151,000	$ 73,750	$ 157,500	$ 80,250	$ 83,000
	Watershed Resource Monitoring	$ 33,800	$ 35,000	$ 111,700	$ 37,900	$ 39,100
	Outreach and Education	$ 5,500	$ 5,500	$ 6,500	$ 6,500	$ 6,500
	Operational Expenses	$ 20,000	$ 20,000	$ 21,000	$ 86,000	$ 21,000
	Management and Infrastructure	$ 436,000	$ 442,225	$ 449,543	$ 455,957	$ 462,466
	Subtotal	**$ 689,500**	**$ 621,475**	**$ 793,043**	**$ 715,207**	**$ 662,466**
	Indirect Costs (Including PCSU) @ approximately 15%	$103,425	$93,221	$118,956	$107,281	$99,370
	Total	**$792,925**	**$714,696**	**$911,999**	**$822,488**	**$761,836**

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APPENDIX O-1:

BLNR Approved Watershed Management Plan Minimum Content Requirements Under Agenda Item D-2

STATE OF HAWAI`I
DEPARTMENT OF LAND AND NATURAL RESOURCES
Land Division
Honolulu, Hawai`i 96813

October 11, 2019

Board of Land and Natural Resources
State of Hawai`i
Honolulu, Hawai`i

STATEWIDE

Update on Development and Implementation of Watershed Management Plans for Leases of Water Rights Pursuant to section 171-58(e), Hawaii Revised Statutes (HRS)

BACKGROUND

At its meeting on March 22, 2019 under agenda item D-11, the Board directed staff to clarify water lease requirements in section 171-58(e), HRS regarding the development and implementation of watershed management plans. Specifically, the Board inquired 1) what is the "minimum content" for a watershed management plan, 2) does the Department need to conduct rule-making pursuant to Chapter 91, HRS, 3) why is the Department focusing on watershed plans that emphasize mauka protection and management, 4) how will existing mauka watershed management plans be used to support the development and implementation of watershed management plans to meet the requirement of section 171-58(e), HRS and 5) does section 171-58(e), HRS apply to non-consumptive use.

REMARKS

1) What is the "minimum content" for a watershed management plan?

Section 171-58(e), HRS states "the board shall prescribe the minimum content of a watershed management plan." While there is no official guidance on what constitutes "minimum content", the Department consulted with subject matter experts, analyzed a sample of 15 existing Hawai'i watershed plans to determine commonalities and researched watershed plan content requirements from other states and agencies. Based on this research, analysis and input from DOFAW natural resource managers, the Department recommends that a watershed management plan developed under section 171-58(e), HRS should include the following minimum content:

1. Purpose, mission, or vision statement
   a) Explains why the plan is needed
   b) Describes what success will look like

2. Watershed inventory[1]
   a) Establishes baseline conditions relative to stated vision
   b) Characterizes the condition and health of the biotic and abiotic components of the watershed
3. Threat and vulnerability assessment
   a) Identifies and prioritizes threats to biological integrity
   b) Identifies and prioritizes vulnerabilities, such as elements at risk due to external factors
4. Goals
   a) Identifies priority outcomes essential to maintain or restore biological integrity to the maximum extent practicable. Generally including, but not limited to[2]:
      i) Removal and control of non-native hooved animals (pigs, goats, deer, sheep, cattle) from important watershed forests.
      ii) Removal or containment of damaging invasive plants and animals that threaten important watershed forests.
      iii) Monitoring and controlling other forest threats including fires, predators, and plant diseases.
      iv) Restoring and out-planting native species in important watershed areas and buffer zones.
      v) Communication, outreach and community education to build capacity for citizen-based watershed protection.
5. Objectives
   a) Description of specific management actions needed to achieve goals
   b) Description of location targeting where the action will occur
   c) Implementation schedules and timeframe
   d) Identification of specific outcomes and performance metrics expected
6. Methods
   a) Identification of strategy, approach, and methods to be employed
   b) Identification of roles and who is responsible for the action
7. Adaptive Management
   a) Establishment of measurable objectives, including performance metrics to measure and report the degree to which management actions have been successful in achieving goals and objectives
   b) Monitoring performance metrics to track success
   c) Establishment of a systematic process to review results and employ adaptive management approaches to improve results where needed
8. Budget
   a) An estimate of costs and categories of expenditures needed
   b) Potential sources of funding for implementing the actions
9. References, Sources and Appendices
   a) Literature cited and supporting documents

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[1] Much of the data and information needed to inform the watershed inventory are available in plans and literature for watersheds in Hawai'i. Where data gaps exist, the watershed management plan should provide for the implementation of actions, including biological surveys, to obtain that information.

[2] The management actions listed were informed by the Department's 2011 "Rain Follows the Forest Plan" and a 2001 Annual Report to the State Legislature (Act 152 Relating to Watershed Protection).

It is important to note that not all areas face the same threats or require the same type of management. Therefore, each watershed management plan is site specific and the management actions for each plan is unique. As part of satisfying the minimum content requirements of section 171-58(e), the Department will work with each individual lessee to determine the specific management actions, based on the site-specific needs, that will result in the prevention and degradation of surface water and ground water quantity and quality within the water lease area. Those actions, described within the plan, will be informed by existing watershed management plans (should they exist). See Section 3 for more information about how existing plans will be used.

2) Does the Department need to conduct rule-making pursuant to Chapter 91, HRS?

No. The provisions in section 171-58, HRS that imposed the requirement of a watershed management plan was adopted in 1990. The House Standing Committee Report from 1990 (H.B. 3286) explicitly states that the Board of Land and Natural Resources can prescribe the minimum content of a watershed plan without adopting rules pursuant to Chapter 91, HRS. The Committee found that "watershed management practices are site specific and rule establishment would not be productive."

3) Why is the Department focusing on watershed plans that emphasize mauka protection and management?

A "watershed" is defined in the *Atlas of Hawaiian Watersheds & Their Aquatic Resources* as a catch-basin or drainage for rain that is funneled into stream beds and terminates at the edge of the ocean. The Department recognizes 558 watersheds across the State. While it is understood that our watersheds extend mauka to makai, the source of Hawaii's fresh water originates from the forest, which capture and absorb hundreds of inches of rain each year, allowing for slow infiltration and replenishment of our aquifers and streams. Understanding this connection between forests and water supply, the Legislature found it vital to encourage the prudent management of watersheds and in 1990 sub-section (e) of HRS section 171-58 was added (H.B. 3286) requiring the incorporation of a watershed management plan into all water lease agreements to help protect fresh water resources (surface and ground water).

Prior to 1990 few watershed management plans existed. Today there are numerous watershed management plans written by different agencies and entities for a wide range of purposes.[3] Some watershed plans focus solely on water quality, while others focus on water quantity. There are also watershed plans that target coral reef and ocean health. For the purpose of section 171-58(e), HRS, the Department understands the word "watershed" to mean mauka forest protection and management. While HRS section 171-58(e) does not explicitly state mauka watershed management plans, it is understood that watershed forests contribute to fresh water supply.

The Division of Forestry was created in 1903 in response to widespread deforestation due to land use change and introduced grazing animals. According to historical accounts, by the mid-1800s denuded landscapes were visible across lower elevations. As forested areas disappeared, water supplies also declined and concern for watershed protection rose in response. Sugar plantations,

[3] Examples of Watershed Plans and Initiatives in Hawai'i is made available as part of **Exhibit A**.

which relied heavily on water, began calling both for reforestation to protect the watersheds and for the control of domestic and feral animals. In 1903, through Act 44, the Territorial Government designated hundreds of thousands of acres, of both public and privately-owned lands, as forest reserve for the purpose of watershed protection. Over the last century, the Division of Forestry and Wildlife has continued this mission to responsibly manage and protect watersheds because "in Hawaii, the most valuable product of the forest is water, rather than wood" – Ralph Hosmer, First Territorial Forester.

In addition to sustaining ground and surface water supplies, healthy forests reduce erosion by holding soil in place, improve water quality, and provide habitat for unique and endangered plants and animals. Focusing on watershed management plans that target mauka protection actions (fencing, removal of hooved animals from important watershed forests, invasive weed control, etc.) that benefit native forests is essential if water lessees are going to have a reliable long-term supply of fresh water.

4) How will existing mauka watershed management plans be used to help support the development and implementation of watershed management plans to meet the requirement of section 171-58(e), HRS?

As previously mentioned, there are many existing mauka watershed plans, including those implemented by the State's Division of Forestry and Wildlife (DOFAW) and groups like the Watershed Partnerships (see Exhibit A). Some water lease applicants also have their own watershed management plans. Unfortunately, the existing watershed plans are not always directly correlated to the water lease area and some plans are old and outdated. In certain places, new threats to watershed health (e.g.: Rapid ʻŌhiʻa Death (ROD)) are not addressed in existing watershed plans. Furthermore, estimated budgets may not reflect the current cost of management if the plan is over 5 years old.

In order to meet the requirement of section 171-58(e), HRS, the Department recommends jointly developing a new plan (no more than 2-5 pages long) with the lessee that cites existing management plans, meets the minimum content requirements, and outlines what reasonable management practices are needed for the water lease area and the current estimated costs associated with implementation. The new plan will be specific to the watershed(s) associated with the lease (the sources that feed the lease area) and management will be based on current estimated costs. For example, the existing Kaʻu Forest Reserve Management Plan meets the minimum content requirements. Therefore, that plan will be utilized to the greatest extent possible, and the Department will work with the Kaʻu lessees to determine how to implement on an equitable basis. A copy of the Kaʻu Forest Reserve Management Plan is included as Exhibit B.

For implementation, the Department will work with the lessee to determine if they are already doing management (per the new watershed plan) that helps protect the watershed, or if an annual cost share contribution (cash or in-kind) is needed. The cost share amount will consider the estimated management costs (as outlined in the new watershed plan) and take into consideration: 1) the amount of water used by the lessee daily and 2) the available amount of water from the source.

The annual cost share is intended to support the implementation requirement of section 171-58(e) by determining a baseline contribution (cash or in-kind) by the lessee that will support actions that help maintain watershed function and yield (stream flow and recharge) within the water lease area. In many places, actions to protect mauka watershed forests in the water lease areas are already underway and management is conducted by DOFAW and its partners. The annual cost share will support the continuation of protection actions by these groups.

In the event that a water lessee has their own watershed management plan, it will be up to the Department to determine if the plan meets the minimum content requirements and sufficiently addresses the protection of watershed forests and fresh water resources in the lease area. If it does not, the Department will work with the lessee to determine the specific actions needed and jointly develop a new plan or update the existing. It should be noted that the existence of a watershed management plan does not absolve a water lessees' duty to help with the implementation of management actions. Proof that a lessee is already contributing to the protection of the watershed must be provided to the Department. Membership in a Watershed Partnership may not fulfill the requirement of implementation.

5) Does section 171-58(e), HRS apply to non-consumptive use?

Yes. A hydroelectric facility that returns water to the stream, is still reliant on a supply of water upstream to power its operation. Therefore, regardless of how much water a lessee uses, or if such use is non-consumptive, effective watershed management is critical to ensure a sustainable water supply to allow for long-term water supply and use.

RECOMMENDATION:

That the Board:

1) Approve the minimum content of a watershed management plan per the requirements of section 171-58(e), HRS to be:

    1. Purpose, mission, or vision statement
    2. Watershed inventory
    3. Threat and vulnerability assessment
    4. Goals
    5. Objectives
    6. Methods
    7. Adaptive management
    8. Budget
    9. References, Sources and Appendices

2) Delegate authority to Department staff to jointly develop watershed management plans with water lessees to ensure plans align with the goal of watershed protection to maintain watershed function and water yield and to restore or maintain a certain level of biological integrity that is the foundation of a healthy watershed.

Respectfully submitted,

Ian Hirokawa
Special Projects Coordinator

APPROVED FOR SUBMITTAL

Suzanne D. Case, Chairperson

Exhibit A: Example Watershed Plans and Initiatives in Hawai‘i
Exhibit B: Ka`u Forest Reserve Management Plan

Exhibit A

Example Watershed Plans and Initiatives in Hawai'i

Plan	Agency	Link	Notes
Watershed Partnership Management Plans	Hawaii Association of Watershed Partnerships (HAWP)	www.hawp.org	10 Watershed Partnerships across the State. Regional plans developed for individual partnerships available at goo.gl/8wEyNr.
DOFAW Forest Reserve (FR) and Natural Area Reserve (NAR) Management Plans	DLNR-DOFAW	http://dlnr.hawaii.gov/forestry/frs/reserves/management-plans/ http://dlnr.hawaii.gov/ecosystems/nars/	Plans for individual Reserves on State lands.
Hawaii Forest Action Plan	DLNR-DOFAW	http://dlnr.hawaii.gov/forestry/info/fap/	Statewide plan.
Natural Area Partnership Program Long-Range Management Plans And Forest Stewardship Management Plans	DLNR-DOFAW	http://dlnr.hawaii.gov/ecosystems/napp/ http://dlnr.hawaii.gov/forestry/lap/fsp/	Plans for individual preserves and stewardship areas on private lands.
Hawaii Water Plan	DLNR-CWRM	http://dlnr.hawaii.gov/cwrm/planning/hiwaterplan/	Water Resource Protection Plan http://dlnr.hawaii.gov/cwrm/planning/hiwaterplan/wrpp/ a component of overall Water Plan
Ocean Resource Management Plan (ORMP)	DBEDT-OP	http://planning.hawaii.gov/czm/ocean-resources-management-plan-ormp/	Management Priority #3: Watershed Management
Oahu Water Master Plan	Honolulu Board of Water Supply	https://www.boardofwatersupply.com/water-resources/water-master-plan	Includes hydrological conditions and recommendations for capturing freshwater.
Oahu District Watershed Management Plans	Honolulu Board of Water Supply	http://www.boardofwatersupply.com/water-	Provides short-, mid-, and long-range guidance for the sustainable management and use of Oahu's surface and ground water resources.

EXHIBIT "A"

		resources/watershed-management-plan	
Hawaii Watershed Guidance	DBEDT-PO CZM	http://health.hawaii.gov/cwb/files/2013/05/Hawaiis-Watershed-Guidance.pdf	Intended to help guide the development and implementation of watershed plans that improve water *quality.*
Nonpoint Source Management Plan (2015-2020)	DOH-CWB Polluted Runoff Control Program	http://health.hawaii.gov/cwb/files/2013/05/2015-Hawaii-NPS-Management-Plan.pdf	Focuses on Total Maximum Daily Loads (TMDLs) to reduce non-point source pollution.
DOH 319 Watershed Management Plans	DOH-CWB Polluted Runoff Control Program	http://health.hawaii.gov/cwb/clean-water-branch-home-page/polluted-runoff-control-program/watershed-plans/	Approved plans that meet EPA's nine requirements for watershed plans.
Atlas of Hawaiian Watersheds & Their Aquatic Resources	DLNR-DAR	http://www.hawaiiwatershedatlas.com/	Baseline data on hydrology, land use, and aquatic life.
Initiative	Agency	Link	Notes
Act 152 (SLH 2000)	State	https://drive.google.com/open?id=0B9DCLCZINC2XdnhwMTRfSk5JZkU	Established Watershed Protection Board. Legislative report identified recommendations and prioritized mauka watershed protection. Noted importance of dedicated funding source.
State of Hawaii Watershed Initiative	DLNR-DOFAW	https://drive.google.com/file/d/0B7FBWuiHeTQOZXNKamRHbDNKYzA/view	Aka: Rain Follows the Forest (2011)
Sustainable Hawaii Initiative (2016)	State	https://governor.hawaii.gov/sustainable-hawaii-initiative/	Protect 30% (253,000 acres) of Hawaii's priority watersheds by 2030. https://governor.hawaii.gov/wp-content/uploads/2016/09/30x30-Watershed-Forests_FINAL.pdf The regional and statewide watershed plans associated with this goal are available at: goo.gl/8wEyNr

Hawaii Fresh Water Initiative (2015)	Hawaii Community Foundation	https://www.hawaiicommunityfoundation.org/strengthening/fresh-water	Goal to create 100 million gallons per day in additional, reliable fresh water capacity for our islands by 2030.
Aloha+ Challenge	Hawaii Green Growth	https://dashboard.hawaii.gov/en/stat/goals/5xhf-begg/4s33-f5iv/wtjm-96jt	Same as SHI. Protect 30% (253,000 acres) of Hawaii's priority watersheds by 2030.
Promise to Pae'āina (P2P) Mālama Honua	Polynesian Voyaging Society		Commitment #2 "Our Island Home" Increase restoration in wao akua (upper watershed) through enhanced acreage of native forest under protection and policy support.
West Maui Ridge 2 Reef Initiative	Multi-agency	https://www.westmauir2r.com/	Multi-agency approach to address adverse impacts to coral reefs in West Maui
Ala Wai Watershed Collaboration	Multi-agency	https://alawai.hawaigreengrowth.org/	Effort to design solutions for threats to the Ala Wai watershed
Resilient Lands and Waters Initiative	NOAA	https://www.habitatblueprint.noaa.gov/landscape-scale-conservation/resilient-lands-waters-initiative/west-hawaii/	Priority watersheds = West Hawai'i, West Maui, and He'eia (O'ahu)
U.S. Coral Reef Task Force – Watershed Partnership Initiative	NOAA	https://www.coralreef.gov/watershed/	Created watershed planning strategy and checklist https://data.nodc.noaa.gov/coris/library/NOAA/CRCP/other/USCRTF/uscrtf_watershed_strategy_final_draft.pdf

Ka‘ū Forest Reserve Management Plan

September 2012

Prepared by:

State of Hawai‘i
Department of Land and Natural Resources
Division of Forestry and Wildlife

EXHIBIT "B"

EXECUTIVE SUMMARY

This plan is one in a series of site-specific plans to be prepared by the Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) for individual forest reserves in the State of Hawai'i. These plans present a brief history of the specific forest reserve, a description of cultural and natural resources, and proposed management actions for the area.

The Ka'ū Forest Reserve (or Reserve) was established by Governor's Proclamation on August 2, 1906 to protect the forest on the lower slopes of Mauna Loa in the Ka'ū District on the southeastern side of the island of Hawai'i. The Reserve is public land, managed by the DOFAW, and consists of 61,641 acres (ac)) (24,945 hectares (ha)) of forested lands. The Reserve was established to maintain the necessary water supply for agricultural lands in Ka'ū. Native Hawaiians recognized the importance of forests in water production and water quality, as is reflected in the saying, "Haihai ka ua i ka ulu la au" (The rain follows the forests). Early foresters also recognized the importance of Hawaiian forests as the primary water source. For example, Ralph Hosmer, Hawaii's first Territorial Forester, stated "In Hawai'i, the most valuable product of the forest is water, rather than wood."

The Ka'ū Forest Reserve is a critical watershed for the people of Ka'ū. The Reserve's water sources are used for domestic supplies as well as agriculture, and maintaining this water supply is important for the future viability of agriculture in Ka'ū. The native forest replenishes springs and other groundwater, and reduces flooding and erosion. The water resources of Ka'ū are threatened by invasive animals and plants, which degrade the native forest and lead to reduced quantity and quality of water.

The Ka'ū Forest Reserve is important for preserving Hawaii's unique native forest ecosystems and its species. These include a wide variety of rare or endangered plants and animals. Endangered birds for which the continuing health of the Reserve may be a critical factor include the 'Akiapōlā'au (*Hemignathus munroi*), Hawai'i Creeper (*Oreomystis mana*) and Hawai'i 'Akepa (*Loxops coccineus*). Survival and recovery of these rare native plants and animals depend upon preservation of habitat by reducing impacts from threats such as ungulates, disease-bearing mosquitoes and other invasive insects, non-native predators, introduced diseases and invasive plants.

Up until the 1970s the Ka'u Forest Reserve supported the endangered 'Alalā or Hawaiian Crow (*Corvus hawaiiensis*). The 'Alalā is extinct in the wild. The entire population of less than 100 birds is housed in two captive breeding facilities, making the 'Alalā one of the rarest birds in existence. The 'Alalā was restricted to the forests in the western and southern portions of the island, associated with 'ohi'a and 'ohi'a-koa forests with an understory of native fruit-bearing trees and shrubs. This understory is essential to the survival of the 'Alalā in the wild, providing food as well as cover from natural predators. The Ka'ū Forest Reserve has been identified by the 'Alalā Recovery Team as one of the high priority sites to restore this rare bird.

The Ka'ū Forest Reserve contains resources that are vital for maintaining Hawaiian culture and practices. Hawaiians consider native plants and animals as family and have a strong spiritual connection to the mountain landscape and the forest itself. Gathering plants such as ferns, maile (*Alyxia oliviformis*), flowers, fruits, and other materials cannot be perpetuated into the future unless the forest remains relatively pristine.

The Ka'ū Forest Reserve is an important area for public use which includes hunting, recreational opportunities, cultural uses, personal gathering, and educational programs and activities. There is currently limited public access to much of this large Reserve, and existing access needs to be maintained as well as improved by working with adjacent landowners to provide additional access, particularly across state-leased and private land below the Reserve.

The Ka'ū Forest Reserve Management Plan describes the natural resources found in the Reserve, identifies the threats to those resources, and proposes management actions to address threats and better protect the area. Proposed management activities will benefit watershed, native forest ecosystems and unique native species as well as the people who use the area for recreation and cultural practices. The following management actions would be undertaken throughout or in selected parts of the Ka'ū Forest Reserve as part of a 15 year management plan for this area:

- Fence management areas in an approximately 12,000 acre portion of the Reserve and remove feral and introduced ungulates from within fenced management areas for watershed and native ecosystem health.
- Remove high priority non-native, invasive plants.
- Implement non-native predator control.
- Restore 'Alalā to the wild.
- Continue forest bird surveys to assess changes in bird population and distribution.
- Survey and inventory rare native plants and animals (including insects and snails).
- Improve habitat and recover rare and endangered plants by propagation and re-introduction of plants into appropriately fenced and protected habitat.
- Maintain existing public access roads and develop new routes to increase access, particularly across private and state-leased lands below the Reserve.
- Continue to facilitate public hunting in the Reserve by developing new access routes to increase hunter access.
- Develop trails and recreational amenities.
- Hire outreach staff and work with partners to provide outreach and education (e.g. volunteer service trips, student internships, and school programs) for the community to enhance public understanding of the Reserve's unique native forest.
- Respond to fires, as needed.
- Monitor forest for insects and disease and conduct other management as required (control of damaging insects, slugs, and/or plant disease).
- Consider environmentally and socially appropriate ways to make the Reserve economically self-supporting to support protection and management.
- Work with adjacent private landowners on cooperative management to make better use of limited funding and resources and more effectively manage interconnected landscapes.

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KA'Ū FOREST RESERVE
MANAGEMENT PLAN SIGNATURE PAGE

Hawai'i District certification: This plan was prepared by a team of Division of Forestry and Wildlife (DOFAW) staff to provide a management framework for Ka'ū Forest Reserve.

Roger Imoto - DOFAW Hawai'i Branch Manager — Date: 11/5/12

DOFAW Administrator's approval: I have reviewed the Ka'ū Forest Reserve Management Plan and concur with the recommendations herein. I agree this Management Plan will serve as a guiding document for the management of Ka'ū Forest Reserve.

Paul J. Conry - DOFAW Administrator — Date: 11/8/12

Department of Land and Natural Resources Board approval: This plan meets the criteria established for State Forest Reserve Management Plans as mandated by Chapter 183, Section 16-4, Hawai'i Revised Statutes.

William J. Aila - BLNR Chairperson — Date: 11/15/12

Approved by the Board of Land and Natural Resources at its meeting held September 28, 2012

DEVELOPMENT PROCESS TIMELINE

Ka'ū Forest Reserve, Hawai'i

Stage of Development	Date Achieved
DOFAW Review	September 2011
Public/Partner Agency Pre-Consultation	October - May 2012
Draft Environmental Assessment (DEA)	May 23, 2012
BLNR Approval	September 28, 2012
Final Environmental Assessment (FEA) and Finding of No Significant Impact (FONSI)	October 23, 2012

I. INTRODUCTION

The Division of Forestry and Wildlife (DOFAW) has management responsibility for the Ka'ū Forest Reserve (Reserve), which is part of the State Forest Reserve System. The Reserve has numerous assets that this plan aims to protect and manage for current and future generations:

- fresh water supply for humans (capturing and filtering rainwater and fog drip for drinking water and agricultural uses)
- native forest ecosystems
- native birds, plants and invertebrates
- cultural and recreational resources for people

DOFAW conducts on-going planning efforts to develop and update management plans for all forest reserves across the State. These efforts serve to organize field management and assist in budgeting and funding requests. DOFAW aims to make the planning process transparent and will seek input and guidance on the plan from its partners and the general public throughout the planning process.

This plan was developed using a variety of methods, including:

- Use of DOFAW's standard management plan format
- Review of DOFAW historic and current files (both at the Administrative and Hawai'i Branch office) and documents obtained from the Land Division, Survey Division, Bureau of Conveyances, as well as State Archives
- Reviewing State of Hawai'i Geographic Information Systems (GIS) maps of biological, historical, and environmental resources in the forest reserve
- Reviewing other plans that identified the forest reserve or the area, such as the Hawaiian Forester and Agriculturalist, the Hawai'i Biodiversity and Mapping Program reports, Hawaii's Comprehensive Wildlife Conservation Strategy, and U.S. Fish and Wildlife Service Recovery Plans
- Input from DOFAW staff from all program areas both at the Hawai'i Island Branch and Administrative offices

The plan identifies management actions for the Reserve to protect the native forest and watershed, and may also be used to help the agency plan budget and staffing needs. The development of the plan may trigger the following actions:

1. Preparation of regulatory compliance documents such as an Environmental Assessment and associated public review process.
2. DOFAW efforts to secure operational and planning funding for plan objectives.
3. Prioritized implementation of plan objectives by DOFAW.
4. Periodic solicitation of requests for proposals or bids for implementation of plan objectives, including issuance of permits, licenses, or contracts (Hawai'i Administrative Rules §13-104-22), as necessary.

II. PROJECT AREA DESCRIPTION

A. Location and Description

The Ka'ū Forest Reserve is located in the Ka'ū District on the southeastern side of the island of Hawai'i (Figure 1). The Reserve is adjacent to the Kahuku section of the Hawai'i Volcanoes National Park, on Mauna Loa Volcano and extends from 2,000 - 7,000 feet (ft) (610 - 2,134 meters (m)) elevation. The nearest towns are Pāhala, Nā'ālehu and Wai'ōhinu.

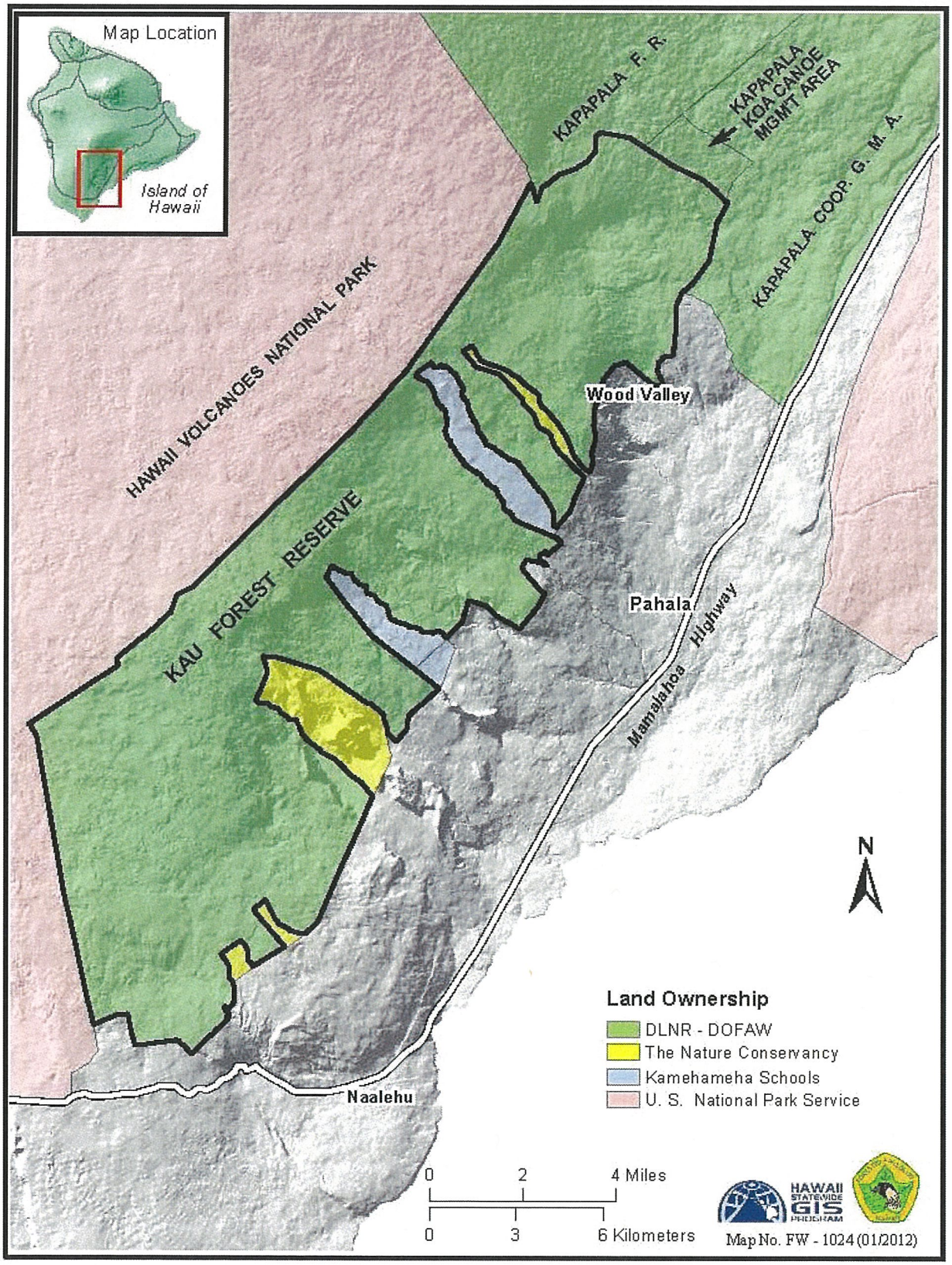
On Hawai'i Island, DOFAW has direct management responsibility for 20 Forest Reserves, which include approximately 476,000 ac (192,630 ha). Adjacent DOFAW lands in the Ka'ū District include Kapāpala Forest Reserve and Kapāpala Koa Canoe Management Area. These lands are not included in this plan, and their management needs will be addressed in the future through the development of other management plans and/or revision of this plan.

The Reserve is adjacent to federal, private and other state lands managed for natural and cultural resource protection. Adjacent major landowners include the U.S. National Park Service (NPS), Kamehameha Schools (KS), and The Nature Conservancy of Hawai'i (TNC) (Figure 1). DOFAW and these adjacent landowners are all members of the Three Mountain Alliance (TMA), a watershed partnership with the goal of cooperative management of Hawaii's natural and cultural resources. The Reserve is also bordered by multiple private land owners, including ranchers, farmers, and residents.

Table 1. Ka'ū Forest Reserve and Adjacent TMA Partnership Lands*
*Data obtained from Hawai'i Statewide GIS Program and DOFAW archives.

Name	TMK Number	Owner	GIS Acres
Hawai'i Volcanoes National Park – Kahuku Ka'ū	(3) 9-2-001:002	NPS	150,194
Ka'ū Forest Reserve	(3) 9-7-001:001,009,013,014,015,016,017,018,019,020,021,022; (3) 9-6-006:009,010,015,018; (3) 9-5-015:003 [portion]	DOFAW	61,641
Kapāpala Forest Reserve	(3) 9-8-001:004	DOFAW	37,276
Kapāpala Cooperative Game Management Area	(3) 9-8-001:010	State (DLNR)	22,109
Kapāpala Koa Canoe Management Area	(3) 9-8-001:014	DOFAW	1,244
TNC Ka'ū Preserve	(3) 9-7-001:002,003,004,007	TNC	3,561
Kamehameha Schools Ka'ū Forest	(3) 9-7-001:005,006,012; (3) 9-6-006:011	KS	2,891

Figure 1. Ka'ū Forest Reserve and Adjacent TMA Partnership Lands



B. Physical Site Data

1. Geology

The island of Hawai'i is the youngest and largest of the main Hawaiian Islands and lies at the southeastern end of the Hawaiian Archipelago. The island was formed by five shield volcanoes that are less than 1 million years old: Kōhala, Hualālai, Mauna Kea, Mauna Loa, and Kīlauea (Stearns and MacDonald 1946). Mauna Loa and Kīlauea are currently active (Takasaki 1993) and their lava flows cover almost two-thirds of the island's land surface.

The geology of the Ka'ū District is derived from volcanic eruptions from Kīlauea and Mauna Loa volcanoes. The forests of the Reserve lie over a variety of different types and ages of volcanic materials from these eruptions. The age and type of volcanic material influences the development of soils and types of forest in the Reserve as well as watershed features such as stream channels and underground water collection.

Geological series (age/type of volcanic material) found in the area include Ninole, Kahuku, Pāhala, and Ka'ū (U.S. Geological Survey 2007, Figure 2). The oldest exposed rocks found in the area originated from the Ninole Volcanic Series and can be seen in steep slopes such as Pu'u Enuhe (Stearns and MacDonald 1946). The Kahuku lava flows are highly permeable and consist of pāhoehoe and 'a'ā flows with some interbedded ash. The Kahuku lava flows lie on top of the Ninole Volcanic Series and underneath the Pāhala Ash. Pāhala Ash consists of pumice fragments carried by the wind from lava fountains during eruptions of Kīlauea, Mauna Loa, and Mauna Kea as well as dust from Ka'ū Desert. The Ka'ū Volcanic Series covers the majority of the district and includes pāhoehoe and 'a'ā basalts of more recent eruptions.

Mauna Loa is still active and has erupted 33 times between 1843 and 1984 (Lockwood and Lipman 1987). Forty percent of Mauna Loa's surface is covered by lava flows less than 1,000 years old, and flows in 1950 reached the upper elevation of Ka'ū Forest Reserve. Portions of the Reserve could potentially be covered by lava from future volcanic eruptions. The Ka'ū Forest Reserve is located within Volcanic Hazard Zones 3 and 6 for Mauna Loa (USGS). During the past 750 years, lava flows have covered about 15 to 20 percent of Zone 3 on Mauna Loa. The portion of the Reserve above Nā'ālehu is classified as Zone 6 because it is currently protected from lava flows by the local topography.

Kīlauea Volcano is also currently active. The Ka'ū District is in the path of volcanic emissions from Kīlauea, particularly from the second active vent at Halema'uma'u. Trade winds blow the volcanic fumes to the southwest, towards Ka'ū, and at times volcanic emissions (which contains sulfur dioxide and other pollutants) have built up to levels that are hazardous to human health and damaging to agriculture. Volcanic emissions may also adversely affect the health of some native plant and animal species (USGS 1997; UH 2008).

The Reserve may also be affected by the frequent seismic activity, including earthquakes and associated landslides and tsunami. Seismic activity in the region is related to the movement of magma within Kīlauea and Mauna Loa or due to movement along numerous fault lines. In 1868, an earthquake caused a large destructive landslide that buried a village in Wood Valley and caused a large seismic sea wave that swept away numerous settlements along the Ka'ū coast (Stearns and MacDonald 1946).

2. Soils

Soils in Ka'ū have developed from volcanic rocks, cinders, and ash. Soil age and composition is a major influence on plant community composition and hydrology. Pāhoehoe, 'a'ā, cinders, and weathered ash provide differing contributions of minerals and drainage characteristics (Mitchell *et al.* 2005). Accumulations of organic matter in the soil and ground litter are the most important factor in soil development on these relatively young substrates. In areas with greater rainfall, deposits of Pāhala Ash developed into soils that are important for agriculture in lower elevations and for watershed functions in higher elevations (University of Hawai'i 1965). The USDA Natural Resources Conservation Service has mapped 36 types of soils in Ka'u Forest Reserve (U.S. Department of Agricultural 2011) (Figure 3, Appendix A).

3. Climate and Rainfall

Average temperature for the Ka'ū Forest Reserve decreases with increasing elevation and ranges from 55° to 75°Fahrenheit (13 - 24°Celsius). Rainfall in the Hawaiian Islands depends greatly on topography and the mountains affect the pattern of annual rainfall (Giambelluca *et al.* 1986). Average annual rainfall in the area ranges from 60 in (1,500 mm) - 120 in (3,000 mm) (Juvik and Juvik 1998) and is highest in the central portions of the forest reserve (Figure 5). Mauna Loa affects the climate in the area, as winds are driven around and upward creating three rainfall regimes: trade wind dominated (Pāhala to Nā'ālehu), rain-shadow (southwest of Kilauea summit), and high elevation. The frequent rainfall between Pahala and Nā'ālehu is thought to be caused by a combination of trade winds and a thermally-driven sea breeze/land breeze cycle (Scholl et al. 1995).

The region experiences flooding from storm runoff and steep slopes. Flash flooding occurs often along the Mamalahoa Highway when streams in the area exceed culvert and bridge capacity. Flooding causes major disruption to Ka'ū communities as it can geographically isolate them and warrant emergency government response, as in 2000.

Figure 2. Ka'ū Forest Reserve Geologic Age

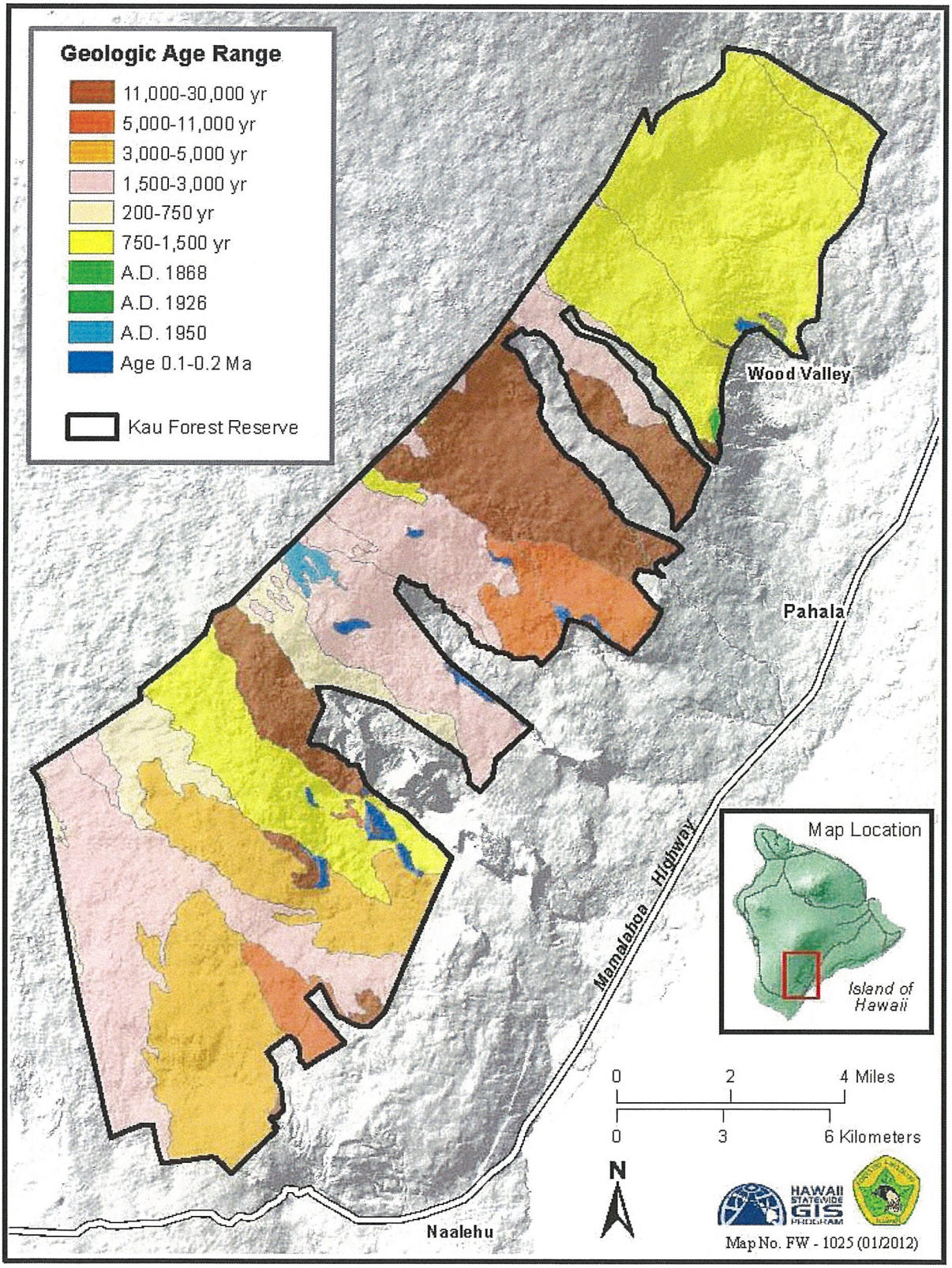
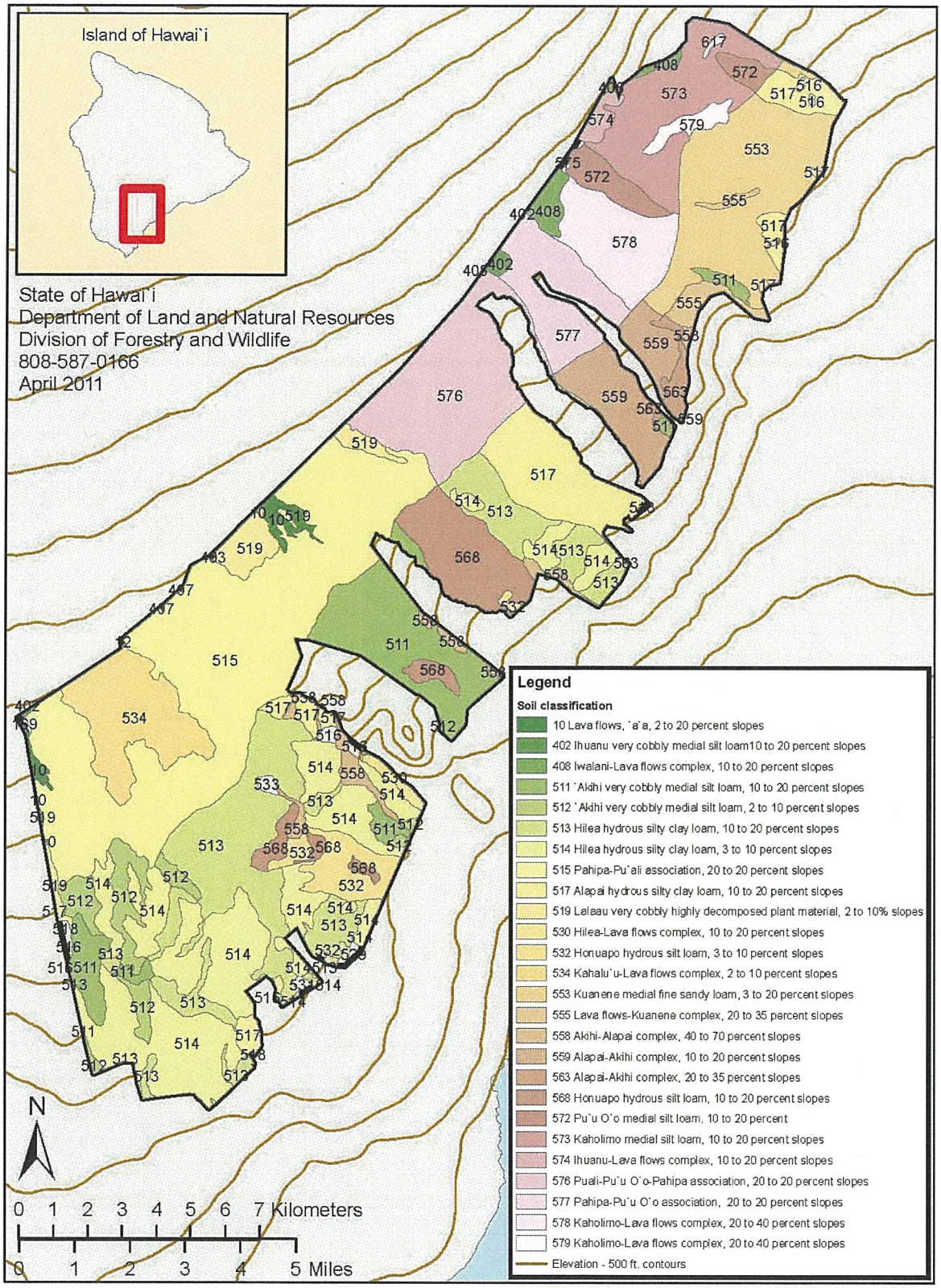


Figure 3. Soils



4. Water Resources

The Reserve was originally established in 1906 to protect the water supply of the district, and the forest continues to provide important watershed services for the community. Native Hawaiians recognized the importance of forests in water production and water quality, as reflected in the Hawaiian proverb, "Haihai ka ua i ka ulu la au" (The rain follows after the forests). Early foresters also recognized the importance of Hawaiian forests as watershed. Ralph Hosmer, the first Territorial Forester stated "In Hawai'i, the most valuable product of the forest is water, rather than wood."

The Hawai'i Stream Atlas defines a watershed as a catch-basin or drainage basin for rain and condensate funneled into stream beds that either join other stream beds or terminate at the edge of the sea (Parham et al. 2008). The Stream Atlas identifies eight watershed basins within the Ka'ū District (Table 2, Figure 5).

Watershed services include providing a fresh water supply, habitat for native plants and animals, allowing better flood control, mitigating climate change impacts, and providing economic, social, recreational and educational opportunities for the human communities in the area. Watershed economic value can be measured in dollars. A University of Hawai'i study estimated the economic value of watershed services provided by the Ko'olau Mountains watersheds on O'ahu to be between $7.44 billion to $14 billion (Roumasset et al. 1997). Although a similar analysis has not yet been done for Ka'ū Forest Reserve, the economic value of the Reserve's watersheds is undoubtedly high.

Table 2. Watersheds of the Ka'ū Forest Reserve

Watershed Basin Name	Streams
Hi'onamoa Gulch	Hi'onamoa, Mo'a'ula, Uwēwale, Ka'ala'ala, Pā'au'au, Waiakaloa Kauhuhuula, Peleli'ili'i, Waihaka, Keāiwa, Pi'ikea, Waloala, Makakupu, Punalu'u
Ninole Gulch	Ninole
Hīlea Gulch	Hīlea
Honuapo	Honuapo
Kaunāmano	Kaunāmano
Nā'ālehu	Alapai Gulch
Wa'ōhinu	Kaluapuhi, Wa'ōhinu
Kawela	Kaalualu

Protecting the forests of the Reserve is important because of the direct impact to humans and our water supply. While many people are familiar with the water cycle and how rainfall ends up in groundwater that is used by humans, fewer people may be aware of the large role forests play in supplying and purifying our fresh water. Fog condensing on trees is an important source of moisture and can increase measurable precipitation by 20% (Juvik and Perreira 1973; Juvik and Nullet 1995). Forests collect and filter water into the groundwater and streams. A healthy forest without soil

disturbance limits aquatic pollutants (e.g. siltation, suspended solids, turbidity, nutrients, organic enrichment, toxins and pathogens) due to erosion and runoff. Forests may also reduce the impacts of flooding and erosion by slowing down water as it flows down the mountain.

Despite the large amount of rain in the upland forests of Ka'ū, there are no perennial streams because the water is absorbed quickly into the highly permeable lava flows (Davis and Yamanaga 1966). Surface water reaches the sea only after periods of heavy rainfall and flooding. The water absorbed into the lava sinks rapidly to the basal water table where it either floats on salt water or is perched on impermeable ash beds and becomes groundwater. Some basal water seeps out at springs at or near sea level along the coast (Stearns and MacDonald 1946).

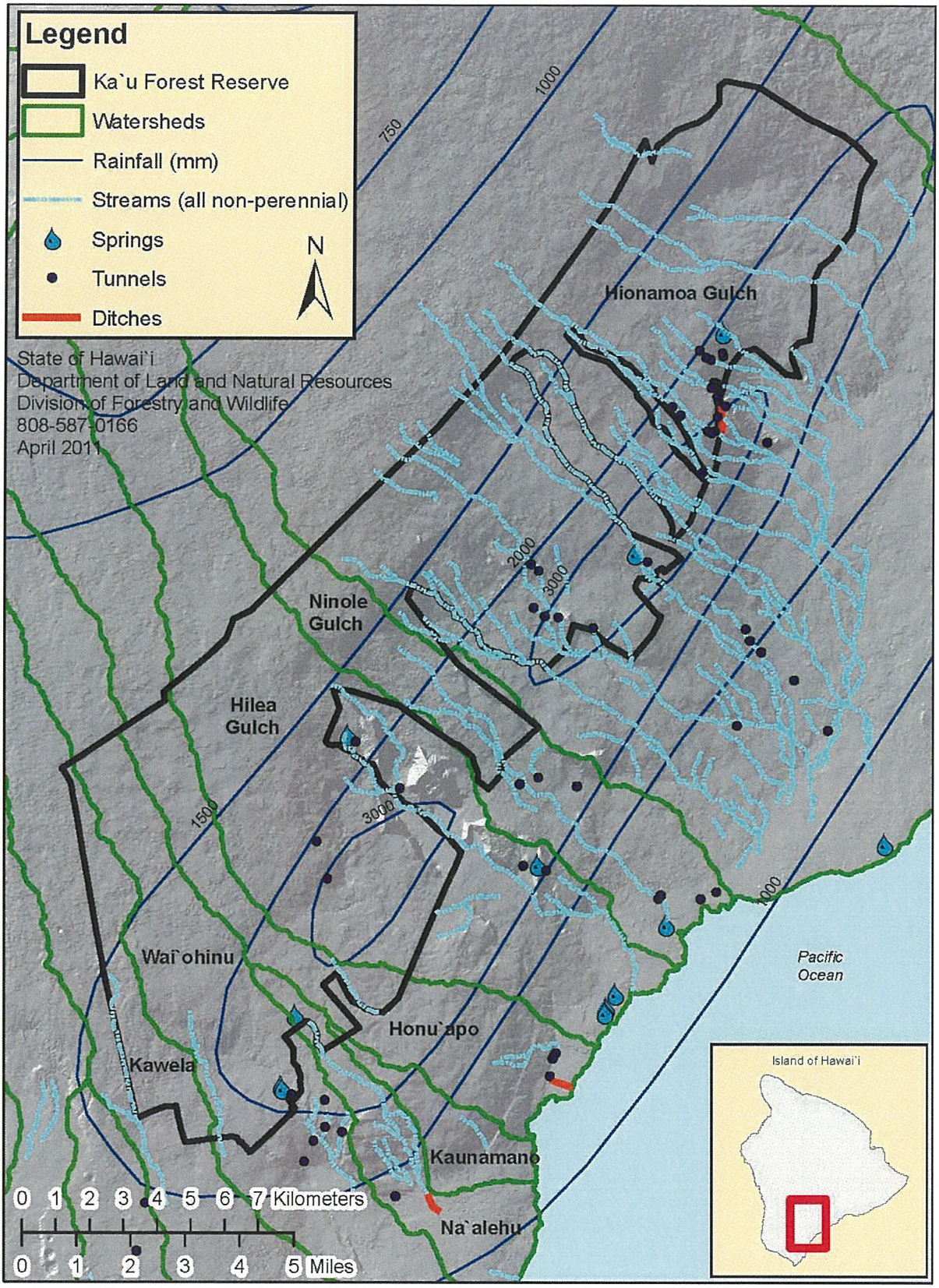
Water from Ka'ū Forest Reserve has been particularly important for Ka'ū agriculture. From the early 1920's to the late 1930's the two sugarcane companies in the district, Hawaiian Agricultural Company in the Pāhala area and Hutchinson Sugar Company in the Nā'ālehu area developed tunnels to recover perched groundwater for sugarcane irrigation and transport to mills via flumes (County of Hawai'i 2005). By 1950, the tunnel and flume transport system had fallen into disrepair (County of Hawai'i 2005). Sugarcane company leases for the water expired in 1973.

Of the 30 tunnels in the Reserve, three are currently being used under an agreement with the Hawai'i County Department of Water Supply (DWS). The DWS receives water for its Pāhala Water System from the Alili Tunnel and the Pāhala well. After the closure of the sugar plantation, the DWS also assumed management of the Wai'ōhinu-Nā'ālehu Water System which serves the communities of Wai'ōhinu, Nā'ālehu and South Point. This system depends primarily on the New Mountain House Tunnel Spring and Haao Spring for its water supply. Over 20 percent of the water drawn from the DWS system is used for agriculture.

The Department of Agriculture's Agribusiness Development Corporation (ADC) is actively working on getting a long-term agreement from DLNR to manage and improve various springs, tunnels and water infrastructure in Ka'ū Forest Reserve for agricultural uses. The ADC was established in 1994 to provide direction for the transition of Hawaii's agriculture industry from one dominated by sugar and pineapple to one composed of a diversity of crops. The mission of the ADC is to acquire and manage in partnership with farmers, ranchers and aquaculture groups high-value lands, water systems and infrastructure for commercial agriculture use for the economic, environmental, and social benefit of the people of Hawai'i. The ADC achieves its goals by facilitating the transition of agricultural infrastructure from plantation operations into other agricultural enterprises; by organizing farmers and users into cooperatives that benefit from participants' common interests and collective efforts; by conducting economic and feasibility studies relating to agriculture; and by providing leadership for the development, financing, improvement, and enhancement of agricultural enterprises. In Ka'ū, many users of springs and tunnels in Ka'ū Forest Reserve formed the Ka'ū Agricultural Water Cooperative (KAWC) in 2006 to work with the ADC on getting the

long-term agreement for the use of water and water infrastructure in Kaʻū Forest Reserve. The Kaʻu Forest Reserve Management Plan recognizes the established uses and planned upgrades to water infrastructure for agricultural and domestic systems. The ADC will be coordinating with DLNR to obtain a long-term agreement and implement practices that protect that values of the Forest Reserve and maintain consistency with the Management Plan.

Figure 5. Ka‘ū Forest Reserve Water Resources



C. Land Use

The Forest Reserve System was created by the Territorial Government of Hawai'i through Act 44 on April 25, 1903. With Hawaii's increase in population, expanding ranching industry, and extensive agricultural production of sugarcane and later pineapple, early territorial foresters recognized the need to protect mauka (upland) forests to provide the necessary water for the agriculture and surrounding communities.

DOFAW has management responsibility for the Ka'ū Forest Reserve, which is part of the State Forest Reserve System. Forest reserves provide recreational and hunting opportunities; aesthetic benefits; watershed restoration; native, threatened, and endangered species habitat protection and management; cultural resources; and fire protection, among many other things.

The Hawai'i State Constitution Article 11 states: "For the benefit of present and future generations, the State … shall conserve and protect Hawaii's natural beauty and all natural resources, including land, water, air, minerals and energy sources, and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State. All public natural resources are held in trust by the State for the benefit of the people." The Forest Reserve System is managed under the guidance of the Hawai'i Revised Statutes (Chapter 183) and associated Hawai'i Administrative Rules (Chapter 104). Through these directives, DOFAW focuses its resources to protect, manage, restore, and monitor the natural resources of the Forest Reserve System, with the highest priority placed on watershed function and native ecosystem preservation, as applicable.

The public is generally welcome into any forest reserve provided it is not dangerous to human life or detrimental to public trust resources such as watershed. The Forest Reserve System accounts for over 642,000 acres of state managed land. Without continued management, these resources would disappear, jeopardizing Hawaii's fresh water supply for people, as well as contributing to the further loss of native ecosystems. Information on the Forest Reserve System can be found at:
http://hawaii.gov/dlnr/dofaw/forestry/FRS

1. Reserve History

The Ka'ū Forest Reserve was established by Governor's Proclamation on August 2, 1906 to protect the forest on the lower slopes of Mauna Loa. The Reserve was established because of its importance in maintaining the favorable conditions on which the water supply of the agricultural lands in the Ka'ū District depend (Hawaiian Forester and Agriculturist 1906).

In 1906, The Board of Commissioners of Agriculture and Forestry, on the basis of a report by Ralph S. Hosmer, Superintendent of Forestry, recommended to the Governor that a forest reserve be established in Ka'ū. Lands proposed for this Reserve had been

under a lease to Hawaiian Agricultural Company and Hutchinson Sugar Plantation Company and many of those leases were about to expire. The leases required protection of the forest, including fencing out cattle, and these companies installed 52 miles of fencing around the forest and developed a water supply with tunnels and ditches.

Although the sugar plantations had installed a system of irrigation, it was deemed the responsibility of the Territory to perpetuate the forest for the procurement of water. The Ka'ū Forest Reserve boundaries were drawn to exclude private land at Kahuku, grazing land at Kāpāpala and land considered important for agriculture along the lower Reserve boundary (Hawaiian Forester and Agriculturist 1906).

Ralph Hosmer, Hawaii's first Territorial Forester, noted the importance of the Ka'ū forest stating "perhaps nowhere in the Territory is there a finer example of the fern jungle, with its dense mass of tree and other high-growing species". Hosmer also noted that "since the forest fence was completed ten years ago [1896] a wonderful difference has been noticed in the appearance of the forest" (Hawaiian Forester and Agriculturist 1906).

Hosmer's report recommending the establishment of the Reserve discussed both the direct benefits to the plantation as well as indirect economic benefits to the Territory through taxation and agricultural activities. Most portions of the Reserve were recommended for protection, with no cattle grazing proposed and limited areas for growing trees for timber and fuel collection (Hawaiian Forester and Agriculturist 1906).

Hosmer summarized the locations and condition of existing fences to protect the forest in a 1912 report on the Reserve in DOFAW files. The report noted that the Hawaiian Agricultural company completed 35 miles of fencing to protect the eastern half of the Reserve in 1896, including fencing through the interior of the forest from Kahuku to Pu'u Enuhe. In 1903-1904, The Hutchinson Sugar Plantation Company constructed a fence, about 17 miles in length, around most of the western end of the Ka'ū Forest Reserve, connecting on the mauka side with the existing Hawaiian Agricultural Company's fence. Only some portions of the lower boundary of the Reserve were left unfenced, most being protected by cane field and other fences.

Various parcels have been added and withdrawn from the Reserve since its establishment (summarized in Appendix A). The Board of Land and Natural Resources has approved the addition of two additional parcels, Kamilo and Kāpapāla Canoe area, which will be added to the Ka'ū Forest Reserve sometime in the next decade, following survey and subdivision. As written, this plan does not apply to those areas; once they are added, the management plan will be revised to address them.

DOFAW lands in the vicinity of Ka'ū Forest Reserve include the Kiolaka'a Ranger Station, which was originally turned over to the Board of Land and Natural Resources for a nursery, arboretum and ranger station in 1929. DOFAW staff currently use the Kiolaka'a Ranger Station to house staff and volunteers working in the area. DOFAW

also owns a cabin situated on NPS lands in upper Kahuku, which DOFAW staff use when working in the upper elevations of Ka'ū Forest Reserve.

2. Surrounding Communities

The Ka'ū District is rural and historically isolated. However, the population has grown substantially over the past 40 years. According to the 2010 U.S. Census, the Ka'ū District experienced a 45% increase in population growth from 5,827 individuals to 8,451 between 2000 and 2010. Increases in population growth during this time were primarily due to 103.7% population growth in the Hawaiian Ocean View area. Pāhala and Nā'ālehu both experienced negative population growth during this same time period (-5.8% and - 1.6% respectively). The overall growth rate for the island was 24.5% (U.S. Census 2010).

There are few economic resources in the Ka'ū District. Commercial centers are located in Pāhala, Nā'ālehu, Wai'ōhinu, and Ocean View. Development in the area includes residential, small retail commercial centers, and family-owned or commercial farms. Major government facilities include schools, a police facility and a hospital. The median household income in 2000 was $29,000. In 1999, 23.9 percent of the Ka'ū population was below the poverty level. Typically, residents live on fixed incomes or are young families and desire a rural lifestyle. The median age in Nā'ālehu is 36.5 yrs and in Ocean View is 44.3 (U.S. Census Bureau).

The primary economic resources in Ka'ū currently are macadamia nut farms, schools, medical services, cattle ranching, and construction. Agriculture is the region's main economic base and the Hawai'i Department of Agriculture classifies sections of land in the Wai'ōhinu, Nā'ālehu, and Pāhala area as Prime Agricultural Land. Sugarcane production dominated the economy between 1868 and 1996, when the last mill closed in Pāhala. Large tracts of plantation land were sold, and many of these lands are now owned or leased for agriculture or cattle ranching. Major crops include macadamia nuts, vegetables, citrus fruits, coffee, and ornamental flowers. There are several active cattle ranches in the region (County of Hawai'i 2005). The macadamia nut industry is one of the most prominent in the district with Mac Farms of Hawai'i in Nā'ālehu being the largest employer in the area. Residents also commute to the labor markets in Hilo, Kona, and the Kohala coast. Tourism is a growth industry in the region with its proximity to Hawai'i Volcanoes National Park (Ka'ū to South Kona Water Master Plan 2004).

The Ka'ū Listening Project, conducted in response to community concerns about large-scale resort development proposed for the area, found that residents generally believe that economic development needs to be balanced with conservation of the environment and the local community. This study also found that the subsistence economy of fishing, gathering, hunting, and gardening remains important today for many families (Kent 2007).

It is unknown how many people use the Reserve for hunting or gathering. Hunter use data is not available as there are no hunter check stations for Ka'ū Forest Reserve. There were approximately 139 licensed hunters in the Ka'ū District in 2010 out of 3,265 licensed hunters on Hawai'i island, approximately 1.6% of the population of the Ka'ū District (DOFAW internal data). However, additional residents that are not registered as licensed hunters may also be hunting in the Forest Reserve. DOFAW has no records of any permits issued for gathering of forest resources in the Reserve. It may be inconvenient for residents to obtain permits because they are issued through the DOFAW office in Hilo.

3. Regional Partnerships

The Ka'ū Forest Reserve is part of the TMA, a voluntary public-private watershed partnership of landowners and agencies with a management interest in the landscape and a goal to coordinate conservation management on a landscape level. The overall management goal of the TMA is to sustain the multiple ecosystem benefits, provided by the three mountains of Kīlauea, Mauna Loa, and Hualālai, by responsibly managing its watershed areas, native habitat and species, historical, cultural, and socio-economic resources for all who benefit from the continued health of the three mountains. TMA lands in the vicinity of Ka'ū Forest Reserve are shown in Figure 1.

TMA lands include the 116,000 ac (46,944 ha) Kahuku section of Hawai'i Volcanoes National Park, which was formerly used as a ranch and was then sold by Damon Estate to the park in 2003 (Figure 1). NPS is currently developing a General Management Plan (GMP) for the park, which will provide a framework to use in making decisions about how to protect resources, what levels and types of uses are appropriate, what facilities should be developed, and how people should access the park. Other ongoing resource management actions at Kahuku include replacing the boundary fence with Ka'ū Forest Reserve, removing feral ungulates, reforestation of pasture and non-native invasive plant control (NPS 2011; Rhonda Loh personal communication. NPS management of Kahuku provides new opportunities for cooperative management with adjacent DOFAW lands in Ka'ū (e.g. public access to the Reserve through Kahuku, recreational opportunities, fire protection, invasive species control etc).

TNC purchased the 3,511 ac (1,421 ha) Ka'ū Preserve in 2002 to protect biologically rich and intact native forest found there. TNC's Ka'ū Preserve consists of four separate sections that are adjacent to the Ka'ū Forest Reserve (Figure 1). The TNC Ka'ū Preserve is included in the state's Natural Area Partnerships Program, which provides state-matching funds on a 2:1 basis with private funds for the management of natural resources on private lands permanently dedicated to conservation. TNC has constructed a fence around a 1,200 ac (486 ha) portion of the preserve at Kaiholena and removed feral ungulates from within the fenced unit. Other management activities include: non-native invasive plant control and education and outreach. TNC has also worked to enhance public hunting in the Ka'ū Forest Reserve by coordinating access through the TNC preserve, maintaining roads and providing fence step-overs.

KS lands include two parcels of approximately 2,883 ac (1,167 ha) of conservation land (Figure 1). KS seeks to *mālama i ka 'aina*: practice ethical, prudent and culturally appropriate stewardship of lands and resources (KS 2000-2015 Strategic Plan). KS intends to integrate Hawaiian cultural values and knowledge into resource stewardship practices, incorporate ahupua'a management principles, and promote a broad understanding of stewardship efforts and, as appropriate, cultural resource management programs.

4. Related Land Use Planning Efforts

There are numerous completed and ongoing planning efforts that may have implications for the management of the Ka'ū Forest Reserve (Table 3). These include plans for adjacent conservation areas as well as plans that may identify goals, objectives and proposed actions for the management of various resources in Ka'ū Forest Reserve.

Table 3. Related Plans and Cooperative Efforts.

Plan/Cooperative Effort	Description
Ka'ū Community Development Plan (CDP) - Under Development http://www.hawaiicountycdp.info/kau-cdp	The CDP was mandated by the Hawai'i County General Plan to translate goals, objectives, and policies into implementation actions as they apply to specific geographical areas. CDP's are "intended to be a forum for community input into managing growth and coordinating the delivery of government services."
Hawai'i Volcanoes National Park General Management Plan (GMP) - Under Development (Draft scheduled to be completed in 2012-2013) http://www.nps.gov/havo/parkmgmt/gmp.htm	A GMP is the broadest level of planning for the future management of national parks. The GMP will describe the general path for managing Hawai'i Volcanoes National Park over the next 15 to 20 years. Alternatives will be developed and analyzed before a preferred direction is selected. The Draft GMP is scheduled to be finalized in 2014.
DOFAW Statewide Assessment and Resource Strategy (SWARS) 2010 http://www.hawaiistateassessment.info/SWARS/	Identifies areas of greatest need/opportunity for forests in Hawai'i and develops a long-term strategy. Objectives include: 1.1. Identify and conserve high-priority forest ecosystems; 2.2. Identify, manage and reduce threats to forest and ecosystem health; 3. 3. Enhance public benefits from trees and forests; 3.1. Protect and enhance water quality and quantity; 3.5. Protect, conserve and enhance wildlife and fish habitat; 3.7. Manage and restore forests to mitigate and adapt to global climate change.
Three Mountain Alliance (TMA) Management Plan (2008) and TMA Weed Management Plan (2009) http://hawp.org/_library/documents/three-mountain-alliance/tma%20mgmt%20plan.final.2.pdf	TMA watershed partnership and TMA weed management plans identify the importance of natural resources in Ka'ū Forest Reserve and propose management activities.
TNC Ka'ū Preserve Long Range Management Plan: Fiscal Years 2006-2018 (2012) and Final Environmental Assessment http://oeqc.doh.hawaii.gov/Shared%20Documents/EA_and_EIS_Online_Library/Hawaii/2000s/2006-09-23-HA-FEA-KAU-PRESERVE-NATURAL-AREA-PARTNERSHIP.pdf	This plan documents long-range goals and strategies for TNC's Ka'ū Preserve including the following activities: ungulate control, invasive plant control, resource monitoring, rare species protection and research, community outreach, and watershed partnership. TNC is currently preparing an updated plan to cover Fiscal years 2013 - 2018.
Hawai'i Comprehensive Wildlife Conservation Strategy (2005) http://www.state.hi.us/dlnr/dofaw/cwcs/index.html	Identifies species of greatest conservation need and their affiliated habitats. It includes strategies for addressing those needs and the conservation of the diversity of wildlife species. Ka'u Forest Reserve is identified as a priority area for the enhanced conservation management for the long-term conservation of native wildlife
County of Hawai'i General Plan (2005) http://www.co.hawaii.hi.us/la/gp/2005/main.html	8.2(c) Protect/promote the prudent use of Hawaii's unique, fragile, and significant environmental and natural resources. 8.2 (d) Protect rare or endangered species and habitats native to Hawai'i. 8.3 (b) Encourage collection/dissemination of basic data concerning natural resources. 8.3 (e) Encourage an overall conservation ethic in the use of Hawai'i resources by protecting, preserving, and conserving the critical and significant natural resources of the County.

D. Forest Ecosystems

1. Native Forest Communities

The Ka'ū Forest Reserve is one of the largest native forests remaining in the Hawaiian Islands. The forests of the Reserve currently consist almost entirely of native ecosystems. According to DOFAW's Draft Management Guidelines, most of the Reserve falls into highest quality native ecosystem vegetation classification, with minimal disturbance and low levels (less than 10%) of non-native plants (State of Hawai'i 2001). Also, TNC's Ecoregional Plan rates the condition of most of the Reserve as good or very good with regard to their overall ecosystem viability ranking (TNC 2006b).

Although much of the native forest upper canopy (large trees) is intact, DOFAW and TMA staff has observed serious degradation of large portions of the Reserve from feral ungulates and non-native weeds, threatening the long-term survival of high quality native forest. Upper elevation portions of the Reserve have widespread disturbance from feral ungulates resulting in a ground layer with exposed soil and leaf litter instead of native ferns, small plants and tree seedlings. These openings in the forest floor enhance erosion as soil washes away during storms. Large upper canopy trees may not be replaced as they die due to lack of regeneration of younger generations of native trees in the middle and lower forest layers. Lower portions of the Reserve have severe infestations of weeds that are spreading into the middle and upper areas of the Reserve due to openings in the forest created by feral ungulates. The long-term survival of the forest is threatened by the gradual disappearance of the native trees and plants and conversion to non-native weedy species. Management is needed to address these threats, slow the decline of this unique forest ecosystem and restore areas that have been severely impacted.

There are five major native-dominated natural communities in the Ka'ū Forest Reserve (Figure 7) (UH 2005; Jacobi 1989; Price unpublished data). The wet forest types typically receive > 75 in (1900 mm) average annual precipitation while the mesic forest types receive 50 - 75 in (1300 - 1900 mm).

(1) Wet 'Ōhi'a Forest
(2) Wet Koa Forest
(3) Mesic Koa Forest
(4) Mesic 'Ōhi'a Forest
(5) Montane and Subalpine Shrubland and Woodland

Wet 'Ōhi'a Forest is one of the most widespread wet forest types in the Hawaiian islands and covers a large portion of the the southwest portion of the Reserve in both lowland and montane areas. This forest type is generally dominated by 'ōhi'a, with a dense hāpu'u (*Cibotium* spp.) tree fern layer. Some areas, particularly steep slopes contain more open/stunted 'ōhi'a forest with an uluhe (*Dicranopteris linearis*) understory. An 'ōhi'a-dominated forest belt with more open canopy and shrub layer of kanawao

(Broussaisia arguta) occurs between 5,315 ft (1,620 m) and 5,724 ft (1,740 m) (Jacobi and Price 2007). This community type contains many rare and endangered plants, birds and invertebrates.

Wet Koa Forest occurs in the center of the Reserve and extends to the northeast. ʻŌhiʻa and koa (*Acacia koa*) form the canopy with subcanopy layers rich in endemic trees, shrubs, sedges, and ferns such as ʻōlapa (*Cheirodendron trigynum*), kāwaʻu (*Ilex anomala*), kōlea (*Myrsine lessertiana*), pilo (*Coprosma* spp.), manono (*Hedyotis terminalis*), and ālani (*Melicope* spp.). Native ferns, shrubs, and sedges such as ʻuki (*Carex alligata*) are found beneath the hāpuʻu layer. This forest type has older substrates than elsewhere in the area and supports many native forest birds and invertebrates (TNC 2006b, Jacobi and Price 2007).

Mesic Koa Forest is found at the highest elevation in the northeast and into the Kapāpala Forest Reserve. This forest type has a good representation of ʻōhiʻa and koa forming the canopy layer, with native trees forming the subcanopy layer. Hāpuʻu tree ferns typical of wet forests are scarce or lacking. In addition, plants more characteristic of drier areas, such as manena (*Melicope hawaiensis*), ʻaiea (*Nothocestrum breviflorum*), and pūkiawe (*Styphyelia tameiameiae*) may be present. Where it has not been greatly disturbed, the ground cover is dominated by native ferns, often including large laukahi (*Dryopteris wallichiana*). The groundcover in portions of this forest is dominated by non-native grasses, primarily meadow ricegrass, which is not considered a habitat modifying weed in this area. A number of rare plants, including members of *Clermontia*, *Cyanea*, *Phyllostegia*, and *Stenogyne* occur here (TNC 2006b). This community provides important habitat for forest birds as well as specialized plants and animals such as ʻAlalā (TMA 2007).

Mesic ʻŌhiʻa Forest occurs near the upper Reserve boundary. This community is a transitional vegetation type between wet and mesic montane habitats and drier subalpine shrublands (Hawaiʻi Natural Heritage Program 1995). This forest type is dominated by an ʻohiʻa canopy with native trees and shrubs in the subcanopy. Similarly to mesic koa forests described above, there is a lack of large tree ferns and a ground cover of native ferns.

Montane and Subalpine Shrubland and Woodland occurs at the upper boundary of the Reserve and into Kahuku at the drier upper elevations. This forest type is generally more open canopy with scattered, shorter stature native trees and shrubs. Native grasses such as *Deschampsia nubigena* are found in the understory. This area also contains younger lava flows with less well-developed forests.

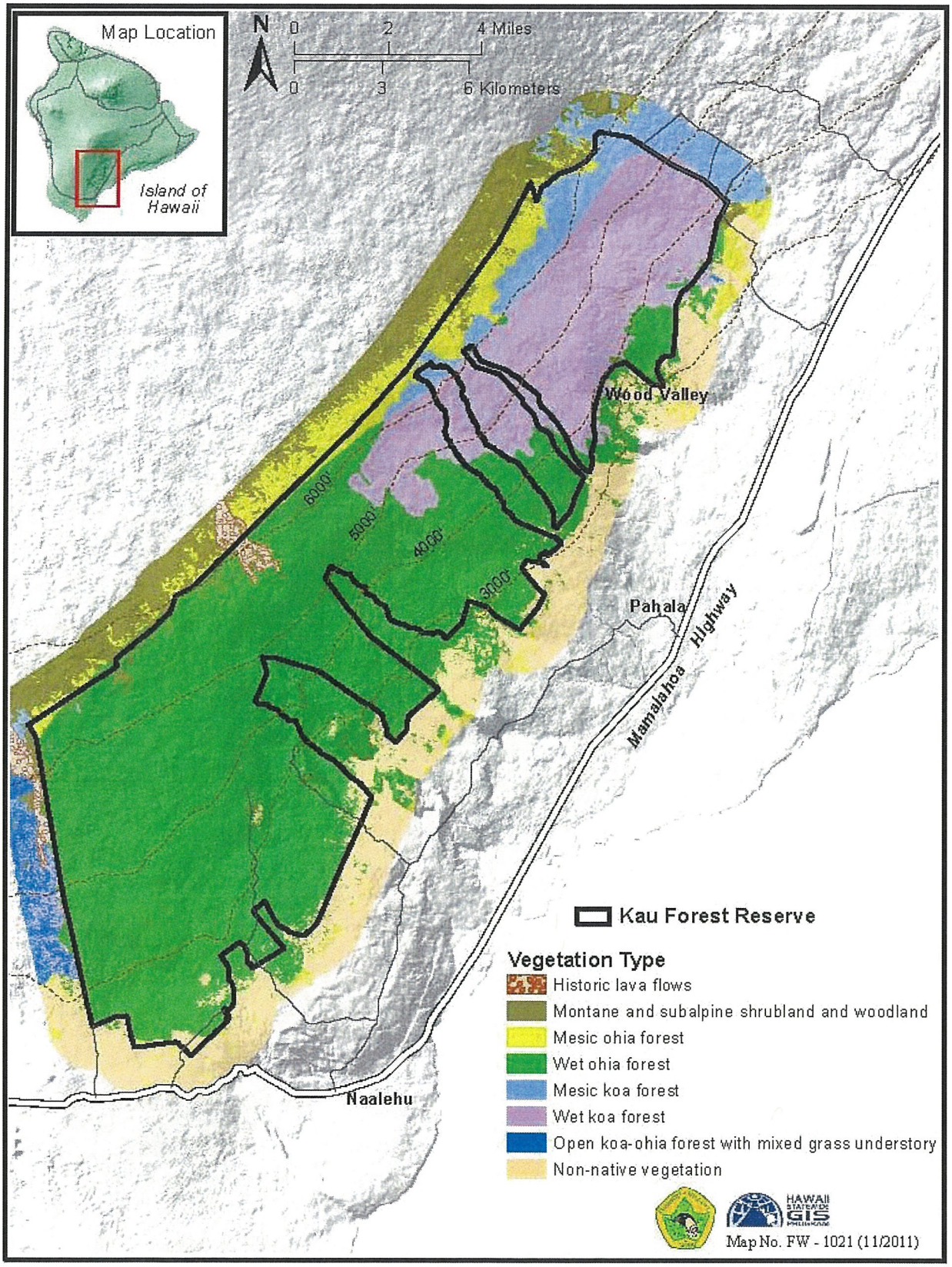
Open Koa-ʻŌhiʻa Forest with a Mixed Grass Understory is present adjacent to the Reserve, at Kahuku. Long-term use of these lands as pasture has resulted in open forest and with a non-native grass understory.

Non-Native Vegetation occurs just outside of the Reserve. The agricultural land along the lower boundary of the Reserve, adjacent to the forest, was cleared for sugar cane

production and is now mainly used for pasture. Serious infestations of habitat-modifying invasive weeds including strawberry guava (*Psidium cattleianum*), Koster's curse (*Clidemia hirta*) and night-blooming jasmine (*Cestrum nocturnum*) occur along the lower forest edge and into some sections of the lower Reserve.

In addition to the communities described above, intermittent streams provide habitat for aquatic insects and other stream-associated organisms. Lava tubes and caves are associated with pāhoehoe lava flows and most likely contain subterranean invertebrate communities, especially in forested portions of the area (Hawai'i Natural Heritage Program 1995).

Figure 7. Vegetation Communities of Ka'ū Forest Reserve



2. Native Flora

The mesic and wet forest ecosystems in the southeast portion of Mauna Loa (eastern side of the Southwest Rift Zone) support 153 endemic plant species and provide habitat for at least 32 known species of rare plants (Table 5). These species are known currently or historically from the Reserve or adjacent areas. Fourteen of these are listed as endangered by the U.S. Fish and Wildlife Service.

The U.S. Endangered Species Act defines Critical Habitat as areas that may or may not be occupied by a threatened or endangered species, but are essential to the conservation of the species. These areas may require special management considerations or protection (16 U.S.C. § 1532 (5)). The Reserve is Critical Habitat for three species of Hawaiian plants: *Phyllostegia velutina*, *Cyanea stictophylla,* and *Melicope zahlbruckneri* (U.S. Fish and Wildlife 2003) (Table 5, Figure 8).

Table 5. Rare Plants found in or near Ka'ū Forest Reserve

Species	Common Name	Federal Status*	Critical Habitat
Argyroxiphum kauense	Mauna Loa silversword	LE	
Asplenium peruvianum var *insulare*		LE	
Asplenium schizophyllum		-	
Clermontia lindseyana	ʻoha wai	LE	
Cyrtandra menziesii		SOC	
Cyanea platyphylla	ʻāku'āku	LE	
Cyanea shipmanii	hāhā	LE	
Cyanea stictophylla	hāhā	LE	X
Cyanea tritomantha		C	
Eurya sandwicensis		SOC	
Fragaria chiloensis	ʻōhelo papa	SOC	
Lobelia hypoleuca		-	
Marattia douglasii	pala, kapuaʻilio	-	
Melicope zahlbruckneri		LE	X
Neraudia ovata		LE	
Nothocestrum breviflorum		LE	
Pittosporum hawaiiense		SOC	
Phyllostegia ambigua		SOC	
Phyllostegia floribunda		C	
Phyllostegia velutina		LE	X
Phyllostegia vestita		-	
Plantago hawaiiensis		LE	
Pritchardia lanigera	loulu	SOC	
Ranunculus hawaiensis	makou	C	
Rubus macraei		SOC	
Sanicula sandwicensis		SOC	

Silene hawaiiensis		LE	
Sisyrinchium acre	mauʻu lāʻili	SOC	
Stenogyne angustifolia		LE	
Strongylodon ruber	nuku ʻiʻiwi	SOC	
Trematolobelia wimmeri	koliʻi	SOC	
Vicia menziesii		LE	

* Key to Federal Status:
Listed Endangered (LE) = Taxa listed as endangered.
Candidate (C) = Taxa for which substantial information on biological vulnerability and threat(s) support proposals to list them as threatened or endangered.
Species of Concern (SOC) = Taxa for which available information meets the criteria for concern and the possibility to recommend as candidate.

E. Wildlife

Ka`ū Forest Reserve contains a variety of wildlife resources including both endemic species of birds and invertebrates as well as the ʻŌpeʻapeʻa, or the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). Non-native species include birds, mammals and invertebrates.

The Hawaiʻi Comprehensive Wildlife Conservation Strategy identifies the Reserve as a priority area for management for the long-term conservation of native wildlife on the island of Hawaiʻi. The area is a priority because it is one of the most diverse and intact forests on the island with high densities of common and rare forest birds and great potential habitat for restoration of some endangered forest bird populations. Lower portions of the Reserve harbor a diverse native insect fauna. As part of a broader landscape that includes Kapāpala Forest Reserve and Hawaiʻi Volcanoes National Park, the Reserve provides a range of elevations and rainfall that would allow wildlife populations to move in response to changing climate or weather conditions (Mitchell *et al.* 2005). Kaʻū Forest Reserve has also been identified as an important bird area by the National Audubon Society (National Audubon Society 2011).

1. Native Wildlife

Birds

The Kaʻū Forest Reserve is very important for the survival and recovery of native Hawaiian forest birds because it contains large tracts of upper elevation native forest. The Reserve provides habitat for eight native forest birds including five of the six birds that are endemic to Hawai'i Island, four of which are federally endangered. An additional five endemic or indigenous species likely use small areas of the Reserve (Table 6). In addition to supporting a diverse avifauna, the area provides habitat for the second largest concentration of native birds on Hawaiʻi Island and some of the highest densities in the State (Gorresen *et al*. 2007).

Populations of native Hawaiian forest birds in the Reserve and across the state have declined due to habitat loss and the ecological impacts of introduced species (threats are discussed in more detail in Section J. of this plan). Of the 46 historically known

forest bird species in Hawai'i, only 24 species still survive, and of these 13 species are listed as endangered. Ten species of endemic Hawaiian birds have likely gone extinct over the past 25 years - an average of one extinction every two years (Pratt *et al.* 2009).

The Reserve provides habitat for six honeycreepers (Subfamily Drepanidinae) endemic to the Hawaiian Islands (occur nowhere else in the world). These include three federally listed endangered species: 'Akiapōlā'au (*Hemignathus munroi*), Hawai'i Creeper (*Oreomystis mana*), and Hawai'i 'Ākepa (*Loxops coccineus*). The non-endangered honeycreepers found in the area include: Hawai'i 'Amakihi (*Hemignathus virens*), 'I'iwi (*Vestiaria coccinea*) and 'Apapane (*Himatione sanguinea*). Other native birds reported from the project area include the federally endangered 'Io or Hawaiian Hawk (*Buteo solitarius*), the Hawai'i 'Elepaio (*Chasiempis sandwichensis*), and the 'Ōma'o or Hawaiian thrush (*Myadestes obscurus*).

Native forest birds are primarily found in the upper elevations (above 4,000 ft (1,219 m)) where colder temperatures minimize the number of mosquitoes and limit avian malaria, a non-native disease carried by mosquitoes. The distributions of 'Akiapōlā'au, Hawai'i Creeper, and Hawai'i 'Ākepa within the Reserve are even more narrowly restricted to a narrow band of forest and adjacent woodland above 5,000 ft (1,524 m) (Figures 8-10). These species have been extirpated from habitat below this elevation at least since 1976 due to the prevalence of mosquito-borne avian malaria (Scott *et al.* 1986). Figures 8 - 10 show the observed density (bird counts are the number of individuals detected along monitoring transects) and ranges of these endangered species in Ka'ū Forest Reserve. Lower elevations are not generally habitat for endangered forest birds on Hawai'i Island due to the presence of mosquitoes but may be important for native forest birds that have developed resistance to avian malaria (Pratt *et al.* 2009).

The Akiapōlā'au, the rarest of the honeycreepers in the Reserve, forage preferentially on koa, but nest almost exclusively in 'ōhi`a. This species is concentrated in the northeastern portion of the Reserve, which supports a large percentage (approximately 56%) of the species' total population (Tweed *et al.* 2007, Table 7). Hawai'i Creeper and Hawai'i 'Ākepa densities are highest in mature 'ōhi'a and koa-'ōhi'a forests in the upper central portion of the Reserve and these two species have a larger distribution and population compared to the Akiapōlā'au. Populations of these three species in the Reserve are separated from other populations on Hawai'i Island. The 'Io, 'Ōma'o, and the other three honeycreeper species are broadly distributed across the Reserve, although the 'I'iwi is restricted to habitats mostly above 5,000 ft (1,524 m) in elevation.

The endemic Nēnē or Hawaiian Goose (*Branta sandvicensis*), 'Ua'u or Hawaiian Petrel (*Pterodroma sandwichensis*) as well as the indigenous 'Akē'akē or Band-Rumped Storm-Petrel (*Oceanodroma castro*), Kōlea or Pacific Golden Plover (*Pluvialis fulva*) and Pueo or Short-eared Owl (*Asio flammeus sandwichensis*) may use small portions of the Reserve; the importance of the Reserve to these species is unknown or low.

Finally, in recent years (1970's) the Ka'ū Forest Reserve also supported the 'Alalā or Hawaiian Crow (*Corvus hawaiiensis*). The 'Alalā is listed as endangered and the

species is extinct in the wild. The entire population, approximately 95 birds, is housed in two captive breeding facilities, making the ʻAlalā one of the rarest birds in existence. Known from the island of Hawaiʻi (and from fossils on the island of Maui), the ʻAlalā was restricted to the dry and mesic forests in the western and southern portions of the island. The species was associated with ʻōhiʻa and ʻōhiʻa-koa forests with an understory of native fruit-bearing trees and shrubs. This understory is essential to the survival the ʻAlalā in the wild, providing food as well as cover from natural predators such as ʻIo. Threats to wild ʻAlalā include predation by non-native mammals, non-native diseases (avian malaria and toxoplasmosis), habitat degradation, fragmentation, and loss, and direct human impacts (e.g. shooting and harassment).

Although they are insulated from these threats in captivity, their small population size makes them vulnerable to inbreeding problems, which has resulted in genetic-related egg and chick death as well as to demographic problems (e.g. uneven sex ratio). Recently, this problem has been minimized and production of young in captivity has dramatically increased during the last three years. In addition, unpredictable environmental events such as hurricanes, droughts and volcanic activity will further complicate the restoration of this species to the wild. All of these threats will challenge the species for many years post-release.

The current captive population of ʻAlalā is at the point where restoration of a wild population can proceed. Several potential release sites have been identified in the Kaʻū Forest Reserve and elsewhere. The Reserve is a high priority site to restore this wide ranging species to the wild due to the large size and elevational range of the forest, as well as the fact that the area recently supported ʻAlalā. The restoration of a wild population of ʻAlalā will require minimizing threats, including predator control, and protecting significant areas of forest protected from ungulates. In addition to the restoring ʻAlalā, these efforts will benefit the watershed resources of the Reserve as well as native plants, invertebrates, and other birds. Restoring the ʻAlalā to the wild will require human assistance, including providing supplemental food, a semi-permanent infrastructure and a constant, long-term human presence. Planning for initial releases is underway, although, the Reserve may not be the first release site.

Table 6. Native Birds with Habitat in Ka'ū Forest Reserve.

Species	Scientific Name	Island Distribution	Federal Status*	State Status*
Nēnē or Hawaiian Goose	*Branta sandvicensis*	H, K, M, Mo	LE	LE
'Ua'u or Hawaiian Petrel	*Pterodroma sandwichensis*	H, L, K, M	T	LE
`Akē`akē or Band-rumped Storm Petrel	*Oceanodroma castro*	H, K	C	LE
Kōlea or Pacific Golden Plover	*Pluvialis fulva*	Throughout Hawai'i	MBTA	Indigenous
'Io or Hawaiian Hawk	*Buteo solitarius*	H	LE	LE
Pueo or Hawaiian Short-eared Owl	*Asio flammeus sandwichensis*	Throughout Hawai'i	MBTA	Endemic
Ālalā or Hawaiian Crow	*Corvus hawaiiensis*	Captivity	LE	LE
Hawai'i 'Elepaio	*Chasiempis sandwichensis*	H	-	Endemic
'Ōma'o	*Myadestes obscurus*	H	MBTA	Endemic
Hawai'i 'Amakihi	*Hemignathus virens*	H, M, Mo	MBTA	Endemic
'Akiapōlā'au	*Hemignathus munroi*	H	LE	LE
Hawai'i Creeper	*Oreomystis mana*	H	LE	LE
Hawai'i 'Ākepa	*Loxops coccineus*	H	LE	LE
'I'iwi	*Vestiaria coccinea*	H, K, O, M, Mo	MBTA**	Endemic
'Apapane	*Himatione sanguinea*	Throughout Hawai'i	MBTA	Endemic

* Key to Federal and State Status:
Listed Endangered (LE) = Taxa listed as endangered.
Threatened (T) - Taxa listed as threatened
Candidate (C) = Taxa for which substantial information on biological vulnerability and threat(s) support proposals to list them as threatened or endangered.
Migratory Bird Treaty Act (MBTA) = It is illegal to harass or kill birds listed under the MBTA
Endemic and Indigenous species are protected under Hawai'i Revised Statutes 183D and 195D
** USFWS is reviewing the status of this species and will decide within a year whether it should be LE.

Table 7. Estimated Population Status of Endangered Forest Birds in Ka'ū Forest Reserve (Gorresen *et al.* 2007)

Species	Total Population	Ka'ū Population
Ālalā	~95	0
'Akiapōlā'au	1,900	1,073 (616 - 1,869)
Hawai'i Creeper	14,000	2,268 (1,159 - 4,438)
Hawai'i 'Ākepa	12,000	2,556 (1,340 - 4,876)

Figure 8. Hawai'i 'Ākepa - Observed Density in Ka'ū Forest Reserve

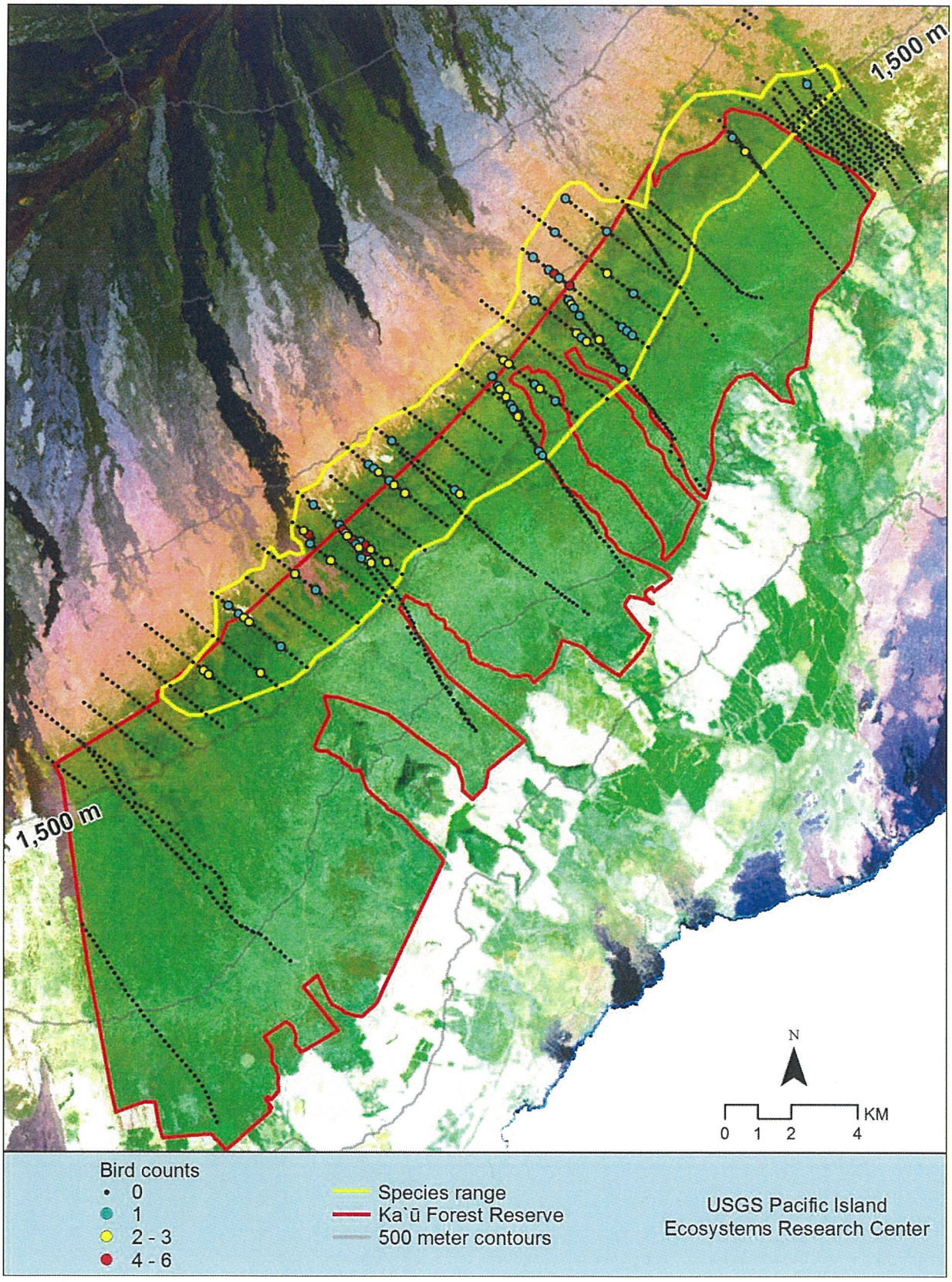


Figure 9. Hawai'i Creeper - Observed Density in Ka'ū Forest Reserve

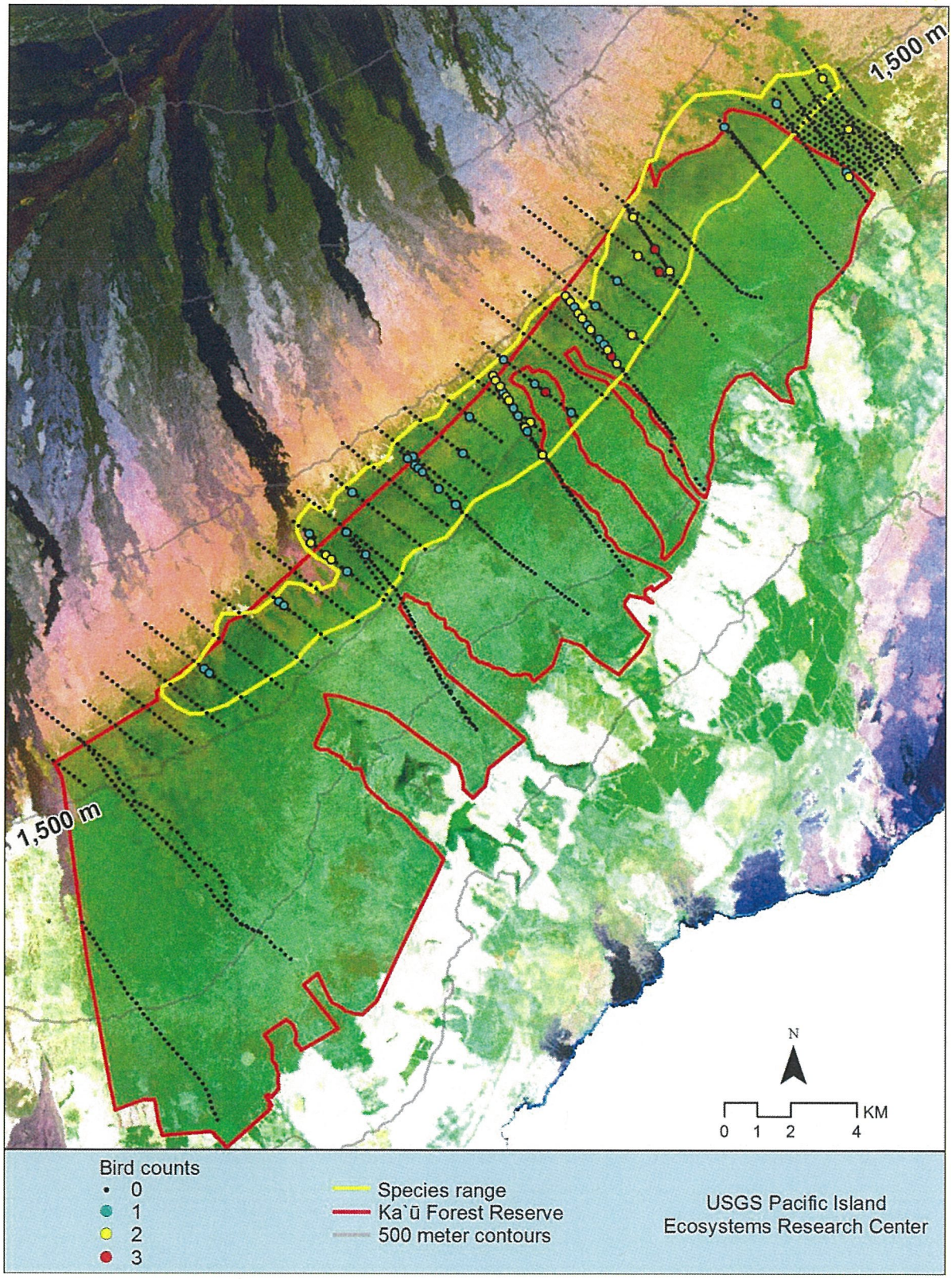


Figure 10. ʻAkiapōlāʻau - Observed Density in Kaʻū Forest Reserve

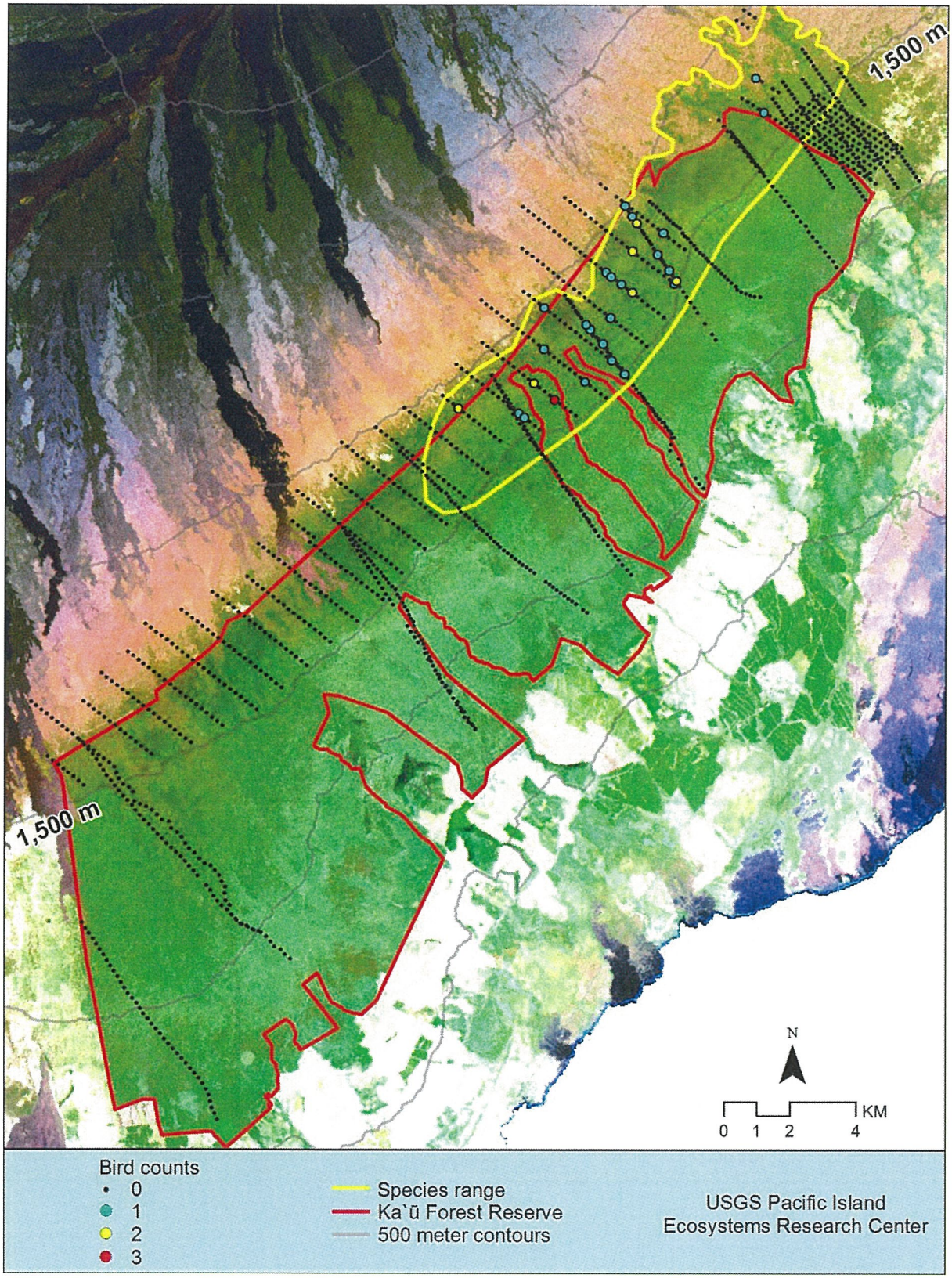
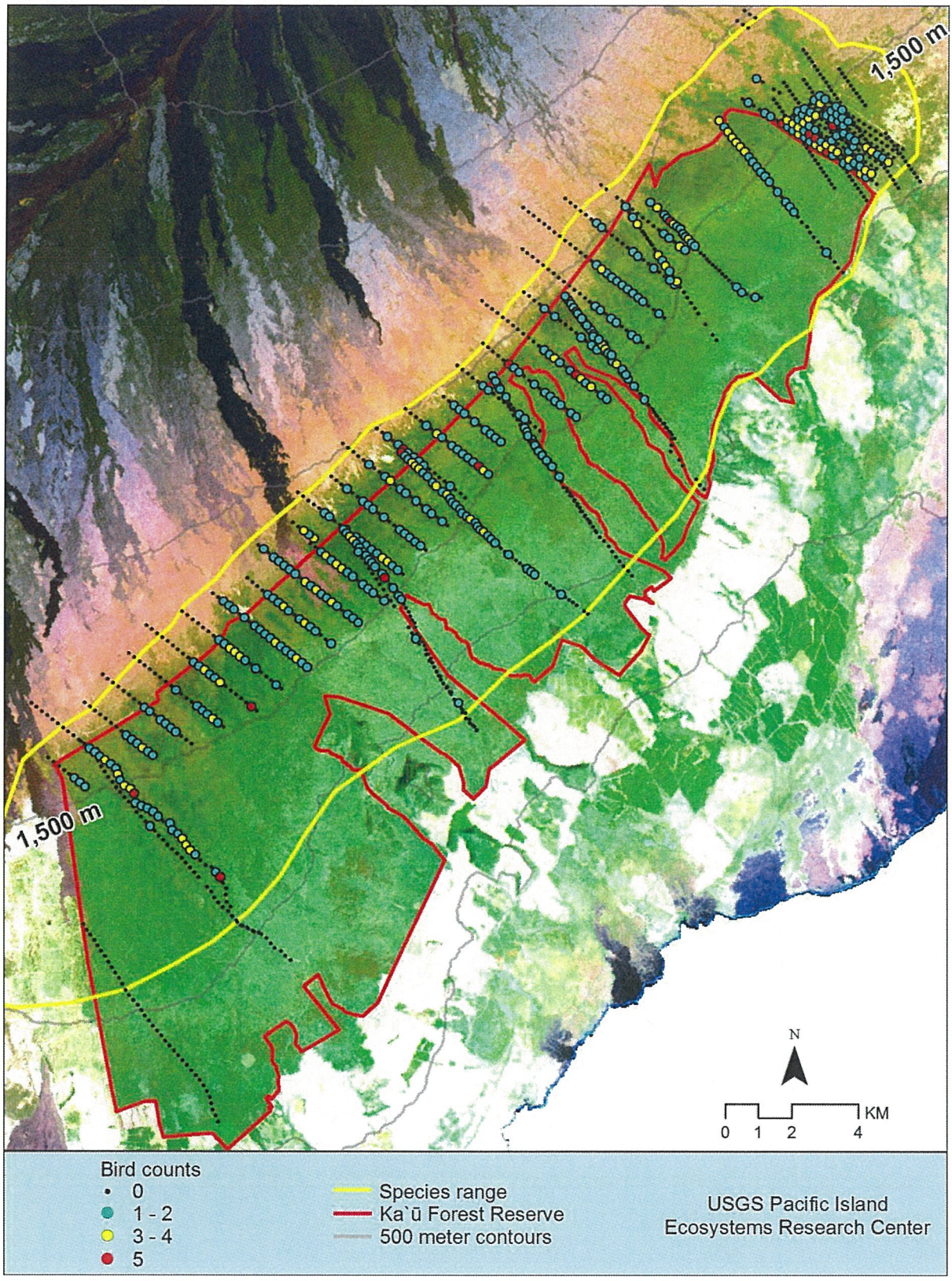


Figure 11. ʻIʻiwi - Observed Density in Kaʻū Forest Reserve



Mammals

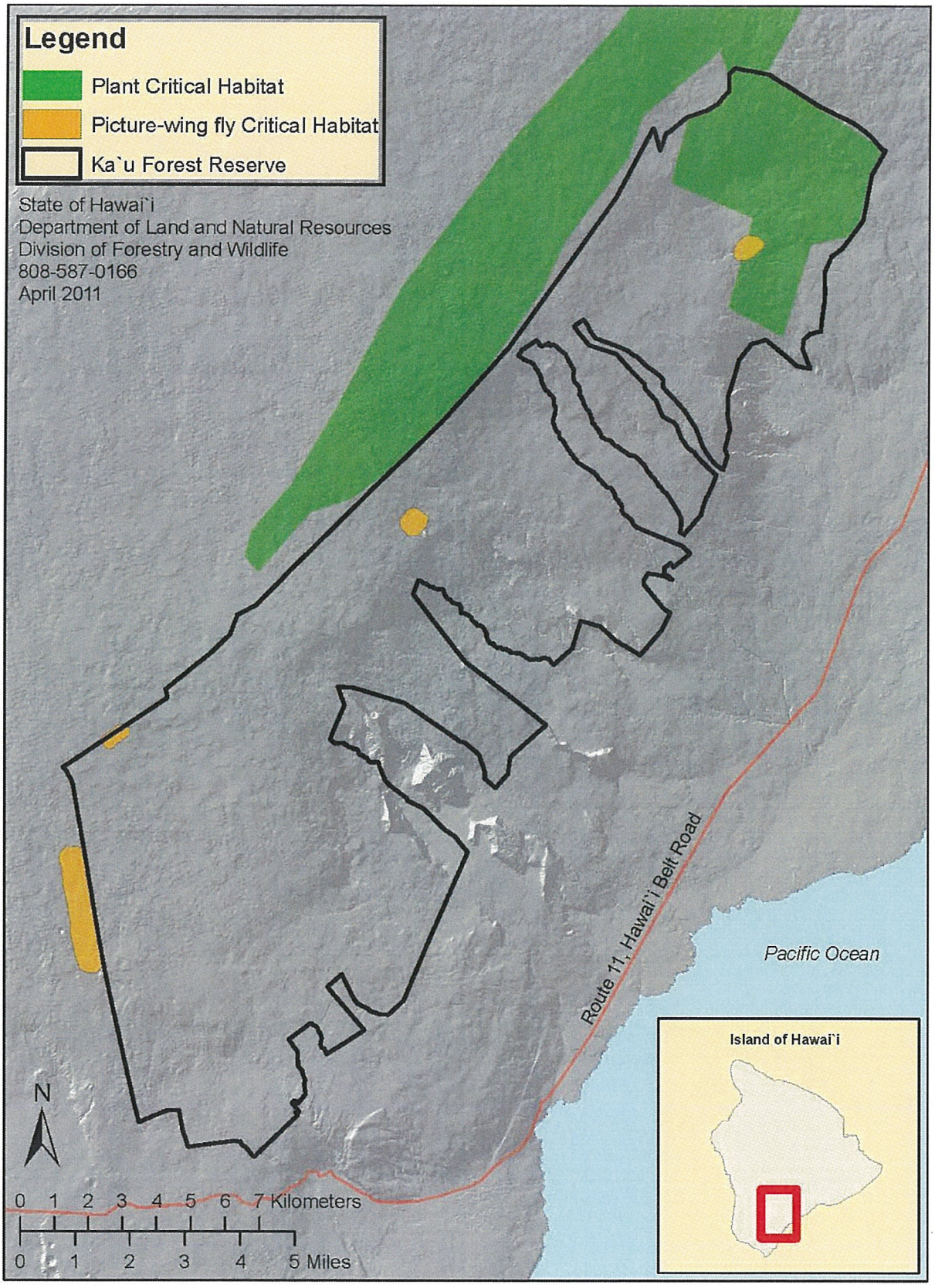
The ʻŌpeʻapeʻa, or the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), is the only endemic terrestrial mammal in Hawaiʻi (Hawaiʻi Natural Heritage Program 1995). The ʻŌpeʻapeʻa is listed as endangered under the U.S. Endangered Species Act. Recent surveys of TNC lands below the Reserve at Kaiholena and on NPS lands at Kahuku have noted the presence of the ʻŌpeʻapeʻa, and it is presumed that the species also uses the Reserve, as they use similar forested areas at that elevation across the island.

Invertebrates

Kaʻū Forest Reserve contains 245 ac (99 ha) of designated critical habitat in two separate areas for one endangered species of Picture Wing Fly (*Drosophila heteroneura*) (U.S. Fish and Wildlife 2008) (Figure 8). Habitat for this species is in wet, montane, ʻōhia and ʻōhia/koa forest and larval stage host plants include ʻōlapa, and *Clermontia* sp. (U.S. Fish and Wildlife Service 2006b). The Hawaiian Picture-Wing Fly group consists of 106 known species, most of which are relatively large with elaborate markings on their wings. The picture-wing *Drosophila* have been referred to as the "birds of paradise" of the insect world because of their relatively large size, colorful wing patterns, elaborate courtship displays and territorial defense behaviors. Each species is found only on a single island, and the larvae of each are dependent upon only a single or a few related species of native host plants.

Kaʻū Forest Reserve also contains habitat for three endemic species of Pinao or Hawaiian Damselfly: *Megalagrion blackburni*, *Megalagrion calliphya* and *Megalagrion xanthomelas*. *Megalagrion xanthomelas* is a candidate for listing as an endangered species and is known from Hīlea gulch (Parham *et al*. 2008).

Figure 12. Ka'ū Forest Reserve Critical Habitat



2. Non-Native Wildlife

Birds

A large variety of introduced birds inhabit the Ka'ū Forest Reserve. The most common species include the Japanese White-eye (*Zosterops japonicus*), Northern Cardinal (*Cardinalis cardinalis*), and Red-billed Leiothrix (*Leiothrix lutea*). The densities of these species appear stable and relatively low in the upper elevations. Japanese White-eye was the most abundant non-native species recorded in Ka'ū and occurs in forest and open habitat. Red-billed Leiothrix were widespread throughout the Reserve and most abundant at lower elevations (Gorreson *et al*. 2007).

Other species present in Ka'ū include the Japanese Bush-Warbler (*Cettia diaphone*), Hwamei (*Garrulax canorus*), Common Myna (*Acridotheres tristis*), House Finch (*Carpodacus mexicanus*), Erckel's Francolin (*Francolinus erckelii*), Kalij Pheasant (*Lophura leucomelanos*), Spotted Dove (*Streptopelia chinensis*), and Barn Owl (*Tyto alba*). Bush-Warblers are rapidly expanding their range on Hawai'i Island and are expected to be a common species on the island in the future (Tweed *et al*. 2007). Other species present along the open, grassy patches at the edge of the Reserve and in adjacent areas (Kahuku and Kāpapala) include Yellow-fronted Canary (*Serinus mozambicus*), Saffron Finch (*Sicalis flaveola*), Japanese Quail (*Coturnix japonica*), Chukar (*Alectoris chukar*), Zebra Dove (*Geopelia striata*), Wild Turkey (*Meleagris gallopavo*), and (Eurasian) Sky Lark (*Alauda arvensis*)

Mammals

A variety of non-native mammals such as feral pigs (*Sus scrofa*), feral cattle (*Bos taurus*), mouflon sheep (*Ovis musimon*), feral sheep-mouflon hybrids (*Ovis aries-Ovis musimon*), rats (*Rattus* spp.), mice (*Mus musculus*), cats (*Felis catus*), and small Indian mongoose (*Herpestes auropunctatus*) are present in the Reserve. Other ungulates including sheep (*Ovis aries*), feral goats *(Capra hircus)* and Axis deer (*Axis axis*) are not known from the Reserve, but may be present in adjoining areas.

F. Cultural Resources

DOFAW contracted Keala Pono Archaeological Consulting to prepare a comprehensive Cultural Impact Assessment for the project. This Assessment includes information on archaeological and historic sites as well as traditional and cultural practices. The Assessment consisted of archival research as well as community consultation with knowledgeable parties recognized as having a cultural, historical, genealogical, or managerial connection to the project area in Ka'ū. Sources included historic maps and photos, accounts from early visitors, Hawaiian language newspaper articles, mele, oli, 'ōlelo no'eau, collections of mo'olelo, and archaeological reports obtained from individuals and institutions across the State of Hawai'i and ethnographic surveys consisting of oral history interviews.

1. Archaeological and Historical Sites

Archaeological and historic sites are protected by state law and will not be impacted by management actions proposed in this plan.

Most of this dense forest area has not been surveyed for sites. Trails, small forest shrines, burial caves and lava tube shelters are the types of features that may be present, as the greater area was used historically by Hawaiians for activities such as bird hunting, harvesting timber for canoe-making and gathering forest plants for medicinal uses.

Other historical sites include ranching era walls along the Reserve boundary, tunnels and infrastructure from old water systems and historic trails.

The Ainapo Trail, a historic trail nominated to the National Register of Historic places, is located in Kapāpala, adjacent to Ka'ū Forest Reserve. This trail is currently used by the public to access the eastern side of the Reserve as well as used as a route up Mauna Loa. This trail was used by ancient Hawaiians as well as foreigners (beginning from as early as 1790). An undeveloped historic trail, the Kahuku- Ainapo Trail, connects to the Ainapo trail. This historic trail is primarily above the Reserve in the Kahuku section of Hawai'i Volcanoes National Park; however portions of the trail are within the Reserve. Old maps also show a trail from Mountain House to Kahuku as well as numerous trails from the bottom of the Reserve boundary leading to tunnel systems within the Reserve.

2. Cultural Practices

The Reserve's native Hawaiian ecosystems and species are an essential part of the overall cultural-historical landscape. Today, both traditional and more contemporary cultural practices continue to be perpetuated within the Reserve. Notably, the Reserve is used for gathering plants, such as maile, māmaki, palapalai, 'a'ali'i, and'olonā. Wai is also collected from springs up mauka, which is used for ceremonial purposes. Additionally, hunters continue to use this area as a means of subsistence. The Cultural Impact Assessment discusses consulted individuals' knowledge and opinions regarding places that have special associations and resources that have ongoing cultural uses.

G. Public Access and Recreation

Public access is allowed in the Reserve for recreational and cultural uses, including hunting, hiking and gathering of plant material (with a permit).

Vehicular Access: Access to Ka'u Forest Reserve is via public roads including Lorenzo Rd, Kiolaka'a Rd, Mountain House Rd., Waterfall Rd. (known as Galimba access at Pu'u One), Honanui Rd. and Ainapo Rd. Ainapo and Honanui roads have locked gates and permission for access is through Kāpapala Ranch (call 982-8403 for combination for lock on gate between the hours of 7:30 and 8:30 p.m. Check-in is at 6:00 a.m. and check-out is at 6:00 p.m.

Trails: There are no officially designated state-managed trails in Ka'ū Forest Reserve.

Hunting: DOFAW manages public hunting on all Forest Reserve System lands, and hunting is allowed in Ka'ū Forest Reserve, which lies within Hunting Unit B. DLNR's Division of Conservation and Resource Enforcement (DOCARE) carries out enforcement of hunting regulations (Chapter 122 Rules Regulating Game Bird Hunting, and Chapter 123 Rules Regulating Game Mammal Hunting). General hunting regulations can be found in Hawai'i Revised Statutes Title 13 Chapter 121. Current information regarding hunting rules, seasons and bag limits for all game species can be obtained by contacting the DOFAW Hilo office at 19 East Kawili Ave. Hilo, Hawai'i, (808) 974-4221.

All persons are required to have a valid Hawai'i hunting license on their person to hunt or have a bagged game mammal in their possession. Hunting licenses may be purchased online from http://www.ehawaiigov.org/DLNR/hunting/, from any DOFAW office or from any registered hunting license vendor. All hunting license applicants must show proof of having successfully completed a hunter education course that is recognized by the National Hunter Education Association.

Camping: No camping is currently allowed in the Ka'ū Forest Reserve.

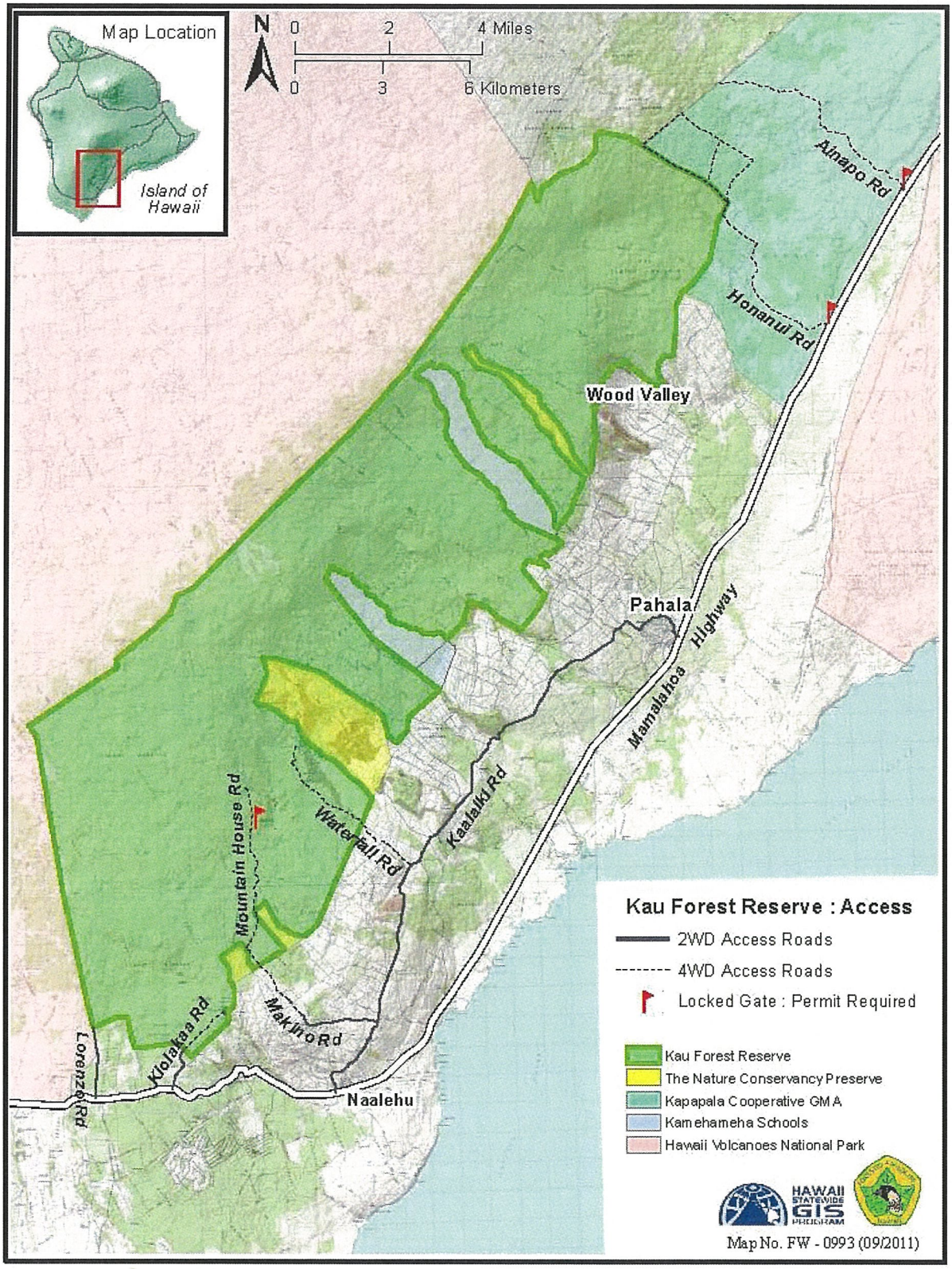
Forest Products: Small-scale non-commercial harvesting or salvage is allowed, such as materials for cultural uses. Non-timber forest products such as ferns, maile (*Alyxia oliviformis*), flowers, fruits, and lei-making materials etc for cultural or personal use may be collected from within the Reserve. Gathering of forest products is permitted and regulated by DOFAW through Forest Reserve System permit procedures. Permit applications for gathering plant material can be obtained from the DOFAW Hilo office at 19 East Kawili Ave. Hilo, Hawai'i, (808) 974-4221. These permits are available, upon approval, free of charge (for common, personal use items) or for a fee, depending on the purpose. Gathering of materials from listed species is not permitted.

H. Infrastructure

Infrastructure within the Reserve consists of unimproved trails and four wheel-drive roads. No recreational facilities (e.g. bathrooms, freshwater sources, improved campsites) exist within the Reserve.

The Reserve contains water system infrastructure including 30 water tunnels.

Figure 13. Ka'ū Forest Reserve Public Access



I. Revenue

According to HRS §183.5 (5), the department shall: Devise and carry into operation, ways and means by which forests and forest reserves can, with due regard to the main objectives of title 12, be made self-supporting on whole or in part.

There is not currently any revenue collected for DOFAW from the Ka'ū Forest Reserve.

J. Threats

The major threats to the Reserve integrity in this area include introduced plants, animals, diseases, climate change and volcanic activity (vog).

1. Ungulates

Ungulates are hoofed animals such as pigs, sheep, goats and cattle. The primary ungulates of concern in the Reserve are feral (wild) pigs, feral cattle and mouflon sheep. Feral ungulates are a threat to native ecosystems, species and watershed because they eat and trample native plants and cause increased erosion and soil runoff. Hawaiian plants evolved without such animals and have no defenses to protect themselves from browsing animals (e.g. thorns and chemicals). Feral ungulates are one source of watershed pollutants, (i.e. animal waste) and increase turbidity in streams due to soil erosion.

Feral cattle are one of the greatest threats to forests in Hawai'i. Small populations of feral cattle are currently located in the upper, northeastern portion of Ka'ū Forest Reserve. Grazing and trampling by feral cattle is extremely destructive to native forest, and removing cattle has been a management focus (through fencing and/or cattle control) since the Reserve was originally established in 1906.

Pigs were originally brought to Hawai'i with the first Polynesian settlers as a domesticated species (Tomich 1986). After the arrival of Captain Cook, the larger European wild boar was intentionally introduced and quickly became feral. Feral pigs in Hawai'i today are generally smaller in size to their mainland cousins as a result of over 200 years of interbreeding between the smaller Polynesian pig and the larger European boar (Tomich 1986).

Feral pigs are present throughout the Reserve. Pigs pose a significant threat to native biodiversity and watershed integrity of Hawaiian forests by damaging native vegetation and exposing soil to erosion (Stone 1985). In montane wet forests, there is a direct correlation between pig-induced soil disturbance and the increase of weeds (Aplet et al. 1991). In addition, feral pigs have been shown to spread root-rot fungi (Baker 1979), create muddy areas that provide mosquito breeding habitat that helps transmit avian diseases spread such as avian pox and malaria (Baker 1979, USGS 2005; USGS 2006c), eat native plants (Cooray and Mueller-Dombois 1981), and carry parasites and diseases transmittable to humans and dogs, such as leptospirosis (Warner 1959 –

1969) and tuberculosis (Giffin 1978). Decades of feral pig control in Hawai'i verify that the only successful method currently available to adequately protect an area from feral pigs is to use physical barriers such as fencing to exclude the animals (Stone 1985).

Mouflon sheep were introduced to Kahuku in 1968 and by 2008 the Kahuku population was estimated at approximately 1,500 individuals (Hess et al. 2006; Hess, personal communication). Mouflon are primarily present in the Kahuku section of Hawai'i Volcanoes National Park, Kapāpala Forest Reserve and the Kapāpala Cooperative Game Management Area, but their range has been expanding and mouflon have been documented throughout the Reserve.

Axis deer, a species introduced to Hawai'i from India, have recently been observed below the Ka'ū Forest Reserve. This species is not yet established on the island of Hawai'i and it is unknown how and when these deer were introduced to the Ka'ū area. Axis deer are established on Maui, where they cause major damage to native forest, agricultural crops and resort areas. They also pose a human health and safety concern due to vehicle collisions (Anderson 1999).

2. Invasive Non-Native Plant Species

Invasive non-native plants, or weeds, constitute a severe threat to the native ecosystems in the Reserve. Certain weeds are a problem because they can establish and survive in undisturbed native forest, disperse long distances via wind or birds, affect large portions of land, displace native vegetation, grow and reproduce rapidly, convert a diverse native forest plants to a monoculture of alien species, and encourage fire by increasing fuels. Invasive weeds can displace distinctive native flora, resulting in a loss of species diversity and eventually in changes to ecosystem function such as nutrient cycling. Many invasive weeds completely replace native vegetation resulting in total loss of native habitats thereby negatively affecting native birds and invertebrates (Cuddihy and Stone 1990; Vitousek 1992). In addition, forests that have been severely invaded by weeds such as strawberry guava show increased evaporation of water to the atmosphere, which reduces water available for human use (Giambelluca, unpublished research).

Invasive weeds with great potential for spreading and causing habitat modification are identified in this plan as high priority for control. Weed species were prioritized based on observed invasiveness and other criteria including growth form, dispersal mechanisms, ability to displace native vegetation and ability to alter ecosystem cycles (water, nutrients and succession) (Table 8).

Only a small portion of the Reserve has had systematic surveys for weeds. In general, the upper elevations and interior portions do not appear to be heavily infested with weeds. However, there are some localized areas, particularly in the lower elevations, that are heavily infested with high priority weeds and these are spreading into the interior portions of the forest.

Currently known locations for priority weeds include glory bush at Mountain House Road, strawberry guava on the southwest end of the Reserve, isolated patches of cat's claw and palm grass at Mauna Kea Springs Pipeline Road, cane tibouchina at Waterfall Road, and kahili ginger along the lower forest edge. The lower elevation forest edge, which is adjacent to lands originally cleared for sugarcane plantations and now are mainly used for pasture and cattle grazing, contains abundant priority weeds, particularly strawberry guava. Night-blooming jasmine is present along the forest edge on the east side of Pu'u Enuhe, and dominates the understory of the eastern portion of the forest, northeast of Wood Valley, and it is spreading. DOFAW staff have collected incidental location points of night-blooming jasmine at the far eastern extent of this population. *Bocconia* has been spreading into the Reserve from eucalyptus plantations in the Wood Valley area.

Table 8. High priority invasive weeds present in Ka'ū Forest Reserve

Species	Common Name
Bocconia frutescens	bocconia, plume poppy
Caesalpinia decapetala	cat's claw
Cestrum nocturnum	night blooming jasmine
Clidemia hirta	clidemia, Koster's curse
Hedychium garderianum	kahili ginger
Morella faya	faya
Psidium cattleianum	strawberry guava, waiawi
Rubus ellipticus	yellow Himalayan raspberry
Setaria palmifolia	palm grass
Sphaeropteris cooperi	Australian tree fern
Tibouchina herbacea	cane tibouchina
Tibouchina urvilleana	glory bush

3. Introduced Species - Other Animals

A variety of non-native mammalian predators are serious pests to the biodiversity found in Ka'ū Forest Reserve. Mongoose, feral cats, dogs, rats, and mice prey upon native species and have a severe impact on native birds in the Reserve. In addition, small mammals serve as vectors of diseases and can affect the water quality and cause human and wildlife diseases. Leptospirosis and Cryptosporidiosis are potentially fatal illnesses caused by water-borne microorganisms spread by pigs, dogs, mongooses and rats.

Feral cats kill forest birds as well as native sea birds and other species that nest on the ground or in burrows (USGS 2006a). Cats are the host of a potentially fatal disease called toxoplasmosis. In Hawai'i, toxoplasmosis has killed native Hawaiian birds such as the 'Alalā, the endangered Nēnē and even seabirds such as the Red-Footed Booby (*Sula sula*). Because the organism that causes toxoplasmosis (*Toxoplasma gondii*) can complete an important part of its life cycle in seawater, this disease also poses a threat to marine mammals such as the endangered Hawaiian monk seal (*Monachus*

schauinslandi) and spinner dolphin (*Stenella longirostris*). In addition to threatening wildlife, toxoplasmosis poses a significant health risk to pregnant women (USGS 2006a).

Rats prey on native bird eggs, nestlings, native land snails and also eat the fruits and/or strip the bark of native plants. Similarly, mice consume the seeds of native plants; seed predation can be a major factor contributing to species decline.

The Reserve has been invaded by non-native forest birds; however their impacts on native species have not been determined. Non-native birds may compete with native forest birds for food and other resources and act as vectors for avian diseases. Non-native birds may also contribute to the spread of weeds by eating the fruits of weedy species and spreading seeds.

Non-native invertebrates are present, but largely undocumented, and can consume native plants, interfere with plant reproduction, predate or act as parasites on native species, transmit disease, affect food availability for native birds, and disrupt ecosystem processes. The invasion of the yellowjacket wasp (*Vespula pennsylvanica*), voracious predators of numerous species of native invertebrates, is of concern. Other non-native parasitoids adversely impact native moth species, and ants are a significant mortality factor for native invertebrates. Slugs (*Milax gagates*, *Limax maximus*, *Veronicella* spp.) consume fruit from native plants and prey on seedlings and mature plants. The two-spotted leafhopper (*Sophonia rufofascia*) is a major concern for the *uluhe* fern, which is particularly sensitive to leafhopper feeding. Mosquitoes (*Aedes albopictus* and *Culex quinquefasciatus*) transmit deadly diseases to native birds and humans.

Both Jackson's chameleon (*Chamelaeleo jacksonii*) and Coqui frog (*Eleutherodactylus coqui*) have growing populations on the island, and these species can consume native invertebrates, such as insects, spiders, and small snails.

4. Wildfire

Fire poses a threat to the Reserve, particularly during times of drought and in areas adjacent to human activity. Hawaii's flora evolved with infrequent, naturally-occurring fire, so most native species are not fire-adapted and are unable to recover quickly after wildfires. Wildfires leave the landscape bare and vulnerable to erosion and non-native weed invasions. Continued feral ungulate damage to native ecosystems can convert native forest to non-native grasses and shrubs, which provide more fuel for fires. Weeds, particularly grasses, are often more fire-adapted than native species and will quickly exploit suitable habitat after a fire. The principal human-caused ignition threats are from catalytic converters and other hot surfaces of vehicles or heavy equipment and illegal campfires. The principal natural ignition sources are lightning and lava flows.

5. Disease

Introduced diseases and pathogens threaten native animals and plants. Given the lack of biosecurity in Hawai'i, the introduction of new diseases and pathogens is highly likely. Avian pox and avian malaria are mosquito-transmitted diseases that currently kill or weaken many native Hawaiian birds and are thought to be responsible for the extinction of numerous forest bird species. In the extreme isolation of the Hawaiian Islands, birds evolved in the absence of these diseases and lost their natural immunity. Avian pox is caused by a virus (*Avipoxvirus*) and avian malaria by a single-celled parasite (*Plasmodium relictum*). For many native forest bird species, infection with these diseases is almost always fatal (USGS 2005; USGS 2006c).

Introduced plant diseases such as 'ōhi'a rust (*Puccinia psidii*) and koa wilt (caused by the fungus *Fusarium sp.*) have the potential to impact the major components of the forest throughout the Reserve. 'Ōhi'a rust affects 'ōhi'a as well as other plants in the same family (Myrtaceae) (HEAR 2010). In severe infections, growing tips wither and die back. Koa wilt is a serious, often fatal disease of the native tree, koa. Trees affected with the disease rapidly lose their canopies and may die within a few months (UH-CTAR 2010).

6. Climate Change, Volcanic Activity and Hurricanes

Climate change may affect the Reserve by altering rainfall patterns and amounts. Changing climate may affect the abundance and seasonality of precipitation, thereby altering forest composition, growth and structure. Rare ecosystems and species may be negatively affected by relatively rapid changes in precipitation, temperature, and humidity that result from a rapid and drastic change in regional or local climate patterns (e.g. prolonged drought, higher temperatures). Detrimental invasive species may change their distribution and abundance due to changes in the climate (e.g. mosquitoes may be more frequently found at higher elevations due to warming temperatures).

Volcanic activity has the potential to impact the Reserve. Mauna Loa flows reached the top portions of Ka'ū Forest Reserve in 1950. The Ka'ū Forest Reserve is located within Volcanic Hazard Zones 3 and 6 for Mauna Loa (USGS). During the past 750 years, lava flows have covered about 15 to 20 percent of Zone 3 on Mauna Loa. The portion of the Reserve above Nā'alehu is classified as Zone 6 because it is currently protected from lava flows by the local topography. Kīlauea Volcano is also currently active. Volcanic gases or vog from nearby vents can cause high concentrations of gases that affect native plants, animals and people.

Although natural disturbances such as hurricanes and lava flows are regular occurrences in Hawai'i, native species and ecosystems may not be able to recover from these disturbances as readily due to small populations and/or invasion of non-native weed species.

7. Illegal Human Activity

Illegal human activity occurs on a small scale, primarily in the form of illegal camping, off-road all-terrain vehicle use, dumping, unpermitted harvesting (maile, hāpu'u, and other native trees and plants), marijuana cultivation, and vandalizing signs and fences. These activities destroy infrastructure and native species. Some illegal activities create openings in the forest that can be invaded by weeds.

III. KA'Ū FOREST RESERVE MANAGEMENT

A. Summary of Existing Management and Research Activities

1. Watershed Values and Native Ecosystems

DOFAW has been conducting feral cattle control to protect the watershed and native ecosystems in the Reserve. Hundreds of feral cattle have been removed since the 1980's, particularly from the northern and central portions of the Reserve. Currently, there are low numbers of feral cattle in the Reserve, and DOFAW staff are continuing to remove the remaining cattle. Adjoining ranchers have primary responsibility for maintaining and constructing fences to prevent additional cattle from entering the Reserve.

2. Threatened and Endangered Species Management

Seven forest bird surveys were conducted between 1976 and 2008 by DOFAW and other cooperating agencies and organizations. These surveys, generally conducted every five years, provide information on bird populations in the Reserve. The Hawai'i Forest Bird Interagency Database Project analyzes the monitoring data every five years and produces reports on forest bird densities and population trends. A summary of survey results is available at: http://pubs.usgs.gov/of/2007/1076/of2007-1076.pdf (Gorreson *et al.* 2007).

In 1995, DOFAW contracted TNC to inventory plant and animal species and prepare a report on the biological resources on the Waihaka portion of Ka'ū Forest Reserve, an area that had been proposed as a potential Natural Area Reserve (TNC 1995). This area was found to have important biological resources, including rare species of plants and birds.

Two sites in Ka'ū Forest Reserve (southwest and central) were included in a rapid assessment of vegetation at six potential 'Alalā release sites on the island of Hawai'i to rank sites for suitability as reintroduction sites for this species (Jacobi and Price 2007). Out of the six sites examined, the two Ka'ū study sites ranked first and second overall.

Several small fenced areas have been constructed for protection and/or outplanting of rare plant species.

3. Invasive Species Control and Resource Protection

DOFAW and Big Island Invasive Species Committee (BIISC) staff have controlled populations of priority weeds in Ka'ū Forest Reserve including cats claw, bocconia, palm grass, ginger, strawberry guava and night blooming jasmine.

Limited portions of the Reserve have been surveyed for weeds. Surveys have been conducted along the lower boundary and on Hawai'i forest bird survey transects. BIISC also surveyed portions of the Reserve for bocconia.

In 2010, TNC contracted with Resource Mapping Hawai'i to collect high resolution aerial imagery with a fixed wing aircraft in TNC's Ka'ū Preserve and also along the lower edge of the Ka'ū Forest Reserve, where the forest meets the pasture. These aerial images will help identify patches of priority weeds in the forest so they can be controlled. TNC and Resource Mapping Hawai'i have been analyzing, compiling and checking the accuracy of the imagery data which will allow resource managers to view the imagery and obtain information about priority weed locations. Three weed species are a focus of these efforts: strawberry guava, kahili ginger, and night blooming jasmine.

4. Public Activity

DOFAW staff maintain roads used for public access to the Ka'ū Forest Reserve.

B. Management Goals and Objectives

Forest Reserves are multi-use areas that encompass and incorporate a variety of public uses and benefits, from fresh water supply to recreation. Each Forest Reserve within the system has differing goals depending on the nature of the resources found within it. DOFAW manages the Forest Reserves individually for their unique resources as well as provides an overall management philosophy for the entire Forest Reserve System, in keeping with the rules it must abide by. Broad management action categories within the Forest Reserve System include:

- Watershed Values (aquifer recharge and erosion control)
- Native Ecosystems (landscape level protection)
- Invasive Species Control (incipient and established plants and animals)
- Threatened and Endangered (T&E) Species Management (Federally listed, State listed, and rare plants and animals)
- Public Activity (non-income generating uses, such as recreation, cultural activities, personal gathering, educational or research activities, and events, among others)
- Resource Protection (fire, insects, and disease)
- Game Animal Management (areas managed to enhance public access for hunting game birds and mammals)
- Commercial Activity (income generating activities such as timber, tours, etc.)

From within these broad management action categories, specific management goals for Ka'ū Forest Reserve were determined from the unique resources and management needs for the area, mandates that regulate DOFAW activities, including Draft Management Guidelines (Appendix C), past planning efforts and Administrative Rules, as well as input from DOFAW Staff. Goals for Ka'ū Forest Reserve include the following, in priority order.

1. Watershed Values: Protecting and managing the forested watersheds for production of fresh water supply for public uses now and into the future
2. Native Ecosystems: Maintaining native ecosystems and rare and endangered species
3. Public Activity: Providing public access, recreational and hunting opportunities

C. Proposed Management

Management objectives and proposed actions for each of the broad management action categories are discussed below. Proposed actions have been prioritized based on the three specific management goals for Ka'ū Forest Reserve. The highest priority actions proposed have multiple benefits and accomplish numerous management objectives.

1. Watershed Values and Native Ecosystems

Management Objective: Protect and manage forested watersheds to produce fresh water for public use, reduce land-based pollutants (e.g. soil erosion, animal waste), improve coastal water quality and maintain native ecosystems.

Actions:

1. Prevent damage to watershed and native ecosystems by removing all feral cattle from within the Reserve and controlling livestock trespass through maintenance of existing boundary fencing.
2. Protect watershed and native ecosystems from feral ungulate damage by construction of approximately 12,000 ac (4,856 ha) of new fenced management units in the upper elevation central portions of the Reserve.
3. Remove feral ungulates from within fenced management units using a variety of approved methods including special public hunts, trapping, and staff control.
4. Inspect, maintain and replace fences.
5. Monitor fenced management units for ungulate presence following complete removal and control ingress ungulates, if necessary.
6. Protect and maintain biological diversity of the Reserve's ecosystems.
7. Monitor watershed function.
8. Participate in collaborative initiatives such as the Three Mountain Alliance Watershed Partnerships with other public and private forest landowners.
9. Protect important forested lands through addition to the Forest Reserve System.

It is important to protect the Reserve's native ecosystems because this forested watershed impacts the quantity and quality of water in the wells and tunnels used for the District's domestic and agricultural water supply. While many people are familiar with the water cycle and how rainfall ends up in groundwater that is used by humans, fewer people are aware of the forest's role in producing and filtering our drinking and fresh water. Forests are critical for accumulating fresh water. Fog condensing on trees is an important source of moisture and can increase measurable precipitation by 20% (Juvik and Perreira 1973; Juvik and Nullet 1995). Forests collect and filter water into the ground water and streams. A healthy native forest without soil disturbance limits aquatic pollutants (e.g. siltation, suspended solids, turbidity, nutrients, organic enrichment, toxins and pathogens) due to erosion and runoff. Forests may also reduce the impacts of flooding and erosion by slowing down water as it flows down the mountain.

Feral cattle have long been a threat to the watersheds of Ka'ū Forest Reserve, and continued work is needed to remove feral cattle from the Reserve and prevent the ingress of additional cattle from adjacent lands. Adjacent ranchers are responsible for maintaining boundary fences. DOFAW staff are planning on continuing their efforts to remove all feral cattle from the Reserve, through staff hunting and other approved animal removal methods. Additional boundary fencing may be required to prevent the ingress of cattle into Ka'ū Forest Reserve.

To protect the water resources of the Reserve and limit damage to native Hawaiian ecosystems, a combination of fencing and feral ungulate removal from fenced units is needed. Without fencing, ungulate control is not effective, due to reproduction of existing populations and continued ingress from adjacent areas. The construction of fenced management units is proposed for approximately 12,000 ac (4,856 ha) in the upper elevation (4,000 - 5,000 ft (1,219 - 1,524 m)) central portions of the Reserve.

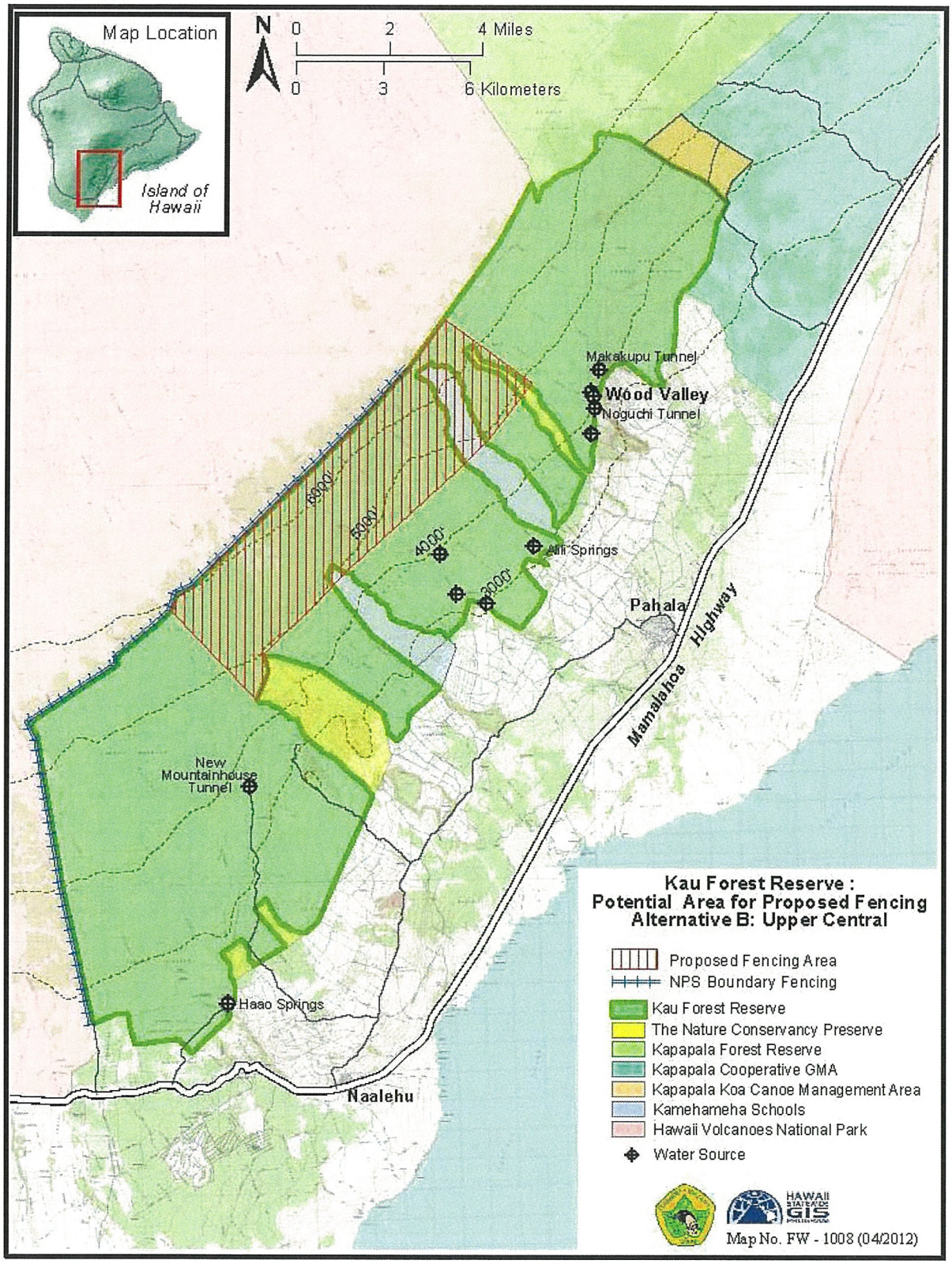
Fencing will be constructed in the upper central portion of the Reserve, shown in Figure 14. We have prioritized this area because the proposed fencing and feral ungulate removal would protect a large portion of the Ka'ū Forest Reserve landscape, including important watershed and existing native species habitat, particularly habitat for the three endangered forest bird species. This area is also a priority for restoration for release of the 'Alalā. Monitoring data from forest bird transects shows this area is the portion of the Reserve that has the most feral ungulate damage. Although there is currently an intact canopy of tall native trees, in many areas much of the ground and understory layers of ferns, small plants and young tree seedlings have been damaged by feral ungulates, leaving the ground bare and exposed. Without management, the native forest will continue to decline because young trees will not be able to grow and become established to replace the older canopy trees as they die. Fencing and feral ungulate removal will benefit native ecosystems by limiting the browsing and trampling of native plants. Other benefits include reduction of soil erosion/exposed soil and subsequent invasion of non-native plants.

We are still determining the location, size design and number of the fenced units that would be constructed within the fenced area. The area would be subdivided into separate fenced subunits of 2,000 - 4,000 ac (809 - 1,619 ha) in size that would be fenced over time, as funding becomes available. The final configuration and number of fenced unit(s) will consider factors such as water resources, quality of native ecosystems and habitat for native species, level of damage from ungulates, public use of area, cooperation with adjacent landowners, terrain, logistics, accessibility, and feasibility for effective feral ungulate removal. Field surveys will be conducted to identify locations for the planned fence alignments, and final fence alignments will be sited to avoid any impacts to botanical, faunal, and archaeological resources. Fences are not meant to restrict public access into management units, and walkovers and gates will be installed in order for people to access fenced areas. Fencing costs are estimated at approximately $150,000 per mile (labor, materials and helicopter), and will be completed based upon the availability of funding for labor and materials. DOFAW staff and/or contractors will need to implement construction of fenced units in phases.

As fence construction is completed, DOFAW staff will use various approved methods to remove ungulates from within the fenced units (State of Hawai'i 2007). Public hunting will be encouraged during the first phase of ungulate removal where safe, feasible and effective, but additional control methods including drives, trapping, staff control with dogs, and snaring, may be needed to remove all the ungulates.

Regular fence inspection and maintenance will be needed once fence construction is complete. Fences will also need to be replaced as they deteriorate and costs for fence replacement will need to be taken into account in future management plans.

Figure 14. Ka‘ū Forest Reserve Fencing (Central Portion of the Reserve)



2. Invasive Species Control

Management Objective: Protect intact native forest by removing high priority non-native, invasive weeds and other invasive species.

Actions:

1. Monitor and map the distribution of high priority weeds and develop a control strategy.
2. Identify highest priority areas for intensive weed control.
3. Control weeds along invasion corridors (e.g., roads, trails, fences) and within fenced management units using approved methods.
4. Maintain procedures to prevent introduction of new weeds.
5. Monitor weeds to determine whether weed control measures are effective and to detect changes in long term distribution and abundance.
6. Monitor and map the distribution of other invasive species and develop a control strategy, as needed.

Weed mapping is essential to developing a comprehensive control strategy. Distribution mapping includes compiling transect monitoring data, incidental observations and reconnaissance surveys to map the distribution and abundance of weeds. Results from surveys will then be used to better delineate the weed populations core extent and outlying individuals, and permit the development of an effective control strategy. DOFAW staff will monitor weed control areas to evaluate the effectiveness of control efforts. Ka'ū Forest Reserve is also targeted for additional weed mapping using new mapping technologies (high resolution aerial imagery). Analysis of the aerial imagery will assist DOFAW staff in locating priority weeds for control purposes.

Weed control priorities include suppression and containment of priority weeds (night blooming jasmine, kahili ginger, bocconia, clidemia, and strawberry guava) along the lower Reserve boundaries to prevent and reduce the spread of these weeds into more intact native forest areas in the higher elevations. Regular surveys along the lower boundary and along forest bird survey transects should be continued to detect new incipient weeds and increased spread of priority weeds into the upper Reserve. DOFAW will develop cooperative weed control projects with adjacent private landowners and lessees to benefit ranching, forestry and agriculture as well as suppress priority weeds in critical native forest buffer areas.

Other weed control priorities include the following: reducing the spread of bocconia from Wood Valley into the Reserve; develop a containment strategy for night-blooming jasmine (e.g. keep Waihaka gulch population farthest to the east from spreading further east); eliminate kahili ginger from Mauna Kea Springs Hunter Trail vicinity west of Waihaka gulch: and control glory bush on Mountain House Road.

Priority areas for weed management will also include fenced, ungulate-free management units. Removal of ungulates from fenced units is a critical first step in weed control because it allows for the recovery of native vegetation by minimizing

ground disturbance and reducing the spread of weeds by ungulates. Certain incipient weeds (high priority weeds that are just beginning to invade the area) may be targeted in unfenced areas to prevent their establishment and spread.

Weed control goals include early detection and preventing the establishment of incipient, habitat modifying weeds that are not currently present (e.g. miconia) or are still localized. For priority weeds already present, the goal is to eliminate all known occurrences within targeted control areas and/or to contain the spread of priority species. Due to limited resources for monitoring and control throughout these dense rainforest areas, DOFAW staff will focus control efforts in disturbed areas such as roads, trails, and fence lines as these often serve as corridors for weed establishment and spread. Prevention is a critical component of the weed management program, and it is important to avoid and/or reduce the inadvertent introduction and spread of weeds by people working in and visiting the area. DOFAW staff and volunteers will follow protocols for cleaning of boots, equipment and vehicles.

A combination of control techniques including staff control using manual, mechanical and approved herbicides will be used to remove weeds. The technique used is based on the characteristics of the target species, the sensitivity of the area in which the species is found, and the effectiveness of the control technique. Due to widespread and heavy infestations of certain weeds and limited resources, DOFAW will use approved biocontrol agents within the Reserve, when available, and if shown to be effective.

3. Threatened and Endangered Species Management

Management Objective: Protect occurrences of threatened and endangered species and restore populations of these species in appropriate habitat to assist with the overall recovery of these species.

Actions:

1. Fencing and feral ungulate removal (discussed above in section on Watershed Values - actions #1 - 4).
2. Weed management and preventing the introduction of new habitat-modifying species are discussed above (Invasive Species Control - actions #1-5).

General actions to protect watershed values and native ecosystems discussed above (e.g. fencing, ungulate removal and weed control etc) are critical to the long-term health and recovery of native ecosystems which provides habitat for threatened and endangered plants and animals. These management actions are the most critical actions needed to protect existing native habitat, biological diversity and rare species. These actions, as well as other actions specific to individual species, are recommended in U.S. Fish and Wildlife Service Recovery Plans (Appendix C). The areas proposed for fencing and ungulate removal are a high priority because they contain existing populations of forest birds as well as rare and endangered plant species.

In some instances, the implementation of actions described above is not enough to recover certain threatened and endangered plants and animals. These species may have wild populations that are so low that the species cannot survive and recover without additional management. These species may require additional management actions to maintain the persistence of wild populations or re-establish new populations. Additional specific actions for forest birds, ʻAlala and rare plants are discussed below.

a) Forest Birds

Actions:

1. Predator control
2. Continue long-term forest bird monitoring program in cooperation with the Hawaiʻi Forest Bird Interagency Database Project to assess changes in the population and distribution.

The native birds of Kaʻū will benefit from previously discussed management actions in all alternative areas proposed including fencing and ungulate removal and invasive species control. Although there is still a forest canopy in the areas proposed for fencing, removal of feral ungulates will allow native understory plants and trees to regenerate, providing additional areas for birds to forage for fruit and nectar resources as well as ensuring the long-term presence of the forest into the future. Further, removing pigs would reduce the number of mosquito breeding sites, which would reduce the transmission of avian diseases, and reduce the spread of non-native plants. The former is critically important as climate change increases the area over which mosquitoes and the avian malaria parasite will be able to survive reduces the overall area of disease free forest available for native forest bird habitat.

Native forest birds will benefit from management actions directed at ʻAlalā described below, such as predator control of non-native mammals. Non-native mammals eat native birds and eggs as well as seeds/fruit and arthropods that are critical foods to sustain native birds. Thus any reduction in their numbers would likely benefit native birds. Small mammalian predator removal is extremely difficult and costly to implement on a large-scale using currently existing methods. DOFAW staff may implement predator removal in certain high priority areas (e.g. upper elevation, fenced management units, ʻAlala release sites, bird nesting sites) using existing, approved methods (trapping and application of rodenticides using bait stations). New methods for widespread control of these species across large conservation areas are currently being developed and may be implemented if they are approved and offer a cost-effective way to remove predators.

b) ʻAlalā Restoration

The restoration of ʻAlalā to the wild will require significant management actions, including the construction of holding aviaries, and a constant human presence at

release sites. The following management actions are recommended by the Revised Recovery Plan for the ʻAlalā (2009):

Actions:

1) Fencing and ungulate control - a minimum area of approximately 2,500 ac (1,012 ha) is required for initial releases.
2) Remove predators from the release area (all feral cats and 80% of other non-native predators (mongoose, rats).
3) Restore native food plants through planting, as needed
4) Construct release cages
5) Determine ʻIo density and the relationship between ʻIo density and the availability of rodents and game birds, and vegetation density.

Fencing a management unit of 2,500 ac (1,012 ha) is the minimum area needed for initial releases to start the restoration of a small wild population of ʻAlalā. ʻAlalā may use both unfenced and fenced areas in the Kaʻū Forest Reserve as well as adjoining lands. The size area needed to sustain a large wild population of ʻAlala is not known at this time. In previous releases of ʻAlalā in Kona, the released birds used an area of about 10,000 ac (4,047 ha), but there were, at the most, 12 birds in the field at any one time, and none had set up breeding territories.

Holding or release aviaries will be erected at release sites. These will most likely be placed on scaffolding to minimize predator access. DOFAW will attempt to place aviaries in natural openings in the forest; however, some clearing of native vegetation may be necessary. Given the need to have staff on site at all times, the construction of a remote cabin or weatherport will be needed. The release and monitoring team will need to maintain a constant presence at the release site for an undetermined length of time to care for, feed, monitor, and track released birds. It is difficult to estimate the length of time that the release and monitoring team will have to remain on site. Much will depend on the availability and use of wild foods by the ʻAlalā, their dependence on supplementary food, their health, and how they adjust to their new environment.

Other management actions involved with ʻAlalā release will require additional staff. The predator control team will track the abundance of predators and trap and bait as needed. The ungulate and vegetation team will track the abundance of ungulates, remove ungulates from fenced areas, monitor Io abundance, restore food plants, monitor vegetation recovery, track and control invasive species and check and repair fence. The latter two teams do not need to maintain a constant presence at the site.

c) Rare Plants

Actions:

1. Survey, map and monitor existing populations and individual rare plants and collect propagation material.
2. Propagate and re-introduce certain species of rare and endangered plants in appropriate protected habitat through outplanting, in coordination with other agencies and organizations working on rare plant recovery.

3. Monitor growth and survival of reintroduced plants.
4. Protect rare plants in areas outside fenced management units through the construction of small fenced exclosures
5. Conduct other management, as required (control of damaging weeds, insects, slugs, plant disease and/or mammalian predators).

Over the past decade, numerous species of rare plants have been propagated and reintroduced into fenced, ungulate-free areas to contribute to their overall recovery in the wild. Species listed in Table 5 will be the focus for the DOFAW rare plant program in Ka'ū Forest Reserve. The goal of rare plant management is to remove threats to these species and ensure their long-term survival in secure and self-sustaining wild populations.

DOFAW staff will work cooperatively with other organizations and agencies on rare plant recovery including the Hawai'i State Plant Extinction Prevention Program (PEPP) and the Volcano Rare Plant Facility (VRPF) of the University of Hawai'i. Management actions specific to rare plant recovery includes rare plant surveys to locate wild individuals, collection of propagation and genetic storage materials, propagation, and reintroduction through outplanting. PEPP is focused on preventing the extinction of taxa with fewer than 50 individuals in the wild. The VRPF and/or other state permitted facilities will propagate all rare plants used in the DOFAW program.

DOFAW staff will follow rare plant collection and reintroduction guidelines recommended by the Hawai'i Rare Plant Restoration Group (interagency group of rare plant experts) http://www.hear.org/hrprg/. DOFAW staff will tag and map the locations of all outplanted plants and monitor their survival and growth. They will do additional management of wild and/or reintroduced populations if needed (e.g. small fences around wild plants that are not within fenced management units, control of damaging weeds, insects, slugs, plant disease and/or mammalian predators).

d) Rare Invertebrates

Specific management actions to protect invertebrates are not proposed at this time. Little is known about native invertebrates in Ka'ū Forest Reserve so additional surveys are needed to inventory species and identify important habitat for rare species. Previously discussed management actions to benefit watershed and native ecosystems and other rare species will also benefit rare native invertebrates, as native invertebrates are generally dependent on native plants for food and as host plants.

4. Public Activity

Management Objective: Provide for continued public use of Ka'ū Forest Reserve including hunting, recreational opportunities, cultural uses, personal gathering, educational programs and activities.

Actions:

1) Maintain existing public access roads.

2) Develop new access routes to increase access, particularly across private and state-leased lands below the Reserve.
3) Continue to facilitate public hunting in the Reserve.
4) Develop trails and recreational amenities (e.g. picnic and/or camping areas).
5) Hire outreach staff and work with partners to provide community outreach and education (e.g. volunteer service trips, student internships, school programs etc) to build public understanding and support for Ka'ū Forest Reserve's unique native resources.
6) Develop more effective and user-friendly methods to issue DOFAW permits for gathering and other activities.
7) Hire additional staff to implement proposed actions, establish a regular DOFAW presence in the area and continue consultation with the community.

Public activity and recreational uses of the Reserve are a high priority as long as these activities are compatible with the protection of watershed and natural resources. DOFAW Draft Management Guidelines (Appendix C) classify the Reserve as "light use" for recreation. Recreational uses will be limited to certain areas to minimize impacts on natural resources and trails would be the main recreational feature for this type of classification. DOFAW management of recreational uses of the Reserve will emphasize low-impact activities and minimal improvements that are consistent with the remote, wilderness nature of the Reserve.

The transition of lands from sugar production to numerous private landowners and state-leases has reduced public access to the Reserve. DOFAW needs to ensure continued public access for recreational uses, hunting, and traditional and cultural practices as private lands adjacent to the Reserve get sold and developed. Additional forest access routes to Ka'ū Forest Reserve are currently being assessed by DOFAW, and community input will be sought on priority access routes. DOFAW will implement increased public access to the Reserve through various methods including developing easements, land acquisition or public access agreements with adjacent landowners.

There are not currently any designated trails or camping areas within the Reserve; however, these types of recreational amenities may be appropriate for certain areas within the Reserve. DOFAW will seek community input and recommendations on the potential development of and locations for additional recreational amenities for Ka'ū Forest Reserve such as picnic and camping areas, trail development and public cabins/shelters.

DOFAW management will seek to ensure the long-term availability and sustainability of native plant resources for traditional resource gatherers in Ka'ū Forest Reserve. The current extent of use of the Reserve for traditional and cultural gathering is not currently known. DOFAW will explore more effective and user-friendly ways to issue permits to the public for gathering including potentially establishing a satellite office with a more regular staff presence in Ka'ū and/or implementing a on-line computerized permitting system. The sustainability of these resources will be enhanced by protection of native

forest ecosystems through fencing, feral ungulate control and weed control as well as a greater staff presence in the region.

NPS is currently developing a general management plan for the Kahuku section of Hawai'i Volcanoes National Park. This plan may increase access to and recreational uses of Ka'ū Forest Reserve as this section of the park surrounds Ka'ū on two sides. DOFAW will work cooperatively with NPS on the development of additional trails and access routes through the park. Trails through the Reserve could potentially connect to other trails in the park, including historic trails such as the Kahuku - Ainapo trail across the top of Ka'ū Forest Reserve as part of a larger trail system. For example, historic maps depict a trail from Mountain House through the Reserve to Kahuku (connecting with the Kahuku-Ainapo trail), which may be a good trail to reestablish for public use.

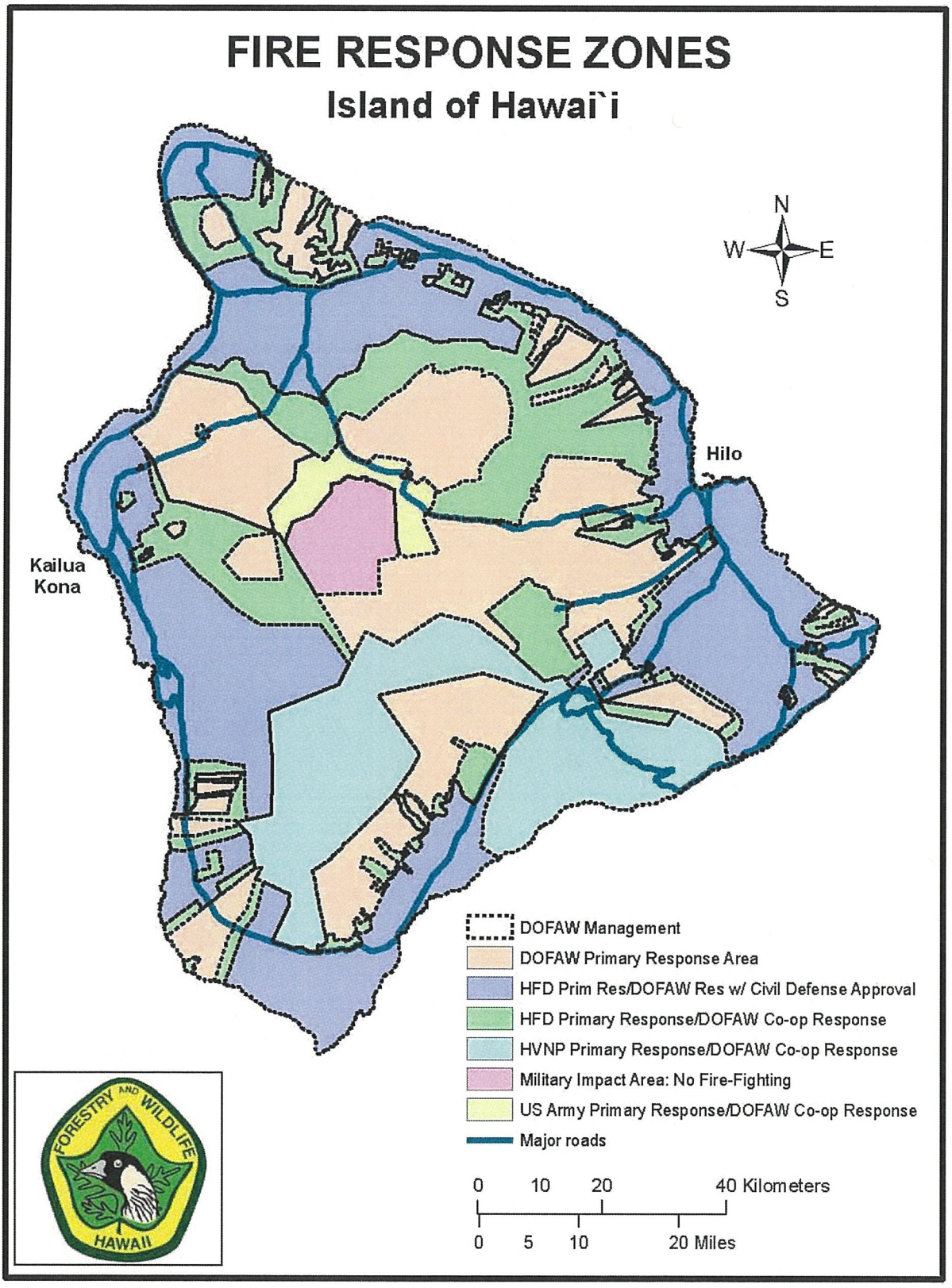
5. Resource Protection

Management Objective: Reduce the threats of fire, insects, and disease to the Ka'ū Forest Reserve.

1. Install a remote automatic weather station to monitor fire weather in the Reserve and/or adjacent areas (specific location to be determined).
2. Respond to fires, as needed.
3. Monitor forest for insects and disease.

Management actions to protect watershed values and native ecosystems will maintain the overall health of the forest, which will make the forest more resistant to threats from fire, insects and disease. DOFAW is the primary responder to fires within the Ka'ū Forest Reserve (Figure17). DOFAW is responsible for fire protection within DOFAW lands and is also required to cooperate with Hawai'i County Fire Department and fire control agencies of the Federal Government in developing plans, programs and mutual aid agreements for assistance for prevention on other lands.

Figure 15. Fire Response Zones, Island of Hawai'i



6. Game Animal Management

Management Objective: Continue to provide public hunting opportunities in Ka'ū Forest Reserve.

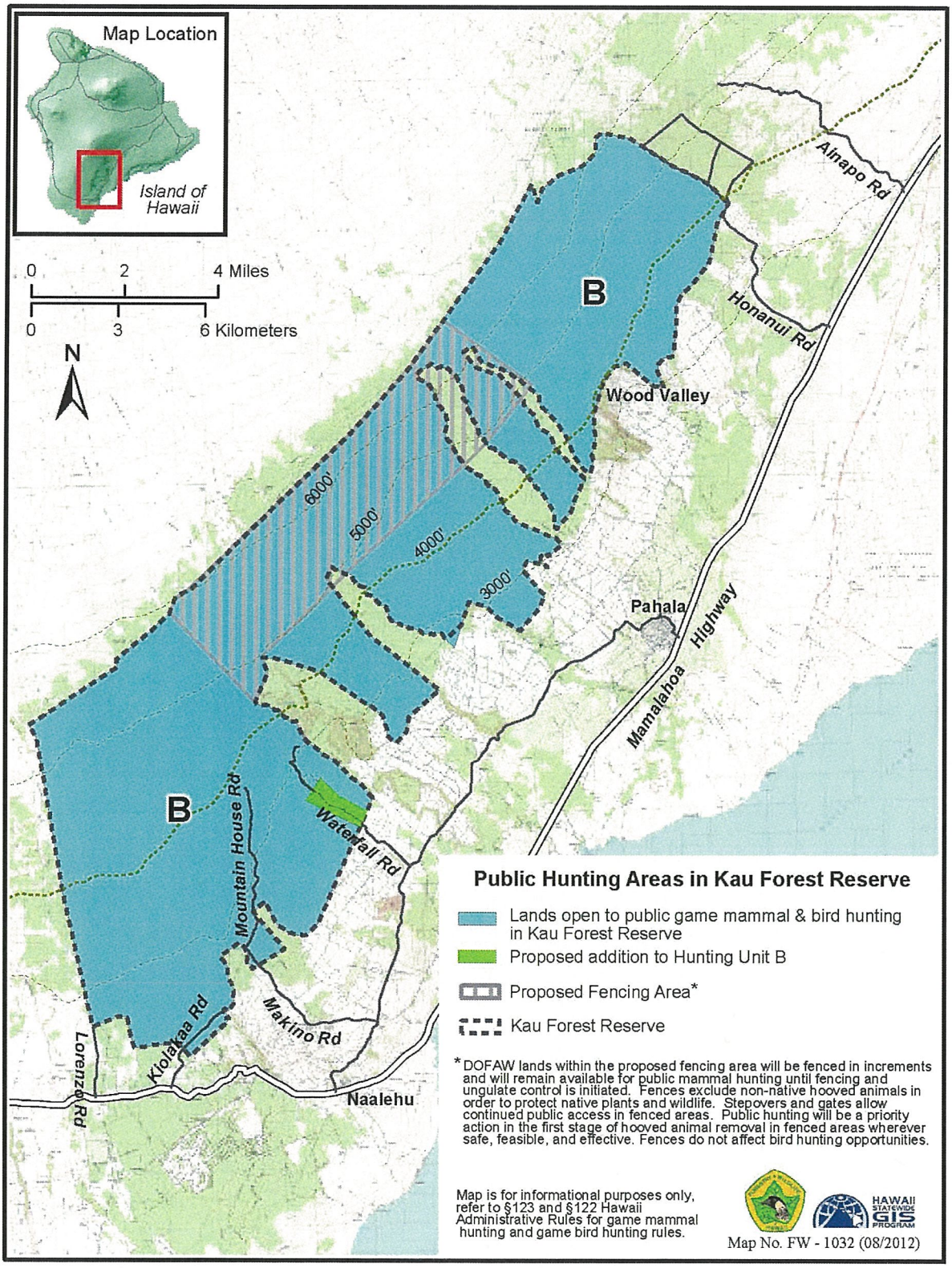
Actions:

1) Continue to provide public hunting in the Reserve as part of Hunting Unit B.
2) Maintain existing public access roads for use by the public.
3) Develop new access routes to increase public access, particularly across private and state-leased lands below the Reserve.
4) Use public hunters to assist with the removal of feral pig and sheep removal in fenced, management units prior to staff control whenever safe, feasible and effective.
5) Investigate opportunities to increase hunting in other less environmentally sensitive lands outside of the Reserve.

Ka'ū Forest Reserve is currently part of Hunting Unit B, and the Reserve is used by local residents for hunting, particularly for feral pigs. Game mammal management for the Reserve includes continuing to provide public hunting in the Reserve and enhancing public hunting opportunities whenever safe, feasible, and effective. This is accomplished through the establishment of liberal hunting conditions and measures designed to increase access to the hunting areas, particularly across lands below the Reserve. Figure 18 depicts areas that will be available for public hunting (approximately 49,000 ac or 80% of the Reserve) following establishment of the planned, fenced management units. DOFAW lands within the proposed fencing area will be fenced in increments and will remain available for public mammal hunting as part of Hunting Unit B until fencing and ungulate control is initiated. Public hunting will be used in the initial stages of feral ungulate removal from fenced management areas wherever safe, feasible, and effective.

DOFAW seeks to balance the objective of continuing to provide public hunting opportunities in the Reserve with the protection of native ecosystems and watersheds. The Ka'ū Forest Reserve is very large (61,641 ac (24,945 ha) of public land) and will be able to accommodate both management objectives. The Reserve is not designated as an area where habitat will be manipulated to enhance game populations due to the high quality of the native ecosystems and watersheds. This plan emphasizes increasing access to lower portions of the Reserve to allow for public hunting while increasing watershed and native ecosystem protection in more remote, inaccessible upper portions of the Reserve through fencing of management units and removal of feral ungulates.

Figure 16. Public Hunting Areas in Ka‘ū Forest Reserve



7. Commercial Activity

Management Objective: Develop means to make Ka'ū Forest Reserve economically self-supporting, in whole or in part, as has been done with other forest reserves across the state.

Actions:
1. Determine environmentally compatible means for generation of revenue to support proposed management activities.

According to HRS §183.5 (5), the department shall: Devise and carry into operation, ways and means by which forests and forest reserves can, with due regard to the main objectives of title 12, be made self-supporting on whole or in part.

Commercial activity is not a priority management activity for Ka'ū Forest Reserve. DOFAW will only develop commercial activities in the Reserve that are compatible with the highest priorities - protection of watershed values and native ecosystems, and that do not interfere with public activity.

Water is one of the most important sustainable resources generated by the Reserve. One potential source of funding for watershed management is a long-term agreement with ADC for the use of water and water infrastructure in Ka'ū Forest Reserve. ADC is interested in developing such an agreement to benefit agricultural water users in Ka'ū. Funds generated from an agreement with ADC could be used for the implementation of watershed protection projects, which would improve the quantity and quality of water generated from the Reserve.

D. Management Plan Implementation

1. Management Plan Cost

The estimated costs of proposed management actions are outlined in Table 9. The management actions proposed in this plan will require a greatly increased level of funding in order to implement over the next ten or more years.

There are currently limited financial resources to manage the Forest Reserve System, and DOFAW has estimated there is approximately $0.25/acre funding available for forest reserve management statewide. Increased funding for high cost projects outlined in this plan will be obtained through outside grants as well as funding from partners, including federal and private organizations. High profile actions such as the reintroduction of 'Alalā to the wild will provide an opportunity for increased funding for management that will provide multiple benefits (e.g. funding for fencing and ungulate removal will benefit watershed values, native ecosystems and native forest birds, including the 'Alalā). Ka'ū Forest Reserve is a high priority for increased management for conservation agencies and organizations across the state and nationwide. The

completion of management planning and compliance for actions proposed in the plan will likely generate increased financial resources to manage the area.

2. Staffing

Current staffing levels are not adequate to implement the projects proposed in this plan. DOFAW anticipates obtaining outside funding through federal and private grants to increase staff levels to implement projects. Major actions such as fencing may be contracted to outside entities; however, a DOFAW team of 5-10 people (wildlife biologists and field personnel) will be needed to implement other projects proposed in this plan. Similar ongoing DOFAW and watershed management projects elsewhere in the state hire personnel through the University of Hawai'i Pacific Cooperative Studies Unit. Additional funding and staff support will also be available from partners such as the TMA.

3. Timetable

To be determined based on available funding.

E. Overall Measures of Success

Indicators that may be used to gauge the success of the various management actions proposed for Ka'ū Forest Reserve include:

- Number of cattle removed from forest
- Miles of fence, or number (acres) of fenced management units constructed
- Miles of fence, or number (acres) of fenced management units maintained
- Numbers of feral ungulates removed from fenced management units
- Area and percent of forest land with significant soil erosion
- Levels of nutrients, dissolved oxygen, suspended sediment, turbidity, siltation or temperature change in water
- Ground-water recharge rates and aquifer sustainable yields
- Level of rainfall gauging
- Improved public access by roads and trails
- Reintroduction of extirpated species
- Native forest bird populations stable or increasing
- Percent cover by forest type
- Acres of invasive plants controlled
- Miles of unpaved access road maintenance
- Number and extent of fires in the area
- Level of forest disease incidence or pest infestation
- Number of special use permits issued
- Amount of revenue generated

IV. FUTURE RECOMMENDATIONS

Forest Reserves encompass and incorporate a variety of public uses and benefits. DOFAW will continue to seek to balance these uses to accomplish overall goals for Ka'ū Forest Reserve including protecting watershed values and native ecosystems and providing public recreational opportunities. This plan is intended to cover a fifteen-year time frame and will be revised, as necessary, as actions proposed in the plan are successfully implemented.

Future plans will address management of additional areas which are currently in the process of being added to the Ka'ū Forest Reserve (Kapāpala Koa Canoe Management Area and Kamilo). These areas contain different resources (e.g. koa canoe logs, coastal ecosystems), and DOFAW will have different priorities for the management of these areas.

Ka'ū Forest Reserve will continue to be a major water resource for future generations. Watersheds services include providing humans with a fresh water supply, providing habitat for native plants and animals, allowing better flood control, mitigating climate change impacts, and providing economic, social, recreational and educational opportunities for the human communities in the area. Economic and agricultural development in the Ka'ū District and an increasing population will require the fresh water produced and filtered by the forested watershed.

Future management will need to benefit watershed, native forest ecosystems and unique native species and people who use the area for recreation and cultural practices. Future plans may propose additional fencing and ungulate removal, particularly in areas critical to protect the watershed and native plants and animals.

Table 9. Ka'ū Forest Reserve Management Summary (15 years)

Management Goal	Management Objectives	Recommended Major Actions	Estimated Cost
Watershed Values and Native Ecosystems	Maintain native forest for production of fresh water for public use, reduction of land-based pollutants and improvements in coastal water quality. Maintain the long-term presence of native ecosystems	Remove all feral cattle from within the Reserve and control livestock trespass through continued DOFAW staff cattle control and maintenance of existing fencing Protect forested watershed from feral ungulate damage by constructing fenced management units for approximately 12,000 acres, removing feral ungulates from within fenced management units, and inspecting and maintaining fences.	$250,000 $3,300,000 (22 miles fencing) $1,350,000 (ungulate control) $ 200,000 (inspect/maintain)
Invasive Species Control	Protect intact native forest from non-native, invasive weeds	Monitor and map the distribution of high priority weeds and develop a control strategy. Control weeds and prevent the introduction of new habitat-modifying species Identify highest priority areas for intensive weed control. Control weeds along invasion corridors (e.g., roads, trails, fences) and within fenced management units. Monitor weeds to determine whether weed control measures are effective and to detect changes in long term distribution and abundance.	$350,000 (aerial imagery) $1,000,000 (control) $300,000 (map/monitor)
Threatened and Endangered Species Management	Assist with the recovery of threatened and endangered species by protecting occurrences of these species and restoring them in appropriate habitat	Forest Birds • Monitor to assess changes in the population and distribution. 'Alalā • Predator control • Restore native food plants	$150,000 $2,500,000

		• Construct release cages, release birds Plants • Survey, map and collect propagation material. • Propagate and re-introduce plants through outplanting. • Monitor growth/survival of reintroduced plants. • Protect rare plants outside fenced management units through the construction of small fenced exclosures	$100,000
Public Activity	Provide for continued public use including hunting, recreational opportunities, cultural uses, personal gathering, and educational programs.	Maintain existing public access roads. Develop new access routes to increase access, particularly across private and state-leased lands below the Reserve. Continue to facilitate public hunting in the Reserve. Develop trails and recreational amenities Hire outreach staff and work with partners to provide community outreach and education	$300,000 $500,000 $500,000 $500,000
Resource Protection	Reduce the threats of fire, insects, and disease to the Ka'ū Forest Reserve	Respond to fires, as needed. Monitor forest for invasive insects and disease.	100,000 $50,000
Game Animal Management	Continue to provide public hunting opportunities in Ka'ū Forest Reserve.	Maintain existing public access roads for use by hunters. Develop new access routes to increase access, particularly across private and state-leased lands below the Reserve. Provide opportunities for public hunters to	Costs under public activity Costs under public activity Costs under ungulate control

		assist with the removal of feral pigs and sheep in fenced, management units prior to staff control.	
Commercial Activity	Develop means to make Reserve economically self-supporting, in whole or in part, as has been done with other forest reserves across the state.	Determine environmentally compatible means for generation of revenue to support proposed management activities.	
TOTAL			$11,450,000

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VI. APPENDICES

A. Kaʻū Forest Reserve Additions and Withdrawals

Action	Date	A/W	Description	Acres	Copy of Survey Furnished (CSF)	Tax Map Key
Governor's Proclamation	August 2, 1906	A	Set aside to continue protection of the forest on the lower slope of Mauna Loa	65,850 ***/1**	1722	397001001 (por.) 398001004 (por.) 397001022 397001007 (por.) 397001006 397001018 397001013 397001005 397001012 397001014 397001008 397001004 397001016 397001023970 01020 397001015 397001003 397001017 397001002 397001019
Governor's Proclamation	February 4, 1911	A	Addition of lands at Kaʻalaʻala-Makakupu, Keaīwa, Kaʻauhuhuula and Pālima	216.2 ***/2**	2213	397001001 (por.) 397001007 (por.)
Governor's Proclamation	October 17, 1930	W	Modify - boundary revision/revised description of Kaʻu Forest Reserve	67,078 ***/3**	5652	397001001 (por.) 397001022 397001007 397001006 397001018 397001013 397001005 397001012 397001014 397001008 397001004 397001016 397001021 397001020 397001015 397001003 397001017 397001002 397001019

Governor's Proclamation	April 13, 1932	A	Addition (portion of the lands of Waiʻōhinu in the vicinity of Hāʻao Springs) as land important for the conservation of water	266.80	5842	397001001 (por.) 397001009
Executive Order 1560	May 1, 1953	W	Withdraw from Governor's proclamations of August 2, 1906, February 4, 1911, October 17, 1930 and April 13, 1932	5,955	11599	397001013 397001012 397001014 397001008 397001004 (por.) 397001016 397001021 397001020 397001015 397001003 397001017 397001002 (por.)
Executive Order 4156	April 24, 2006	A	Land set aside for public purpose, for addition to Kaʻū Forest Reserve	4,744.90	24187 24188 24189	396006018 396006015 396006010 396006009 397001014 397001016 397001021 397001020 397001015 397001017

*/1 Includes private lands at Kāhilipalinui (165 ac.), Hīlea Nui (2620 ac.), Hīlea Iki (37 ac.), Punaluʻu (1275 ac.), Pāʻauʻau 2 (1675 ac.), and Keaīwa (460 ac.).

*/2 Includes private lands at Keaīwa (23 ac.).

*/3 Includes private lands at Kāhilipalinui (169 ac.), Kīʻolokū (211 ac.), Hīlea Nui (2620 ac.), Hīlea Iki (37 ac.), Punaluʻu (1378 ac.), Pāʻauʻau 2 (1598 ac.), and Keaīwa (511 ac.).

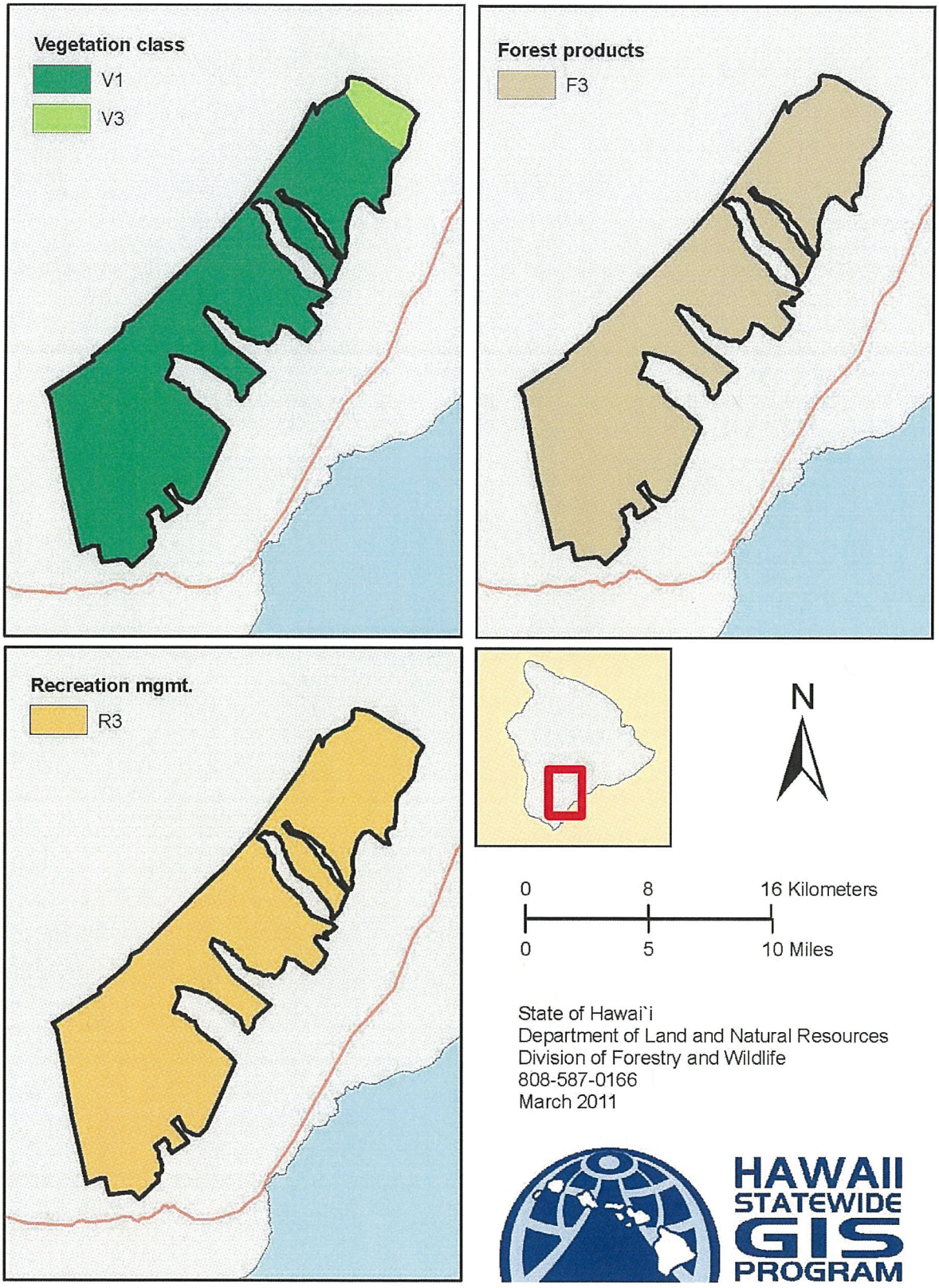
B. DOFAW DRAFT Management Guidelines for Ka'ū FR

DOFAW prepared DRAFT Management Guidelines in 2001 to balance desired levels of activities (human use) on DOFAW managed lands. DOFAW is currently in the process of updating these draft management guidelines. The guidelines emphasize three program areas with conflicting resource demands or user groups. Current management guideline maps show classification of native vegetation according to its relative intactness and habitat quality and recommended levels of human use within these vegetation classifications for the following activities: Outdoor Recreation, Forest Products, Game Management and Hunting.

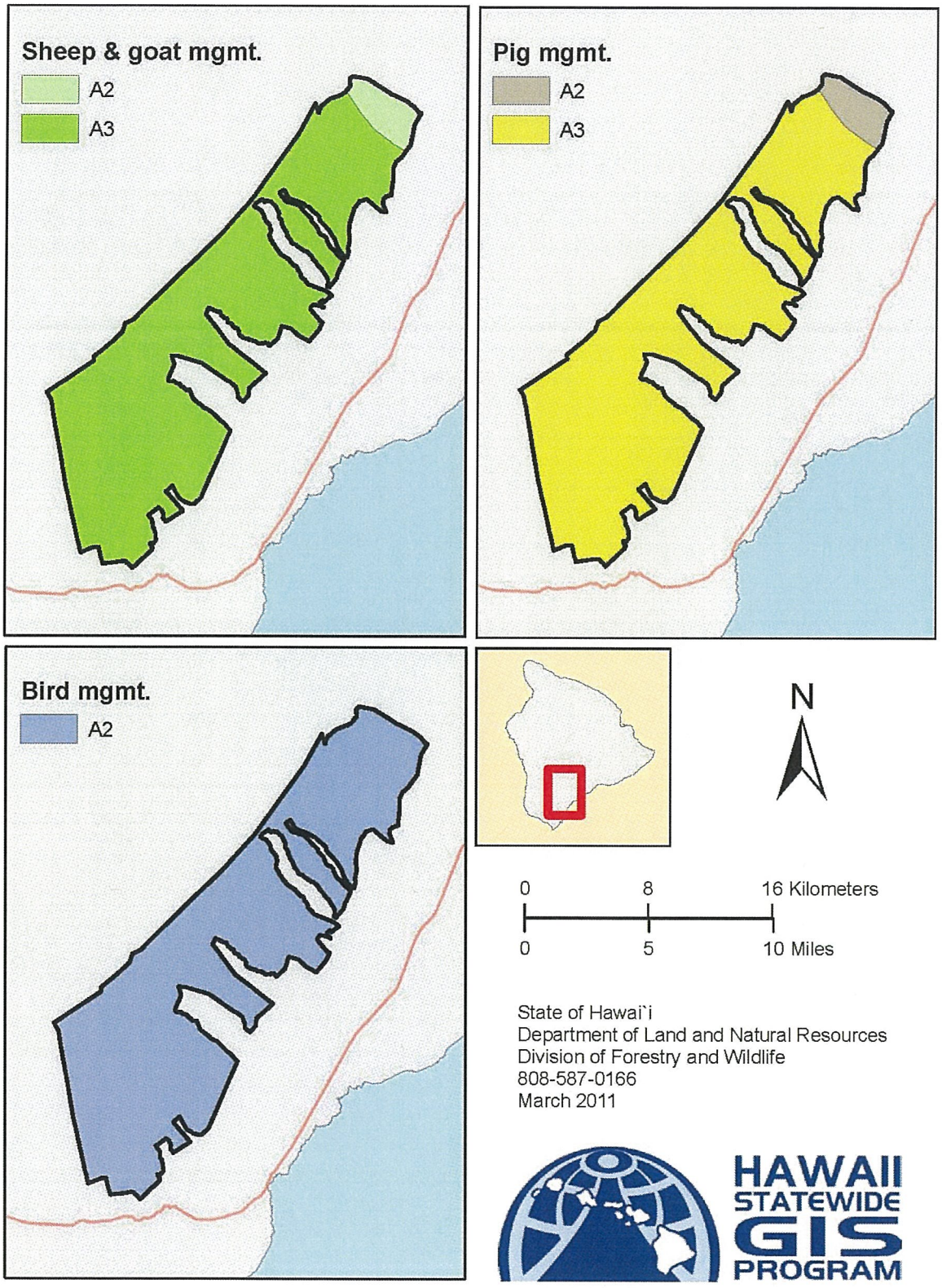
Management Guideline	Classification	Objective	Permitted activities
Vegetation	V-1 Highest Quality Native Ecosystems	Protect and perpetuate these areas, by preventing non-sustainable activities or intensities of use	Permitted activities are minimally disruptive, and would be focused on ecosystem preservation
	V-3 - Considerably Disturbed Areas*	Prevent activities or intensities of use that result in degradation of unique native species and secondary forest resources (water supply, erosion control & aesthetic values).	Permitted activities may have high levels of disturbance, as long as they don't negatively impact remaining native plant populations and have an eventual net benefit to other resources like water, or an improved vegetative cover for other activities. Native plant conservation may be focused at a species, rather than an ecosystem level.
Game Management and Hunting	A3 - Game Control (public)	Resource protection is the primary objective, with emphasis on native plant communities and watersheds.	Seasons and bag limits are designed for public hunting to reduce impacts to native resources
	A2 - Mixed Game and Other Uses	Game management is an objective integrated with other uses.	Habitat may be manipulated for game enhancement. Game populations are managed to acceptable levels using public hunting.
Outdoor Recreation	R3 Light Use	Recreation would be limited to certain areas, or occasional levels of use due to impacts on resources or programs.	Trails would be the main recreational feature, and their use may be restricted.
Forest Products	F3 Personal		Small-scale non-commercial harvesting or salvage is allowed, such as materials for cultural uses. Permit and/or license required with appropriate restrictions.

* According to DOFAW staff, Ka'ū FR areas classified as V-3 in 2001 are not currently distinctive from adjacent V-1 areas. V-3 areas may have been classified due to disturbance due to feral cattle that have since recovered due to feral cattle removal.

DOFAW DRAFT Management Guidelines for Ka'ū FR (Vegetation Class, Forest Products and Recreation Management)



DOFAW DRAFT Management Guidelines for Ka'ū FR (Vegetation Class, Forest Products and Recreation Management)



C. U.S. Fish and Wildlife Service Recovery Plans/Critical Habitat Designations for Ka'ū Species of Plants and Animals

Recovery Plan/Critical Habitat Designation	Comment
Revised Recovery Plan for the 'Alalā (*Corvus hawaiiensis*) (2009)	Recommendations for management actions for the benefit and recovery of the 'Alalā. http://www.fws.gov/pacific/ecoservices/endangered/recovery/documents/AlalaDraftRevisedRecoveryPlan.pdf
U.S. Fish and Wildlife Designation of Critical Habitat for 12 Species of Picture-Wing Flies From the Hawaiian Islands (2008)	Provides recommendations for habitat management for *Drosophila heteroneura* http://www.gpo.gov/fdsys/pkg/FR-2008-12-04/pdf/E8-27664.pdf#page=2
U.S. Fish and Wildlife Revised Recovery Plan for Hawaiian Forest Birds (2006)	Recommendations for management actions for the benefit and recovery of native forest birds. http://ecos.fws.gov/docs/recovery_plan/060922a.pdf
U.S. Fish and Wildlife Final Designation and Nondesignation of Critical Habitat for 46 Plant Species From the Island of Hawai'i, HI (2003)	Discusses management actions for the benefit and recovery of *Cyanea stictophylla, Melicope zahlbruckneri, and Phyllostegia velutina* http://www.fws.gov/policy/library/2003/03-14143.pdf
U.S. Fish and Wildlife Big Island II: Addendum to the Recovery Plan for the Big Island Plant Cluster (1998a)	Provides recommendations for management of *Phyllostegia velutina* and *Melicope zahlbruckneri* http://ecos.fws.gov/docs/recovery_plan/980511a.pdf
U.S. Fish and Wildlife Recovery Plan for the Hawaiian Hoary Bat (1998b)	Supports objective 2: protect and manage current populations and identify and manage threats http://ecos.fws.gov/docs/recovery_plan/980511b.pdf
U.S. Fish and Wildlife Recovery Plan for Four Species of Hawaiian Ferns (1998c)	Provides recommendations for management of *Asplenium peruvianum* var *insulare* http://ecos.fws.gov/docs/recovery_plan/980410e.pdf
U.S. Fish and Wildlife Recovery Plan for the Big Island Plant Cluster (1996)	Provides recommendations for management of *Clermontia lindseyana, Cyanea stictophylla,* and *Nothocestrum breviflorum* . http://ecos.fws.gov/docs/recovery_plan/960926a.pdf

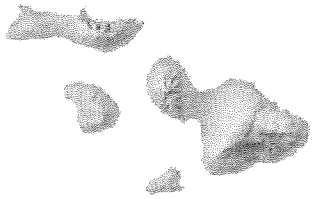
APPENDIX P:

County of Maui Department of Water Supply
Correspondence with Akinaka & Associates, Ltd.
Dated July 24, 2020

MICHAEL P. VICTORINO
Mayor

JEFFREY T. PEARSON, P.E.
Director

HELENE KAU
Deputy Director



DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
200 SOUTH HIGH STREET WAILUKU,
MAUI, HAWAII 96793
www.mauiwater.org

July 24, 2020

Mr. Scott Kunioka
Akinaka & Associates, Ltd.
1100 Alakea Street, Suite 1800
Honolulu, Hawaii 96813

Dear Mr. Kunioka: Scott:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) FOR THE PROPOSED LEASE (WATER LEASE) FOR THE NAHIKU, KEANAE, HONOMANU, AND HUELO LICENSE AREAS

The following is in response to your letter dated July 14, 2020 requesting assistance from the Department of Water Supply, as it pertains to comments and questions made to the Draft Environmental Impact Statement (DEIS) for the Proposed Lease (Water Lease) for the Nahiku, Keanae, Honomanu, and Huelo License Areas.

Question 1a - Fig 1-3 shows the Alexander and Baldwin (A&B) use area for diverted water but does not indicate the County of Maui Department of Water Supply (MDWS) use area that depends upon the EMI diversions. The EIS needs to provide this information.

> ***DWS RESPONSE***: Figure 3 – Upcountry Maui Water System Service Area needs to be corrected as follows: 1) The label "Makawao-Pukalani" should be corrected to read "Makawao" and 2) The label "Haiku" should be removed and the area should be the same color as "Makawao" as it is part of the Makawao System and not a separate water system.
>
> Please refer to the attached EXHIBIT "A" (map titled "Approximate Maui Department of Water Supply Upcountry Service Areas") that shows the service area for Makawao, Lower Kula, and Upper Kula water systems to correct Figure 3. Note that Figure 3 is correct to show the Ag Park as a service area of MDWS, however it should be noted as a non-potable service area.
>
> The Makawao and Kula Ag system are fed by the EMI diversions during normal operations, however, the EMI diversion waters are pumped to the Lower Kula and Upper Kula Systems when needed to supplement those systems. Therefore, these systems also depend on the EMI diversions.

Question 1b (part 1) - Fig 2-3 shows the MDWS service area, but needs to show which parts can be served by the Upper and Lower Waikamoi pipelines, which parts are served by the Wailoa ditch, and which parts are served by wells.

DWS RESPONSE: If one of the figures in the subject DEIS is revised, to address this question, please note the following: 1) Upper Waikamoi pipeline serves the Upper Kula System; 2) Lower Waikamoi pipeline serves the Lower Kula System; 3) Wailoa Ditch serves the Makawao System; 4) Kaupakalua and Haiku wells serve the Makawao System; and 5) Pookela Well is used as a back-up source to Upcountry surface water sources and serves the Makawao, Lower Kula, and Upper Kula systems. Please refer to the attached EXHIBIT "A" (map titled "Approximate Maui Department of Water Supply Upcountry Service Areas") that shows the service areas for each of these systems.

Question 1b (part 2) - Fig 2-4 shows MDWS treatment plants and the upper Kula ditch, but needs to show which areas are served by these facilities.

DWS RESPONSE: Please note that Figure 2-4 does not shown an "upper Kula ditch" that the question is referring to. Please provide clarification so that DWS can provide a concise response.

Figure 2-4 should be corrected for the following reasons: 1) It does not show the Lower Kula Pipeline which begins at the Piiholo Water Treatment Plant; 2) The "Kula Pipeline" shown should be labeled "Upper Kula Pipeline"; and 3) A connection is shown between the Upper and Lower Waikamoi Flumes and MDWS is not aware of a connection, please verify with EMI.

If Figure 2-4 is revised to show the separate systems (Makawao, Lower Kula, Upper Kula, Kula Ag systems), please note the following: 1) Kamole-Weir Water Treatment Plant serves the Makawao System; 2) Piiholo Water Treatment Plant serves the Lower Kula System; and 3) Olinda Water Treatment Plant serves the Upper Kula System. Please refer to the attached EXHIBIT "A" (map titled "Approximate Maui Department of Water Supply Upcountry Service Areas") that shows the service areas for each of these systems.

Question 1c - The location of the MDWS aqueduct systems (Upper and Lower Kula Pipelines) which occur almost entirely outside the lease area and are not dependent upon continued water diversion from the lease area by EMI is not illustrated at all in the DEIS; it needs to provide this information.

DWS RESPONSE: Please refer to the attached EXHIBIT "C" (map titled WAIAKAMOI Water Sources Kula Water System") shows the location of the Upper Kula Pipeline (red line) and the Lower Kula Pipeline (blue line).

The Makawao and Kula Ag system are fed by the EMI diversions during normal operations, however, the EMI diversion waters are pumped to the Lower Kula and Upper Kula Systems when needed to supplement those systems. The Lower Kula and Upper Kula Systems service areas are fed through the Upper and Lower Kula Pipelines. Therefore, these systems also depend on the EMI diversions.

Request 1 under Question 1 – Does MDWS have service area maps with surface water sources for Upcountry Maui? (delivered by the Wailoa Ditch, Upper Waikamoi Flume and Lower Waikamoi Flume) and basal wells.

DWS RESPONSE: MDWS does not have a map showing both the surface water sources for Upcountry Maui (conveyed through the Wailoa Ditch, Upper Waikamoi Flume and Lower Waikamoi Flume) and the service areas (Makawao, Lower Kula and Upper Kula water systems) on the same map.

Request 2 related to Question 1c – For the Upcountry Maui water system, are there maps to show the "interconnectedness" between surface water and potable water service.

> ***DWS RESPONSE***: Please clarify what is meant by "interconnectedness" between surface water and potable water service so that MDWS can provide a concise response.

Request 3 related to Question 1c – Are there maps that provide the location of Upper and Lower Kula pipelines (reference Figure 2-4 of EIS).

> ***DWS RESPONSE***: Please note that Figure 2-4 does not shown an "Upper and Lower Kula pipelines". Please provide clarification so that DWS can provide a concise response.

Question 2a - Please describe the current and possible anticipated future expansion or improvement of the entire county system within the EIS Areas.

> ***DWS RESPONSE***: MDWS has no current or anticipated future expansion or improvement of the system within the EIS Areas at this time.

Response/Request 1 related to question 2a – Are there plans for water system improvements/expansion within the EIS Areas? Is there a list of upcoming CIP projects for East Maui and the Upcountry Systems?

> ***DWS RESPONSE***: MDWS has no current plans for water system improvements/expansion within the EIS Areas. MDWS does not have a list of upcoming CIP projects for East Maui and the Upcountry Systems.

Questions 2b - Further, the expansion of the County of Maui system serving Nahiku will impact the closely interrelated hydrology of the area. The hydrology reports developed during the "Kuhiwa Well Contested Case Hearing" are useful and educational. There is a clear understanding of the hydrology and interconnectedness of Makapipi Stream, Hi'inui Stream (aka: "the unnamed stream") and Hanawi Stream, including "Big Springs"."

> ***DWS RESPONSE***: MDWS is not aware of an "expansion of the County of Maui system serving Nahiku". Please provide clarification so that MDWS can provide a concise response

Question 3a - Please provide Diagrams showing specifically where Nahiku water comes from and how much need to be included in the Draft EIS. Records show that underground tunnels naturally feed the Nahiku intake pipe and there is no shutoff. So the claim that Nahiku would be at risk of losing their water if the proposal from A and B stream flow is not accepted seems to be a scare tactic, and if so, another strike against them for irresponsibly "yelling fire in a crowded theater" only for their gain."

> ***DWS RESPONSE***: The attached EXHIBIT "D" (Fire Protection Map 45 Nahiku) shows the West Makapipi Tunnel 2 (State Well No. 4806-07), also known as the "Nahiku Tunnel". The Nahiku water is conveyed to the Nahiku Water System through an intake pipe located within the Nahiku Tunnel. Currently, this source is the sole source of water for the Nahiku Water System. MDWS is not aware of backup source that A&B has that they can provide water to MDWS's Nahiku Water System.

Question 3b - Please describe in detail the complete County of Maui Department system currently serving the Nahiku Community, including maps and tax map keys (TMK). Is the system supplied by a tunnel or from the East Maui Irrigation "ditch" system? Please describe in detail.

DWS RESPONSE: MDWS's Nahiku Water System is comprised of an intake within the West Makapipi Tunnel 2 (State Well No. 4806-07), also known as the "Nahiku Tunnel". The water from the Nahiku Tunnel is conveyed through an intake pipe that exits the tunnel into a 4" pipe, two (2) pressure break tanks, a 2" pipe, and into the Lower Nahiku Tank. The Nahiku Water service area is then fed from the Lower Nahiku Tank through 4" and 2" pipes. The attached EXHIBIT "E" (map titled, "Maui Department of Water Supply Nahiku System") shows the tax map keys served by the Nahiku Water System.

Question 3c - Please describe the TWO (2) water tanks in close proximity on opposite sides of the Lower Nahiku Road. Are both tanks County of Maui owned and maintained? If not, please disclose the ownership and water source for the second tank. Is the source for either tank a well? If so, please describe in detail and disclose the well drilling permit and subsequent monitoring reports.

DWS RESPONSE: Please refer to EXHIBIT "D" (Fire Protection Map 45 Nahiku) that shows the location of the Lower Nahiku Tank situated Makai of Hana Highway along Lower Nahiku Road. The other two (2) tanks shown on the map are mauka of Hana Highway. MDWS owns and maintains all three (3) tanks. The source for all three (3) tanks is the Makapipi Tunnel 2 (State Well No. 4806-07), also known as the "Nahiku Tunnel". MDWS is not aware of a well that is able to service the Nahiku Water System.

Question 4 - On page 4 - 5, it states that 4.9 MGD of water is delivered from four Upcountry Wells (Ha'iku, Po'okela and the 2 Kaupakalua Wells). These wells are an important back-up source for Upcountry. How do these wells decrease Upcountry's dependence on East Maui's aqueduct system water?

DWS RESPONSE: Page 2-10 of the DEIS is incorrect as MDWS has only 1 Kaupakalua Well.

Page 31 of the Introduction of the subject DEIS, states that "approximately 80-90 percent of water delivered within the MDWS Upcountry Maui Water System is supplied by surface water and the remainder is by groundwater (wells)."

The Kaupakalua Well and the Haiku Well are not back-up sources for Upcountry, but are primary sources for the Haiku portion of the Makawao Water System. The Pookela Well serves as a temporary back-up for the Makawao, Lower Kula, and Upper Kula water systems during periods of drought or during periods of repair and maintenance at the water treatment facilities. This back-up well source is capable of providing approximately 1.2 million gallons per day (based on a 24-hour run time.

Question (under Question 4) – Are these wells an integral part of the source for the area. Do they provide about 10% – 20% of water delivered to the Upcountry System? Is their total pump capacity 3.4 mgd?

DWS RESPONSE: The Kaupakalua and Haiku wells are an integral part of the source for the Haiku portion of the Makawao System. These wells, along with Pookela Well, provides approximately 10 to 20 percent of Upcountry water production, with monthly and annual variations. The total pump capacity of these wells is 2.1 mgd (24-hour pumping).

If you have any questions, please contact me at (808) 270-7834.

Sincerely,

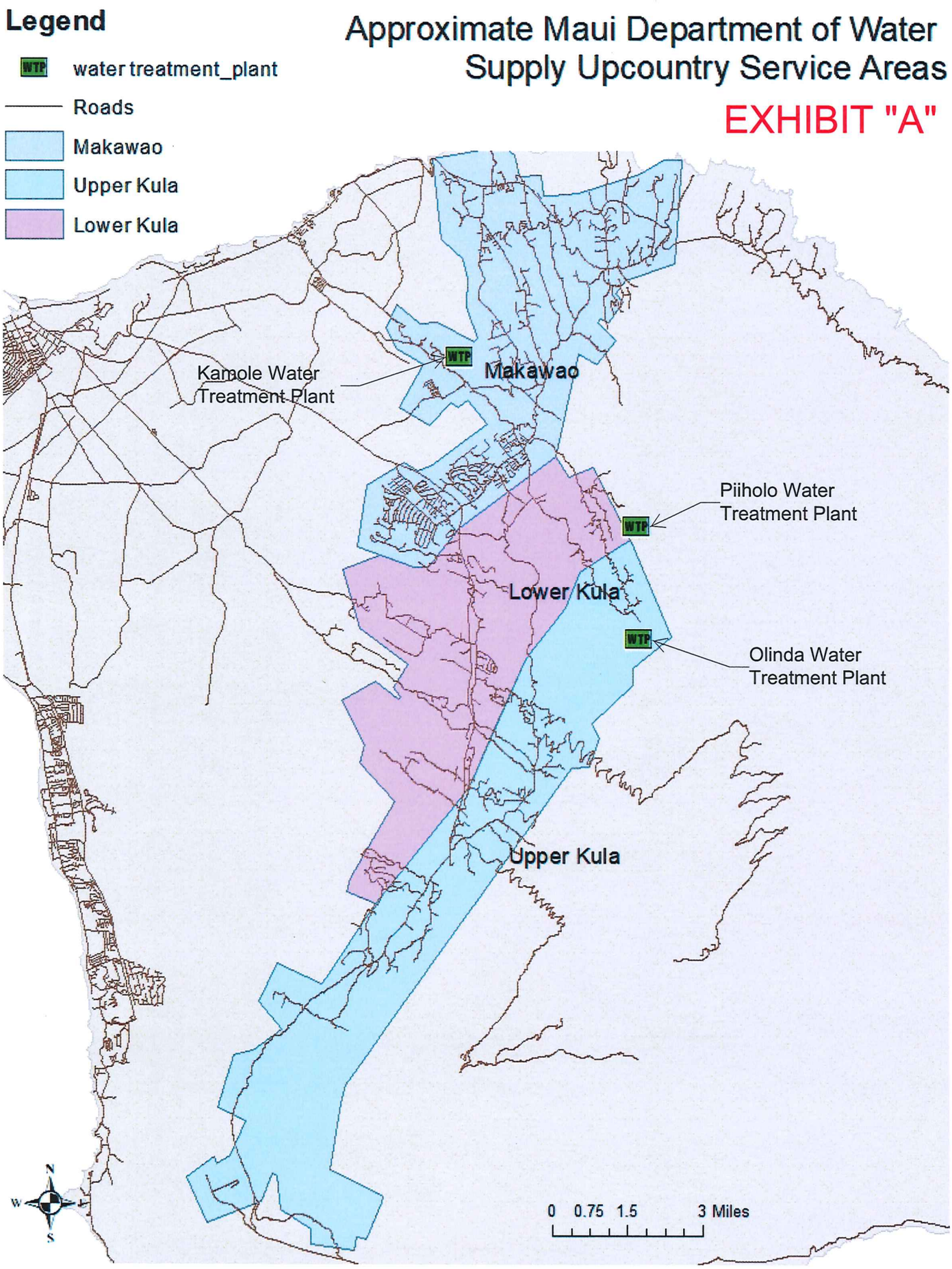
JEFFREY T. PEARSON, P.E.
Director

Attachments: EXHIBITS "A", "B", "C", "D", and "E"

cc: Ken Kawahara (Ken Kawahara(kck@akinaka.com)
Grant Nakama, Mahi Pono (grant.nakama@mahipono.com)

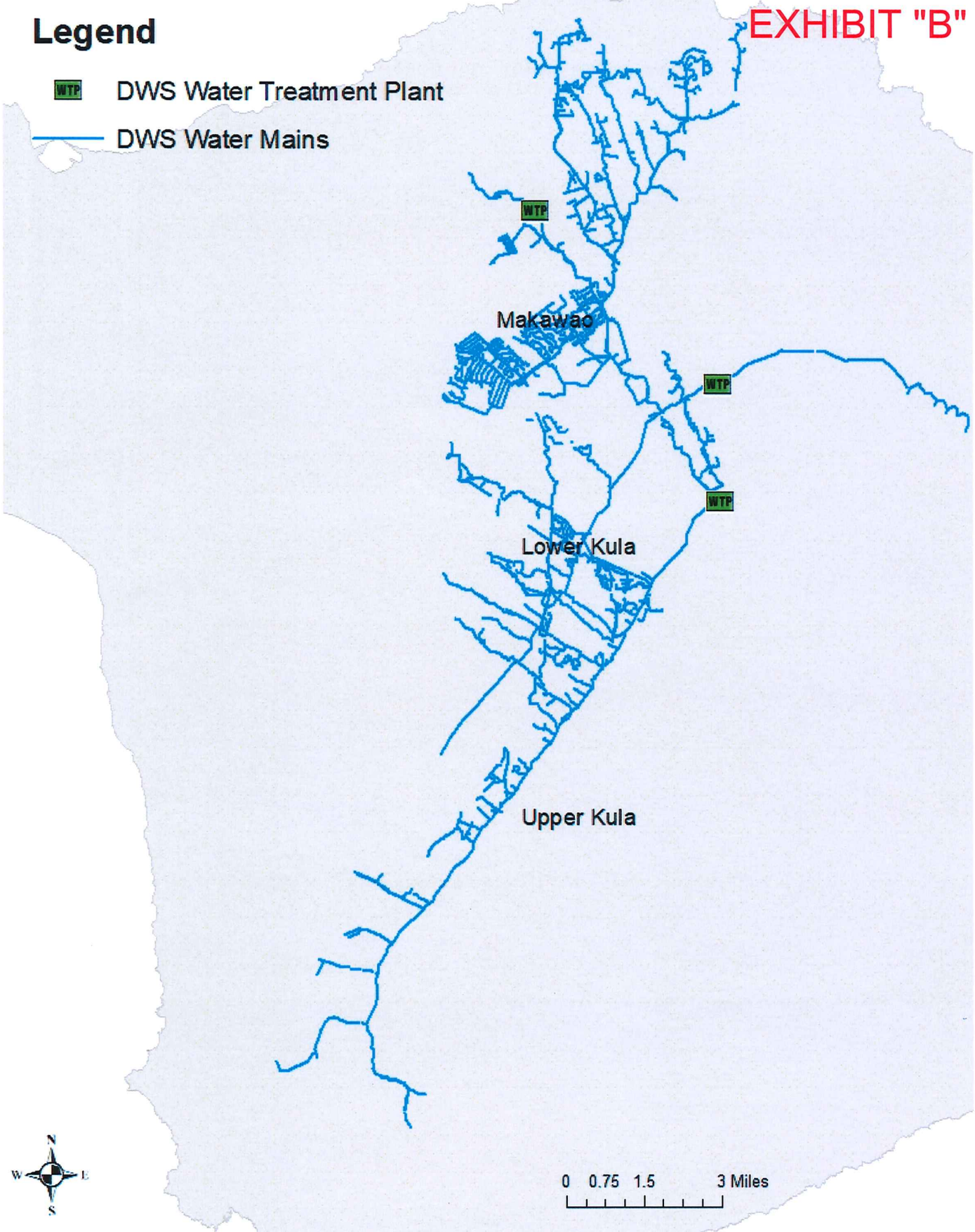
Approximate Maui Department of Water Supply Upcountry Service Areas

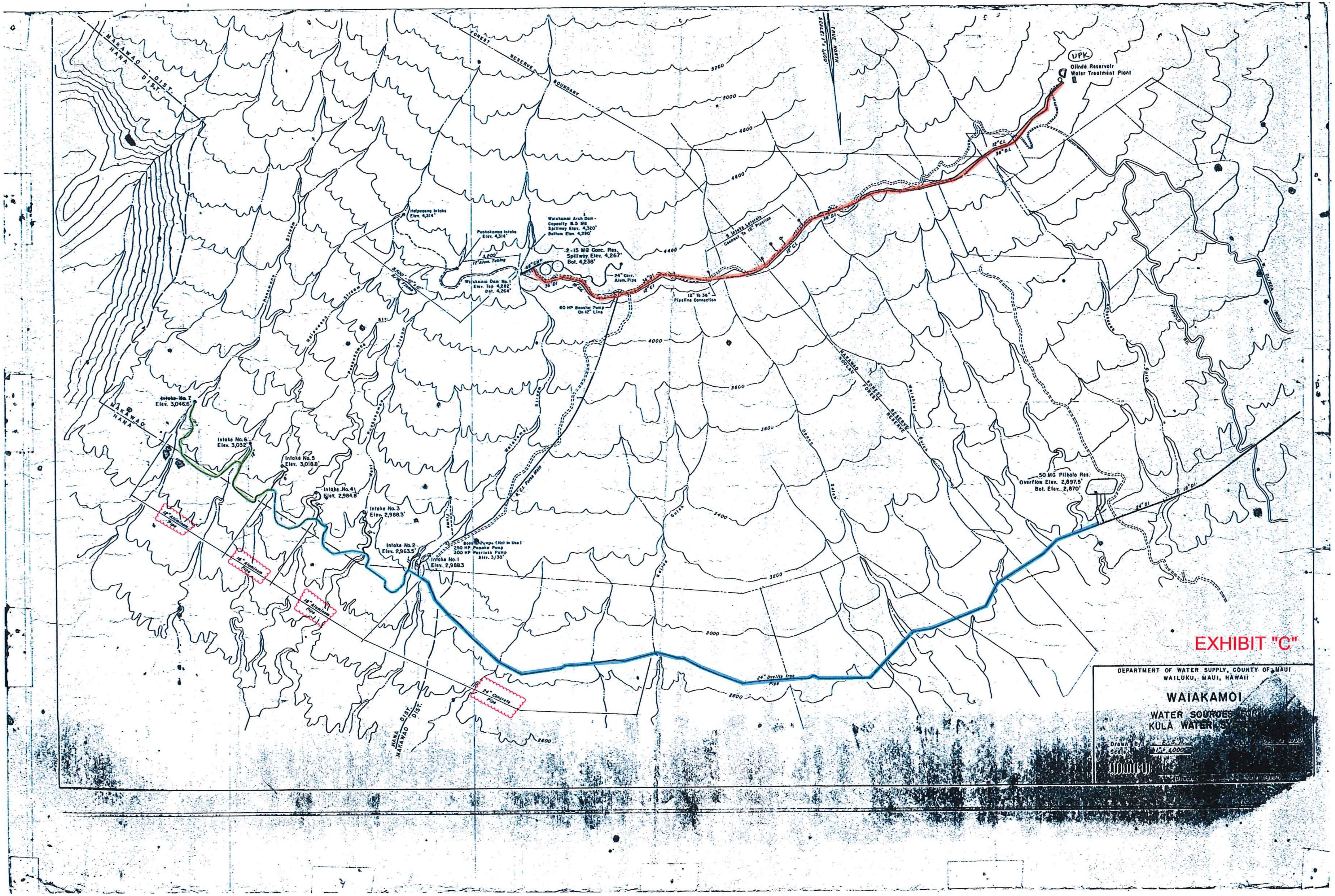
EXHIBIT "A"



Maui Department of Water Supply Upcountry System Pipes

EXHIBIT "B"




UPK
Olinda Reservoir
Water Treatment Plant
TRUE NORTH
SCALE: 1" = 4000'
FOREST RESERVE BOUNDARY
MAKAWAO DIST.
HANA DIST.
5200
5000
4800
4600
4400
4000
3800
3600
3400
3200
3000
2800
2600
Haipuaena Intake
Elev. 4,314'
Puohokamoa Intake
Elev. 4,314'
Waikamoi Arch Dam -
Capacity 8.5 MG
Spillway Elev. 4,320'
Bottum Elev. 4,29C'
2-15 MG Conc. Res.
Spillway Elev. 4,267'
Bot. 4,238'
3,200'
12" Alum. Tubing
5,500' - 12" x 12" R/W Flume
48" CMP
Waikamoi Dam No. 1
Elev. Top 4,282'
Bot. 4,264'
24" Corr. Alum. Pipe
36" DI
16" C.I.
12" C.I.
60 HP Booster Pump
On 12" Line
12" To 36"
Pipeline Connection
5 Intake Laterals
Connect To 12" Pipeline
12" C.I.
36" D.I.
Intake No. 7
Elev. 3,046.6'
Intake No. 6
Elev. 3,032'
Intake No. 5
Elev. 3,018.8'
Intake No. 4
Elev. 2,984.8
Intake No. 3
Elev. 2,988.3'
Intake No. 2
Elev. 2,963.5'
Intake No. 1
Elev. 2,988.3
Booster Pumps (Not In Use)
250 HP Pomona Pump
300 HP Peerless Pump
Elev. 3,130'
8" C.I. Force Main
12" Aluminum Pipe
16" Aluminum Pipe
18" Aluminum Pipe
24" Concrete Pipe
24" Ductile Iron Pipe
50 MG Piiholo Res.
Overflow Elev. 2,897.5'
Bot. Elev. 2,870'
24" DI
18" DI
MAKAWAO-KOOLAU FOREST RESERVE
EXHIBIT "C"
DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
WAILUKU, MAUI, HAWAII
WAIAKAMOI
WATER SOURCES FOR
KULA WATER
Drawn By E. S. H.
Scale 1" = 4000'

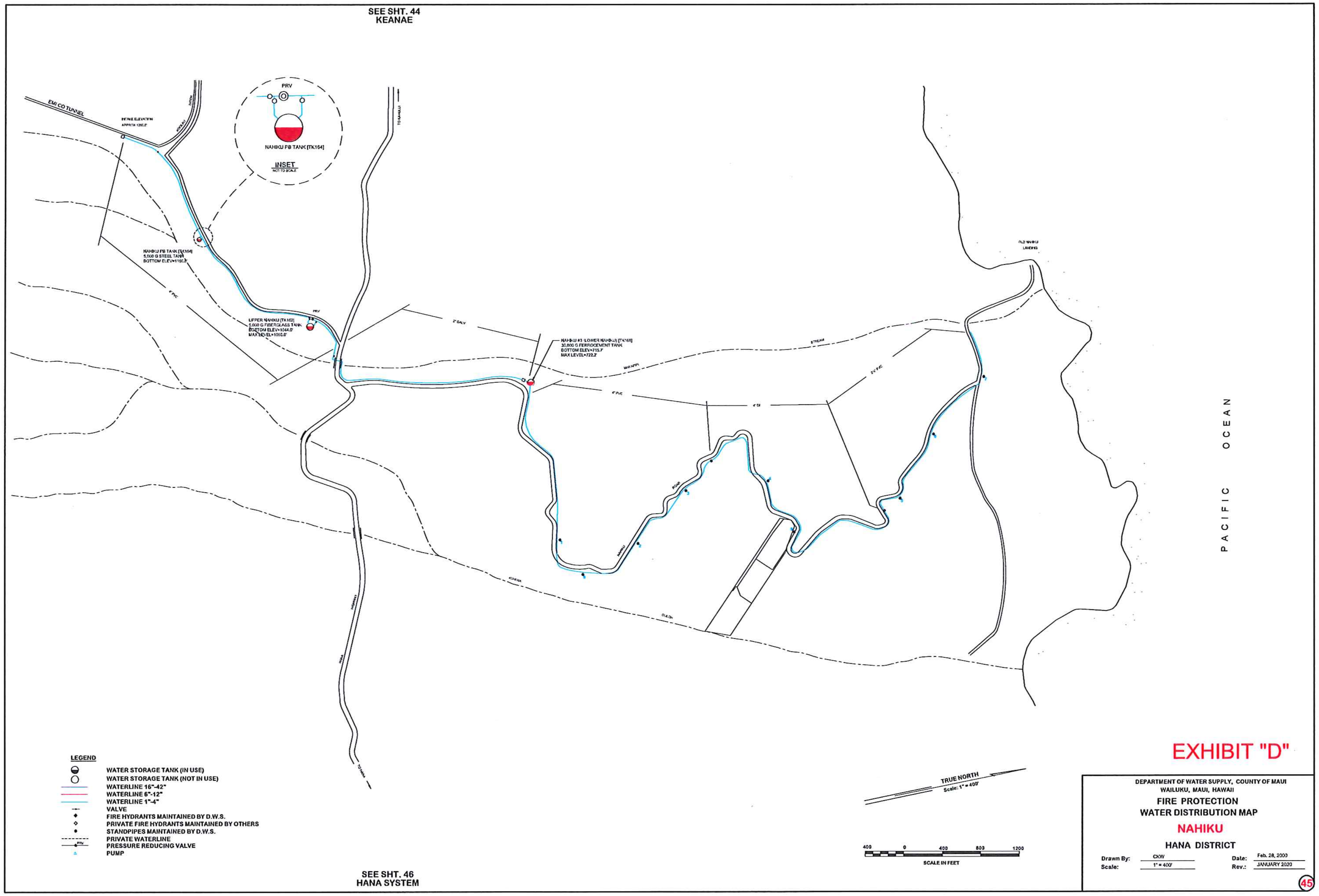


EXHIBIT "D"

DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
WAILUKU, MAUI, HAWAII

FIRE PROTECTION
WATER DISTRIBUTION MAP

NAHIKU

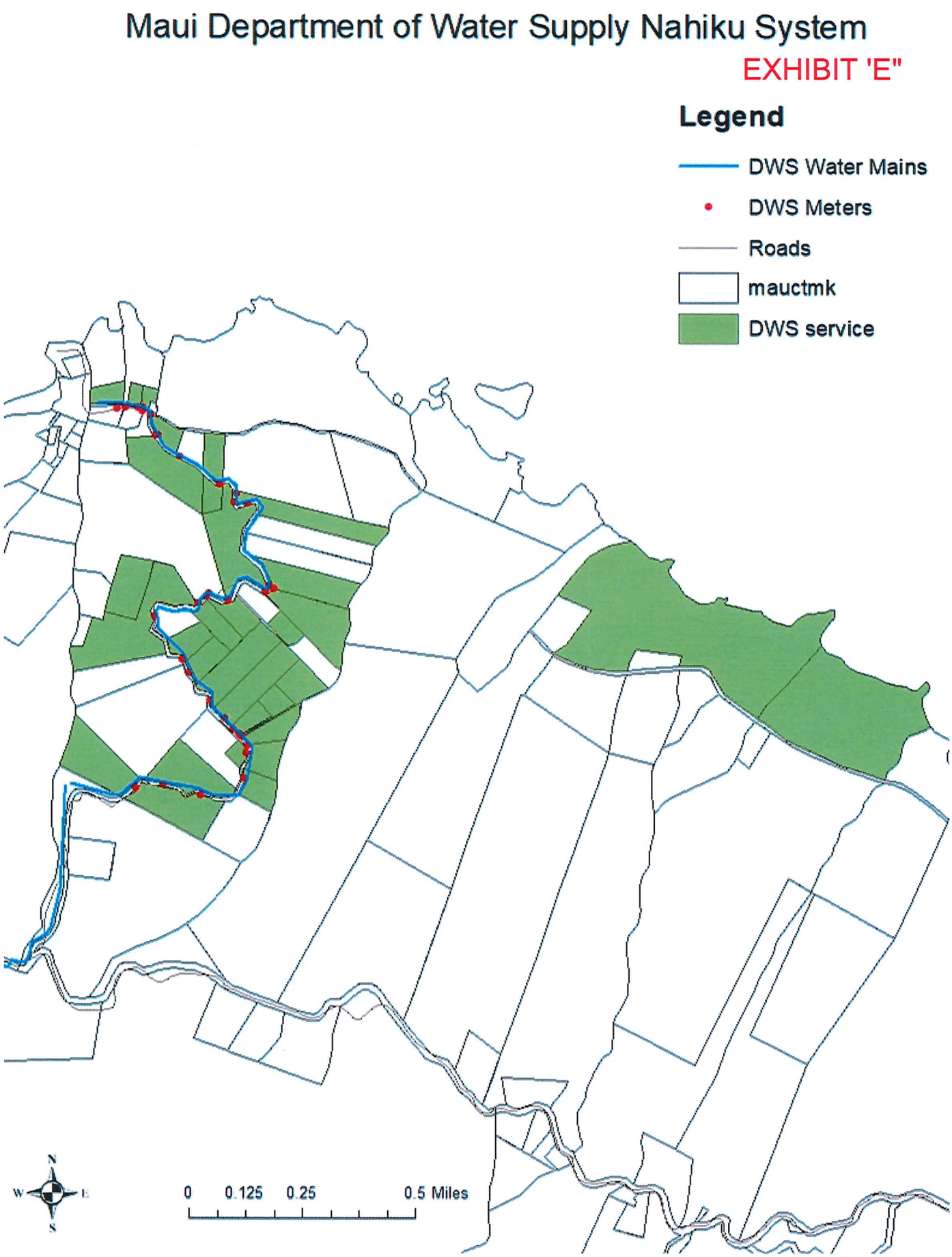
HANA DISTRICT

Drawn By: CKW
Scale: 1" = 400'
Date: Feb. 28, 2000
Rev.: JANUARY 2020

45

Maui Department of Water Supply Nahiku System

EXHIBIT 'E"



APPENDIX Q:

Board of Water Supply Temporary Investigative Group Report October 17, 2019

Board of Water Supply
Temporary Investigative Group
October 17, 2019

Feasibility of Purchasing and Maintaining the EMI Water Delivery System

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2. DRAFT BOARD OF WATER SUPPLY LETTER TO MAHI PONO, AWAITING APPROVAL BY MAYOR VICTORINO
3. SENATOR KAIALI`I KAHELE LETTER TO MAYOR MICHAEL VICTORINO, MAY 2, 2019
4. EAST MAUI H20 ROUNDTABLE
5. AUGUST 2, 2017 TRANSMITTAL FROM CORPORATION COUNCIL TO THEN-COUNCIL MEMBER ELLE COCHRAN
6. HONOLULU VS. COLLINS DECISION (CONDEMNATION)
7. LAND LEASE BEARING, GENERAL LEASE #3578, 1959
8. WAI O KE OLA HE WAHI MO`OLELO NO MAUI HIKINA
9. WAI O KE OLA HE WAHI MO`OLELO NO MAUI HIKINA
10. WAI O KE OLA HE WAHI MO`OLELO NO MAUI HIKINA
11. NELSON V. DHHL
12. HRS 171-58
13. 1973 LEASE AND AMENDMENTS THROUGH SEPTEMBER 2018
14. MAP OF EAST MAUI STREAMS AND DITCHES

NOTES ON DOCUMENT:

MUCH OF THIS DOCUMENT CONSISTS OF EXCERPTS FROM OTHER DOCUMENTS, WHETHER THE MAUI ISLAND DRAFT WATER USE AND DEVELOPMENT PLAN OR THE DRAFT EIS CREATED BY ALEXANDER & BALDWIN AND EAST MAUI IRRIGATION OR VARIOUS LEGAL DOCUMENTS RELATED TO OWNERSHIP OF THE WATER SYSTEM AND RELEVANT LANDS.

ALL DOCUMENTS ARE INCLUDED AS A REFERENCE FOR WHAT HAS BEEN SAID ABOUT THE SYSTEM, MAUI RESIDENTS' NEEDS, AND THE LEGAL ENVIRONMENT. INCLUSION IN THIS REPORT DOES NOT IMPLY THAT THE TEMPORARY INVESTIGATIVE GROUP HAS IN ANY WAY CONFIRMED THE VERACITY OF ANY DOCUMENTS OR CLAIMS.

WE HAVE MADE EVERY ATTEMPT TO INCLUDE INTERNET LINKS TO THE ORIGINAL DOCUMENTS AND/OR ATTACHMENTS AS APPENDICES, AND TO MAKE THE SOURCES OF TEXTS CLEAR. WE HOPE THAT THE READER WILL USE THIS DOCUMENT AS A STARTING POINT FOR FURTHER RESEARCH.

PLEASE ALSO NOTE THAT SOME GRAMMATICAL ERRORS, MISSPELLINGS, AND INCONSISTENCY IN SPELLINGS OF HAWAIIAN PLACE NAMES ARE PART OF THE ORIGINAL DOCUMENTS, AND THEREFORE HAVE NOT BEEN CORRECTED.

I. TIG Investigation Background:

Stated Purpose of the Investigation:

> ***Explore the Feasibility of Purchasing and Maintaining the EMI Water Delivery System and Examine Other Alternatives for Ensuring That The People of Maui County Have Authority Over the Delivery of Water, Which is A Public Trust***

Attempts to Access Information on Behalf of the Public:

Over the last several months the Maui County Board of Water Supply (BWS) has had several discussions regarding the role of Mahi Pono in the community. In a letter approved unanimously by the Board on September 19, 2019 to be sent to Mahi Pono Operations Manager Grant Nakama, contingent upon approval by Mayor Michael Victorino, the BWS stated the following:

> …the [Maui County] Board [of Water Supply] has been extending invitations for Mahi Pono, LLC to attend one of our board meetings since March. We are very eager to have a continued dialog between the Board and Mahi Pono as we continually get testimony submissions and questions from the Maui community on water and land use subjects that are beyond our purview. A dialog between the Board and Mahi Pono can help mitigate any falsely placed frustrations throughout the community that are generated from the perceived lack of transparency from the Board when we don't have the answers to provide them.
>
> As a Board that is dedicated to addressing matters related to safeguarding Maui residents' access to water, we are very interested in developing a clear vision of the island's total water resources and current and future demand. To that end, the Board has recently reached out to all private water purveyors and extended invitations to meetings. These invitations have been extended in order to gain an inclusive picture of the island water resources and delivery options as well as to see if there are untapped opportunities for County and private water purveyors to support one another.
>
> Based on statements made in your July 1 letter and discussions during recent meetings, the Board would still welcome your attendance at our next meeting. If that cannot be arranged, we would like to extend some follow-up questions regarding Mahi Pono's current and future plans as they relate to water use. Having some answers to these questions that we pose here will help us to communicate with the wider Maui community that has been addressing the Board. For example: In your July 1 letter, you state: **"We have always been committed to supplying the County of Maui – and by**

extension, the Upcountry Maui community – with water from the EMI system. Having said that, our ability to supply water is 100% dependent on our right to legally access and deliver water." You further state, "That said, if a [Revocable Permit] is successfully obtained – whether by A&B, EMI or by Mahi Pono – then the County will continue to receive water for the Upcountry Maui community." We appreciate the clarity of this statement but the follow up to this is what will happen if Mahi Pono does not obtain a Revocable Permit to divert water?

"We would greatly appreciate any clarity that Mahi Pono can provide on this list of questions that has been generated by or presented to the Board:

- **If Mahi Pono does not obtain a Revocable Permit, will Mahi Pono be able to still commit to working with the County of Maui to ensure affordable access to water for upcountry Maui residents?**
- **Since the water that flows from the Wailoa Ditch to the Kamole Treatment Plant is maintained by Mahi Pono and EMI, would the lack of a Revocable Permit cease that ditch maintenance and flow?**
- Is Mahi Pono interested in exploring an agreement to provide water that is harvested from its own lands to the County's Kamole Water Treatment plant?
- Is Mahi Pono willing to consider shared management of the Wailoa Ditch and other ditch systems? The current condition of the ditch system and the cost of maintenance/repairs that are needed would help clarify the monetary constraints of providing water to the Kamole Water Treatment plant, and
- If the water leases are obtained by EMI, what portion would go to Mahi Pono lands and what portion would go to remaining A&B lands, many of which are entitled for development? Are there other agreements besides the original sales agreement between Mahi Pono and A&B?"

(Bold added for emphasis, July 1, 2019 Grant Nakama letter and BWS draft letter attached, Appendices 1 and 2)

As noted in the letter, the Board of Water Supply has been reaching out to Mahi Pono since March, 2019. The only communication received from Mahi Pono was the letter referred to above from Mr. Nakama to Director Jeff Pearson, which Mr. Pearson has stated was intended to be shared with the BWS.

As a result of growing concerns about communication and transparency, a Temporary Investigative Group (TIG) to explore options for ensuring access to water was approved on July 18, 2019, including the following TIG members:

- Board Member Norman Franco
- Board Chair Shay Chan Hodges
- Board Member Toni Eaton
- Board Member Joseph Aquino

Norman Franco was approved to be Chair of the TIG, Shay Chan Hodges was approved to be Vice Chair.

On July 23, 2019, Joseph Aquino resigned from the TIG due to work responsibilities.

Scope of investigation:

As approved on July 18, 2019, during its investigation, the temporary investigative group (TIG) may:

a. Conduct interviews and discussions with County of Maui personnel related to the delivery of water to Upcountry and Central Maui.
b. Conduct interviews and discussions with State of Hawaii personnel related to the delivery of water to Upcountry and Central Maui.
c. Conduct interviews and discussions with anyone whom the TIG determines has the knowledge, expertise and experience necessary to assist TIG members in increasing their understanding of the scope, operations and maintenance of the EMI Water Delivery System as well as the costs related to the purchase or condemnation of the EMI water delivery system and the cost of its maintenance, including, if necessary, the purchase or condemnation of relevant Mahi Pono lands.
d. Conduct interviews and discussions with anyone whom the TIG determines has the knowledge, expertise and experience necessary to assist TIG members in increasing their understanding of potential financial mechanisms and organizational structures necessary for the acquisition and governance of the EMI Water Delivery System, in order to promote system sustainability, ensure fiscal integrity, maximize the public welfare and maintain the public trust.
e. Consult with representatives and stakeholders with diverse expertise relating to the TIG investigation.
f. Review documents, contracts, studies and other written information relevant to the investigation.

Urgency of Investigation:

Mahi Pono's Intentions per the Draft EIS

On September 23, 2019, the East Maui Irrigation System (EMI) and Alexander & Baldwin (A&B) Draft Environmental Impact Statement (DEIS) for the *Proposed Lease (Water Lease) for the Nāhiku, Ke'anae, Honomanū, and Huelo License Areas*[1], situated at TMK Nos. (2) 1-2- 004:005, 007 (por.), 1-1-002:002, 1-1-001:044, 1-1-001:050, 2-9-014:001, 005, 011, 012, *017 in the Makawao and Hana Districts, on the island of Maui* was posted by the Hawaii Department of Health Office of Environmental Quality Control (OEQC) in its bulletin and on its website.

The 2,700 page Draft Environmental Impact Statement provides some information regarding Mahi Pono's costs and plans, and is available online (see footnote). It is referenced throughout this report as "DEIS" with accompanying page numbers.

This document answers some of the questions posed by the Board. For example:

> "Without the Water Lease, even if EMI could find it economically feasible to continue maintaining the EMI Aqueduct System to divert non-governmental water for diversified agriculture in Central Maui, **there may not be enough water to allocate much or any to the MDWS**. This lack of water would exacerbate the effects of drought when other surface water sources are unreliable for the KAP and the Nāhiku, this could eliminate their primary source of water. **Insufficient water delivered to the County through the EMI Aqueduct System could have significant effects on health and safety of those who currently rely on that water delivery**."

(Bold added for emphasis, DEIS, *Page xiii, Relationship Between Local Short-term Uses of Humanity's Environment and the Maintenance and Enhancement of Long-Term Productivity)*

> "The existing water delivery agreements with the MDWS are contingent upon the Water Lease being issued, therefore **if no Water Lease is issued, it is assumed that the delivery of water to the MDWS would terminate.** Under the Reduced Water Volume alternative, depending on the amount of water authorized under the Water Lease, the MDWS may receive no water from the Wailoa Ditch or some amount up to 7.1 mgd[2]. **The greater the reduction in the amount authorized under the Water Lease, proportionally less water will be available to the MDWS**."

(Bold added for emphasis, DEIS, *Page 3-5, 3.2 Alternative Analysis 3.2.1 Reduced Water Volume Alternative)*

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[1] http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2019-09-23-MA-DEIS-East-Maui-Water-Lease.pdf

[2] "mgd" = million gallons per day

The following table from the Draft EIS, Page 1945, T-1, shows how Mahi Pono intends to allocate water from the EMI Aqueduct under various scenarios, including "no lease," along with other water sources.

Table 1. Water Supply, Allocation, and Costs

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
1.a. SURFACE AND BRACKISH WATER SUPPLY							
Surface water from the EMI System							
East of Honopou Stream							
State lands	70%	n.e.	n.e.	n.e.	61.57	-	mgd
Private lands	30%	n.e.	n.e.	n.e.	26.39	26.39	mgd
Total, east of Honopou Stream		n.e.	n.e.	23.99	87.95	26.39	mgd
Honopou Stream to Maliko Gulch, private lands	D&O & A&A	n.e.	n.e.	4.37	4.37	4.37	mgd
Total surface water supply	A&B or D&O	**156.54**	**113.71**	**28.36**	**92.32**	**30.76**	**mgd**
Brackish groundwater	A&B, D&O, or PEP	**42.50**	**69.90**	-	**21.31**	**7.69**	**mgd**
Total water supply		**199.04**	**183.61**	**28.36**	**113.63**	**38.44**	**mgd**
Reduction in supply of surface water							
From typical sugar flow of 156.69 mgd		-	42.83	n.e.	64.22	125.79	mgd
From recent sugar flow of 113.71 mgd			-	n.e.	21.39	82.96	mgd
1.b. WATER ALLOCATION							
MDWS, surface water from EMI	D&O	**3.23**	**7.10**	**2.86**	**7.10**	-	**mgd**
Ag and related uses							
Sugarcane	D&O	143.19	132.45				mgd
Pineapple	HC&S	0.25					mgd
HC&S, industrial activities	D&O	7.98	6.25	1.00			mgd
Diversified Ag	A&B or Total less losses			4.00	82.34	29.72	mgd
Maintenance of reservoirs for fire protection	D&O			n.e.			mgd
Other	D&O		0.41				mgd
System losses (excludes water for pineapple)	22.7% losses or D&O	44.39	41.67	n.e.	24.18	8.73	mgd
Total Ag uses	Supply less MDWS	**195.81**	**180.78**	**n.e.**	**106.53**	**38.44**	**mgd**
System losses, Ag use and system losses		22.7%	23.05%	n.e.	22.7%	22.7%	
Ag Uses, after system losses (excluding pineapple)							
Irrigation Use	Residual	143.19	132.45	n.e.	82.34	29.72	mgd
Non-irrigation Use	Above	7.98	6.66	n.e.	-	-	mgd
Total Ag uses, after system losses		**151.17**	**139.11**	**ne.**	**82.34**	**29.72**	**mgd**
Split							
Irrigation use		94.72%	95.21%	n.e.	100.0%	100.0%	
Non-irrigation use		5.28%	4.79%	n.e.	0.0%	0.0%	
Irrigation use, after system losses							
Surface water	Residual	112.07	81.24	n.e.	65.88	23.77	mgd
Brackish groundwater	Groundwater – % loss x % irrigation use	31.12	51.21	n.e.	16.47	5.94	mgd
Total Ag use (excluding pineapple)	from above	143.19	132.45	4.00	82.34	29.72	mgd
Split							
Surface water		78.3%	61.3%	n.e.	80.0%	80.0%	
Brackish groundwater		21.7%	38.7%	n.e.	20.0%	20.0%	
Adjustment			(4.27)				mgd
Total water use		**199.04**	**183.61**	n.e.	**113.63**	**38.44**	**mgd**
1.c. WATER DELIVERY COSTS							
Surface water from EMI	MHI	3.5	3.9	16.2	6.8	12.9	¢/1,000 gal
Brackish groundwater	A&B/EMI	n.e.	52.0	52.0	52.0	52.0	¢/1,000 gal

The DEIS describes the ownership relationship of EMI, Mahi Pono, and A&B in this way:

"the EMI Aqueduct System is owned and operated by the EMI. EMI was previously a wholly owned subsidiary of A&B. In February, 2019, MP EMI, LLC, became a co-owner of EMI. In addition to becoming the co-owner of the EMI Aqueduct System, as noted above, Mahi Pono acquired former sugarcane and watershed lands, including the Central Maui agricultural fields, from A&B in December 2018. Agricultural operations are centralized under Mahi Pono, LLC." (*DEIS, Page 1-2, The EMI Aqueduct System.*)

BWS TIG Obligations to the Public

The Board of Water Supply approved convening a "Temporary Investigative Group" to examine Alternatives for Ensuring That The People of Maui County Have Authority Over the Delivery of Water, Which is A Public Trust" in July, 2019.

According to the Draft Environmental Impact Statement that was completed as a necessary step in Mahi Pono's application for a 30-year lease:

> ***"if no Water Lease is issued, it is assumed that the delivery of water to the [Maui Department of Water Supply] would terminate," and given that -- as stated in the DEIS -- "insufficient water delivered to the County through the EMI Aqueduct System could have significant effects on health and safety of those who currently rely on that water delivery.***

On October 11, 2019, contrary to recommendations by its staff, the Board of Land and Natural Resources unanimously approved a one-year permit allowing Alexander & Baldwin to continue to divert water from East Maui streams on state lands in 2020 – an increased draw by 10 million gallons per day. Of the 45 mgd[3] approved, 5 mgd would supply state projects and the County Department of Water Supply[4].

Because Mahi Pono has not committed to working with the County of Maui to ensure affordable access to water for Upcountry Maui residents if a revocable permit or lease is not approved and given that the public trust continues to be tethered to legal decisions made regarding EMI, A&B, and Mahi Pono, TIG members believe that it is a public health imperative for the County Council and Mayor to explore all facets for self-determination with regard to access to water as soon as possible.

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[3] mgd" = million gallons per day

[4] Maui News, State board OKs more water for Mahi Pono, October 12, 2019, https://www.mauinews.com/news/local-news/2019/10/state-board-oks-more-water-for-mahi-pono/

II. How the EMI System Impacts East Maui & Upcountry Maui:

Description of the EMI System Per the Draft Environmental Impact Statement:

The EMI Aqueduct System was constructed in phases, beginning in the 1870s and extending to its completion, as it currently stands, in 1923. It consists of approximately 388 separate intakes, 24 miles of ditches, and 50 miles of tunnels, as well as numerous small dams, intakes, pipes, 13 inverted siphons and flumes. **The EMI Aqueduct System collects surface stream water from approximately 50,000 acres of land (Collection Area), of which approximately 33,000 acres are owned by the State of Hawaii (which includes lands within Nāhiku, Ke'anae, Honomanū and Huelo) (License Area)** [5]**, and the remaining approximately 17,000 acres which are privately owned by EMI and Mahi Pono**.[6]

The EMI Aqueduct system starts at Makapipi Stream, in the Nahiku portion of the License Area, with the Koolau Ditch. The Koolau Ditch traverses westward across the Ke'anae License Area and into the Honomanū License Area where it crosses paths with the Spreckles Ditch. This is where streams had multiple diversions at different levels to supply water to the EMI Aqueduct System. Separating higher elevation ditches allows them to maintain the very slight slope necessary to convey flows by gravity over long distances to irrigate higher elevation fields. This avoids the cost of energy required to pump water up from ditches delivering water at lower elevations. As the system continues westward, the Koolau Ditch transitions at the boundary between the Honomanū and Huelo portions of the License Area to the Wailoa Ditch. Makai of the Koolau/Wailoa Ditch, are the Manuel Luis and the Center Ditch. At Waikamoi Stream, the New Hamakua Ditch begins, running parallel to the Wailoa Ditch, but at a lower elevation.[7]

The Spreckles Ditch terminates its mauka segment at Waikamoi Stream, and begins its makai segment at Ka'aiea Stream, until it converges with the Lowrie Ditch at Nili'ilihaele Stream. Makai of Lowrie Ditch is the Haiku Ditch. At Honopou Stream, the water collected within the License Area by the EMI Aqueduct System exits the License Area. Crossing this western boundary of the License Area in descending elevation are the Wailoa Ditch, the New Ditch, the Lowrie Ditch, and the Haiku Ditch. West of Honopou Stream, the EMI Aqueduct System traverses land that was largely owned by A&B and is now largely owned by Mahi Pono. Additional flows from streams located on this land are diverted by the EMI Aqueduct System until it crosses Maliko Gulch beyond which there are no stream diversions. Crossing Maliko Gulch in descending elevation are the Wailoa Ditch, Kauhikoa Ditch, Lowrie Ditch, and the Haiku Ditch. [8]

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[5] DEIS, Page 1-2

[6] DEIS, Page 2-4

[7] DEIS, Page 2-4

[8] DEIS, Page 2-4

Current Diversion by the EMI Delivery System As Stated in the Draft EIS:

Currently, the EMI Aqueduct System is only diverting approximately 20 mgd[9]. As a result, very little surface stream water is currently being diverted relative to what would be allowed should the Water Lease be awarded per the Proposed Action. However, the amount of water that may be diverted should the Water Lease be issued is substantially less than the amount that was diverted during normal sugar production. For example, in 2006 it is estimated that the EMI Aqueduct System delivered approximately 156.69 mgd at Maliko Gulch, whereas under the CWRM[10] D&O[11], it is estimated that the delivery at Maliko Gulch will be approximately 92.32 mgd (Akinaka, 2019). [12]

Examples of Community Concerns as Relayed at Focus Group Per DEIS:

Excerpts from the DEIS, 4.7.2 Social Characteristics (Page 4-135):

A focus group with residents and farmers from Huelo and Ha`ikū was convened on November 15, 2018 at Hale Akua in Huelo. Most of these participants live in the Huelo watershed area and many live and farm in areas adjacent to streams that are subject to the CWRM's and D&O.

Also, participants said that EMI personnel do not notify residents in the area when the gates open to allow downstream flow. The sudden onrush of stream water has endangered several people who happened to be in/near the stream at that time.

It was noted that, with the closing of the sugar plantation, the low level of maintenance has deteriorated even further given the reduction of EMI staffing to, reportedly, about eight people.

A second major concern with this group is fairness in how they, as a community, have been treated in two ways. First, they reported of the 25 streams in the petition before the CWRM, only three streams in the Huelo watershed were considered kalo streams and designated for full flow. While they agreed with such designation in other watersheds, they felt more streams in their area should have been considered.

Another fairness related concern raised by the group is that residents and farmers in Huelo and streams. Except for those whose properties have deeds allowing stream water access via pipes, most cannot access stream water. They cannot use the water for agriculture or domestic uses. Participants noted that they are off the electricity grid, and they are very interested in using stream flow for hydroelectricity. It was reported that there have been drought times in which residents had to truck in water even though they live next to streams. It was also said that those who were fortunate to have wells on their property share their water with neighbors during these times.

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9 mgd" = million gallons per day

10 CWRM=Hawaii State Commission on Water Resource Management

11 D&0=Decision and Order

12 DEIS, Page 2-8

An issue often raised in the November 2018 focus group sessions was the reportedly poor condition of the EMI Aqueduct System. Interviewees also discussed this topic from the perspective of reducing water losses. They said that the reduction of water losses would reduce the amount of water required for agricultural operations.

These interviewees wanted to know how Mahi Pono will ensure that continued use of the EMI Aqueduct System will be monitored and operated for efficient use of water, which is valued as a public trust, an integral environmental resource, and essential for healthy ecosystems.

Interviewees pointed out that, even though the CWRM D&O restored several streams in East Maui, the social and cultural effects of historical and significant stream diversions have yet to be rectified. This belief was reiterated several times in the November 2018 focus groups and expressed by those interviewed.

While there has been interaction between Mahi Pono and East Maui residents, there still needs to be acknowledgement of past wrongs and a "path to healing" that will allow residents and the new landowner to have a constructive relationship.

Those interviewed understood that Mahi Pono is not responsible for whatever occurred during A&B's tenure. Mahi Pono inherited a legacy that developed for over one hundred years. Nevertheless, to move forward as an integral part of the Maui community, Mahi Pono needs to "make pono" with East Maui so that everyone can move forward. One person said, "There needs to be apology, repentance and reparation."

Description of EMI System Per Dept of Water Supply Draft Water Use & Development Plan for Ko`olau and Central Sectors:

Excerpted from the Maui Island Water Use And Development Plan Draft, Part III Regional Plans, Ko`olau Aquifer Sector Area (ASEA)[13]:

Transport of Stream Water from East Maui

The EMI collects surface water from the [Ko`olau] sector and delivers it to Hawaiian Commercial & Sugar's (HC&S) Central Maui cane fields. Some of the water is also used to generate electrical power. **A relatively small amount of water is used for residential and agricultural use by the DWS for its Upcountry Maui Water Systems, which include the Upper Kula and Lower Kula Water Systems.** The EMI ditch system, which began construction in 1876, is the nation's largest privately built and operated water system; it consists of approximately seventy-five (75) miles of ditches, tunnels, siphons, flumes, and reservoirs. The Ko`olau Department of Agriculture's AWUDP (2004) listed the average delivery at 165 mgd with a delivery capacity of 435 mgd[14].

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13 https://waterresources.mauicounty.gov/DocumentCenter/View/223/Draft-Plan-Section-III-Chapter-17-PDF?bidId=

14 Ko`olau WUDP, Page 22

Wailoa Ditch	195 mgd
New Hamakua Ditch	100 mgd
Lowrie Ditch	70 mgd
Ha`ikū Ditch	70 mgd
Total Capacity	435 mgd

In drought conditions, both the Lower and Upper Kula systems require supplemental surface water from Kamole Weir and groundwater pumped up to 4,000 feet. Under current agreement with EMI, MDWS receives 12 mgd from the Wailoa Ditch with an option for an additional 4 mgd. During periods of low flow, MDWS will receive a minimum allotment of 8.2 mgd with HC&S also receiving 8.2 mgd, or prorated shares if less water is available. Proposed amended IIFS could restrict Wailoa ditch off stream uses so that less than 7 mgd is available a few days a year. When more than 7 mgd is available under non-drought conditions, the proposed restored amount would come from EMI's share of the 16.4 mgd. The 2017 Proposal and the current allocation between MDWS and EMI would allow sufficient ditch use for MDWS to meet current demand on the Upcountry system. Under normal flow, exceeding 16 mgd at Wailoa Ditch, and under an allocation of up to 12 mgd for MDWS, projected future demand of 16.4 mgd could also be met. Treatment of more than 6 mgd at the Kamole Weir will require expansion of the water treatment facility and storage construction. Future demand on the Upcountry system as a whole is addressed in the Central aquifer sector report.[15]

Water Use Maui Department of Water Supply Upcountry System

MDWS relies on three surface water sources, one of which is delivered by EMI through the Wailoa Ditch, and the other two through two MDWS higher elevation aqueducts maintained by EMI that transport water to Olinda and Kula, under a contractual agreement originated under the 1973 East Maui Water Agreement and subsequent agreements. MDWS and EMI diverts water from Ko`olau ASEA, conveyed to treatment plant facilities located in Ko'olau ASEA (Piiholo Water Treatment Facility) and the Central ASEA (Olinda and Kamole Weir Water Treatment Facilities) [16].

Water Treatment Facility	Elevation	Conveyance System	Production Capacity	Average Production
Olinda	4,200 feet	Upper Kula Flume	2.0 mgd	1.6 mgd
Piiholo	2,900 feet	Lower Kula Flume	5.0 mgd	2.5 mgd
Kamole-Weir	1,120 feet	Wailoa Ditch	6.0 mgd	3.6 mgd

15 Ko`olau WUDP, Page 123

16 Ko`olau WUDP, Page 119

Excerpted from Department of Water Supply Fiscal Year 2018 Annual Report:[17]

- **Piiholo Water Treatment Plant**: Water produced during FY18: 1,197,415,000 gallons.
- Daily average: **3.28 MGD**
- **Kamole Water Treatment Plant:** Water produced during FY18: 449,530,000 gallons. Daily average: **1.50 MGD**
- **Olinda Water Treatment Plant**: Water produced during FY18: 484,370,000 gallons. Daily average: **1.33 million gallons per day (MGD).**

Excerpted from the Maui Island Water Use And Development Plan Draft, Part III Regional Plans, Central Aquifer Sector Area (ASEA):[18]

The Olinda facility diverts water at the upper Waikamoi Flume from the Waikamoi, Puohokamoa, and Haipuena Streams. Water is stored in two 15 million gallon reservoirs and one 100-million gallon reservoir. The Piiholo facility diverts water from the Waikamoi, Puohokamoa, Haipuena Streams and Honomanu streams into a 50-million gallon reservoir. The Kamole-Weir facility relies on EMI diversions from eastern most Makapipi stream to the western most Honopou stream.

The Upcountry system spans Ko`olau and Central aquifer sectors, …and serves about 35,200 people. MDWS also serves non potable water to 31 farm lots at the Kula Agricultural Park (KAP). Current water use at the KAP is about 0.4 mgd. About 80 – 90 percent of the delivered water comes from surface water sources and the remaining portion from basal aquifer wells. Haiku Well and Kaupakalua Well are located in the Ko`olau ASEA, Hamakuapoko Well 1 & 2 and Po`okela Well are located in the Central ASEA. The combined surface and groundwater source production capacity is 17.9 mgd, 13 mgd from surface water and 4.9 mgd from groundwater. Accounting for system and operational limitations, and use restrictions from Hamakuapoko wells, the reliable capacity is 9.1 mgd. Current water use averages 7.9 mgd within a range of 6 – 10 mgd.

The DOH[19] divides the MDWS Upcountry System into three separate systems: Upper Kula; Lower Kula and the Makawao systems, although all three are interconnected.

<u>MDWS Makawao/Upcountry Water System (PWS 213)</u>
The MDWS Makawao/Upcountry System, also referred to as Makawao District by the DOH, generally serves the area extending from Ha`iku, Makawao, and Pukalani to Hali`imaile/Pa`ia. The system has 6,680 meters and serves about 28,702 people. The sources of water are primarily from surface water imported from East Maui (80%) and well water (20%) from the Haiku and Makawao aquifers. Surface water from the Wailoa Ditch, generated in the Ko`olau ASEA, is

17 https://www.mauicounty.gov/DocumentCenter/View/115629/DWS-FY18-Annual-Report

18 https://waterresources.mauicounty.gov/DocumentCenter/View/221/Draft-Plan-Section-III-Chapter-15-PDF?bidId=, Page 45, 46

19 DOH=Department of Health

treated at the Kamole Water Treatment Facility (WTF). The facility uses micro-filtration technology and is the largest surface water treatment facility on Maui. It has four booster pumps to move water up to the 2,800 foot elevation, where it can be pumped to the highest service areas at 4,500 feet. Historically, the Kamole WTF is the primary source of water for nearly all of Upcountry during times of drought. There is no raw water storage at the WTF.

MDWS Lower Kula/Upcountry Water System [PWS 247]

The MDWS Lower Kula/Upcountry System, also referred to as Lower Kula District by the DOH, generally serves the area extending from Kula Kai to Omaopio to mid and lower Kimo Drive areas. The system has 1,064 meters and serves about 3,192 people. The sources of water are primarily from surface water imported from East Maui treated at the Pi`iholo WTF. The facility uses direct filtration technology. Granular activated carbon and air stripping treatments were added in 2015 to reduce disinfection-byproducts in the water supply. The system can be supplemented with groundwater from Makawao aquifer.

MDWS Upper Kula/Upcountry Water System [PWS 215]

The MDWS Upper Kula/Upcountry System, also referred to as Upper Kula District by the DOH, generally serves the area extending from Upper Kula to Kula Highlands to Kama`ole to Upper Olinda-Piiholo to Kula Glen to Ulupalakua-Kanaio. The system has 2,346 meters and serves about 7,038 people. The source of water is primarily from surface water from Waikamoi treated at the Olinda WTF. The facility uses micro-filtration technology. Disinfection is provided by anhydrous ammonia, blended with chlorine to form chloramines. Water is stored in 30 MG[20] Waikamoi Reservoirs and the 100 MG Kahakapao Reservoirs.

Future Water Use MDWS Upcountry System

Based on growth rates and the socio-economic forecast referenced in the Maui Island Plan, the population Upcountry is projected to grow by about 8,424 to a total of about 43,675 people by 2030. Projected water demand for the base, low and high growth scenarios are shown below.

> Water losses due to leaks, seepage, evaporation and other inefficiencies in the treatment, conveyance, distribution and storage of water range widely depending on storage and source transmission system age, length, type and many other factors. To account for water losses and determine source needs for Upcountry, water produced, rather than water billed is used as basis to determine source needs. For the Upcountry system, water losses average 20%.[21]

[20] MG=million gallons

[21] Ko`olau WUDP, Page 121

	2014	2035 Base	2035 High	2035 Low
Consumption	6.26	7.02	7.57	6.42
Production	7.61	8.53	9.20	7.80

Table 16-56 Projected Consumption and Production MDWS Upcountry District System, Base, High and Low Scenarios (mgd) *Excludes Kula Ag Park

Upcountry Meter List[22]

In 1993, the MDWS determined that the existing Upcountry water system was found to have insufficient water supply developed for fire protection, domestic and irrigation purposes to add new or additional water services without detriment to those already served.

MDWS created a list of Upcountry properties, by date of application, who requested new and additional water service. In 2002, an administrative rule "Water Meter Issuance Rule for the Upcountry Water System", Title 16, Chapter 106 was created. The rule outlined the procedure for processing applications for water service. New applicants were continually added to the list until provisions were codified in 2013 so that no new applications were accepted after the 2013 provisions became effective. A 2015 ordinance provided certain fire protection exemptions. Still, about half of meter offers are declined presumably due to the expense of required system improvements. The Priority List is estimated to represent an additional 3.7 – 7.3 mgd demand on the Upcountry system as a whole. There are about 1,800 requests for 4,300 meters (excluding those that did not accept a reservation offered, accepted a reservation, or where a meter was installed) for 1,900 dwelling units and a nominal number of commercial units. About two-thirds of the remaining requests are located outside designated growth areas. There remains uncertainty over the number and timing of new meters as well as occupancy.

Sources for requests in Haiku are primarily served by basal wells with sufficient backup capacity to reliably add new services. Sources for requests on the Lower and Upper Kula subsystems are East Maui streams in the Waikamoi area that are subject to Instream Flow Standards and vulnerable to drought. Groundwater from Po`okela Well in Makawao aquifer can supplement the Lower and Upper Kula subsystems. There remains uncertainty over the number and timing of new meters as well as occupancy.

Providing reliable capacity to satisfy the Priority List could be accomplished in alternative ways:

1. Develop basal wells to provide reliable capacity and assume significantly higher cost of service due to energy required to pump up to 4,000 foot elevation
2. Separate the Priority List by service area and source, so that subsystems with adequate and reliable capacity are prioritized over subsystems reliant on surface water.
3. Public-private partnerships to develop source and infrastructure that benefit end users of the same subsystem.

[22] Central WUPD, Page 106-107

III. Strategies for Creating and Conserving Fresh Water Capacity

Hawaii Fresh Water Blueprint for Action:

Excerpted from website:[23]

Hawai'i has been blessed with consistent rainfall, advantageous geology, and high- quality drinking water stores for centuries. **Recent findings, however, have raised concern about long-term fresh water security for our Islands. University of Hawai'i and other scientists have documented troubling trends including reduced rainfall, higher evaporation rates, and declining stream flows in recent decades.** These findings, coupled with the demand of an ever-increasing population, suggest that Hawai'i is entering an era of fresh water uncertainty.

The Hawai'i Fresh Water Initiative (Initiative) was launched in 2013 to bring multiple, diverse parties together to develop a forward- thinking and consensus-based strategy to increase water security for the Hawaiian Islands. Organized by the independent, nonprofit Hawai'i Community Foundation (HCF), the Initiative relied on a blue ribbon advisory panel of individuals (Hawai'I Fresh Water Council or Council) with deep knowledge of water and a collaborative spirit to articulate a vision for a more secure and sustainable water future based on shared values, and shared sacrifice. This Blueprint is the result of their work, and provides Hawai'i policy and decision-makers with a set of solutions that have broad, multi-sector support in the fresh water community that should be adopted over the next three years to put Hawai'i on a path toward water security. The Blueprint also builds on the good work, findings, and recommendations over the years by preceding stewards of Hawai'i's most important resource.

> ***Goal: The Fresh Water Council distilled nearly two years of research and analysis into a single goal: creating 100 million gallons per day (mgd) in additional reliable fresh water capacity for island by 2030.***

To achieve the ambitious goal of 100 mgd in additional fresh water capacity, the group outlined three aggressive water strategy areas and individual targets that the public and private sectors must work together to achieve by 2030:

1. ***Conservation*:** Improve the efficiency of our population's total daily fresh groundwater water use rate by 8% from the current 330 gallons per day/person to 305 gallons per day/person. By 2030, this goal will provide 40 mgd in increased water availability.
2. ***Recharge*:** Increase Hawai'i's ability to capture rainwater in key aquifer areas by improving storm water capture and nearly doubling the size of our actively protected watershed areas. By 2030, this goal will provide 30 mgd in increased water availability.

[23] https://www.hawaiicommunityfoundation.org/file/cat/Fresh_Water_Blueprint_FINAL_062215_small.pdf, Page 3

3. ***Reuse:*** More than double the amount of wastewater currently being reused in the Islands to 50 mgd. By 2030, this goal will provide an additional 30 mgd in increased water availability.

Initiative Principles[24]

***Water is a complex issue that demands a comprehensive set of solutions.**
*Solutions will come from many different sectors, and a good solution in one geographic area may not be appropriate for another area.
***Solutions should focus on financial sustainability and cost effectiveness.**
***Better information and access to accurate data facilitates good decision-making.**
***Entering an era of climate unpredictability argues for more aggressive gathering and monitoring of water data than currently occurs.**
*"Applied" and/or "targeted" education efforts are more effective than general outreach and awareness campaigns.
***Water is as important to our economy and culture as it is to our ecology.**
***The current price of water in Hawai'i does not reflect its "true cost."**
***Any successful supply solution must provide for Hawai'i's broad spectrum of water uses.**
*Hawai'i is better-positioned than many other geopolitical bodies to meaningfully address long-term fresh water sustainability.
***Native Hawaiian cultural traditions place a high value on water and can provide guidance on how best to steward water.**
*Public Trust doctrine and our state water code provide an adaptable framework.
***There is an urgency to the fresh water supply issue that is not widely evident to the public.**
***Costs to address fresh water supply will rise with each year of delay.**
***The nexus between water and energy is clear and compelling.**

Adapting To Climate Change, State of Hawaii, Office of Planning:

Hawaii's Climate Change Adaptation Policy[25]

Act 234, Session Laws of Hawaii 2007, established the state's policy framework and requirements to address Hawaii's GHG emissions. In Act 234, the legislature recognized the following: "… climate change poses a serious threat to the economic well-being, public health, natural resources, and the environment of Hawaii. **The potential adverse effects of global warming include a rise in sea levels resulting in** the displacement of businesses and residences and **the inundation of Hawaii's freshwater aquifers**, damage to marine ecosystems."

24 Fresh Water Blueprint, Page 13

25 https://planning.hawaii.gov/czm/initiatives/adapting-to-climate-change-2/

Water Use Development Plan Strategies for Addressing Impacts of the Climate Crisis:

Excerpted from the Central ASEA Draft Water Use and Development Plan[26]:

Issue and Background: Data and research suggest that Hawai'i should be prepared for a future with a warmer climate, diminishing rainfall, declining stream base flows, decreasing groundwater recharge and storage, and increased coastal groundwater salinity, among other impacts associated with drought. Reliance on surface water will become more uncertain in a future of longer droughts and varying rainfall. No streamflow projections are available for the coming century but projections include a decline in base flow and low flows, with stream flows becoming more variable and unstable (flashy), especially in wet years. Groundwater recharge decreases in drought but local impact from climate change has not been projected to date.

The Central ASEA is especially vulnerable due to water resources used:

- Upcountry region and agriculture dependent on surface water as primary resource.
- Irrigation and other non-potable wells in Paia and Kamaole aquifer coastal areas are subject to sea-level rise

In consistency with the *Climate Change Adaptation Priority Guidelines*, water purveyors should increase resilience and reduce vulnerability to risks related to climate change. Chapter 12 Island Wide Strategies in this plan include the following strategies that can mitigate impacts from climate change:

1. Continue Maui County financial support for watershed management partnerships' fencing and weed eradication efforts (Chapter 12.3, Strategy#1). The Central ASEA is heavily dependent on forested watersheds in the Wailuku and Ko`olau hydrologic units to provide fresh water supplies.
2. Demand side conservation measures, such as water conserving design and landscaping in new development, incentives for efficient irrigation systems, landscape ordinance and promoting xeriscaping in dry areas will increase tolerance for prolonged droughts. (Chapter 12.3 Strategies # 13, 14, 15, 17)
3. Promote alternative resource incentives, such as greywater systems and rainwater catchment to supplement conventional resources. Incentives for green infrastructure and use of alternative water sources are needed to ensure such upfront investments in new development. (Chapter 12.3 Strategies# 20 and 21)
4. Diversify supply for agricultural use to increase reliability. Under extended droughts and low stream flows, diversified agriculture on HC&S lands will compete with priority public trust uses for surface water. Planned extension of R-2 recycled water from the Kahului WWTF to HC&S fields can supplement groundwater from the Central aquifer sector. (Chapter 12.3 Strategy #51).

[26] Central WUDP, Page 124

5. Expand requirements for new development to connect to recycled water infrastructure, promote closer collaboration between MDWS and MDEM to utilize Drinking Water State Revolving Funds to maximize recycled water use. (Chapter 12.3 Strategies # 61 and 62)
6. Explore and promote opportunities for large volume stormwater runoff for agricultural irrigation. (Chapter 12.3 Strategy # 66)

Excerpted from the Ko`olau ASEA Draft Water Use and Development Plan:

The concerns regarding climate change in the Ko`olau aquifer are more general. References include:

- Improving the understanding of the concepts of "precautionary planning" to reduce and adapt to the effects of drought and climate change upon water resource availability and quality is important. [27]
- Understanding potential impact of climate change adds to uncertainty in long-term groundwater availability. The primary responsibility to determine potential impacts on water resource availability lies with the State CWRM who in turn relies on studies and predictions by the scientific community and other agencies. Water purveyors need guidance how to mitigate and adjust to potential changes in groundwater availability. [28]
- Strategy #3: Support collaborative hydrogeological studies to inform impact from climate change and future well development on groundwater health for Haiku and Honopou aquifers. [29]

Upcountry Conservation:

The Upcountry region has experienced voluntary and mandatory conservation measures for decades, primarily in dry season when the MDWS Upcountry System reservoir levels are low. Reliance on surface water and constraints in developing additional groundwater causes the system to be vulnerable to droughts.

Demand Side Conservation Measures

Demand side conservation strategies recommended in Section 12.2 that would target outdoor uses of potable water include comprehensive water conservation ordinance to include xeriscaping regulations, landscaping and water efficient irrigation system incentives.
In evaluating cost-effectiveness, MDWS compared the costs to develop and deliver new sources of water to meet future demand with the savings attributed to conservation.

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[27] Ko`olau WUDP, Page 4

[28] Ko`olau WUDP, Page 104

[29] Ko`olau WUDP, Page 105

A preliminary analysis of the proposed conservation measure portfolio outlined in Section 12.2 shows that doubling current investments (MDWS annual FY14 – FY17 conservation budget, excluding leak detection is $170,000) would result in net capital and operational savings. The potential for a net savings is expected for both the MDWS Central System and the Upcountry System due to the need for new source development.

Recommended demand side conservation measures at all levels and type of use for public water systems are outlined in table 13-1 (strategies # 10 – 25). There is an opportunity to design and implement conservation measures in new housing development throughout planned growth areas. The recommended conservation Strategies #17, 22 and 25 outlined in Table 13-1 are implemented in the design and build phase and are especially appropriate in planned growth areas:

- Revise county code to require high efficiency fixtures in all new construction. Develop a comprehensive water conservation ordinance to include xeriscaping regulations.
- Revise County Code: Water conserving design and landscaping in new development (xeriscaping targets dry areas).
- Revise County Code and/or incentivize water- efficient building design that integrates alternative sources (grey water, catchment).

Supply Side Conservation Measures

The sustainable and efficient use of water resources, as well as the capacity and integrity of water systems, can be improved by accounting for water as it moves through the system and taking actions to ensure that water loss is prevented and reduced to the extent feasible.

A water audit provides a data driven analysis of water flowing through a water system from source to customer point-of-service and is the critical first step in determining water supply efficiency and responsible actions to manage and reduce water loss consistent with available source, operational and financial resources. Public water systems serving a population of 1,000 or more and those within water management areas regardless of population served are required to submit annual water audits beginning July 1, 2020. Except for the MDWS systems, there are no large public water systems in the aquifer sector subject to the requirement. The fiscal year 2017 audit for the Upcountry system revealed that apparent water losses are often due to data gaps between the amount of water withdrawn at the source, treated, stored and billed. The results will guide MDWS data collection, maintenance and repair programs.

Input from the WUDP public process and issues identified in the community plans relate to water shortages and conservation[30]:

[30] Central WUDP, Page 102

- Reliance on surface water Upcountry makes the system vulnerable to drought conditions
- Voluntary and mandatory water use restrictions imposed on residential and agricultural users during droughts often negatively impact the productivity of farmers
- Promote conservation of potable water through use of treated wastewater effluent for irrigation.
- Reuse treated effluent from the County's wastewater treatment system for irrigation and other suitable purposes in a manner that is environmentally sound.
- Provide incentives for water and energy conservation practices.
- Promote energy conservation and renewable energy.
- Incorporate drought-tolerant plant species and xeriscaping in future landscape planting.

Qualitative criteria to evaluate and measure resource strategies against this planning objective include:

- Per capita water use decreased
- Potable and irrigation systems water loss decreased
- Community water education increased
- Incentives for water conservation increased
- Renewable energy use increased

Other Ways of Increasing Availability of Potable and Non-Potable Water:

Reservoirs:	
Central WUDP, Page 123: In summary, reservoir and treatment plant expansion would have multiple benefits: 1. Improve reliable capacity 2. Economical water supply that minimizes expensive groundwater pumping costs 3. Defer source development in Haiku aquifer in light of uncertainties related to the East Maui Consent Decree 4. Recharge regional groundwater in wet season when maximizing use of stormflow from rainfall If financing can be secured, raw water storage construction presents an economic strategy compared to basal well development. If a string of basal wells and extensive transmission would be added to the MDWS Upcountry System during the same time frame as a reservoir, the economic benefit would be significantly diminished. Both resource strategies have long implementation time frames and can be adjusted over time. Should development of basal source in the Makawao aquifer produce adequate yield and quality, additional wells in Haiku aquifer ***OR*** expanded surface	Central WUDP, Page 124: Strategy #8**:** Pursue hydrologic studies needed to explore the Haiku aquifer **and** an updated ditch flow analysis to optimize raw water storage and treatment plant capacity at Kamole Weir in order to expedite the most feasible new source. Raw water storage and Kamole Water Treatment Facility expansion are contingent on a long term agreement with A&B Properties allocating adequate surface water for the MDWS Upcountry System. Lead agency is MDWS. This strategy supports multiple planning objectives, including to seek expanded municipal withdrawal from the lowest cost source to serve the Upcountry region and to increase water storage capacity with a reserve for drought periods. Central WUDP, Page 104, Water Loss Mitigation*:* Explore funding and conduct a cost benefit analysis of improvements to the EMI non potable conveyance system to mitigate losses and preserve existing reservoirs at risk of decommissioning. County of Maui and A&B Properties/EMI Company in partnership would

water storage and treatment will meet projected demand. Uncertainties in future stream flow must be weighed against increased reliability and cost of basal well development. Maximizing affordable surface water use in wet season must be weighed against "over building" expensive wells and infrastructure that is not used to capacity. On Oahu, the BWS also operates brackish and recycled water nonpotable water systems for irrigation and industrial use in ʻEwa, Mākaha, and Hālawa Airport. The BWS owns and maintains five dams or open reservoirs. Four reservoirs in Nuʻuanu are now used solely for flood control, and the fifth, Mauna ʻOlu reservoir, stores nonpotable water used for irrigation. The four Nuʻuanu reservoirs may be used for stormwater capture, infiltration, or hydropower in the future.[31]	lead initiatives. Priority components and associated costs TBD. Page 3-4, DEIS: EMI Aqueduct System has eight reservoirs, mostly along the lower ditch systems, and the Central Maui field irrigation system has 48 major reservoirs The combined storage capacity of these existing reservoirs is approximately 1,344 mg (Akinaka, 2019). Most of these reservoirs, however, have not been used since the closure of sugar in 2016 and others have not been used because they do not meet dam safety requirements. As a result, many will require extensive upgrades to put them back into service. These upgrades could cost between $50 – 100 million (Akinaka, 2019). Obtaining permits to upgrade and repair these reservoirs will also be challenging due to current dam safety requirements. Assuming that the existing reservoirs can be restored to their full capacity of 1,344 mg, and the amount of flow available for irrigation under the Proposed Action is approximately 92.32 mgd, then the existing reservoirs could provide about 16 days of storage
Recycled Water:	
The State of Hawai`i defines R-1 water as the highest-quality recycled water; it has undergone filtration and disinfection to make it safe for use on lawns, golf courses, parks, and other areas used by people. R-2 recycled water can only be used under restricted circumstances where human contact is minimized.	Central WUDP, Page 57: Wastewater generated within the Central ASEA is treated at the Kahului Wastewater Reclamation Facility (WWRF), east of Kahului Harbor, and the Kīhei WWRF.
Rainwater Catchment:	
Ko`olau WUDP, Page 73: Rainwater catchment is the collection of rainwater from a roof or other surface before it reaches the ground. Rainwater catchment systems are not regulated by the Department of Health, making estimates of their use difficult. No inventory of installed catchment systems throughout the island is available. Central WUDP, Page 129: Rain barrel incentive programs are included in recommended demand side conservation strategies and the MDWS conservation program. Catchment systems for agricultural uses have historically played an important role Upcountry. Support for increased adaptation to natural ambient rainfall and climate adapted crops is consistent with the objective to	Ko`olau WUDP, East Maui, Page 28: On average, USGS data indicates rainfall ranges from 101-454 inches per year, making the Ko`olau ASEA Maui Island's rainiest ASEAs and one of the wettest places in Hawai`i. The heaviest rainfall is in the Ke`anae ASYA, where it rains as much as 454 inches per year. The cooler, dryer upper elevations may have as little as 101 inches of rain per year. Rainwater catchment is not as reliable a conventional water resource because it is extremely sensitive to the climate; however, rainwater catchment is a viable option in this region. Central WUPD, Upcountry and Central, Page 56: Rainfall averages 15 inches along the southern coastline on Haleakala, and it increases to 70 inches as one moves eastward and into higher elevations. Rainfall catchment systems occur in the eastern part of the hydrologic unit,

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use appropriate water quality for appropriate uses.	from Makawao and Olinda and also scattered throughout Kula. There is no official inventory of catchment systems but it is an important supplemental resource for non-potable purposes. Catchments systems using potable treatment technologies have been installed Upcountry due to water meter limitations imposed by the Upcountry Meter Priority List.
Stormwater Reuse:	
The Fresh Water Council believes that a critical element of protecting long-term water security in the Hawaiian Islands is to aggressively increase our ability to capture rainfall and surface storm water. Our underground fresh water supply can be restored with: 1) reduced pumping from the aquifers; 2) increased rainfall; and/or, 3) increased effective recharge. [32] Central WUPD, Page 129: Stormwater capture and use can provide multiple mitigating effects on climate change, including off-setting potable supply for irrigation needs; recharging low level and more brackish portions of the region's aquifers; and mitigating sediment runoff reaching the nearshore marine environment and reefs. Central WUDP, Page 58: Capture and reuse of stormwater runoff is an under-utilized water resource that provides an opportunity to reduce reliance on groundwater and surface water for landscape irrigation, especially when incorporated into the design of development projects in order to minimize infrastructure costs.	There is no reported stormwater reuse within the Ko`olau ASEA, although a limited number of development projects may have stormwater controls incorporated into project design to reduce runoff and its effects. Stormwater reuse at the parcel scale may also provide an opportunity to offset landscape and other irrigation demand of projects or households. Central WUPD, Page 58: There is no reported stormwater reuse in the Central ASEA, although some development projects may have stormwater controls incorporated into project design to reduce runoff and its effects. The *Hawai'i Stormwater Reclamation Appraisal Report, 2005, and Study Element 3: An Appraisal of Stormwater Reclamation and Reuse Opportunities in Hawai'i*, September 2008, screened and identified four projects on Maui within the final ranking, which might provide opportunities to augment agricultural irrigation water that is diverted currently from Maui streams, in addition to providing other benefits.
Desalinization:	
Desalination of ocean or brackish water was studied as an option in the 2013 MDWS study, Maui Island Water Source Development Options for the Central MDWS system, but an assessment has not been conducted for the Ko`olau ASEA, and there are presently no desalination projects within. There are no desalination projects in the Central ASEA.	One major cost to operate a desalination plant is the high energy demand of the process, and the disposal of the brine liquid byproduct creates logistical and environmental challenges that also increase cost. As desalination technology advances and energy costs decrease, brackish and ocean water desalination should continue to be evaluated for their potential as effective future water supply alternatives.

32 Fresh Water Council, Page 13

Excerpted from the Maui Island Water Use and Development Plan Draft, Part III Regional Plans, Ko`olau Aquifer Sector Area (ASEA)[33]:

Conventional water sources include groundwater (wells and tunnels) and surface water (stream diversions). Region specific planning objectives related to ground and surface water use and development identified and confirmed in the WUDP update public process include:

- Improving the understanding of the concepts of "precautionary planning" to reduce and adapt to the effects of drought and climate change upon water resource availability and quality

- Adapting future populations to local water resource conditions, integrating conservation and the use of alternative resources

- Water needs of DHHL in the Ko`olau should be considered in general and in accordance with the 2017 State Water Projects Plan

Planning objectives related to groundwater and surface water source use and development identified to apply island wide include:

- Manage water equitably
- Provide for Department of Hawaiian Homelands needs
- Provide for agricultural needs
- Protect cultural resources
- Provide adequate volume of water supply
- Maximize reliability of water service
- Minimize cost of water supply
- Increase water storage capacity with a reserve for drought periods.
- Ensure that adequate water capacity is available for domestic needs of the region.
- Ensure that the development of new water sources does not adversely affect in-stream flows.
- Improve the existing potable water distribution system and develop new potable water sources prior to further expansion of the State Urban District boundary or major subdivision of land in the State Agricultural or Rural Districts.
- Ensure adequate supply of groundwater to residents of the region before water is transported to other regions of the island.

33 Ko`olau WUPD, Page 103

East Maui Watershed Management:

Excerpted Ko`olau Draft Water Use and Development Plan[34]:

East Maui watersheds are predominately vegetated by native Hawaiian rainforest. The plants there evolved over millions of years into the most efficient water collection system for our island's geography. It works in layers – tall ʻoȟiʻa and koa trees provide a canopy for shorter trees, while shrubs and ferns fill in underneath, and a thick layer of mosses and leaf litter complete the floor. These layers act like a giant sponge, slowing down heavy raindrops and soaking up water for slow release into underground aquifers. Even during droughts, our watersheds can produce water, pulling water out of the clouds by collecting fog drip. This uniquely evolved, specialized forest is the key to Maui's healthy water supply harbor endemic and rare native plant and bird species. The main threats to the native forest and ecosystems are habitat loss and alterations due to feral ungulates (pigs, deer, goats) and invasive plants. These are detrimental both to biodiversity and water supply.

Active management to ensure protection and preservation of these important watershed lands occur on federal, state and community levels.

Excerpted from the Central Draft Water Use and Development Plan[35]:

Issue and Background: Most land within this hydrologic unit are water resource "import" areas, rather than "export" areas in the sense that population and agricultural operations rely on water resources from adjacent watersheds. Watershed management in both types of watersheds are important. The Department of Land and Natural Resources has identified "Priority Watershed Areas" which are areas of highest rainfall and resupply, based on climatic conditions that provide high recharge and fog capture. Currently protective measures are focused in these priority areas above the 3,000 foot elevation with direct benefit to makai lands and the nearshore environment. The East Maui Watershed Partnership (EMWP) manages most of the forested upper critical watersheds of Ko`olau aquifer sector. Ongoing efforts include ungulate control through fence construction, retrofitting and regular trap checks weed management, monitoring, and human activities management through outreach and education. On the dry side of Haleakala, the Leeward Haleakala Watershed Restoration Partnership (LHWRP) works towards restoring the disturbed landscape where once dryland forests captured rain and fog that recharged the freshwater supply. The Maui Invasive Species Committee (MISC) targets pest animals and plant species to prevent their influx and establishment in the mauka critical watersheds. Their efforts occur throughout the Central ASEA in rural and agricultural regions as needed.

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34 Ko`olau WUDP, Page 99

35 Central, WUDP, Page 100, 101

The Makawao-Pukalani-Kula Community Plan states as objectives:

- ***Recognize the importance of the forested watershed areas and that their health and well- being are vital to all the residents of the Upcountry area.***

- ***Explore a comprehensive reforestation program to increase and catch more rainwater for the Upcountry area.***

The objectives support the ongoing efforts by EMWP, LHWRP and MISC. State and county agencies as well as private purveyors can provide financial support and participation in watershed protection partnerships and reforestation programs. Strategies for watershed management in Ko`olau is addressed in the Ko`olau ASEA Report, Chapter 16.8.1. Management efforts on leeward Haleakala is addressed in the Kahikinui ASEA Report, Chapter 18.8.1

Maui Forest Protection and Cost Savings:

Recent studies underway are showing that investment in the restoration and maintenance of the East Maui watershed will provide financial benefits far greater than the costs being expended. The benefits will come in the form of increase water supply, more dependable water supply, and perhaps even fewer costs in the maintenance of the ditch system itself.

For example: Researchers from the University of Hawaii Economic Research Organization (UHERO) and Water Resources Center partnered with the Nature Conservancy of Hawaii to evaluate how native forest conservation contributes to local water supplies in a water stressed area in East Maui. They found that by preventing the degradation of native forest, conservation efforts could save the local water utility up to 137.6 million dollars over 100 years depending on a range of assumptions. This finding demonstrates that it makes practical sense for water utilities to join collective action efforts to finance watershed conservation, which in turn provides a suite of benefits in addition to water.[36]

The Department of Water Supply Division of Water Resources and Planning provided $20,000 to help fund the study through a grant to the Nature Conservancy. The UHERO study limited data to watershed conversion from one native species (ohia) to one invasive species (strawberry guava). DWS is funding a USGS study that addresses complex relationship between hydrologic impact from actual watershed protection/restoration of specific native species and habitats on Maui. This completion date of the study is not yet determined.

[36] https://uhero.hawaii.edu/news/view/356

Excerpts from a paper titled "Contributions of native forest protection to local water supplies in E. Maui Study"[37]:

While the direct and indirect benefits of forest conservation efforts are multiple and diverse, we focus on quantifying one key hydrologic service (groundwater recharge) and associated benefit (present value benefit[1] to the water utility), as an important step towards understanding the synergies between land and water management.

> We focus on groundwater recharge benefits, as groundwater is an important source of drinking water and was identified by the Maui County Department of Water Supply (DWS) as clearly linked to future costs of meeting water consumption needs into the future. We worked with DWS to estimate future water consumption needs and to calculate the projected benefits (expressed in present value terms) of protecting groundwater recharge via watershed conservation. We also collaborated with the land manager, The Nature Conservancy, to assess management costs of protection.

2.5. Costs of watershed management

In order to compare the benefits of forest conservation in terms of groundwater recharge and cost savings to the water utility to the costs of maintaining native forest through watershed protection and management, we also estimated the management costs covered by the land manager. Watershed management efforts in Waikamoi began over three decades ago. Historical expenditures over the period 1995–2012 were aggregated from The Nature Conservancy's Long-Range Management Plans (The Nature Conservancy of Hawai'i, 1993, The Nature Conservancy of Hawai'i, 1999, The Nature Conservancy of Hawai'i, 2006, The Nature Conservancy of Hawai'i, 2011). Costs were attributed to ungulate control, invasive plant control, invertebrate and small mammal control, monitoring, rare species protection and research, public outreach programs, personnel, equipment, and facilities. Expenditures on fence construction for the exclusion of ungulates were estimated based on the total length of regularly inspected fence line in Waikamoi (30.6 km) and unit costs of $124,275/km and $246,064/km for pig and deer fences respectively. Recent expenditures (2013–2017) were obtained through discussions with TNC Maui staff. Future annual watershed protection costs for the period 2018–2117 were projected based on average historical maintenance costs, i.e. not including costs associated with initial fence construction and major ungulate removal drives.

[37] https://www.sciencedirect.com/science/article/pii/S0048969719327937

3.2. Monetary benefits of avoided loss of groundwater recharge/reduced water costs

Present value benefits for the benchmark scenario (assuming a 10% spread rate, 3% discount rate and 2035 shortfall year) totaled $37.2 million. Reducing the non-native forest spread rate from 10% to 5%, while keeping the discount rate and shortfall assumption unchanged, substantially reduced benefits to $11.1 million. However, benefits appear fairly robust to changes in the shortfall year for both counterfactual scenarios. Varying the date of initial supplementation of existing groundwater sources to 2030 and 2040 resulted in benefits of $38.5 million and $35.7 million respectively for the 10% spread rate scenario and $11.3 million and $10.9 million for the 5% spread rate scenario. Benefit estimates were much more sensitive to the discount rate. Assuming a 10% spread rate, decreasing the discount rate to 1% increased benefits to $137.6 million, while increasing the discount rate to 5% reduced benefits to $11.3 million. In the 5% spread case, reducing the discount rate raised benefits to $52.1 million, while increasing the discount rate lowered benefits to $2.7 million.

Nexus Between EMI Delivery System & East Maui Watershed:

A detailed environmental and cost analysis of Watershed Management and Restoration building on the Water Use and Development Plan and UHERO study above is needed.	**Watershed Restoration has proven water production results. In order to ensure optimum water value realization based on research and data, public and private entities must be required to make the necessary investments.**
The Hawaii Fresh Water Initiative calls for investment in watershed protection statewide as a crucial step for water security. Consistent, reliable public funding is the most difficult and important part of watershed protection and storm water capture. [38]	One recent University of Hawai'i Economic Research Organization (UHERO) study estimated that investing $43.2 million in watershed restoration work in the Ko'olau mountains could result in over $900 million in actual realized water value for O'ahu.[39]
Current commitments to management and restoration by Maui County represent 1/3 of total investment. Fiscal Year 2020: $900,000	Watershed Partnership Annual Investment in East Maui Watershed Restoration. Fiscal Year 2020: $1,781,000
There appear to be no specific commitments to Management and Restoration of the East Maui Watershed by Mahi Pono/EMI in the Draft EIS. Page 2-2, DEIS: Under the Proposed Action, it is **anticipated** that EMI and/or Mahi Pono will continue to pursue watershed management activities."	HRS § 171-58(e) requires that any new lease of water rights "shall contain a covenant that requires the lessee and the department of land and natural resources to jointly develop and implement a watershed management plan. The board shall not approve any new lease of water rights without the foregoing covenant or a watershed management plan."
Commitments to providing water for taro farming are crucial to the care of the watershed.	… Native Hawaiians divided the land into *ahupua'a* — subdivisions running from the ocean to the mountains, roughly defined by their watersheds. Fresh water flowed through complex ditch systems called *'auwai*, often toward taro *lo'i*, where it supported the cultivation of hundreds of variety of taro—a dietary mainstay for the population. Intact native forests in the *wao akua*, along with diversion systems of *'auwai* and *lo'i* in the lowland areas slowed down water down and increased aquifer recharge in each watershed.[40]
Various computer climate models predict divergent precipitation futures for Hawai'i, although there seems to be common agreement that our rainfall future will be increasingly extreme and inconsistent. There is also high variation throughout the islands in terms of each watershed's ability to catch and hold water. In sum, the question is not whether Hawai'i will have water in the future, but rather will Hawai'i continue to have an a affordable, predictable supply in the places we need at the times that we need for a growing population?"[41]	• Rainfall in Hawai'i decreased by 18% over a 30 year period in Hawai'i from 1978 to 2007. • Annual "tradewind days" have declined 28% from 291 days in 1973 to 210 days in 2009, resulting in less rain and recharge of aquifers. • Hawai'i has been feeling the impact of prolonged drought. In the summer of 2013, 75% of Hawai'i's land area was "Abnormally Dry." • Groundwater provides 99% of the state's domestic water use and in several key areas groundwater levels have been dropping. • Increased temperatures associated with global warming mean increased evaporation for surface water and soil moisture. • Certain invasive plant and tree species have higher evapotranspiration rates than native species in Hawai'i. Hawai'i forests are increasingly encroached on by invasives.[42]

[38] Fresh Water Blueprint, Page 13

[39] Fresh Water Blueprint, Page 7

[40] Fresh Water Blueprint, Page 9

[41] Fresh Water Blueprint, Page 5

[42] Fresh Water Blueprint, Page 5

Stream Restoration:

A separate but related issue for watershed management and repair and maintenance of the EMI Water Delivery System is restoration of the streams, due in part to changes in stream diversions.

In 2020, the State Department of Agriculture is providing $4.5 million to support local agriculture. This is currently a one-time allocation, which will support the plans, design and construction to rebuild auwai in Ke'anae-Wailuanui and similar rural water infrastructure projects. This allocation is considered to be a fraction of what is truly needed to support taro farmers, and is limited somewhat because funds can only be used on public lands (county or state) and expenses for each project are high due to accessibility and dangerous conditions. The goal is to maintain and hopefully increase funding in the future. Further, it indirectly helps the watershed by supporting lo`i (see above).

Environmental and Social Impacts of Agriculture:

Per the November 2018 Impact investing in the global food and agricultural investment space, Investing profitably whilst fostering a sustainable and thriving agriculture[43]:

> ***It is now acknowledged that agriculture is a strong contributor to climate change, with a sector contribution of 19-29% of total global greenhouse gas emissions. According to the Food and Agriculture Organization (FAO), Agriculture, forestry and other land uses (AFLOU) have emitted a total of 10.6 gigatonnes of CO2 equivalent in 2010. The main direct sources of GHG emissions in agriculture are not only carbon dioxide (CO2), but also nitrous oxide (N2O), mostly through the application of fertilizers, and methane (CH4), essentially from livestock and rice cultivation. Deforestation and land degradation have also reduced the sector's capacity to absorb or sequester carbon dioxide from the atmosphere.***

Moreover, as has been stated in the report on "Strategies for mitigating climate change in agriculture" by California Environmental Associates and Climate focus, April 2014, while governments, bilateral development agencies, and multilateral financial institutions are dedicating significant resources to increasing agricultural yields globally, less emphasis has been placed on making agriculture environmentally sustainable. Croplands and pasturelands already cover nearly 40 percent of the earth's land area, and agriculture consumes 70 percent of freshwater used by humans.

[43] https://www.valoral.com/wp-content/uploads/Valoral-Advisors-Impact-Investing-November-2018.pdf

Agriculture is also the world's largest driver of species loss and habitat conversion and is a major contributor to toxic and nutrient pollution, soil degradation, and invasive species introductions. These pressures on our resources will only continue to grow as global population and income levels rise. It is important that the agriculture sector transforms itself and implements sustainable agricultural practices that allow it to become more caring of nature and of the environment that surrounds us.

At the same time, climate change is already affecting the agriculture sector in a multitude of ways, which can vary from region to region. For example, we have started to observe rising temperatures, loss of biodiversity, increased prevalence of extreme weather events such as floods, cyclones and hurricanes and increased unpredictability of weather patterns.

…All these changes have deep consequences in the agriculture sector, and can be translated into harmed crops and reduced yields, reduced feed supply and carrying capacity of pastures and increases in animals' vulnerability to disease, which reduces fertility and milk and meat production, reduced fish stocks due to warmer water temperatures and reduced capacity of forests to provide crucial goods and services.

According to its DEIS, Mahi Pono intends to use 65.88 mgd of water from the EMI aqueduct for agriculture, and while the EIS acknowledges the negative impacts of agriculture on the climate crisis, there are no specific estimates of how Mahi Pono's farm activities will impact climate, only the statement that ranching activities will be "negligible." The following section is excerpted from the Draft EIS[44]:

The Proposed Action will allow for the continued conveyance of water through the EMI Aqueduct System to allow for the transition of the agricultural fields in Central Maui to a diversified agricultural operation. Various studies indicate that agricultural activities can be a source of GHGs that aggravate climate disruption. Agriculture creates both direct and indirect emissions. Direct emissions come from fertilized soils and livestock manure. While indirect emissions come from runoff and leaching of fertilizers, emissions from land-use changes, use of fossil fuels for mechanization, transport and agro-chemical and fertilizer productions. Various management practices in the agricultural land can lead to production and emission of GHGs, which range from fertilizer application to methods of irrigation, tillage and cattle and feedlots.

However, the agricultural sector has large potential to mitigate climate change. According to the Intergovernmental Panel on Climate Change (IPCC) (2013), mitigation is an intervention to reduce the emissions sources or enhance the GHG sinks. GHG emissions through energy conservation, lower levels of carbon-based inputs, lower use of synthetic fertilizer and other features that minimize GHG emissions and sequester carbon in the soil.

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44 DEIS, P. 4-74 and 4-75

As Mahi Pono's farm plan becomes operational, GHG emissions from internal combustion engines in farming equipment, and transportation related to crop production and workers will increase over the current fallow conditions. When fully operational, the amount of GHG emissions compared to former sugarcane operations does not suggest that one would be significantly greater than the other. There will be seasonal differences in emissions with a sugar monocrop generating more emissions during seasonal harvests while diversified agriculture would likely be distributed due to differences in crop cycles. Sugar also involved burning but such emissions were not from fossil fuels. Sugar also involved transporting products overseas for processing and distribution while diversified agriculture could reduce the amount of food crops imported from overseas as it increases the amount of local food production.

Mahi Pono's farm plan proposes livestock operations on the agricultural fields in Central Maui. The livestock sector requires a significant amount of natural resources and has a role in GHG emissions, especially methane and nitrous oxide. Methane, mainly produced by enteric fermentation and manure storage, is a gas which has an effect on global warming 28 times higher than carbon dioxide. Nitrous oxide, arising from manure storage and the use of organic/inorganic fertilizers, is a molecule with a global warming potential 265 times higher than carbon dioxide (IPCC, 2013). However, in comparison to other livestock operations on the island, such as Ulupalakua Ranch, which operates on approximately 18,000 acres, Mahi Pono's livestock operation will be negligible. Additionally, Mahi Pono's farm plan also includes a utility scale solar farm to supply power to the public power grid, and will also use power from two existing hydro- electric facilities to provide power to pumps and wells, and other infrastructure.

However, the exact nature of how the climate will change and impacts from any changes is unknown. As research into this area continues, there will be increased knowledge of the most effective ways to focus efforts toward adaptation strategies to address climate change.

General Resource Management:

Planning objectives related to resource management identified in the WUDP update public process include: [45]

- Watershed protection and its prioritization, including invasive alien plant control, ungulate control, and reforestation via watershed partnership programs
- Maintaining access to lands for gathering, hunting and other native Hawaiian traditional and customary practices
- Improving the understanding of the concepts of "precautionary planning" to reduce and adapt to the effects of drought and climate change upon water resource availability and quality

[45] Ko`olau WUDP, Page 99

- Consultation and coordination with Native Hawaiian community/moku and local experts on resource management and invasive species removal

The Hāna Community Plan reflects regional issues expressed at the community WUDP meetings. Policies related to water resource management include:

- Protect, preserve and increase natural marine, coastal and inland resources, encouraging comprehensive resource management programs
- Ensure that groundwater and surface water resources are preserved and maintained at capacities and levels to meet the current and future domestic, agricultural, commercial, ecological and traditional cultural demands
- Recognize residents' traditional uses of the region's natural resources which balance environmental protection and self-sufficiency
- Discourage water or land development and activities which degrade the region's existing surface and groundwater quality
- Encourage resource management programs that maintain and re-establish indigenous and endemic flora and fauna
- Protect, restore and preserve native aquatic habitats and resources within and along streams
- Ensure that the development of new water sources does not adversely affect in-stream flows
- Increase water storage capacity with a reserve for drought periods.
- Improve the existing potable water distribution system and develop new potable water sources prior to further expansion of the State Urban District boundary or major subdivision of land in the State Agricultural or Rural Districts.
- Ensure adequate supply of groundwater to residents of the region before water is transported to other regions of the island.

Key issues for the Ko`olau region were identified in public meetings held in Hāna over 2016. Community concerns overlap with those of the Hāna aquifer sector and relate to watershed management and participation by the local community; maintenance of traditional resource management using the ahupua`a system and ensuring that traditional and customary practices are safe guarded. Community members state that younger generations are returning to Ko`olau and Hāna to establish taro lo`i. Other key issues for the region focus on providing affordable water for future needs, providing for taro lo`i and other public trust uses during droughts, and managing resources in a sustainable way.

Due to resource interdependencies, East Maui (Hāna and Ko`olau ASEAs) community concerns are also related to the primary concerns of Makawao-Pukalani-Kula residents, which center on the limited development of water resources and a distribution system to meet the needs of the region. The proper allocation of water resources is considered essential to, in order of priority:

(1) preserve agriculture as the region's principal economic activity, promote diversified agricultural activities, and effectively encourage the development of Department of Hawaiian Home Lands (DHHL) parcels; and

(2) However, water use in the Upcountry region is recognized as having impacts on the streams of East Maui and the agricultural activities of the central valley.

A comprehensive water management strategy must be developed to strike a balance between the various interests and accommodate environmental, agricultural and on Upcountry and East Maui water issues as they relate to each other and the Central Maui ASEA.[46]

[46] Ko`olau WUDP, Page 98

IV. Native Hawaiian Land & Water Rights

Hawaiian Homes Commission Act, 1921:

(Bold added for emphasis):

[§101. Purpose.] *[Text of section subject to consent of Congress.]*

(a) The Congress of the United States and the State of Hawaii declare that the policy of this Act is to enable native Hawaiians to return to their lands in order to fully support self-sufficiency for native Hawaiians and the self- determination of native Hawaiians in the administration of this Act, and the preservation of the values, traditions, and culture of native Hawaiians.

b) The principal purposes of this Act include but are not limited to:

1) Establishing a permanent land base for the benefit and use of native Hawaiians, upon which they may live, farm, ranch, and otherwise engage in commercial or industrial or any other activities as authorized in this Act;

2) Placing native Hawaiians on the lands set aside under this Act in a prompt and efficient manner and assuring long-term tenancy to beneficiaries of this Act and their successors;

3) Preventing alienation of the fee title to the lands set aside under this Act so that these lands will always be held in trust for continued use by native Hawaiians in perpetuity;

4) Providing adequate amounts of water and supporting infrastructure, so that homestead lands will always be usable and accessible; and

5) Providing financial support and technical assistance to native Hawaiian beneficiaries of this Act so that by pursuing strategies to enhance economic self- sufficiency and promote community-based development, the traditions, culture and quality of life of native Hawaiians shall be forever self-sustaining.

c) In recognition of the solemn trust created by this Act, and the historical government to government relationship between the United States and Kingdom of Hawaii, the United States and the State of Hawaii hereby acknowledge the trust established under this Act and affirm their fiduciary duty to faithfully administer the provisions of this Act on behalf of the native Hawaiian beneficiaries of the Act.

d) Nothing in this Act shall be construed to:

1) Affect the rights of the descendants of the indigenous citizens of the Kingdom of Hawaii to seek redress of any wrongful activities associated with the overthrow of the Kingdom of Hawaii; or

2) Alter the obligations of the United States and the State of Hawaii to carry out their public trust responsibilities under section 5 of the Admission Act to native Hawaiians and other descendants of the indigenous citizens of the Kingdom of Hawaii. [L 1990, c 349, §1]

§220. Development projects; appropriations by legislature; bonds issued by legislature; mandatory reservation of water.

a) Subject to subsection (d), the department is authorized directly to undertake and carry on general water and other development projects in respect to Hawaiian home lands and to undertake other activities having to do with the economic and social welfare of the homesteaders, including the authority to derive revenue from the sale, to others than homesteaders, of water and other products of such projects or activities, or from the enjoyment thereof by others than homesteaders, where such sale of products or enjoyment of projects or activities by others does not interfere with the proper performance of the duties of the department; provided that roads through or over Hawaiian home lands, other than federal-aid highways and roads, shall be maintained by the county in which the particular road or roads to be maintained are located.

b) The legislature is authorized to appropriate out of the treasury of the State such sums as it deems necessary to augment the funds of the department and to provide the department with funds sufficient to execute and carry on such projects and activities. The legislature is further authorized to issue bonds to the extent required to yield the amount of any sums so appropriated for the payment of which, if issued for revenue-producing improvements, the department shall provide, as set forth in section 213.

c) To enable the construction of irrigation projects which will service Hawaiian home lands, either exclusively or in conjunction with other lands served by such projects, the department is authorized, with the approval of the governor, and subject to subsection (d), to:

1) Grant to the board of land and natural resources, or to any other agency of the government of the State or the United States undertaking the construction and operation of such irrigation projects, licenses for rights-of-way for pipelines, tunnels, ditches, flumes, and other water conveying facilities, reservoirs, and other storage facilities, and for the development and use of water appurtenant to Hawaiian home lands;

2) Exchange available lands for public lands, as provided in section 204 of this Act, for sites for reservoirs and subsurface water development wells and shafts;

3) Request any such irrigation agency to organize irrigation projects for Hawaiian home lands and to transfer irrigation facilities constructed by the department to any such irrigation agency;

4) Agree to pay the tolls and assessments made against community pastures for irrigation water supplied to such pastures; and

5) Agree to pay the costs of construction of projects constructed for Hawaiian home lands at the request of the department, in the event the assessments paid by the homesteaders upon lands are not sufficient to pay such costs;

provided that licenses for rights-of-way for the purposes and in the manner specified in this section may be granted for a term of years longer than is required for amortization of the costs of the project or projects requiring use of such rights-of-way only if authority for such longer grant is approved by an act of the legislature of the State. Such payments shall be made from, and be a charge against the Hawaiian home operating fund.

d) For projects pursuant to this section, sufficient water shall be reserved for current and foreseeable domestic, stock water, aquaculture, and irrigation activities on tracts leased to native Hawaiians pursuant to section 207(a). [Am Jul. 10, 1937, c 482, 50 Stat 507; Nov. 26, 1941, c 544, §6, 55 Stat 786; Jun. 14, 1948, c 464, §7, 62 Stat 393; Aug. 1, 1956, c855, §1, 70 Stat 915; am L 1963, c 207, §§2, 5(a); am L 1986, c249, §4; am L 1991, c 325, §2]

Cross References

Bond issues, see Organic Act, §55 and HRS chapters 39, 47, and 49.

Water or irrigation projects, see §§167-13, 167-14; §174-13.

Attorney General Opinions

Lien on lands as security for improvement bonds is not authorized. Att. Gen. Op. 63-25.

Law Journals and Reviews

Native Hawaiian Homestead Water Reservation Rights: Providing Good Living Conditions for Native Hawaiian Homesteaders.25 UH L. Rev. 85.

Case Notes

Pursuant to article XI, §§1 and 7 of the Hawaii constitution, subsection (d) of this Act, and §174C-101(a), a reservation of water constitutes a public trust purpose.103 H. 401, 83 P.3d 664.

Where commission on water resource management failed to render the requisite findings of fact and conclusions of law with respect to whether applicant had satisfied its burden as mandated by the state water code, it violated its public trust duty to protect the department of Hawaiian home lands' reservation rights under the Hawaiian Homes Commission Act, the state water code, the state constitution, and the public trust doctrine in balancing the various competing interests in the state water resources trust.103 H. 401, 83 P.3d 664.

Where commission on water resource management refused to permit cross examination of water use applicant's oceanography expert regarding the limu population along the shoreline, in effect precluding the commission from effectively balancing the applicant's proposed private commercial use of water against an enumerated public trust purpose, the commission failed adequately to discharge its public trust duty to protect native Hawaiians' traditional and customary gathering rights, as guaranteed by this section, article XII, §7 of the Hawaii constitution, and §174C-101.103 H. 401, 83 P.3d 664.

§221.Water.

(a) When used in this section:

1) The term "water license" means any license issued by the board of land and natural resources granting to any person the right to the use of government-owned water; and

2) The term "surplus water" means so much of any government-owned water covered by a water license or so much of any privately owned water as is in excess of the quantity required for the use of the licensee or owner, respectively.

b. All water licenses issued after the passage of this Act shall be deemed subject to the condition, whether or not stipulated in the license, that the licensee shall, upon the demand of the department, grant to it the right to use, free of all charge, any water which the department deems necessary adequately to supply the livestock, aquaculture operations, agriculture operations, or domestic needs of individuals upon any tract.

c) In order adequately to supply livestock, the aquaculture operations, the agriculture operations, or the domestic needs of individuals upon any tract, the department is authorized (1) to use, free of all charge, government-owned water not covered by any water license or covered by a water license issued after the passage of this Act or covered by a water license issued previous to the passage of this Act but containing a reservation of such water for the benefit of the public, and (2) to contract with any person for the right to use or to acquire, under eminent domain proceedings similar, as near as may be, to the proceedings provided in respect to land by sections 101-10 to 101-34, Hawaii Revised Statutes, the right to use any privately owned surplus water or any government-owned surplus water covered by a water license issued previous to the passage of this Act, but not containing a reservation of such water for the benefit of the public. Any such requirement shall be held to be for a public use and purpose. The department may institute the eminent domain proceedings in its own name.

d) The department is authorized, for the additional purpose of adequately irrigating any tract, to use, free of all charge, government-owned surplus water tributary to the Waimea river upon the island of Kauai, not covered by a water license or covered by a water license issued after July 9, 1921. Any water license issued after that date and covering any such government-owned water shall be deemed subject to the condition, whether or not stipulated therein, that the licensee shall, upon the demand of the department, grant to it the right to use, free of all charge, any of the surplus water tributary to the Waimea river upon the island of Kauai, which is covered by the license and which the department deems necessary for the additional purpose of adequately irrigating any tract.

Any funds which may be appropriated by Congress as a grant- in-aid for the construction of an irrigation and water utilization system on the island of Molokai designed to serve Hawaiian home lands, and which are not required to be reimbursed to the federal government, shall be deemed to be payment in advance by the department and lessees of the department of charges to be made to them for the construction of such system and shall be credited against such charges when made.

4. **All rights conferred on the department by this section to use, contract for, or acquire the use of water shall be deemed to include the right to use, contract for, or acquire the use of any ditch or pipeline constructed for the distribution and control of such water and necessary to such use by the department.**

5. Water systems in the exclusive control of the department shall remain under its exclusive control; provided that the department may negotiate an agreement to provide for the maintenance of the water system and the billing and collection of user fees. If any provision or the application of that provision is inconsistent with provisions contained in this section, this section shall control.

   Water systems include all real and personal property together with all improvements to such systems acquired or constructed by the department for the distribution and control of water for domestic or agricultural use. [Am Aug. 1, 1956, c 855, §§2, 3, 70 Stat 915; am L 1963, c 207, §§2, 5(b); am Const Con 1978 and election Nov. 7, 1978; am L 1981, c 90, §10; am L1984, c 36, §1; am L 1990, c 24, §1]

Cross References

Board of land and natural resources empowered to prepare irrigation plans, see §§174-5, 174-6.

Law Journals and Reviews

Native Hawaiian Homestead Water Reservation Rights: Providing Good Living Conditions for Native Hawaiian Homesteaders 25 UHL. Rev. 85.

Case Notes

Although the Hawaii administrative rules denominate aquifer- specific reservations of water to the department of Hawaiian home lands, such a limitation for purposes of water resource management does not divest the department of its right to protect its reservation interests from interfering water uses in adjacent aquifers.103 H. 401, 83 P.3d 664.

Insofar as the commission on water resource management, as the agency authorized to administer the state water code, determines the contents of the Hawaii water plan, which includes the designation of hydrologic units and sustainable yields, and the commission's "interpretation of its own rules is entitled to deference unless it is plainly erroneous or inconsistent with the underlying legislative purpose", it is within the commission's authority to limit reservations of water to specific aquifers.103 H. 401, 83 P.3d 664.

Where commission on water resource management failed to render the requisite findings of fact and conclusions of law with respect to whether applicant had satisfied its burden as mandated by the state water code, it violated its public trust duty to protect the department of Hawaiian home lands' reservation rights under the Hawaiian Homes Commission Act, the state water code, the state constitution, and the public trust doctrine in balancing the various competing interests in the state water resources trust. 103 H. 401, 83 P.3d 664.

Where commission on water resource management's findings supporting its conclusion that the proposed use of water would not interfere with department of Hawaiian home lands' reservation rights under this section failed to address whether the proposed user had adduced sufficient evidence with respect to the impact of the proposed use on the department's reservation in the adjacent aquifer system, commission erred in concluding that proposed user had met its burden under §174C-49 to obtain a water use permit. 103 H. 401, 83 P.3d 664.

Excerpt from the Ko`olau Water Use and Development Plan, DHHL Maui Island Plan:

The Hawaiian Homes Commission adopted its Maui Island Plan as the overarching planning document in 2004. The Department of Hawaiian Homelands (DHHL) East Maui planning region encompasses three tracts totaling 985 acres: Ke`anae, Wākiu, and Wailua. All three tracts are within the Hāna Community Plan designated Area. However, only Ke`anae (150.6 acres) and Wailua tracts are within the Ko`alau ASEA, covering 242 acres the State Land Use Commission has mostly zoned Agriculture, with a very small percentage zoned Conservation. The County zoning and Community Plan designations for the lands is Agricultural. For the Ke`anae tract, Two acres of community use is proposed on the makai property, and 32 three- acre agricultural lots are proposed on 57 acres of the mauka property. The chosen DHHL project for the Wailua tract proposes 28 acres of subsistence agricultural use, 52 acres of General Agricultural use and 10 acres of Conservation. [47]

Excerpt from the Central Water Use and Development Plan DHHL Water Resources:

Due to the extensive Department of Hawaiian Homelands (DHHL) land holdings and their plans to further develop the area for Native Hawaiian habitation and farming activities; adequate water supply is becoming increasingly important for Native Hawaiians to resettle and facilitate their cultural practices in the area. DHHL lands are occupied by Native Hawaiians who are assumed to live the full-range of traditional Native Hawaiian cultural practices based on their ability to implement the knowledge of their heritage. Upcountry Maui (Kēōkea/Waiohuli, Ulupalakua, Kualapa) has over 6,000 acres of DHHL lands.

The Makawao-Pukalani-Kula Community Plan section, "Identification of Major Problems and Opportunities of the Region Problems," cites "limited development of water resources and distribution system to meet the needs of the region as a primary concern," and notes that "The proper allocation of water resources is considered essential to encourage the development of Department of Hawaiian Home Lands (DHHL) parcel." [48]

Kēōkea/Waiohuli – Priority Tract
According to the DHHL Maui Island Plan, with adequate water and funding, this area has the potential to be the largest homestead region on Maui. Over 6,000 acres of DHHL land are

[47] Ko`olau WUDP, P. 43

[48] Central WUDP, Page 30

located below Kula Highway on the slopes of Haleakala. A 70-unit farm lot subdivision at Kēōkea was planned prior to the *Maui Island Plan*. A second phase of 343 residential lots can be implemented using allocations from the existing water system if planned in the mid-section of the tract between existing residential lots and the Kēōkea farm lots. An additional 768 residential lots are proposed for future residential homesteads at Waiohuli pursuant to the development of an on-site production well.

Kualapa
Located along Kula Highway south of Ulupalakua near Kanaio, this tract does not have immediate development potential due to infrastructure constraints. The water system is old and undersized and is not able to accommodate any further growth; and extensive off-site improvements would be needed to support residential development.

Kula Residence Lots
The Kula Residence Lots subdivision is located in the northern portion of the Kēōkea-Waiohuli homestead area (yellow on the accompanying map). The subdivision will include a total of 420 lots developed to Rural Residential half-acre standards.

Future DHHL Development
DHHL has long range conceptual plans for about 1,100 more residential lots in the area below the latest developments. The future subdivisions are envisioned to include community facilities, a school site, parks, archaeological preserves, and open space. These future plans are dependent on the development of water, wastewater, road improvements, and funding. The timeframe for these developments is beyond 2020.

Excerpts from Draft EIS Relating to DHHL Lands:

The DHHL staff has identified 11,455,510 gpd (10,428,000 gpd for K kea-Waiohuli + 1,027,510 gpd for Pulehunui) of water as their recommendation for a reservation of water rights sufficient to support current and future homestead needs related to this proposed Water Lease.
The DHHL has indicated that reserved water may be available for other purposes until the DHHL has an actual need for the water. For its K kea-Waiohuli and Pulehunui lands, the DHHL will be dependent on the EMI Aqueduct System collecting and transporting East Maui stream waters, in order to get waters to its lands. Until actual need materializes, the DHHL would receive payments related to lease rents paid by the lessee for those waters should EMI use a portion/all of the DHHL's Water Reservation, and the DHHL could receive other possible compensation or consideration.[49]

[49] DEIS, Page 2-4

Failure of the State to Fulfill Fiduciary Responsibility:

Whether the State of Hawaii is meeting its fiduciary responsibility to Native Hawaiians regarding their claim to revenue sharing as granted by the State Constitution needs to be resolved.

In Nelson v. the Hawaiian Homes Commission, six individual plaintiffs filed a first amended complaint alleging that the State Defendants and DHHL had violated Article XII, Section 1 of the Hawai‘i State Constitution. That constitutional provision states the following:

The legislature shall make sufficient sums available for the following purposes: (1) development of home, agriculture, farm and ranch lots; (2) home, agriculture, aquaculture, farm and ranch loans; (3) rehabilitation projects to include, but not limited to, educational, economic, political, social and cultural processes by which the general welfare and conditions of native Hawaiians are thereby improved; (4) the administration and operating budget of the department of Hawaiian home lands; in furtherance of (1), (2), (3) and (4) herein, by appropriating the same in the manner provided by law.

Plaintiffs alleged that the State had failed to make sufficient sums available to DHHL for the four purposes enumerated above. In Count 2, the Plaintiffs alleged that DHHL breached its trust duties to its beneficiaries by failing to request sufficient sums from the State. The progress of this case and the appeals provides insight into the dissatisfaction of beneficiaries with regard to revenue sharing.

Case is attached as Appendix 11.

Ownership Considerations & Reversion of Crown Lands with Cessation of Sugar Cane:

Excerpts from: Wai o ke Ola He Wahi Mo'olelo no Maui Hikina, A Collection of Native Traditions and Historical Accounts of the Lands of Hāmākua Poko, Hāmākua Loa and Ko`olau, Maui Hikina (East Maui), Island of Maui, Kumu Pono Associates[50]

At the request of Garret Hew, Manager of East Maui Irrigation Company, Ltd. (EMI), Kumu Pono Associates conducted a two phased study of cultural historical resources in the lands of Hāmākua Poko, Hāmākua Loa, and Ko'olau, in the region of Maui Hikina (East Maui), Island of Maui (an area that includes some 73 individual ahupua'a or native land divisions). The study included— conducting detailed research of historical records in public and private collections (Volume I); and conducting oral history interviews with individuals known to be familiar with the cultural and natural landscape, and history of land use in the Maui Hikina study area (Volume II). This study was conducted in conjunction with the Water License Application of the East Maui Irrigation Company, Ltd., to the Board of Land and Natural Resources of the State of Hawai'i.[51]

Page 444-445 (Appendix 8)

In 1928, J.H. Foss (Chief Engineer, East Maui Irrigation Company), submitted a paper to the Public Lands Commission as a part of the appraisal process associated with General Lease No.'s 1134 (Honomanu), 974 (Hamakua), and 276 B (Spreckels). In the paper, Foss provided readers with a historical summary of the history of the East Maui Ditch System and Water Licenses:

A brief history of Government Water Licenses on East Maui will give a background for the details to be considered in these three appraisements. There are in all five such licenses, two in addition to the above three. All of them are now somewhat interwoven due to the fact that the transportation of water from each is handled by one and the same general ditch system; accordingly, the two additional ones...are Keanae, No. 1706; and Nahiku, No. 520 B...

…Honomanu License, No. 1134, is a new license which replaced the original lease on Honomanu lands. At the expiration of said lease all improvements thereon, and in connection therewith, reverted to the Government. The present Honomanu License also provides that improvements thereon and in connection therewith revert to the Government...

The present ownership of the ditches transporting water from the Honomanu and Spreckles Hamakua Licenses is somewhat involved. The original ditches on the Honomanu lease are the Spreckels and M. Louis, which are to a great extent still in use. They reverted to the Government at the expiration of the Honomanu lease in 1908. The Koolau Ditch which also crosses the Honomanu License, but which was built under the Keanae License in 1903 1904, reverted to the Government at the expiration of that license in 1925. Thus all the aqueducts in the land of Honomanu are now, and have been for several years, the property of the Government.

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[50] http://www.ulukau.org/elib/collect/maly6/index/assoc/D0.dir/book.pdf

[51] Wai o ke Ola He Wahi Mo'olelo no Maui Hikina, Page 3

The Spreckels, Center, Lowrie and New and Old Haiku Ditches are still the property of East Maui Irrigation Co[19]. Those portions of those ditches located on Government land may automatically become the property of the Government at the expiration of the Spreckels License in 1938, although the Spreckels License does not provide for reversion of improvements.

Those portions of the new and old Hamakua Ditch, located upon Government land, reverted to the Government with the expiration of the Hamakua (1916) and Keanae (1925) Licenses respectively; and accordingly have been the property of the Government for some time. The Wailoa Ditch, which is located on the Spreckels Hamakua License, is still the property of East Maui Irrigation Co., but those parts which are on Government land will revert to the Government at the expiration of the Spreckels Hamakua License in 1938...

Page 448-449 (Appendix 9)
September 7, 1876
C.T. Gulick, Interior Department;
to Messrs. Castle and Cooke, Agents Haiku Sugar Co. : .

..I am directed by His Excellency the Minister of the Interior to say in reply to your Application of the privileges, that the Government will grant to the Haiku Sugar Co., Alexander and Baldwin, James M. Alexander, The Grove Ranch Plantation and Thomas Hobron, and their respective and several successors heirs and assigns the license to take water from the streams named in the application and to carry the same over all Govt. lands intervening between the said Streams and the remotest of the lands to which it is now desired to carry said water for the period of twenty (20) years from date of acceptance at the rate of One Hundred Dollars ($100.) pr Annum, upon condition:

1st: That a sufficient ditch, canal or other waterway shall at once be commenced and finished in a reasonable time.

2nd: That this grant shall in no way interfere with the rights of tenants upon said Government streams or lands.

3rd: Nor shall it in any way affect the right of the Government to grant to any person or persons the right to take water (not to interfere with the water herein granted) from the same or other streams to be carried over the same land or lands for any purpose whatsoever, and if need be through the ditch or canal to be constructed by these grantees, provided however that during the said twenty years the supply of water, a right to take which is herein granted, shall not be diminished by act of the Government.

4th That at any time during the said period the government may purchase the said ditch canal or other water way, * (* upon payment of the actual cost thereof only) and in case of said

purchase will continue to furnish water to these grantees and their respective and several successors, heirs and assigns at a just and reasonable rate not to exceed that paid by other parties taking water from such ditch or waterway.

Page 486-489 (Attached Appendix 10)

[*Extension of Lease from the 30th of Sept. 1893, to the 30th of Sept. 1916]*
August 10, 1893 J.A. King, Minister of the Interior; to Haiku Sugar Company and Paia Plantation Company]

An Indenture made this 10th day of August, A.D. 1893, by and between His Excellency, James A. King, Minister of the Interior of the Hawaiian Islands, acting with the advice and consent of the Executive Council of the Provisional Government of said Islands, of the first part, and The Haiku Sugar Company and the Paia Plantation Company, Corporations established and existing under and by virtue of the laws of the said Islands, of the second part;

Whereas said parties of the second part hold a certain grant of the right to take water for purposes of irrigation from certain streams on the Island of Maui, and the right of way across certain Government Lands for a ditch to convey such water, which said grant is contained in an Indenture made by and between W.L. Moehonua, Minister of the Interior, acting with the consent of the King in Cabinet Council, of the first part, and the Haiku Sugar Company, James M. Alexander, Alexander and Baldwin and T.H. Hobron, of the second part, dated Sept. 30th, 1876, of record in the Hawaiian Registry of Deeds in Lib. 49, Fols. 167 172, which said grant is for the term of twenty years;

And Whereas said Indenture was, on the 7th day of Oct. 1878, modified by agreement of the parties, of record in said Registry in Lib. 57, Fols. 343 345, the parties of the second part, then associated under the name of the Hamakua Ditch Company, on consideration of the waiver by the party of the first part of the right reserved to purchase said ditch and appurtenances, agreeing to pay the sum of Five hundred Dollars ($500.00) per annum rental;

And Whereas the Paia Plantation Co. has acquired all of the rights of said James M. Alexander, Alexander and Baldwin, and T.H. Hobron in said Indenture;

And Whereas said indenture contains a covenant for renewal for a further term of twenty years, provided the rights therein granted should be granted to any person or corporation…

Honolulu, July 25, 1898. Senator Hocking; to J. F. Brown Esq., Agent of Public Lands:

...Mr. H. P. Baldwin, Mr. W. F. Pogue and myself have entered into a preliminary agreement to erect a sugar mill at Nahiku, Island of Maui, for the purpose of manufacturing sugar from cane grown and furnished by parties who have taken up government lands at Nahiku, Island of Maui, and also to pipe and ditch water along the heads of said lands, providing we can acquire the right from the Government to do so.

Therefore providing the Company be incorporated under the law of Hawaii, will you grant it a license to use the water on said lands for the above named purpose, providing it be used for the benefit of all parties owning land in said tract, and depriving no person of their rights to water, we would necessarily like the privilege for a long term of years if you should decide to grant this license will you please state the terms... [HSA, F.O. & Ex, Public Lands Commission – 1898]

August 2, 1898 Land License No. 520 B Public Lands Commission;
The water from this tract shall be used for the general benefit of the owners and occupiers of lands within the Nahiku tract of Public Lands Map No. 20, for irrigation and domestic purposes, and for cane fluming and general Mill and Plantation purposes, and no person or persons shall be deprived of the use of any water to which they would have been entitled in the absence of this License.

…The right as regards the use of the land to be occupied under this license, is limited to such operations as are required for ditching, building dams, flumes and for the utilization and conveyance of water, no rights of taking timber except for construction of such dams, flumes and c, and no rights of using the said tract for other purposes being granted.

At the expiration of the term of this license all flumes, pipes and improvements for conducting said water shall remain upon said land and shall revert to the Government.

Per the Office of Hawaiian Affairs, Kipuka database, of the 30,000 acres of land on the Tax Map Key numbers listed in the Draft EIS, 18,000 are crown lands.[52]

TMK	Acres
2/1-2-004-005	1576.07
2/1-1-004-007	3821
2/1-1-002-002	13007.1
2/1-1-001-044	3371.97
2/1-1-001-005	2121.85
2/2-9-014-001, 005, 011, 012, 017	6630.84
Total acres	**30,528.83**

52 http://kipukadatabase.com

TMK: 2/1-1-002-002

- 35,740 acres owned by the State DLNR-DOFAW considered Ko`olau Forest Reserve
- 13,518 acres of Crown Land

1895 Land Use: Kalo Iaukea Description[53]:

These three lands adjoin each other and extend along the coast from Makoloaka point where Wailua joins the government land of Waiohue on the east, to a ravine called Napuumahoenui at the extreme westerly end of Honomanu, a distance of about 6 1/2 miles. These tracts are mostly mountain and wood land, and full of deep and precipitous gulches. At Keanae there is quite a stretch of low table land where considerable taro is cultivated and where the most of the natives reside. Has a very good landing. In the Wailua valley all of the lower portion is rice land, about 75 acres. On these lands there is at all times a great abundance of water. The land of Honomanu is valuable for its water, from which a large section of the Hawaiian Commercial and Sugar Co.'s land is supplied. Wailua contains about 3000 acres, Keanae 11,148 and Honomanu 3260.

- Land Patent Grant 10879 from the Territory of Hawaii to Amalia K. Bodnar 7.75 acres dated 9/4/40.
- Royal Patent Grant #3223 awarded to Kaakuamoku and Kailiau for 120 acres in 1879, Book 15

TMK: 2/1-1-001-044 Honomanu

- 4270 acres of Crown Land
- Same description as above
- 1895 Land use: Valuable Water Rights

[53]Source: Iaukea, Biennial Report, 1894

V. Considerations RE: Purchasing & Maintaining EMI System

The Maui County Board of Water Supply Temporary Investigative Group has conducted interviews and discussions with various individuals in the community with knowledge, expertise and experience who have increased TIG members' understanding of the scope, operations and maintenance of the EMI Water Delivery System as well as the costs related to the purchase or condemnation of the EMI water delivery system and the cost of its maintenance, and the purchase or condemnation of relevant Mahi Pono lands.

The BWS TIG has also reviewed various documents related to the above.

General Considerations:

In response to community research, the BWS TIG learned that there are many members of the community who have been considering the option of purchasing the East Maui water delivery system and/or watersheds and had already begun their own analyses prior to the establishment of the TIG.

For example the East Maui H20 Roundtable discussed the following:

<table>
<tr><td>East Maui H2O Roundtable, convened by Sustainable Living Institute of Maui, June 2018, Break-out group on Financing strategies for East Maui Watershed and Water systems.</td><td>Participants:
ALLISON COHEN (Nature Conservancy)
GLADYS BAISA (DWS DIRECTOR at the time)
CARL FREEDMAN (economic analyst on water and energy policy)
DAVID FISHER (Economist and business advisor)
CAROL REIMAN- A&B Public relations head WARREN WATANABE- Maui farm bureau
LUCIENNE DE NAIE - Sierra Club Maui/ east Maui resident
HUGH STARR- ag property specialist/ water researcher</td></tr>
<tr><td colspan="2">Price tag depends on needed systems improvements and community priorities. Costs associated with watershed and ditch system (not County water treatment systems) include:
• ditch system upkeep and maintenance
• watershed management and restoration activities
• monitoring gear / programs
• alternative water sources
• needed studies and plans
• system modifications/ expansions
• OHA/DHHL share</td></tr>
<tr><td>Funding Sources:
• System users
• Private sector funding
• International & local bonds
• Social impact investors interested in :
• sustainability
• education
• carbon offset
• adopt a tree programs</td><td>• NGO investors (charitable foundations)
• Corporate sponsors
• County
• Federal appropriations (climate impact mitigation funds?) - USFWS/ USDA/ EPA- GRANTS
• USGS programs and projects
• State - Legislature plus CWRM/ OHA/DHHL</td></tr>
</table>

Determine **pricing structure** for portion of funding coming from potential water system users:

- DWS: potable system & ag parks
- A&B or successor- farming leases /hydropower
- taro farmers/ kuleana farmers
- Hui partition holders in Huelo
- Maui Gold pineapple
- Ranches
- Recreational users PUC would need to regulate the prices set & PUC bases decision on cost, not "value"

SIDEBAR: AG WATER RATES

- Charging 3 cents per 1000 gal , 100 mgd would cost $1 million
- Upcountry farmers currently pay $1.10/ 1000 gal at the County Ag park
- State irrigation district (Hawaii Island) charges 20 cents/ 1000 gal.

Condemnation Requirements (Per Maui County Corp Counsel):

In an August 2, 2017 transmittal from then-Corporation Counsel Pat Wong to then-Council Member Elle Cochran, advice is provided on the process for initiating condemnation proceedings by the County of Maui. Mr. Wong cites the following sections of the Hawaii Revised Statutes (HRS):

§46-1.5 (6) Each county shall have the power to exercise the power of condemnation by eminent domain when it is in the public interest to do so;

§46-61 Eminent domain; purposes for taking property. Each county shall have the following specific powers: To take private property for the purpose of establishing, laying out, extending and widening streets, avenues, boulevards, alleys, and other public highways and roads; for pumping stations, waterworks, reservoirs, wells, jails, police and fire stations, city halls, office and other public buildings, cemeteries, parks, playgrounds and public squares, public off-street parking facilities and accommodations, land from which to obtain earth, gravel, stones, and other material for the construction of roads and other public works and for rights-of-way for drains, sewers, pipe lines, aqueducts, and other conduits for distributing water to the public; for flood control; for reclamation of swamp lands; and other public uses within the purview of section 101-2 and also to take such excess over that needed for such public use or public improvement in cases where small remnants would otherwise be left or where other justifiable cause necessitates the taking to protect and preserve the contemplated improvement or public policy demands, the taking in connection with the improvement, and to sell or lease the excess property with such restrictions as may be dictated by considerations of public policy in order to protect and preserve the improvement; provided that when the excess property is disposed of by any county it shall be first offered to the abutting owners for a reasonable length of time and at a reasonable price and if such owners fail to take the same then it may be sold at public auction.

§46-62 Eminent domain; proceedings according to chapter 101. The proceedings to be taken on behalf of the county for the condemnation of property as provided in section 46-61, shall be taken and had in accordance with chapter 101, as the same may be applicable.

§101-13 Exercise of power by county. Whenever any county deems it advisable or necessary to exercise the right of eminent domain in the furtherance of any governmental power, the proceedings may be instituted as provided in section 101-14 after the governing authority (county council, or other governing board in the case of an independent board having control of its own funds) of the county has authorized such suit by resolution duly passed, or adopted and approved, as the case may be. The resolution, in the case of the city and county of Honolulu or an independent board thereof, shall, after its introduction, be published in a daily newspaper with the ayes and noes, once (Sundays and legal holidays excepted) at least three days before final action upon it, and in the case of any other county or an independent board thereof, be published in a newspaper with the ayes and noes, at least one day (Sundays and legal holidays excepted), before final action upon it.

§101-14 Plaintiff. The attorney general of the State may, at the request of the head of any department of the State, or as otherwise provided by law, institute proceedings for the condemnation of property as provided for in this part. Any county may institute proceedings in the name and on behalf of the county for the condemnation of property within the county for any of the purposes provided in this part which are within the powers granted to the county.

Section 4-2(7) of the Revised Charter of the County of Maui (1983) states: "Resolutions authorizing in eminent domain shall be adopted as provided by law."

Maui County Code Section 3.44.O15(E) states: "The council may authorize proceedings in eminent domain by resolution. Any proceedings so authorized are subject to the requirements of chapter 101, Hawaii Revised Statutes."

The remainder of HRS chapter 101 sets forth the process for completing condemnation proceedings.. In summary, after the Council passes a resolution, the County is required to file a complaint in Circuit Court and provide notice of the action to all owners of the property. The County will be required to compensate the property owners for the property taken, and if the parties cannot agree on compensation, the Court will hold a trial on the issue.

Prior to drafting the resolution, the County should obtain a title report for the property, as well as an appraisal of the property's value. The appraised value of the property should be included in the County's budget. The resolution itself should authorize the Department of Corporation Counsel to initiate condemnation proceedings, specifically describe the property, sate the public purpose proposed for the property, and authorize Corporation Counsel to deposit money equivalent to the estimated value of the property to obtain immediate possession, if applicable. It is also advisable for the Council work closely with the County department that will be responsible for oversight of the property throughout the condemnation proceedings.

In your request, you discuss the possibility of condemnation of the structures but not the land within the proposed property. Owning the structures without owning the land would limit the County's control of the land to effectuate the purpose of the condemnation.

Please see Appendix 5 for a copy of the transmittal.

In an email request from Board of Water Supply Chair and TIG Vice Chair Shay Chan Hodges, Corporation Counsel Caleb Rowe, stated the following:

"In general, when a condemnation occurs, the governmental body undertaking the condemnation must pay "fair market value" of the property taken. The Hawaii Supreme Court in its decision in Honolulu v. Collins (attached) specifically states that the value of use of water derived from the land shall be considered in a determination of fair market value ("this land has a special value as water producing land. The owners, therefore, are entitled to compensation according to its value as such.")

> ***The calculation of damages would be a little weird for this one since the system is technically on state land and the rights to the water are entirely speculative (dependent on the RP from BLNR). Still, some consideration of the value of water would likely be deemed appropriate in a determination of fair market value."***

See Appendix 6 for a copy of Honolulu vs. Collins.

Fair Market value of the EMI System:

Market Value in 2018	**Based on one-year old purchase price**
1. Price paid by Mahi Pono:	$5,442,333.48 per the purchase and sales agreement with Mahi Pono. **Only 50% paid to date.**[54]
2. Assuming that Mahi Pono did its due diligence and assuming that A&B did not sell the EMI System to Mahi Pono for a concessionary price at less than fair market value contrary to the interests of its shareholders, $5.4 million was a fair price for the system last year. **Has the value increased or decreased since the time of purchase?**	Due to the reduction in agriculture, there has been reduced use of the aqueduct system over the last three years, and thus a reduction in EMI staff (as confirmed by Kamole Treatment Plant staff). It is likely that changes in delivery system use combined with less maintenance of ditches and the watershed would have a negative impact on the overall condition of the system.
Increased Value if EMI/Mahi Pono Receives 30-Yr Lease	**A&B/Mahi Pono Purchase and Sale Agreement**
1. The sale by A&B of its property and EMI interest to Mahi Pono required that A&B shareholders be informed of material details of the transaction through the filing of SEC Form 8-K. A&B's 8-K filing prescribes a minimum value of $62 million of Mahi Pono obtaining state water leases with sufficient water to fully implement its plan through a requirement that Mahi Pono be rebated this amount to reflect the diminished value of the property purchased from A&B if the water leases with sufficient allocation are not granted. As false and misleading statements made in SEC filings are prohibited by law, it is reasonable to assume that the information provided in A&B's 8-K regarding Mahi Pono's acquisition is accurate	Seller will make a one-time rebate to Buyer of $31,000,000 of the Purchase Price if at any time prior to the earlier of (i) the date State Leases are obtained as provided in Section 2.7(d) below or (ii) eight (8) years after the Closing Date: (x) EMI or Seller is legally prohibited from delivering the Minimum Water Amount (defined below) to Buyer, and (y) the amount of water that EMI is then not legally prohibited from delivering to Buyer is less than Buyer's actual surface water need at that time, as determined by Buyer in its sole discretion, exercised in good faith, to meet the irrigation requirement of its then existing crops or crops planned for the upcoming 24 months in the area served by East

[54] A&B/Mahi Pono, Purchase and Sales Agreement and Escrow Instructions, Page 4, https://www.sec.gov/Archives/edgar/data/1545654/000119312518354682/d664171dex101.htm

and based on proper due diligence.	Maui surface water (a "Productivity Loss Event." On the date one year after the initial Productivity Loss Event described in subsection (a) (the "Initial Productivity Loss Event"), Seller will rebate to Buyer an additional $31,000,000 of the Purchase Price for a total reduction in the Purchase Price of $62,000,000, unless by that date the Initial Productivity Loss Event is cured.[55]

Legal Ownership of the EMI System:

As noted under "Ownership Considerations" on Page 32, per the contractual agreements between EMI and the Hawaiian government, the East Maui Irrigation System should have reverted back to the Hawaiian government. **A thorough legal analysis of the current ownership needs to take place immediately.**

Assessed Value of the EMI System Relative to Repairs Needed:

Per the Central WUPD: Public concerns were voiced over the EMI system falling into disrepair, inefficiencies due to unlined storage reservoirs and system losses. In the East Maui Streams Contested Case, system losses were assessed to about 22 percent. As sugarcane cultivation is transitioned to other uses, EMI continues to maintain the system and keeping the main ditches functional even with reduced volume flow. CWRM in its June 2018 decision encourages HC&S to seek to make its storage and delivery of water to its fields more efficient to increase the productive yield of the irrigation water from East Maui.[56]

On December 20, 2016, the Department of Water Supply commented on the early consultation for the preparation of the EIS for the proposed 30-year lease. Some comments included:

The costs of the EMI System management, capital improvement, system operation and maintenance are important in assessing the future viability of the system and should be disclosed by the applicant. Relevant information include[s]:

The current and projected costs of the EMI system management, capital improvements, system operation and maintenance.

Although the DEIS, Page 548, refers to some repair and maintenance, there does not appear to be any explicit plans or expenditures cited in the EIS:

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55 https://www.sec.gov/Archives/edgar/data/1545654/000119312518354682/d664171dex101.htm, Page 6

56 Central WUPD, Page 104

Implementation of the CWRM D&O may require modification or complete removal of specific diversion in the EMI Aqueduct System. Mason Architects prepared a Historic Structure Assessment report for the subject Water Lease. It was determined that the EMI Aqueduct System is eligible to be place on the NRHP. Historically significant structures to be modified or removed will be documented photographically and with location sketch plans conforming to the Historic American Engineering Survey (HAER) standards. Any future developments will need to be in conformance with the goals, policies, and objectives of the State of Hawai'i CZMP[57].

Assessing the current condition of the EMI System and the costs of appropriate repairs:	**How would a fair appraisal be conducted?**
1. Comprehensive information from EMI/Mahi Pono about the condition of the delivery system would be extremely useful to the community, not just for the purposes of determining market value, but for assessing overall impacts on the ecosystem, health, safety, and traditional and customary practices. The BWS TIG requested a copy of a safety analysis conducted by Oceanit from EMI that might have provided valuable information about the state of the system, as well as recommended improvements. EMI/A&B declined to provide a copy of the report. BWS TIG requested a tour; which has not been scheduled by EMI yet.	Based on the draft EIS, it is unclear what the current condition of the EMI system is. One statement indicates that there WILL be maintenance but does not clarify what the current maintenance is. Page 3-15, Draft EIS: "ongoing maintenance and operation of the EMI Aqueduct System is expected to take place under all alternatives, to the extent operations and maintenance of the system is financially feasible."
2. Appraisal Process Scope of Work includes details of the property to be evaluated, reason for appraisal, who is ordering, who will receive report and how it will be used. Appraiser then identifies parcels, makes physical inspection, takes measurements, pictures and creates field notes. The appraiser then makes adjustment calculations to compare subject property to similar size, zoned, special features (in the case of vacant land - it is important to note the useable land area, the utilities available on the property, road access) Appraiser identifies any and all improvements on the parcels.	In the case of condemnation for purposes of obtaining a water storage and distribution system for the public trust, the appraiser will need to have an MAI designation (a professional certification) in order to be able to appear in court. Only a handful of appraisers in Hawaii are MAIs. Hiring the appraiser with court experience would probably cost from $25,000 to $50,000.
3. From US Department of thee Interior, Fish and Wildlife Service. Dan Pohlhemus of USFWS attended June 2018 East Maui H20 Roundtable offered the following observations on the E. Maui ditch system from recent experiences he has had doing stream surveys:	Dan Pohlhemus: "At the present time, there is also no water being diverted from any stream east of the Koolau Gap by the Koolau Ditch, because in that sector at least as far west as Wailuanui Stream it is stagnant or dry. EMI and Mahi Pono are only diverting what they currently need to serve Maui County, fire control, and a few limited ag customers, which all amounts to less than 30 mgd. This is easily supplied by diversions on the Wailoa Ditch

[57] CZMP=Coastal Zone Management Plan

" … due to lack of maintenance, the various ditch systems other than the Wailoa Ditch (which has the highest elevation alignment and is thus of greatest use to Maui County Water) are gradually falling apart, with numerous treefalls and land slips beginning to obstruct them, and their headgate machinery rusting and deteriorating. "As far as I can see, neither the Lowry Ditch nor the New Hamakua Ditch are currently functional, and with each passing day it will take progressively more work and money to bring them back into service.	from Puouhokamoa westward, a fair number of which are still active to some degree. But there seems to be no master plan here, just EMI taking the limited amount of water they still need from whatever are the easiest diversions to maintain. Everything else will go back to the forest, as has already happened to many diversions and access roads associated with the Waiahole Ditch on Oahu. Essentially, the system is downsizing itself, although that is not all bad."
4. Community Members provided feedback about the condition of the EMI Delivery System and the impacts on safety at focus groups convened for the Draft EIS. Page 4-121, DEIS: Mr. Hau states that the EMI Aqueduct System requires mapping that shows the 388 intakes, ditches, dams, pipes, and flumes. Each diversion should be located and identified accurately with GPS coordinates. Elevations should also be recorded. The amount of water moving through the system should be measured at specific locations within the EMI Aqueduct System as well.	Page 4-135,DEIS: As landowners and farmers downstream of the EMI Aqueduct System, two major concerns emerged among participants. First, many reported that the EMI Aqueduct System is not maintained in a manner that was safe for people in the area and located downstream. Focus group participants said that portions of the ditch area are so overgrown with vegetation that people visiting the area are injured if they stumble upon or fall into ditches and flumes that are not readily visible. Two bridges on State land often flood in this wet season, and people cannot drive to their residences until the water level subsides. It was felt that the bridges are unsafe because of a lack of maintenance. Also, people who visit popular areas in the vicinity of the State Forest Reserve, such as Twin Falls (which is partially within License Area; the upper falls are within the License Area but, the area that is frequently visited is outside the License Area), and area trails, noted that these areas are subject to overgrown landscaping and flash flood conditions. Participants noted that neither EMI nor the State has participated in maintenance of the EMI Aqueduct System and trails in this area, even though this area attracts residents and visitors alike.
5. Examples of repairs and modifications:	Replace old diversion apparatus with modern diversion devices (solar powered, plus batteries) that allow established minimum flows to pass through, mauka to makai, and divert only excess water, and which allow migrating aquatic animals, plants can pass under device unimpeded both up and downstream. Install 24" pipes as used in mainland fracking water transport, laying the pipe in existing ditches, tunnels, flumes. This will reduce leakage to a minimum and save many mgd.; and prevent contamination of one stream with snails and other biota unique to each stream,
6. A formula for estimating initial repair costs is utilizing 3% of Replacement Asset Value (RAV) per year, over two years, which would total of $12 million.	Page 802, DEIS: "The development and improvement of the EMI Aqueduct System over time has cost nearly $5,000,000, compared to its modern assessment of nearly $200,000,000 to create a comparable system."

Operating Costs and Management Considerations:

In the Draft EIS, EMI provides specific current and anticipated operations costs. If a public entity purchases the EMI Water Delivery System, these figures would represent the cost of operating the system with current EMI staff in place, which would be the most efficient plan at least in the short-term. Given that the EMI system is a relatively small operation with regard to personnel, taking over management and administration of the system would be relatively straightforward.

Breakdown of Operations Per EMI/A&B:	**Page 2-1, 4-150, Draft EIS: $2.5 M Annually**
In the DEIS, EMI provided total operational costs for Mahi Pono, which are quoted here. Specific operational costs are also listed, though not enough information is available to confirm how final calculations were reached.	Page 2-1, DEIS: Total costs for labor, fringe benefits, materials, professional services, taxes, maintenance, anticipated rental payments to the State for the Water Lease, and other expenses are projected to be approximately **$2.5 millio**n per year (Munekiyo, 2019).
1. Personnel	EMI is expected to employ a staff of 17 people with a payroll of $0.8 million. Total direct and indirect jobs is 24, with an associated payroll of **$1.1 million**.
2. Operations	EMI's operating cost (including personnel above) under the Proposed Action would be $0.068 per kgal, for a total of $2.2 million. (**Table 4.** EMI Water System Economic and Fiscal Impacts, DEIS Page 18)
3. Taxes	GET revenue would be estimated at $37,000 while payroll tax would be $45,400 per year
4. Payments to DHHL and OHA	$169,300 would be disbursed to OHA and $254,000 would be set aside for the DHHL
5. State Leases	Based on appraisal

Opportunities for Direct Cost Savings Through Improved Maintenance:

Engineering study of the EMI system that assesses the cost-benefit of mitigating 20% losses is needed.	**What are the funding options available for environmental assessments?**
1. Given the amount of water that is lost through leakages on a regular basis, what would the savings be of proper repair and maintenance to the owner of the system, and would that savings offset any of the R&M costs?	Ko`olau WUDP, Page 121: "…water losses due to leaks, seepage, evaporation and other inefficiencies in the treatment, conveyance, distribution and storage of water range widely depending on storage and source transmission system age, length, type and many other factors…To account for water losses and determine source needs for Upcountry, water produced, rather than water billed is used as basis to determine source needs**. For the Upcountry system, water losses average 20%."**
2. What would the estimated increased availability of water to Upcountry residents be as a result of proper repair and maintenance?	
3. What would the impact be on overall East Maui stream restoration if less water needed to be diverted to supply Upcountry Maui?	

Liabilities:

Prior to the current sale of the EMI system to Mahi Pono, EMI has been operating under a "status quo" mentality with various grandfather clauses in effect. There are numerous liabilities and additional legal obligations that any new owner will need to address such as issues related to abutting landowners:

- Trespass and safety issues related thereto;
- Risks of extra water flow in storms; and
- Trees falling and other natural and man-made dangers encroaching on abutting land.

The DEIS does not contemplate a risk management plan that will be necessary to address these liabilities that Mahi Pono will be assuming when it takes full ownership of EMI and when the various grandfather clause exemptions currently enjoyed by EMI are no longer in effect.

Opportunities for Indirect Cost Savings through Mitigating Health and Safety Risks:

Health and Safety Considerations and Concerns, including Climate Crisis Impacts	**In addition to direct costs, the County should look at other considerations that affect the well-being of Maui residents.**
1. What are the safety concerns that would affect the community at large if the system is not properly maintained, regardless of ownership?	Page 3-14, DEIS: Impact to historic properties. Components of the aqueduct system that deteriorate and begin to fail, such as broken ditch walls or collapsed tunnels, have the potential to alter natural drainage patterns and increase erosion in downstream areas that are outside of established stream channels. These areas have the potential to contain surface and subsurface historic properties that could be affected by flooding and erosion. (Mason Architects, 2019).
2. What are the health and social effects on East Maui residents, including community benefits for intergenerational farmers returning to the valleys that have been without water for over a hundred years, if EMI Delivery system is not maintained optimally?	This would require a thorough study of the impacts of access to water on farmers and communities from a socio-economic perspective, looking at potential impacts of returns to East Maui.
3. How does maintenance of the EMI Delivery System impact Climate Crisis safety concerns with regard to flooding? (Steps to be taken regarding climate crisis mitigation over the next thirty years were not found in the DEIS although climate change is mentioned as a factor.)	Page 4-72, DEIS: Climate change trends suggest increased potential for East Maui, including the License Area, to experience periods of intense, episodic rainfall where several inches of rain can fall in a matter of a few hours. With several streams being within East Maui, greater, episodic rainfall could increase stream flows and possible exceed the capacity of the EMI Aqueduct System as discussed in Section 4.3.1. The Modified Lease Area alternative could present risks to public safety if unfettered public access within the License Area meant more people could be put at risk due to stream flooding.

Opportunities to Support Culturally and Community-Based Economic Development As Defined by the Community:

The EMI Delivery System and Economic Development	**The County should look at how public ownership would further support value-aligned economic options as defined by East Maui residents.**
1. An analysis of the economic and social value of a well-maintained aqueduct system that supports local farming beyond state laws governing stream flow standards would allow the public to support multiple stakeholder needs from a variety of perspectives.	Summary, Page 58, DEIS: At full development, East Maui farms would produce about 1.0 million pounds per year of taro and about 400,000 pounds per year of other crops, resulting in $2.9 million in direct and indirect sales per year. Farms would support a total of 21 direct and indirect jobs. (Munekiyo, 2019).
2. The impact of eliminating water loss on streams and waterfalls could be looked at from the perspective of impacts on the visitor industry.	What would loss of waterfalls impact be on tourism dollars? How would a managed tourism plan that acknowledges the contributions of and impacts on residents and the natural environment look?

Economic and Other Benefits of Accountability Regarding Streams Flows:

Although legal decisions have supported the return of water to streams, there is a lack of funding for monitoring and enforcement	**Public ownership of the water delivery system would provide transparency, accountability, and multiple remedy options to the public if laws are not followed.**
1. As noted previously, maintaining water in the streams has an impact on the watershed. There are also local and global environmental, community, tourism, energy, food security, and cultural imperatives for being able to ensure that streams are being restored as mandated by law.	The Code (HRS § 171C-3) defines "instream use" as: 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.
2. If the water delivery system were publicly owned and/or controlled, there could be more opportunities and motivation for pursuing robust and authentic engagement with East Maui families regarding care of watershed and ahupua'a, including a community-based system of repair and maintenance (kuleana) to support ongoing communication and relationship building, as well as potential sources of funding for community	Ko`olau WUDP, Page 15: There are 36 streams in the Koolau ASEA, that are classified as perennial. Of these streams, 31 are considered continuous and 5 are considered intermittent. The CWRM database indicates that there are 323 declared stream diversions in the Ko`olau ASEA and 11 gauges, of which, only three are "active." Most of these diversions belong to the East Maui Irrigation Company (EMI). Developing an East Maui community-based/owned system of

appropriate technology, including installing monitoring devices that can withstand heavy storm floods with wireless data broadcast that accurately measure stream flow and diversion amounts.	watershed stewardship could be an economic and educational driver from Keanae to Kaupo, based on generations of knowledge combined with environmental and climate change educational opportunities.
3. If EMI/Mahi Pono is granted a 30-year lease, there will be very limited opportunities for the community to demand accountability until 2050, long after intense effects of climate change have impacted Maui.	Page 4-121, DEIS: Mr. Hau relayed via email that he recommends a five-year lease with constant updates due to the fact that the project description lacks information on the amount of water flowing through the EMI Aqueduct System and the actual amount of water collected at each diversion and/or ditch without the factor of climate change accounted for.

Safeguarding Public Health & Community Security:

In addition to weighing the cost/benefits of owning/controlling the EMI Aqueduct System in the context of providing domestic water to Maui residents, the County needs to consider the long-term benefits of having control over its water supply over the next 30 years.	**How does control of the delivery system combined with the fact that water is a public trust support pro-active access to water and system improvements?**
If the County of Maui owns the EMI Delivery system, given that Act 126 specifically allows for the continued diversion of water to serve Upcountry Maui domestic needs, the County would be in a strong position to receive a long-term lease from DLNR. Having its own long-term lease would release the County from dependence on a private company, thereby ensuring that the County can safeguard the public health of Upcountry and East Maui residents.	Issuance of a long-term lease of State land from the Board of Land and Natural Resources pursuant to Hawai'i Revised Statutes (HRS) Section 171-58(c) would provide *the "right, privilege, and authority to enter and go upon"* state-owned license areas *"for the purpose of developing, diverting, transporting, and using government-owned waters"* including the right to go upon those State lands to maintain and repair existing access roads and trails used in connection with the privately owned water aqueduct system.
According to DWS Director Jeff Pearson at the September 19, 2019 Meeting of the Board of Water Supply, the County of Maui would not be able to apply for a revocable permit or lease unless it owned the "diversion." If he is correct in his assertion, ownership of the EMI delivery system would allow the County or another public entity such as a Public Trust Water System to be able to apply for a lease.	Director Pearson made this statement in response to a recommendation by Hawaii State Senator Kai Kahele that Maui County apply for a Revocable Permit and lease immediately. Per Senator Kahele, the county is a domestic water provider, its rights are constitutionally protected. If they have an RP or a long-term lease, no matter who runs the transmission system, they can always get water for Kamole. See attached Appendix #3
Having ownership of the system and its own lease, the County of Maui or "Public Trust Water System" would be able to protect the public interest and support public access to the area as needed. Beyond access to domestic water, there are also health and safety issues related to Climate Change for Upcountry Maui. As noted by the State of Hawaii, Office of Planning, "the potential adverse effects of global warming include a rise in sea levels resulting in … the inundation of	Page 473, DEIS: Changes in precipitation may affect Upcountry Maui's ecosystems and communities include flooding, erosion, drought, and fire. In addition, the ability to support smaller, local farmers and increased food security would be enhanced. Page iii, DEIS: The Water Lease will enable the lessee to enter upon lands owned by the State of Hawai'i in order to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System, and will allow continued operation of the EMI Aqueduct System.

Hawaii's freshwater aquifers."	
Any publicly-owned entity that entity owned and/or controlled the system would have access to public funding for maintenance of the system and restoration of wetlands that a private owner can't access.	A current example of this kind of benefit for public entities is the $4.5 million currently allocated by the Dept of Agriculture to help restore stream access in East Maui. The DoA cannot use the funds on private lands, such as EMI/Mahi Pono property. Similarly, USDA and other funding that could be used to repair the EMI delivery system could only be accessed if the system were owned by a public entity.
Public ownership of the delivery system – particularly if combined with lands owned by the County of Maui – would allow for more comprehensive systems-oriented solutions to water needs by combining renewable energy, farming plans that are tailored to community needs, and efficient water systems.	Water and farming plans that integrate analysis of use of curtailed wind energy for water pumping in agriculture and municipal systems can reduce agricultural water needs, lower energy costs for pumping water upcountry, and potentially increase stream flows. (Examples: A Systems Approach for Investigating Water, Energy, and Food Scenarios in East-Central Maui[58])
Public ownership would also allow for mechanisms that require a Water Management Plan, building on the Water Use and Development Plan, but with enforcement mechanisms and funding allocations.	Page 4-145, DEIS: Interviewees stressed that Mahi Pono should implement a Water Management Plan. The Plan should outline improvements to the EMI Aqueduct System, including brush fire prevention and relate water needs to specific crops.
Public control over water delivery systems and watershed areas would support proactive and integrated efforts to ensure an affordable and predictable supply of water.	Board of Water Supply, City and County of Honolulu, 2016 Master Plan, 6.2 Sustain[59] The BWS manages thousands of acres of watershed area on O'ahu to protect and preserve 212 separate potable water sources, the combination of 194 individual groundwater wells, 13 active potable water tunnels, and 5 shafts. The BWS's proactive efforts to manage and protect the watersheds include limiting access and development, combatting invasive animals and plants, promoting healthy forests, and encouraging customer water conservation to reduce the amount of water withdrawn from the environment. These BWS efforts are discussed in more detail in Section 4, Water Supply Sustainability.
Public or quasi-public ownership of the water delivery system would enable the public to ensure that workers are paid a living wage.	Jobs resulting from the use of a public trust resource such as water should pay enough for Maui residents to support their families.
As noted at the beginning of this document, the impetus for forming the Temporary Investigative Group grew out of the fact that Mahi Pono has been minimally responsive to community concerns and has been unresponsive to requests by the Board of Water Supply for engagement. Water Department Director Jeff Pearson has stated that his continued attempts to encourage Mahi Pono representatives to respond to the Water Board have	Page 4-141of the DEIS: It is recommended that interest groups, or stakeholder groups, are clearly defined so that there is recognition of who will be affected by the proposed Water Lease. Groups should include geographic communities, environmental, agriculture and business interests, and public agencies. Each group would be encouraged to reach consensus on their own needs, concerns, opportunities and possible solutions. It is recommended that interest groups are equitably

[58] http://ulupono.com/media/W1siZiIsIjIwMTQvMTEvMTgvMjNfMjhfNDJfOTQxX0FfU3lzdGVtc19BcHByb2FjaF9mb3JfSW52ZXN0aWdhdGluZ19XYXRlci5wZGYiXV0/A%20Systems%20Approach%20for%20Investigating%20Water.pdf?sha=eea0a5f3

[59] https://boardofwatersupply.com/bws/media/files/water-master-plan-final-2016-10.pdf

been unsuccessful. Even though Director Pearson and the Maui County Administration have lobbied the State Legislature and will be lobbying the Department of Land and Natural Resources to support EMI/Mahi Pono application for a long-term lease, Mahi Pono has not been compelled to meet with the only volunteer board that advises the Mayor and County Council on matters related to water. Given that Mahi Pono is funded through PSP (Public Sector Pension), which "capture[s] value by integrating environmental, social and governance (ESG) factors throughout the investment process and across all asset classes," it is surprising that community engagement, which is a key ESG value, has not been a priority for Mahi Pono. According to PSP's Responsible Investment Report: "Through engagement, one can assess a community's perceptions of the acceptability of a company's project or local operations. In this context, community can be broadly defined to include stakeholders and interested parties well outside the immediate areas of operations, or any group or individual that can affect or is affected by the achievement of a company's project. In other words, companies cannot operate sustainably without community support." [60]	represented in a "Core Working Group" that would serve as a forum for exchanging ideas and collaborative efforts, as well as provide feedback and suggestions to Mahi Pono. Each member of the Core Working Group would be expected to reach out to their own networks to extend the discussion beyond the Core Working Group. While there would likely be strong differences in perspectives and opinions, the Core Working Group would need to find ways to establish core principles, common ground and manageable solutions. The fundamental value that will help bring people to the same table is trust. The Proposed Action has elicited skepticism and distrust over many decades, and these feelings prevent willingness for participating in mediation and collaboration. While developing trust among the various groups will be challenging, the first step is transparency. Being open about intent, plans, and activities can begin to establish credibility and open the door to dialogue.
Public ownership of the EMI water delivery system would provide an opportunity to move towards reparations for the Native Hawaiian families who have not had access to their streams for over 100 years. Unlike local government, which exists to meet the needs of its citizens, a private entity – particularly one that is funded by an institutional investor with obligations to pension fund beneficiaries -- would need to develop a business plan that both maximizes revenues, while addressing environmental and cultural considerations. While this is possible, the DEIS does not describe such a plan.	Ko`olau WUDP: Historically, great efforts were made to allocate water for all needs on Maui. Today, native Hawaiians are challenged with the negative consequences of resource "ownership," with "owners" sometimes lacking sensitivity or requirements to share with others. Perhaps past strategies of sharing distribution and timing of water flows can be adopted in order for all water users to be supplied with this important resource. Consortiums of water partners have been discussed as options to ownership and management of the East Maui Irrigation water system.[61]

Potential Sources of Public and Environmental and Infrastructural investment funds:

As noted in the table, any publicly-owned water delivery entity, whether the County or a "Public Trust Water System" would have access to public funding for maintenance of the system and restoration of wetlands that a private owner can't access.

[60] https://www.investpsp.com/media/filer_public/documents/PSP-2018-responsible-investment-report-en.pdf

61 Ko`olau WUDP, Page 39

For example, grants and loans are available through the US Department of Agriculture, Rural Development agency for water and environmental programs. These grants are focused on populations of 10,000 or less so they could possibly apply to East Maui.[62] The USDA's Rural Utilities Service (RUS) provides much-needed infrastructure or infrastructure improvements to rural communities. These include water and waste treatment, electric power and telecommunications services. The US Bureau of Reclamation also provides funding for large scale water management, efficiency, and development.[63] There are other federal revolving loan funds with favorable terms that are designed to finance these types of water projects. And as noted in the table above, the State of Hawaii can be a source of funding, as it was in the $11.2 million CIP Waikamoi flume replacement project. There are also a number of charitable foundations that have an interest in funding feasibility studies for municipal bond financing of environmentally beneficial projects.

Risks of Leaving Access to the Public Trust in Private Hands:

The County also needs to consider the risks of an outside private equity firm with a "2 and 20" compensation structure and whose institutional funding source is seeking a net annualized return in excess of 10% controlling a significant amount of Maui water supply for 30 years.	**Unless the existing owners make legally binding commitments, the community is at risk.**
The DEIS is very clear that if EMI does not receive a 30-year long-term lease, EMI/Mahi Pono will not guarantee water for Upcountry Maui even though EMI/Mahi Pono has other sources of water that can be accessed for Upcountry (up to 30 mgd based on their reporting).	Page xiii, DEIS: Without the Water Lease, even if EMI could find it economically feasible to continue maintaining the EMI Aqueduct System to divert non-governmental water for diversified agriculture in Central Maui, there may not be enough water to allocate much or any to the MDWS. This lack of water would exacerbate the effects of drought when other surface water sources are unreliable for the KAP and the Nahiku, this could eliminate their primary source of water. Insufficient water delivered to the County through the EMI Aqueduct System could have significant effects on health and safety of those who currently rely on that water delivery.
As climate change creates more uncertainty and extreme impacts on residents, based on statements made in the DEIS and the record of Mahi Pono's parent company Trinitas in California during the California drought in 2015[64], it is imprudent to assume that Mahi Pono will be a responsible community citizen, if extreme weather reduces water availability and/or if community groups request more investment in sustainable farming and/or water conservation practices.	Page 3-11, DEIS: Climate change may cause a decline in rainfall in Upcountry Maui. Any alternative that may result in less water being delivered through the EMI Aqueduct System to the MDWS for use in the Upcountry Maui Water System could increase periods of intense water shortages in Upcountry Maui.
As the climate crisis creates more uncertainty and extreme	A current and very dramatic example of a corporate

62 https://www.rd.usda.gov/about-rd/agencies/rural-utilities-service

63 https://www.usbr.gov

64 https://www.businessinsider.com/the-65-billion-almond-crop-is-driving-the-sharp-debate-about-california-water-use-2015-4

impacts on residents, it would be imprudent to assume that a private equity firm such as Mahi Pono with a financial incentive structure which is not aligned with the long-term public interest will take responsibility for addressing potential infrastructure damage and resource losses which will have significant impact on Maui. The DEIS makes it clear that if Mahi Pono does not receive all the public resources to which it believes that it is entitled, it may cut some or all of its water allocation to upcountry residents "which could pose long-term risks to health" (DEIS 7-5) as well as abandon agricultural fields (DEIS 6-4) and the EMI Aqueduct System. "Under such a scenario, the aqueduct system's historic resources may be found at risk for neglect from reduced or lack of maintenance, and/or possible demolition."	entity not taking responsibility for the potential long-term public impact of neglecting prudent infrastructure and resource management is Pacific Gas & Electric which earlier this month was forced to cut power to 800,000 households causing well over a billion dollars in economic losses in a matter of days. In the case of PG&E, regulatory bodies such as the California Public Utilities Commission have broad authority to implement and enforce corrective action. If Mahi Pono is granted a 30-year water lease under the proposed action, it is unclear what, if any, resourced mechanisms for accountability would be available to ensure that the public interest continued to be served for full term of the lease.
As noted above, PSP is likely seeking an annualized return in excess of 10% on its investment in Mahi Pono. A common approach to increasing return among private equity firms is to leverage an acquisition with a high amount of debt. As highly leveraged deals can rapidly lead to a crisis when financial projections are not met, it is important for stakeholders to have adequate knowledge of the debt structure. The DEIS does not provide this.	Page 3-6, DEIS: "[A] lease term shorter than 30 years could limit the ability of Mahi Pono or a lessee to obtain financing for the needed investment in establishing successful diversified agricultural operations and crops that may take years to reach economic viability."
Perpetuation of a narrative that supports water scarcity, where one has to choose between returning water to the streams and Upcountry domestic water use and/or water in the streams versus agriculture, as opposed to one that promotes collective pro-active measures to support increasing recharge, conservation, and collaborative sharing of water resources has the potential to divide a community that currently is supportive of diverse interests and needs.	Page 4-137, DEIS: "Balance" was a frequent theme among interviewees. They acknowledged that various groups need water originating from East Maui State watershed lands and felt that users should have access to water they truly need. Of note is that, regardless of one's own interest in the Water Lease, no one wanted water withheld from other groups. Page 4-140, DEIS: A common theme with the Upcountry Maui residents was the continuation of reliable water service to Upcountry Maui residents, businesses and farmers. There was general appreciation for water provided by the EMI Aqueduct System. It is noted that these Upcountry Maui residents felt that East Maui agricultural and cultural practitioners should also have the water they need for their activities. They understood the need for flowing cold water in kalo cultivation.
March 2019 WUDP Draft, Water Resource Management, Strategies And Recommendations, Page 231-234: #29 Research, support and use of less water consumptive crops and climate adapted crops" #30 Improve irrigation management and efficiency #32 Augment agricultural water supplies with alternative resources, #47 Diversify supply for agricultural use to increase reliability #50 "Balance existing diversions with alternative sources for agriculture to mitigate low-flow stream conditions #51 Maximize efficiencies in surface water transmission, distribution and storage	In terms of supporting agriculture, it is important to differentiate between export and crops for local consumption; how specific agricultural practices impact the climate crisis; whether the specific economic activity results in good jobs for Maui residents; and or whether it will exacerbate the housing crisis by importing workers. While Mahi Pono is technically governed by pension fund PSP's ESG (Environmental, Social, Good Governance) principles, there has been no explanation of how those principles impact decision making, nor has the company been transparent (Good Governance is the "G" in ESG).

In Summary: Determining Costs and Benefits of Purchasing EMI System

1) Determination of legal ownership of all aspects of the EMI Water Delivery System is necessary, regardless of what the County/public decides to do.
2) A thorough engineering and cost analysis of the current EMI Delivery system is needed to determine the EMI System's true value as a stand-alone or partial system (and the various permutations thereof), in conjunction with improvements. This analysis needs to provide reliable information about:

    - What parts of the system are usable and what is the cost and value of repair, particularly in light of the "natural downsizing" currently taking place as a result of neglect;
    - Based on the domestic water use needs in Upcountry Maui and the condition of various aspects of the EMI system, what would be the most cost-effective strategy for partial purchase and use of the EMI system if there is one?
    - What are the options for condemning parts of the system and/or small tracts of land?
    - What are the benefits, if any, of purchasing specific ditch systems, such as only the Wailoa Ditch System?

3) Annual costs of maintaining the EMI System; including an assessment of liability issues;
4) Potential revenues based on domestic water and agricultural water sales;
5) Potential positive impacts of control of the revenue stream of Wailoa Ditch and/or the entire EMI system, such as:

    - Estimates of socio-economic benefits of increased farming in East Maui based on stakeholder control of instream flows;
    - Estimates of potential cost savings from improved health, safety, and other socio-economic indicators for East Maui residents who rely on the streams for farming and other cultural and recreational practices;
    - Estimates of the value of improved environmental stewardship based on modifications to the appurtenances and increased stream flow;
    - Estimates of potential increased water production from substantial watershed investments, combined with analysis of socio-economic benefits to East Maui of such an investment (with ancillary cost savings to other county departments as a result thereof);
    - Estimates of economic development and support of farming based on decreasing water rates for local farmers and reducing infrastructure costs for local residents with regard to water meters and subdivision outlays.

6) Risk of allowing a private equity firm and foreign pension fund to control a significant amount of Maui's water, which is a Public Trust, and to have outsized influence over Maui's water, agricultural industry and food security for 30 years.

VI. Alternative Water Sources

In addition to considering the viability and costs of purchasing parts or all of the EMI Aqueduct System, the TIG was tasked with assessing alternatives to ownership of the system that might also provide water security for Maui residents.

Pi`iholo and Olinda Water Treatment Facilities:

It is important to remember that with regard to Upcountry Maui, the Maui Department of Water Supply relies on three surface water sources:

- Wailoa Ditch, which is on state lands, and for which the current 30-year land lease is being sought by EMI/Mahi Pono, and
- Two MDWS higher elevation aqueducts that transport water to Olinda and Kula, owned by the County but maintained by EMI, under a contractual agreement originated under the 1973 East Maui Water Agreement and subsequent agreements.

MDWS and EMI diverts water from Ko`olau ASEA, conveyed to treatment plant facilities located in Ko'olau ASEA (Piiholo Water Treatment Facility) and the Central ASEA (Olinda and Kamole Weir Water Treatment Facilities. (*See page 15 of this report*)

The two upper aqueducts are owned by the County and provide the majority of the water to Upcountry Maui. In 2018, they provided a total of 4.61mgd, compared to 1.5mgd at Wailoa.

Per the DEIS, the other two surface water sources are not supplied by the EMI Aqueduct System, but are fed by streams located on lands previously owned by A&B and now owned by Mahi Pono. Under a contractual agreement with EMI, these waters are diverted and transported by two MDWS high-elevation aqueducts (Upper and Lower Waikamoi Flumes) that are also situated on land that was previously owned by A&B and now owned by Mahi Pono, located above the License Area (Ha'iku Uka Watershed). These aqueduct systems deliver water to the MDWS' Olinda and Pi'iholo Water Treatment Plants (See Figure 2- 4). These two high elevation aqueducts are maintained by EMI. However, these sources are not part of the proposed Water Lease being addressed by this DEIS as they are outside the License Area. The water received at the higher elevation is preferred by the MDWS because it can be delivered to users at higher elevations without the cost of pumping from a lower elevation source like the Wailoa Ditch.[65]

[65] DEIS, Page 2-10

Potable Groundwater Development:

From Ko`olau WUDP:

The amount of groundwater that can be developed is limited by the amount of natural recharge and aquifer outflow that contribute to streamflow and to prevent seawater intrusion, established as sustainable yield. Because delineation of aquifer sectors and systems in some cases are based on limited hydrologic information, areas for potential groundwater development must be assessed on its own merits to determine any additional needs for hydrologic studies and interaction with surface water and other sources.

Understanding potential impact of climate change adds to uncertainty in long-term groundwater availability. The primary responsibility to determine potential impacts on water resource availability lies with the State CWRM who in turn relies on studies and predictions by the scientific community and other agencies. Water purveyors need guidance how to mitigate and adjust to potential changes in groundwater availability.

Other constraints on groundwater availability include access and cost. Conveyance from high yield aquifers in remotely located watersheds to growth areas can be difficult and expensive due to topography and distance. Basal well development at high elevations, such as Makawao aquifer above 1200 feet would result in high pumping costs, just in terms of pumping water from the water table to ground elevation.

Potential effects of groundwater development on streamflow and on the quality of water pumped from existing wells in a region can be evaluated by robust hydrologic studies and models. Joint funding and collaboration between the municipal and private purveyors, CWRM and the U.S. Geological Survey would focus studies to maximize benefits and prevent conflicts in water development and designation. Aquifer systems in Ko`olau are not extensively studies, as indicated by CWRM's confidence rating in establishing sustainable yield. Haiku aquifer has sufficient yield to serve regional demand and support development of planned growth areas outside Ko`olau. It is recommended that CWRM prioritize hydrological studies and groundwater modeling in Haiku and Honopou regions to guide private and public well development and ensure potential impacts on surface water is addressed first. [66]

Additional points from Central WUDP:

Other constraints on groundwater availability include access and cost. Conveyance from high yield aquifers in remotely located watersheds to growth areas can be difficult and expensive due to topography and distance. The Central ASEA consists of the driest regions on Maui, with annual rainfall generally less than 50 inches. Population centers and growth rely on groundwater imports from the Wailuku ASEA and the Ko`olau ASEA where rainfall and groundwater recharge are substantially higher. [67]

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66 Ko`olau WUDP, Page 104

67 Central WUPD, Page 105

In order to determine whether development of wells in East Maui should be a considered as an alternative to surface water, yield, aquifer capacity, and energy cost need to be studied.	
Ko`olau WUPD, Page 46: The Ko`olau ASEA includes 149 wells, of which 131 are considered "production" wells, the remainder (18) are classified as "unused" (9), observation (2), and seven classified as "other" that do not produce water. The 131 production wells include County municipal (4), private public municipal (3), domestic (59), agricultural (crop use [39]), agricultural (1), agricultural (aquatic plants & animals use [1]), one agricultural (livestock and pasture use), three agricultural (ornamental & nursery plants use), 15 irrigation, and seven irrigation (landscape/water features use). CWRM pumpage reports for 2014 show that pumpage for the Ko`olau ASEA was approximately 0.92 MGD with County Municipal wells accounting for 0.878 MDG (95.81 percent of total sector pumpage), Municipal Private Public wells accounting for 0.015 MDG (1.63 percent of total sector pumpage), Agriculture wells accounting for 0.014 MGD (1.53 percent of total sector pumpage), Domestic wells accounting for 0.008 MGD (0.86 percent of total sector pumpage), and irrigation wells accounting for 0.0017 MGD (0.19 percent of total sector pumpage). However, it is likely that domestic use is underreported.	Page 4-59, DEIS: While no groundwater is transferred from the Ko'olau Aquifer Sector, surface water is conveyed from the sector to the Central Aquifer Sector via the EMI Aqueduct System. Since surface and groundwater interchange depends on the underlying geology, the increase in surface flow since the cessation of sugar cultivation in 2016 also contributes to an increase in groundwater in East Maui. Central WUDP, Page 112: Strategy #4 Explore East Maui well development in combination with Makawao aquifer basal groundwater to meet projected demand on the MDWS Upcountry System. Initiate a hydrologic study to determine any negative impact on existing ground and surface water sources, stream flow and influences from dikes. Potential yield is more than the needed 6.3 mgd (potentially in addition to development for the MDWS Central System). Lead agencies would be CWRM and MDWS and hydrologic study to be completed by USGS. Page 3-9, DEIS: There may be a connection between decreased stream diversions and increased groundwater. However, the current pumpage of wells in the four aquifers in East Maui (Ha'iku, Honopou, Waikamoi, and Ke'anae of the Ko'olau Aquifer Sector) is well below the SY (Sustainable Yield.)
Wells are more expensive than surface water due to energy costs for development and pumping, but costs can be mitigated with solar, wind, hydro-pumped storage, particularly if the Department has access to land. In order to comprehensively compare costs, all factors described previously in this report related to repair and maintenance of the EMI Aqueduct System, combined with the environmental, safety and cultural benefits of EMI ownership would need to be compared to well development costs. Any well development plan should include scenarios that utilize renewable energy, the costs of the development of which would also need to be calculated. However, agreements with MECO and the benefits of bringing the State to its goal of 100% renewable energy by 2045 would also need to be factored in. Per DWS comments on early consultation for EIS on 12/16/16: Although the non-consumptive use of water	Page 3-2 to 3-3, DEIS: "a single well is normally allowed to pump about 1 mgd within its area" Given current figures regarding Kamole Treatment Plant needs, 3 to 7 wells would need to be developed. Each well site would have an estimated development cost of $6 million. (Akinaka, 2019). The cost of planning, obtaining permits for, and constructing 7 wells would be approximately $13 million. Added to this cost would be transmission pipes, additional pumping and related energy consumption to reach higher elevations, and reservoirs. Central WUDP, Page 110: The 2013 MDWS study estimated well development at 2,050 foot elevation and related booster pump and transmission line to about $8.4M and a 20-year cost of $2.90 per 1,000 gallons for development of 1.2 mgd pump capacity, normally run at 0.8 mgd source capacity. The study only evaluated a scenario with one well in Makawao aquifer and in

involved in hydroelectric uses is likely difficult to appraise, the EIS should describe the extent to which hydroelectricity is generated, including the associated costs and revenues.	combination with well development outside Makawao aquifer. Central WUDP, Page 110**:** Explore new basal well development in the Makawao aquifer to accommodate growth Upcountry and add reliable new source. Potential yield is up to 3 mgd. Lead agency is MDWS, DLNR and/or public/private partnerships.
Central WUDP, Page 109: Adding 20% to projected 2035 demand of 8.53 mgd for Upcountry is 10.23 mgd. With the addition of the Priority List demand of 7.3 mgd, total demand is 17.54 mgd. Available source capacity is 11.2 mgd, which would require the balance 6.34 mgd to be developed. (includes 7.0 Surface Water)	Page 3-17: DEIS: If the MDWS has to replace the 7.1 mgd supplied by the EMI Aqueduct System, and in addition develop to the 7.95 mgd projected to be needed to meet future water demands, the MDWS would need to develop 15.05 mgd of new water source. It is estimated that the life- cycle unit cost to develop those necessary wells and reservoirs for Upcountry Maui is $38 per kgal. This would translate to $2.6 billion, compared to $1.2 billion under the Proposed Action.

VII. Alternatives to Purchasing the EMI System

While community ownership of parts or the full EMI Delivery System, as well as ownership of key land parcels are straightforward avenues for ensuring that the Maui community benefits from and controls Maui water as a public trust, other remedies should also be explored.	**What are the legal actions that can be taken besides condemnation? Are there other vehicles for accomplishing community goals?**
Negotiate new Domestic water use Agreements with EMI/Mahi Pono: As noted in the DEIS, "EMI agreements with the MDWS provide that water supplied to the MDWS **is contingent upon the Water Lease being issued**…Currently the MDWS is being charged 6¢ per 1,000 gallons to receive East Maui surface water for the KAP and other Upcountry Maui farm areas." In the past, EMI was required to maintain the roads and trails, maintain the delivery system, and leave enough water in streams for downstream domestic water users and Kuleana users, and they were required to post a $100,000 performance bond.[68]	One key way to safeguard the public is to negotiate new agreements with EMI/Mahi Pono that: 1. Remove contingency of access to the public trust on a private company receiving permits/leases from BLNR. 2. Require a minimum level of repair and maintenance of the Ditch System by EMI/Mahi Pono to ensure the health and safety of the community. 3. Require that EMI/Mahi Pono reduce leakages in the delivery system to optimize water availability, thereby increasing amount of water going to the Kamole Treatment Plant, and decrease the amount of water diverted from streams, and increase amount of water for agriculture. 4. Require a minimum investment in the care of the watershed and other environmental responsibilities, that includes partnerships with stakeholders. 5. Require EMI/Mahi Pono to address liabilities.
State Irrigation System The Agricultural Resource Management Division manages state irrigation systems at Hoolehua, Kahuku, Waimanalo, Waimea and Honokaa-Paauilo, two on Oahu, two on the island of Hawaii, and one on Molokai. The ARMD also manages Honokaia, Paauilo, Puu Pulehu, Waimea, Waimanalo, and Kualapuu Reservoirs. Arguments in favor of a state irrigation system include the fact that much of the system is on state land, and the state has the bonding to fund big capital improvements.	Concerns re: limited funding of Dept. of Agriculture and the requirement of requesting funding from the state legislature every year, particularly since Molokai Rep Lynn DeCoite is the only farmer in the legislature. However, due to the diversity of stakeholders and the potential revenue sources, the state would be managing a different kind of economic water system. To adequately study this model, legislators, stakeholders, and the Department of Agriculture would need to research this option in the context of the various issues raised in the report.

[68] Land Lease Bearing, General Lease #3578, 1959, Pages 3,4, 15,16, Contracts under Native Hawaiian Land and Water Rights

VIII. Calculations for Initial Purchase Price, Estimated Expenses, and Potential Revenues for a Public Trust Water System

There are numerous variables to consider with regard to acquisition costs, maintenance, and potential revenues. These calculations are presented to provide a framework for beginning the process of determining a financial structure that would feasibly allow a Public Trust Water System to provide the best service to Maui residents in the short- and long-term based on the various considerations already presented in this report. While the purchase price of $5.4 million is very clear, an appraisal could affect the condemnation price and would provide a better estimate of short-term improvements.

Initially, the TIG was interested in considering the cost of acquiring just the Wailoa Ditch System, which feeds into the Kamole Treatment Plant. However, given the number of variables in determining the percentage of the system represented by Wailoa, which could be as high as 70%, this analysis is focusing on the entire system, where numbers are more readily available, specifically the total purchase price and the expected water used by Mahi Pono.

Initial Purchase Price and Cost to Restore EMI Ditch System:

Initial Purchase Price	Amount	Notes
Includes 15,000 acres[69] of land parcels and ditches utilized for the EMI system.	$5,442,333.48 (possibly less any depreciation since 12/17/18 purchase due to neglect.)	Based on MP purchase price for full system, (only half has been paid.)[70]
Estimated costs to restore the EMI ditch system and to correct deferred maintenance.	$12 million over two years.	Based on 6% of Replacement Asset Value (RAV) of $200 million, which is the modern system replacement cost cited in the EMI Draft EIS
Total Purchase Price plus substantial improvements:	**$17.4 million**	**Improvements from the beginning**

Bond Payments:

If the EMI System is acquired by the County or State, properly structured bond financing could be utilized for acquisition and restoration of the system. Borrowing $17.4 million at 3.75% over thirty years would require debt service payments totaling $966,985 annually.

Value of Purchasing System Prior to Mahi Pono Obtaining a Long-Term Lease:

If Mahi Pono is able to obtain a 30-year lease, the company will likely try to argue that the EMI aqueduct system has a higher value with a long-term lease than its purchase price of $5.4 million. There are clear indications from the December 17, 2018 purchase agreement with

[69] https://mauitime.com/news/business/mahi-pono-purchase-agreement-lots-of-legalese-with-a-few-tasty-nuggets/

[70] https://www.sec.gov/Archives/edgar/data/1545654/000119312518354682/d664171dex101.htm

Alexander & Baldwin that a core component of Mahi Pono's investment strategy is the monetization of public trust water resources as evidenced by A&B's obligation to rebate Mahi Pono $62 million of the purchase price if Mahi Pono does not obtain a water lease allocation of at least 30 mgd. (See sales agreement)

Value of the System Based on Water Delivery Rights:

Maui County Department of Water Supply potable water rates for agricultural users: **$1.10 per 1,000 gallons for use over 15,000 gallons per month.**

Maui agricultural users who use less than 15,000 per month pay residential rates ($2.05 to $3.90 per 1,000 gallons.)

Agricultural Use rates per 1,000 gallons on the Big Island are assessed as follows:
In addition to standby, power cost, and energy CIP charges, a consumption charge will be applied to all agricultural use customers as follows:

Up to 5,000 gallons, .93 cents
5,001-15,000 gallons: $2.01
Over 15,000 gallons: $1.27

State Agricultural Rates range from .20 to .50 cents per 1,000 gallons with an additional acreage assessment fee from .36 cents to $9.37 cents per acre per month.

Per the Organisation for Economic Co-operation and Development report on Water Pricing in the United States[71]:

In summary, irrigation costs and prices are rising in most regions of the United States, due to a combination of increasing scarcity, changes in public preferences regarding water allocation among competing uses, increasing budget scrutiny in the national and state legislatures, rising energy prices, and increasing awareness of climate change and the potential implications for rainfall and the availability of surface water resources. These issues likely will continue encouraging public officials to utilize water pricing and other market-based incentives to motivate further improvements in water use efficiency in agriculture and other sectors.

Some of the public investments in irrigation in the United States and other countries have involved large expenditures that governments have not fully recovered from project beneficiaries over time. The subsidies implicit in the lack of cost recovery have gained the attention of citizens and legislators concerned with public budgets, resource allocation, and the off-farm impacts of irrigation and drainage in some areas.

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[71] https://www.oecd.org/unitedstates/45016437.pdf

Many observers agree that irrigation will play a major role in providing sufficient food for the world's increasing population, but many also wish to see the full costs of irrigation reflected in farm-level irrigation water prices (Merrett, 2002). Accurate prices can promote irrigation efficiency within agriculture and increase the likelihood of achieving economic efficiency across the sectors that compete for limited water resources.

…Looking forward, farmers in the United States and elsewhere must adjust to rising energy costs and increasing water scarcity. While the outlook for agricultural prices is uncertain, recent increases in food prices suggest that crop prices might be notably higher in some years. Higher crop prices will contribute to higher land prices, just as subsidies for irrigation water have done historically. From a water management perspective, higher land prices are helpful in promoting farm-level crop and technology decisions that generate higher values per unit of irrigation water. Thus the impacts of irrigation subsidies that once encouraged farmers to plant low-valued crops and to minimize water management efforts, likely will be negated in future by rising land prices and increasing water scarcity.

<u>According to the Draft EIS, Page 2-8:</u>

With the issuance of the Water Lease under the Proposed Action, the EMI Aqueduct System would divert only the maximum allowable amount under the CWRM D&O from streams within the License Area, which is estimated to be approximately 87.95 mgd. The EMI Aqueduct System is estimated to divert an additional 4.37 mgd from the point that it leaves the License Area at Honopou Stream and collects water from streams on privately owned land to its last diversion at Maliko Gulch. Thus, an estimated total of approximately 92.32 mgd would be conveyed to supply the MDWS for users in Upcountry Maui, Nahiku, and the agricultural fields in Central Maui.

<u>According to the Draft EIS, Page 2-18:</u>

The Mahi Pono farm plan assumes the following: **The total surface water available for use <u>after system losses</u> is estimated to be approximately 65.88 mgd.**

Based on maximum delivery of water and current agricultural and domestic water rates charged to Maui County farmers and residents, the highest potential annual agricultural revenue that can be derived from the 65.88 mgd is:

Convert 65.88 mgd to kgal (1,000 gallons)	Convert to kgal per year (365 days)	If water were delivered at current agricultural rates ($1.10 per 1,000 gallons)
65,880 kgal	**24,046,200 kgal per year**	**$26,450,820**

Water System Operations Costs:

There will be variances in operational costs depending on whether the water delivery system is managed by a private, public, non profit, or quasi-public entity.

Or estimates below for maintenance and total expenses are calculated at $10 million higher than Mahi Pono's expenses, based on how they are described in the EMI DEIS.

Per the DEIS, Mahi Pono's $2.5 million in operations costs includes maintenance as well as water leases, but does not appear to include annual monitoring and restoration of the watershed. We calculate an additional $3 million per year for maintenance and $6 million for the watershed.

Estimated Annual Expenses	Amount	Notes
Annual Operating Costs	$2.5 million	Per the Draft EIS, $2.5M includes labor, fringe benefits, materials, professional services, taxes, maintenance, anticipated rental payments to the State for the Water Lease, and other expenses
Annual Improvements, maintenance, and system risk management	$3 million	1.5% of Replacement Asset Value (RAV) of $200 million (EMI DEIS estimate of full system replacement cost)
Annual Watershed Monitoring, Maintenance, and Restoration	$6 million	In 2020, DWS and nonprofits allocated a total of $2.69 million to East Maui watersheds. We recommend adding $6 million to bring total watershed expenditures to $8.69 million annually.
Debt Service on $17.4 million 30-year municipal bond (3.75% interest)	$1 million	Annual $966,985 payment
Total Estimated Annual Expenses	$12.5 million	

Annual operations cost, including yearly improvements, maintenance and risk management along with watershed monitoring and restoration, plus annual debt service results in an estimated $12.5 million in total annual expenses.

As noted above, watershed monitoring is not accounted for by EMI/Mahi Pono and annual improvements are minimal (included in $2.5 million in operations) so totals for both expense categories could be reduced somewhat if needed.

Potential Revenue Streams:

In terms of estimating revenues, factors such as stream restoration, seasonal water flow variations, the actual payments to the state for four leases, plus additional needs by Upcountry residents, the Kula Ag Park and the new Kula Ag Park, and the water meter list would impact how much of the maximum $26 million in water value could and should be recouped.

Additionally, grants and other support that a public or quasi-public entity could access from public and private sources could impact expenses. Furthermore, a pro-active entity could seek out additional private investment or municipal investment in renewable energy systems to address electricity costs associated with Upcountry pumping and domestic water treatment, thereby impacting expenses.

The table below therefore only provides an example of how revenues could be collected to pay for the $12.5 million in annual expenses, which includes the 30-year municipal bond debt service payment. As noted above, there are many variables, including water rates and stakeholder interests that would affect how the revenue streams should be structured in order to be of the highest benefit to the community in the short- and long-term.

Thus, the example below is NOT a recommendation on how revenues should be collected, but instead one example of how the purchase and operation costs could be recouped.

Notes on Assumptions:

Light Grey Column:

- For this scenario, it is assumed that the Public Trust Water System would continue to contract with the Maui County Department of Water Supply to deliver water from the Kamole Treatment plant/Wailoa Ditch at the same rates estimated by EMI in the DEIS. Thus, "2030 water service fee rate is estimated to be $0.10, which has been calculated based on the ratio of operational cost to the MDWS service fee for 2008 to 2013. Under this assumption, EMI would receive an estimated $268,000 in 2030 from the MDWS."

- The total number of gallons per day currently being contracted by MDWS from EMI is already excluded from the 65.88 that Mahi Pono stated that it needs in the DEIS.

- Thus, neither the revenues nor the water use are included in the total calculations.

Dark Grey Column

- The 5.5 mgd shown for new Upcountry water meter users is the average of the additional 3.7 – 7.3 mgd estimated demand on the Upcountry system as a whole if the full water meter list were fulfilled, per the Central Water Use and Development Plan. However, since significant amounts of Upcountry water come from the higher elevation aqueducts that transport water to Olinda and Kula, 5.5 mgd is a high estimate.

- Upcountry agricultural users are often impacted by drought restrictions. An additional 2 mgd allocated to them is added to this table in consideration of the need for dependable water availability. This is a somewhat arbitrary number as studies would need to be conducted to determine how best to support these farmers.

- Since the delivery of the additional Upcountry Water would be added to the current delivery by MDWS, revenues from both of these columns would be absorbed by MDWS, from which appropriate operational, pumpage, and water treatment expenses would be allocated.

- Therefore, although 7.5 mgd of the water volume is subtracted from the 65.88 mgd available water supply, the revenues would be the same rate that EMI/Mahi Pono will be charging for the current water delivery to upcountry users, and thus would only add $273,750 to the Public Trust Water System revenue stream.

Upcountry Users, including domestic, agriculture, and Ag Parks, based on MP estimate for 2030 (.10 per Kgal[72] per DEIS)	Additional water delivery to Upcountry Ag users, based on MP estimate for 2030 (.10 per Kgal per DEIS)	Priority List water meter users, based on MP estimate for 2030 (.10 per Kgal per DEIS)	Central Maui Ag Users – Recommended reduced rate of $.95 per kgal (DWS charges $1.10 per kgal presently) MGD is low end for large ag user	Total Water Delivery Revenues (Excludes $268K Upcountry Ag and domestic use already allocated to WDS). MGD total includes added upcountry water delivery	Increased Stream Flow (In addition to current CWRM D&O)	Net Annual Income (Subtract $12.5 Million Annual Expenses)
7.3465 mgd	2 mdg	5.5 mgd	40 mgd	47.5 mgd	(18.38)	
$268,000	**$73,000**	**$200,750**	**$13,870,000**	**$14,143,370**	**$0**	**$1,643,750**

As stated in the Draft Water Use and Development Plan and the Draft EIS, if repair and maintenance are conducted at proper levels, available water could increase by at least 20% or 13.18 mgd. This additional water could be returned to the stream or added to the water supply for farmers, increasing revenues.

Purchase of the whole EMI Delivery System and Mahi Pono land:

Access to Mahi Pono land in addition to the EMI Water System would allow the Maui community to implement a comprehensive Water Management Plan that includes care of the watersheds, comprehensive support for East Maui cultural practices, renewable energy options, supporting proactive and integrated efforts to ensure an affordable and predictable supply of water combined with flexibility with regard to revenue generation that is not dependent on water consumers. Various regulations relating to renewable energy production, as well as issues such as affordable housing, and how best to ensure that agricultural practices do not negatively impact climate, while also providing food security, provide justifications for purchasing substantial land parcels in addition to the EMI Water Delivery System.

[72] kgal=1,000 gallons

IX. County Bidding on a Long-Term Lease

On May 2, 2019, Hawaii State Senator Kaialiʻi Kahele wrote to Maui County Mayor Michael P. Victorino, and stated the following:

> ***In light of these developments, I would highly recommend that the County of Maui and DWS immediately submit a water lease application to the DLNR. A copy of the Request for State Lands Application Form is attached for your convenience. Doing so now will provide the Board of Land and Natural Resources ample time to review and issue a revocable permit to the County of Maui and DWS by the end of this year so that Maui County secures its own, independent authority to continue to provide its residents with access to diverted surface water imported from state lands in East Maui via the EMI aqueduct system. Domestic water use is a protected "public trust purpose" and I am confident that as the necessary application requirements are satisfied, the County of Maui and DWS will secure a long-term water lease from the State of Hawaiʻi.***[73]

HRS 171-58 c describes the bidding (Auction) process, which includes an Environmental Impact Statement and the joint creation of a watershed management plan. A state lease is subject to Chapter 343 (requiring EIS) and HRS 171-58 describes the jointly created (Lessee/Lessor) watershed management plan prescribed by the BLNR.

Excerpts below (full section attached as Appendix 12)

§171-58 Minerals and water rights. (a) Except as provided in this section the right to any mineral or surface or ground water shall not be included in any lease, agreement, or sale, this right being reserved to the State; provided that the board may make provisions in the lease, agreement, or sale, for the payment of just compensation to the surface owner for improvements taken as a condition precedent to the exercise by the State of any reserved rights to enter, sever, and remove minerals or to capture, divert, or impound water.

…(c) *[Repeal and reenactment on June 30, 2019. L 2016, c 126, §4(1).]* Disposition of water rights may be made by lease at public auction as provided in this chapter or by permit for temporary use on a month-to- month basis under those conditions which will best serve the interests of the State and subject to a maximum term of one year and other restrictions under the law; provided that:

[73] Appendix 3

…(2) Any disposition by lease shall be subject to disapproval by the legislature by two-thirds vote of either the senate or the house of representatives or by majority vote of both in any regular or special session next following the date of disposition; and

(3) After a certain land or water use has been authorized by the board subsequent to public hearings and conservation district use application and environmental impact statement approvals, water used in nonpolluting ways, for nonconsumptive purposes because it is returned to the same stream or other body of water from which it was drawn, and essentially not affecting the volume and quality of water or biota in the stream or other body of water, may also be leased by the board with the prior approval of the governor and the prior authorization of the legislature by concurrent resolution.

… (e) Any new lease of water rights shall contain a covenant that requires the lessee and the department of land and natural resources to jointly develop and implement a watershed management plan. The board shall not approve any new lease of water rights without the foregoing covenant or a watershed management plan. The board shall prescribe the minimum content of a watershed management plan; provided that the watershed management plan shall require the prevention of the degradation of surface water and ground water quality to the extent that degradation can be avoided using reasonable management practices.

(f) Upon renewal, any lease of water rights shall contain a covenant that requires the lessee and the department of land and natural resources to jointly develop and implement a watershed management plan. The board shall not renew any lease of water rights without the foregoing covenant or a watershed management plan. The board shall prescribe the minimum content of a watershed management plan; provided that the watershed management plan shall require the prevention of the degradation of surface water and ground water quality to the extent that degradation can be avoided using reasonable management practices.

X. Example Governance Structures

Page 4-140, DEIS: Another theme, expressed primarily in the Kula / Pukalani focus group, was that water is a public trust, and should not be controlled by a single private corporation. They suggested a restructuring of public utilities to include a water utility that would be administered similar to the current electricity in the public utility structure. Further, profit made from use of this public trust should be invested in public need.

In addition to the various considerations described in the last 70-plus pages, consideration of the pros and cons of the various governance structures is recommended.

For example:

Governance structure	Pros	Cons
Shareholder owned (Example, A&B)	• Significant access to capital and human resources	• Objectives of shareholders are often not aligned with the public interest
Private Equity controlled (Example, Mahi Pono)	• Potential to facilitate growth and innovation • Access to various sources of capital	• Relatively high cost of capital • Financial incentive structure which is misaligned with the long-term public interest • Potential financial distress with broad impact if acquisition is heavily leveraged. • Absentee ownership and foreign governance
Co-op	• May have access to Rural Development funding • Align stakeholder interests	• Strength of leadership may vary based on outcome of board elections. • Local population might be unengaged or uninterested in water co-op management
Municipal Water Authority	• Low cost of capital • May benefit from access to tax exempt debt financing • Public accountability • Could lower rate water rates for local farmers and fund watershed restoration and management	• Potential difficulties in recruiting employees with adequate technical skills needed to run water authority • May be subject to political interference.
Hybrid (private sustainable business corporation with majority government ownership)	• Public / private ownership could provide "best of both worlds." • Government ownership can present "halo" effect for raising capital • Potential for both equity and debt • Exempt from civil service restrictions	• Potential political interference. • Possible conflicting incentives between entities on the board. Uncommon ownership structure may result in greater legal complexity and stakeholder confusion

Independent Public Water Authority	• With well designed and implemented governance structure, would allow for optimized delivery and system reliability, coordinated planning in sync with public interest.	• Requires establishment of independent entity. • Possible need for charter amendment • Potential challenges in raising capital

Given the amount of information needed to serve the public purpose, and the importance of coordinating various public entities (Department of Water Supply, Wastewater, Environmental Management, and Energy Commissioner) with the activities of private purveyors, Department of Hawaiian Homelands (DHHL) and Office of Hawaiian Affairs (OHA), as well as diverse stakeholders, from native Hawaiian taro farmers to Upcountry domestic and agricultural water users, this Temporary Investigative Group recommends that Maui County thoroughly research how best to create a public governance model with bonding authority, hereinafter referred to as the "Public Trust Water System (PTWS)."

The TIG has researched some of the steps necessary for creating a Public Trust Water System. These steps include, but are not be limited to:

1) Outlining the legal requirements for creating the PTWS with bond authority and determining whether it would be regulated by the Public Utilities Commission (PUC);
2) Determining whether a charter change would be necessary and how such a change fits into the overall timeline of purchasing EMI and obtaining bidding rights;
3) Identifying potential private and public partners, if appropriate, including investors, public funders, and foundations;
4) Developing a design for the governance infrastructure that embeds transparency, accountability, and commitment to environmental, cultural, and community values, with a focus on decision-making taking place in the affected communities.

The County will need access to:

- ✓ Legal expertise about how to create new water utility with bonding authority,
- ✓ Financial and real estate expertise to evaluate feasibility and to estimate a fair cost of acquisition,

In order to ensure maximum accountability, the Public Trust Water System would need to include very strong mechanisms for ensuring oversight by diverse stakeholders, with priority given to DHHL, kuleana water rights, riparian rights, and traditional and customary native Hawaiian access rights. Furthermore, hearings and other engagement processes need to take place in the affected communities.

XI. Recommendations and Conclusion:

At the conclusion of its investigation, the Temporary Investigative Group shall:

a. Present recommendations to the Board of Water Supply regarding the feasibility of the purchasing or condemnation of the EMI Water Delivery System and, if necessary, the purchase or condemnation of relevant Mahi Pono lands, including the structure of the governing entity that would have authority over the system, and/or
b. Other strategies for ensuring that the people of Maui County have authority over the delivery of water, which is a public trust.

1. Primary Considerations with Regard to the Public Trust:

As noted in the Scope of the Temporary Investigating Group, the primary objective of this body was to determine how best to ensure that the people of Maui have authority over the delivery of water, which is a public trust.

In making this determination, TIG members examined:

- **Needs of East Maui residents and taro farmers and**
- **Needs of upcountry domestic and agricultural water users.**

The TIG also considered short-term needs as well as long-term impacts of climate change, including ensuring maximum availability of water within the context of the realities of climate crisis impacts in the next 5, 10, 15, 20 years and longer; and how those impacts would affect water supply and the safety of residents, thereby affecting **the public's access to water in the future, specifically:**

1) Watershed Protection;
2) General storage, wastewater, and other conservation options;
3) Renewable Energy and battery storage, including solar, wind, and hydro (including wastewater use);
4) Improved maintenance of water systems to reduce and eliminate water loss;
5) Integration of the above with agricultural recommendations that support food security and soil regeneration (with labor and affordable housing considerations).

2. Other Considerations Re: Serving the People of Maui:

- **Environmental Considerations Not Directly Related to Water Security;**
- **Native Hawaiian Land and Water Rights;**
- **Support of Beneficial Agriculture;**
- **Community Control of Where the Water Goes;**

- **Maintaining a Reasonable Cost of Delivered Water;**
- **Support of Economic Development for Residents.**

Hawaiian land and water rights also included examining:

1) Complying with DHHL requirements, including intent as well as the letter of the law;
2) Supporting Native Hawaiian customary practices for social justice and environmental reasons in addition to DHHL requirements.

It was determined that in order to ensure that all of these considerations are taken into account and integrated into a comprehensive, binding, and well-funded water plan that balances source development, surface water use, support of Hawaiian communities, and long-term maintenance of the aquifer, the following principles need to be followed:

- **Communication among and within government entities;**
- **Utilization of existing research and data, as well as funding of additional up to date research;**
- **Transparency by all government and private entities involved in water production and delivery;**
- **Accountability of all government and private entities involved in water production and delivery;**
- **Mechanisms that ensure accountability to ALL stakeholders, including decision-making in and by affected communities.**

3. Recommended Immediate Actions:

Based on all the information available to the TIG at this time, the Temporary Investigative Group is convinced that in order to protect the public's health, safety, and well-being in the short- and long-terms, actions need to be taken immediately to utilize legal and financial vehicles to secure the public's control of the EMI Water Delivery System.

A. County Application for a Long-Term Lease:

Maui County should immediately apply for a long-term (Water Lease) for the Nāhiku, Ke'anae, Honomanū, and Huelo License Areas, situated at TMK Nos. (2) 1-2- 004:005, 007 (por.), 1-1-002:002, 1-1-001:044, 1-1-001:050, 2-9-014:001, 005, 011, 012, 017 in the Makawao and Hana Districts, on the island of Maui.

The above action would be valuable on its own, in terms of supporting the next step, as well as working in tandem with "Recommended Near-Term Actions" below.

B. Re-negotiate Current Contracts with EMI/Mahi Pono

Maui County should immediately re-negotiate a new contract with EMI/Mahi Pono that does not require that EMI/Mahi Pono obtain a Revocable Permit or Lease in order for the Kamole Treatment Plant to access Wailoa Ditch waters. This lease could also include requirements that address the various issues raised in this document from repair and maintenance of the system to native Hawaiian stream rights to investment in watershed protection and addressing liability issues.

By applying for a long-term lease, the County would be better positioned to re-negotiate the contract with EMI/Mahi Pono. Excluding corporation counsel personnel costs, this option would be relatively straightforward and would not be cost prohibitive. (See current Lease Appendix 13.)

However, this option would require enforcement on the part of the County, which would only be realistic if the County were willing to fully utilize its powers and responsibilities to protect the public interest. Furthermore, long-term solutions are needed to ensure the well-being of Maui residents.

4. Recommended Near-Term Actions:

As outlined under "Governance Structures" and described in more detail previously, because the financial incentive structure of a private equity-controlled water delivery system is misaligned with the long-term public interest, it would be imprudent to assume that the "Primary" and "Other Considerations" described above will be addressed by Mahi Pono.

Therefore, the TIG recommends that the County of Maui exercise its powers of eminent domain as soon as possible to begin the process of supporting acquisition of the system.

Furthermore, if the County of Maui is interested in facilitating community control of the EMI Aqueduct system and meeting the multiple needs of stakeholders, acquiring the system at a price close to the $5.4 million paid by Mahi Pono in December 2018 is essential. As noted previously, if Mahi Pono obtains a 30-year water lease, the private equity fund will likely argue that the EMI aqueduct system has a value higher than the original purchase price. (Mahi Pono's sales agreement with A&B states that the water lease is worth a minimum of $62 million.) Acquiring the system in the near term will thus increase the chances of minimizing long-term debt.

5. *Additional Recommendations for Long-Term Stewardship of the Public Trust:*

In order to evaluate the most cost-effective and comprehensive solutions that address the urgent issues described in this report and to facilitate purchasing the EMI Aqueduct by a Public Trust Water System, the Temporary Investigative Group recommends that the Maui County Council and Mayor plan on taking the following steps:

Evaluate Capital Expenses Of Acquisition And Modernization

- ✓ Contract engineering studies of the current condition of the EMI Delivery System;
- ✓ Obtain reliable data regarding elevations and the amounts of water moving through the 388 intakes, ditches, dams, pipes, and flumes;
- ✓ Obtain cost estimates for repair and maintenance as well as alternate modifications, such as installing pipes in open ditches and flumes and modern diversions that support connectivity for streamlife;
- ✓ Determine the amount of the EMI Aqueduct and possibly other water systems that are connected to the Kamole Weir, as well as watershed lands that would be optimal for the most efficient short- and long-term delivery of water to the public, with maximum sustainability of the aquifer;
- ✓ Draft a plan for the County to acquire existing land, easements, and infrastructure by eminent domain, using bond financing.

Research Forward-Thinking Revenue and Expense Models

- ✓ Contract additional studies that build on current research regarding the measurable impact of watershed restoration on increased availability of water;
- ✓ Develop models and estimates regarding potential costs of installation of renewable energy systems to support treatment facilities, uphill transmission, and/or well pumping, along with energy savings;
- ✓ Develop models and estimates of hydro-pumped energy creation and storage utilizing water and wastewater;
- ✓ Determine the water rate fee structure that allows a reasonable rate of return to the investors, estimates of fees collected from the Department of Water Supply, Mahi Pono, A&B, residents, farms, and other commercial users. (If the structure created is regulated by the Public Utility Commission (PUC), the PUC will approve a fee structure that allows a reasonable rate of return to the investors to recover the capital expenses of acquisition and modernization, plus operating costs, and watershed restoration.)
- ✓ Develop a risk management plan that addresses liabilities that a new owner will assume when the various grandfather clause exemptions currently enjoyed by EMI are no longer in effect.
- ✓ Work with the East Maui community to create models for community stewardship and educational programs that operate the EMI system in the long-term.

Philanthropic support is available for the funding of some of these studies and models.

6. *In Conclusion:*

Determining the most efficient and effective way to ensure that the public water trust is managed and controlled by stakeholders is of the utmost urgency, given the current stressors on the water systems that serve Maui residents, residents' diverse needs, and the impending realities of the climate crisis.

Furthermore, because of the risks that will be borne by Maui residents and the County of Maui if a private entity controls the EMI Aqueduct for thirty years (which is the current stated goal of Mahi Pono/EMI), combined with the benefits of purchasing the system before any private owner has obtained a long-term water lease, the benefit of purchasing the EMI water delivery system in the near-term is much higher than it would be further in the future.

It is therefore incumbent on those who represent the interests of Maui residents to determine the most cost-effective way to achieve true control of access to water by the public as soon as possible.

This TIG believes that ownership of the EMI Water Delivery system by the people of Maui – in the form that is most cost-effective, accountable, environmentally responsible, transparent, and meets the needs of the island's diverse stakeholders, in particular native Hawaiians – will ultimately be the only way to guarantee that the public trust is maintained and remains safely in community hands.

The TIG therefore recommends that the County of Maui take immediate steps to secure community ownership and control of the EMI water delivery system.

XII. Final Statements

This report has been approved by all three members of the Temporary Investigative Group (TIG).

The TIG members would like to mahalo the many community members, experts in their fields, and government employees who provided valuable information for this report, including those who worked on the studies and reports referenced herein.

In all, TIG members volunteered approximately 30 hours in meetings as a group, more than 25 additional hours each on research, and 50-70 hours in report preparation.

The TIG was not provided with a budget to complete this work. As a result, all research was based on existing documentation, interviews, and a tour of the Kamole Weir.

Please note that TIG members are volunteers whose professional knowledge is not in the environmental or engineering spheres. Feel free to contact us through the Department of Water Supply to relay any corrections to data or information, or to submit questions.

The members learned a great deal, enjoyed their time learning from experts, and appreciate the time that they spent working together.

APPENDIX R:

1938 Agreement

THIS INDENTURE, made this 18th day of March, 1938, by and between the TERRITORY OF HAWAII, acting by and through L. M. Whitehouse, Commissioner of Public Lands for the Territory of Hawaii, with the consent and approval of the Governor and of the Land Board of said Territory, hereinafter called the "Territory", and the EAST MAUI IRRIGATION COMPANY, LIMITED, an Hawaiian corporation, hereinafter called the "Company",

W I T N E S S E T H   T H A T :

WHEREAS it is the desire of the Territory to have competitive bidding on licenses to divert water from government lands situated in East Maui; and

WHEREAS the joint use by any future Licensees of the Territory and by the Company of the aqueduct system on East Maui, Territory of Hawaii, extending from Nahiku to Honopou inclusive, which system is partly on government land and partly on Company land, will make competitive bidding possible,

NOW THEREFORE:

I.

THE TERRITORY, in consideration of the easements hereinafter granted to it by the Company and of the covenants and agreements herein contained to be observed and performed by the Company, does hereby grant to the Company a perpetual (except as to cancellation as hereinafter provided) right and easement:

(1) To convey all water now or hereafter owned by the Company and all water covered by any water license now held by the Company or which in the future may be granted to it, jointly with the Territory, without charge, through any or all aqueducts now or hereafter crossing government lands situated in East Maui

extending from Nahiku to Honopou inclusive; and

(2) To divert such water thus conveyed, after due allowance has been made for evaporation, leakage and seepage losses at a point or points designated by the Company, which have been or will be equipped at the Company's expense with suitable turnout and water measuring devices, provided however, that such right and easement to convey and divert such water shall be subject to the following restrictions, to-wit:

(a) During times when the total water contributory to these jointly used aqueducts does not exceed the capacity thereof, that portion of the flow therein, which shall be considered the Company's water, is to equal the quantity of water contributed thereto from sources owned in fee and from those held under license by the Company, and the remaining water shall be considered the Territory's water;

(b) During times when the total water contributory to these jointly used aqueducts exceeds the capacity thereof, that portion of the flow therein which shall be considered the Company's water shall bear the same ratio to the total capacity thereof as the long term average water yield (as hereinafter defined) contributory thereto from sources owned in fee and held under license by the Company bears to the total long term average water yield contributory to these jointly used aqueducts, and the remaining water shall be considered the Territory's water.

II.

THE COMPANY, in consideration of the foregoing grant and of the covenants and agreements to be observed and performed by the Territory, herein contained, does hereby grant to the Territory a perpetual (except as to cancellation as hereinafter provided) right and easement:

(1) To [illegible]ay water jointly with the Co[illegible]ny, without charge, through aqueducts crossing the Company's lands situated in East Maui extending from Nahiku to Honopou inclusive; and

(2) To divert water thus conveyed - after due allowance has been made for evaporation, leakage and seepage losses at points in said area designated by the Territory which have been equipped or will be equipped at the Territory's expense with suitable turn-outs and water measuring devices; the portion of the flow which shall be considered the Territory's water to be that specified above;

(3) To use reservoirs which are owned by the Company and are situated East of Honopou on East Maui, jointly with the Company, without charge, to the end that:

(a) Water in excess of the maximum capacity of, and otherwise contributory to, that portion of the aqueduct system crossing the drainage areas on which these reservoirs are situated, is to be conveyed jointly by the Territory and the Company into these reservoirs, in so far as this can be done by gravity using the existing aqueduct system (natural and artificial);

(b) Water in these reservoirs shall be drawn therefrom and put into that portion of the aqueduct system, which can thus be served by gravity, at a maximum rate limited either by the capacity of the reservoir outlets or the capacity of that portion of the aqueduct system into which the reservoir water is being put, so as to keep the aqueduct system flowing as nearly full as possible; the portion of the water thus drawn from the reservoirs which shall be considered the Territory's water shall bear the same ratio to the total water drawn therefrom as the long term average water yield (as hereinafter defined) contributory to that portion of the aqueduct system located on the drainage areas on

which these reservoirs a ltuated and derived from sour( )wned by the government not then under license to the Company, bears to the total long term average water yield contributory to said portion of the aqueduct system, and the remaining portion thus drawn from the reservoirs shall be considered the Company's water.

III.

THE COMPANY, for the consideration aforesaid, does hereby agree that, in order to supplement the stream flows, it will endeavor to develop existing ground water on the Government and Company lands at Nahiku and Keanae above the existing aqueduct system by means of tunneling if in its opinion there are locations where it is feasible to develop water economically.

IV.

IT IS MUTUALLY COVENANTED AND AGREED by and between the parties hereto that:

(1) Each of the existing five licenses now held by the Company to use and convey water from government lands on East Maui shall be cancelled, and/or extended, as the case may be, so that they shall terminate on that June thirtieth nearest to the date stipulated in each respective license as the otherwise normal expiration date; and the final rental on each of these licenses shall be adjusted according to the resulting proportionate curtailment or extension of time, as the case may be;

(2) Licenses 267-B and 974 (two of the said five licenses) which overlap and have no definite line separating them shall be combined and considered under one license on and after the day following the above agreed termination by cancellation, namely on and after the first day of July, 1938.

V.

IT IS FURTHER AGREED that if the Territory, after due legal notice thereof, shall put up at public auction at least sixty days previous to its termination by the above agreed cancellation, and

thereafter at least sixty (60) days previous to its stipulated expiration, each of the aforementioned licenses (reduced to four in number) for a term of thirty (30) years, the Company agrees to bid on such licenses and offer to purchase the right to the water to be granted by any given license, providing the annual sums required to be paid by the licensee thereunder (i.e. the upset price) do not exceed the annual sums which would be required to be paid if the upset price were determined in the manner hereinafter set forth in subsections (a), (b) and (c) hereof and further providing such licenses contain provisions substantially similar to the provisions of subsections (d), (e), (f) and (g) hereof:

(a) When the average price per pound of raw sugar for a given annual payment period, July 1st to the following June 30th, inclusive, is three cents (3¢) or less, the price per million gallons of water diverted from the licensed area under consideration during the given payment period shall be that given in the price list hereinafter set forth;

(b) When the average price per pound of raw sugar for a given annual payment period, July 1st to the following June 30th, inclusive, is greater than three cents (3¢) and not more than four cents (4¢) the price per million gallons of water diverted from the licensed area under consideration during such given payment period shall be that resulting from the price given in the said price list being increased at a rate of three per cent. (3%) for every one-tenth (1/10th) of a cent the said average price of raw sugar exceeds three cents (3¢) per pound;

(c) When the average price per pound of raw sugar for a given annual payment period, July 1st to the following June 30th, inclusive, is greater than four cents (4¢) the price per million gallons of water diverted from the licensed area under consideration during the given payment period shall be that determined as above

percentage per pound of raw sugar of four cents (4¢).

PRICE LIST FOR WATER DIVERTED FROM EAST MAUI LICENSED AREAS

AREA	AREA COVERED	PRICE PER MILLION GALLONS WHEN RAW SUGAR IS THREE CENTS OR LESS PER POUND
Wailuku	From Hana-Koolau boundary to Waiaaka Stream	$ .9539
Keanae	From and including Waiaaka Stream to Nuaailua Stream	1.5009
Honomanu	From and including Nuaailua Stream to Puohakumoa Stream	2.1043
Huelo	From and including Puohakumoa Stream to and including Honopou Stream	2.0980

(d) In the event the Company is the successful bidder on any license it shall, from March to November inclusive of each year, take all of the available East Maui water to which it has acquired a right by license and by ownership in fee, up to that portion of the capacity of the aqueduct system to which it has a right under this agreement; provided, however, if the sugar cane area irrigated by the Company's water is reduced by governmental restrictions this required minimum quantity of water to be taken by the Company may, if the Company desires, be reduced proportionately. During January, February and December of each year the Company shall take only such water as it desires. The curtailed quantity of water, resulting from either of the two foregoing reductions of water, shall be considered as having been taken proportionately from drainage areas, irrespective of whether owned by the Territory or by the Company, according to the long term average yield of each such area and such curtailed quantity of water deemed to be taken from a licensed area shall be the quantity

constructively (according to the above proportionate plan) diverted from that area.

(e) The rental payments required to be made for each of said licenses, in the event the Company is the successful bidder therefor, shall be made semi-annually in advance on or before July 10th and January 10th of each license year, and the amount thereof shall be determined as follows:

(f) The estimated rental shall be determined for the ensuing six months on the basis of the successful bid and upon the assumption that the average price of raw sugar for said six months will be three and one-half cents (3½¢) per pound, and that the quantity of water diverted from the licensed area under consideration will be the long term average quantity for six (6) months diverted therefrom;

(g) Adjustment of rental shall be made within six (6) months after the expiration of the license year, June 30th, so that the resulting rental paid by the Licensee to the Territory will conform to the successful bid, average price of raw sugar for the license year under consideration and the quantity of water actually and constructively diverted during this license year from the licensed area under consideration; refunds or additional payments as the case may be will be made accordingly.

VI.

IT IS ALSO AGREED that:

(1) Failure to bid, by the Company, on any of the said licenses under the specified conditions shall not automatically operate as a cancellation of this agreement but such failure shall give the Territory the option of cancelling the same;

(2) Failure to put up at auction any of the said licenses at the specified time, or failure to fix the upset price in the manner herein required shall not automatically operate as a cancella-

tion of this agreement but such failure shall give the Territory the option of cancelling the same.

Company

VII.

The cost of operation and maintenance of said aqueduct system shall be borne by the Territory and the Company in direct proportion to the use made thereof; that is to say, so long as the Territory has not granted a license to any one other than the Company to take and use water from any of said land or otherwise made use of any of said water, the Company shall be deemed to be the sole user of said aqueduct system and the total cost of operation and maintenance of said aqueduct system shall be borne by the Company. If, however, one other than the Company should become the purchaser of one or more of the licenses, or otherwise become the user of any of said water, then, and in that event the cost of operation and maintenance shall be borne by the Territory and the Company in direct proportion to the product of the water conveyed, and the distance through which it is conveyed through the artificial channels of said aqueduct system by each party respectively.

VIII.

WORDS AND PHRASES appearing herein shall have the following additional special meanings in so far as they apply:

(1) "Territory" shall include its duly appointed representatives, successors, assigns, licensees and lessees;

(2) "Company" shall include its duly appointed representatives, successors and assigns;

(3) "Aqueduct" or "aqueduct system" shall include open ditches, tunnels, flumes, pipe lines, natural and artificial channels, reservoirs, diverting dams, gravel and sand traps, intake structures, together with regulating gates, spillway structures and water measuring devices, and shall also include roads, trails, bridges, etc., used in connection therewith;

(4) "Long term average water yield" shall be the arithmetical average annual water yield which would have been diverted from any given drainage area under consideration had the aqueduct system, at the time of the determination, been in existence during the entire period in which water records are available for such area, and shall be determined jointly by the Territory's and the Company's hydrographers based on all available applicable water measurements and long term rainfall records;

(5) "Average price per pound of raw sugar" shall mean the average of the daily full New York market price, Hawaiian basis, for ninety-six degree (96°) centrifugal raw sugar (at present officially reported from time to time by the Hawaiian Sugar Planters' Association) or its equivalent. In case there is more than one quotation of such market price during any day the arithmetical average of the quotations shall be the market price for such day. In case there is no quotation of such market price for any day then the market price for the last previous day shall be taken as the market price of any such day for which there is no quotation. The average market price for the license year, July 1st to June 30th inclusive, shall be determined by taking the arithmetical average of the daily market prices for each and every day, including Sundays and holidays, for said license year.

IX.

All matters of disagreement that may arise under this agreement which cannot be adjusted by the parties hereto to their mutual satisfaction, as well as any matter herein left to future mutual agreement at the option of either the Territory or Company, shall be submitted to and determined by three arbitrators in the manner prescribed in Chapter 116 of the Revised Laws of Hawaii 1925, as amended from time to time. In any such case either

party may give to the other written notice of the desire to so arbitrate the matter in difference and shall appoint one arbitrator in such notice, whereupon the other party shall, within ten (10) days after receipt of such notice, appoint a second arbitrator, and in case of failure so to do, the arbitrator first named shall appoint such second arbitrator, and the two arbitrators so appointed (in either manner) shall select and appoint a third arbitrator; in the event that the two arbitrators so appointed shall fail to select and appoint a third arbitrator within ten (10) days after the appointment of the second arbitrator, either party may request the appointment of such third arbitrator by the person then holding the position of First Judge of the Circuit Court of the First Judicial Circuit in the Territory of Hawaii at that time; the three arbitrators so appointed shall thereupon proceed to determine the matter in question, difference or disagreement to be determined, and the decision of any two of them, including the disposition of the costs of arbitration, shall be final, conclusive and binding upon both parties unless vacated, set aside or modified as provided by the statutes aforesaid. The arbitrators shall have the powers and duties prescribed by said statutes and judgment may be entered upon such award by said Circuit Court of the First Judicial Circuit.

X.

Nothing herein contained shall be construed to in any way affect any easement or right of way heretofore granted by the Territory to the Company.

IN WITNESS WHEREOF the parties hereto have duly executed

this instrument, in duplicate, the day and year first above written.

TERRITORY OF HAWAII,

By _____
Commissioner of Public Lands.

EAST MAUI IRRIGATION COMPANY, LIMITED,

By _____
Its Vice-President

By _____
Its Treasurer

APPROVED:

_____
Governor of the Territory of Hawaii.

APPROVED:

_____
Member of the Land Board, Territory of Hawaii.

APPROVED AS TO FORM:

_____
W. E. Kemp, Attorney General, Territory of Hawaii.

STANLEY, MIDKIFF, PRATT & WINN
ATTORNEYS AT LAW
HONOLULU, HAWAII

LIBER 1[illegible] PAGE 12

CORPORATION

TERRITORY OF HAWAII, }
City and County of Honolulu } ss.

On this 18th *day of* March *A. D. 193*8, *before me appeared* J.Waterhouse and Jas.F.Morgan, *to me personally known, who, being by me duly sworn, did say that they are the* Vice-President and Treasurer, *respectively of* East Maui Irrigation Company, Limited, *and that the seal affixed to the foregoing instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors, and the said* J.Waterhouse and Jas. F. Morgan, *acknowledged said instrument to be the free act and deed of said corporation.*

Notary Public, First Judicial Circuit.
Territory of Hawaii.

-TERRITORY OF HAWAII-)
: Ss
-CITY AND COUNTY OF HONOLULU-)

On this 21st day of March, A.D. 1938, before me personally appeared L. M. WHITEHOUSE, Commissioner of Public Lands of the Territory of Hawaii, to me known to be the person who executed the foregoing instrument, under his official seal, and acknowledged that he executed the same as his free act and deed as such Commissioner of Public Lands, on behalf of the Territory of Hawaii.

Notary Public, First Judicial
Circuit, Territory of Hawaii.

-TERRITORY OF HAWAII-)
: Ss
-CITY AND COUNTY OF HONOLULU-)

On this 21st day of March, A.D. 1938, before me personally appeared J. B. POINDEXTER, Governor of Hawaii, to me known to be the person who executed the same as his free act and deed as such Governor, on behalf of the Territory of Hawaii.

Notary Public, First Judicial
Circuit, Territory of Hawaii.

Entered of Record this 22nd day of March A. D. 1938 at 5:26 o'clock A.M. and compared. Mark H. Hucksteln, Registrar of Conveyances.

By [redacted] Clerk

CORRECTION AGREEMENT

LIBER 1435 PAGE 269

This indenture made this 24th day of March, 1938, by and between THE TERRITORY OF HAWAII, acting by and through L. M. Whitehouse, Commissioner of Public Lands for the Territory of Hawaii, with the consent and approval of the Governor and of the Land Board of said Territory, hereinafter called the "Territory" and the EAST MAUI IRRIGATION COMPANY, LTD., an Hawaiian corporation, hereinafter called the "Company".

W I T N E S S E T H T H A T:

Whereas, through inadvertence, the word "Territory" appears on page 8 in the fourth line of paragraph VI sub-paragraph (2) of that certain agreement dated March 18, 1938 by and between the above mentioned parties which agreement is recorded in the office of the Bureau of Conveyances, Honolulu, City and County of Honolulu said Territory and in Book 1435, pages 1 to 12, and

Whereas the parties desire to correct such error by deleting the word "Territory" and substituting in lieu thereof the word "Company".

NOW, THEREFORE:

It is agreed by and between the parties hereto that the word "Territory" appearing on page 8 in the fourth line of paragraph VI, sub-paragraph (2) of that certain agreement dated March 18, 1938, recorded in the office of the Bureau of Conveyances said Honolulu in Book 1435, pages 1 to 12 be deleted and the word "Company" be inserted in lieu thereof.

IN WITNESS whereof the parties hereto have duly executed this instrument, in duplicate, the day and year first

above written.

TERRITORY OF HAWAII

By _____
Commissioner of Public Lands

EAST MAUI IRRIGATION COMPANY, LTD.

By _____
Its _____

By _____
Its _____

APPROVED:

_____
Governor of the Territory
of Hawaii.

_____
Member of the Land Board,
Territory of Hawaii.

APPROVED AS TO FORM:

_____
Attorney General of said Territory.

CORPORATION

TERRITORY OF HAWAII, }
City and County of Honolulu } *ss.*

LIBER 1435 PAGE 271

On this 24th *day of* MARCH, *A. D. 1938, before me appeared*

J. WATERHOUSE and JAS. F. MORGAN

to me personally known, who, being by me duly sworn, did say that they are the

VICE-PRESIDENT and TREASURER

respectively of EAST MAUI IRRIGATION COMPANY, LTD., a Hawaiian corporation

and that the seal affixed to the foregoing instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors, and the said J. WATERHOUSE and JAS. F. MORGAN *acknowledged said instrument to be the free act and deed of said corporation.*

Notary Public, First Judicial Circuit,
Territory of Hawaii.

-TERRITORY OF HAWAII-)
: Ss
-CITY AND COUNTY OF HONOLULU-)

On this 11th day of April, A.D. 1938, before me personally appeared L. M. WHITEHOUSE, Commissioner of Public Lands of the Territory of Hawaii, to me known to be the person who executed the foregoing instrument under his official seal, and acknowledged that he executed the same as his free act and deed as such Commissioner of Public Lands, on behalf of the Territory of Hawaii.

Notary Public, First Judicial Circuit, Territory of Hawaii.

-TERRITORY OF HAWAII-)
: Ss
-CITY AND COUNTY OF HONOLULU-)

On this 11th day of April, A.D. 1938, before me personally appeared J. B. POINDEXTER, Governor of Hawaii, to me known to be the person who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed as such Governor, on behalf of the Territory of Hawaii.

Notary Public, First Judicial Circuit, Territory of Hawaii.

Entered of Record this 13th day of April A. D. 1938 at 9:04 o'clock A.M. and compared. Mark N. Buckstein, Registrar of Conveyances.

By [redacted] Clerk.

APPENDIX R-1:

HC&S Exhibit C-12

EAST MAUI IRRIGATION COMPANY, LIMITED

A SUBSIDIARY OF ALEXANDER & BALDWIN, INC.
P. O. BOX H
PAIA, MAUI, HAWAII 96779

October 24, 1985

Mr. Stanley F. Kapustka
District Chief
U.S. Geological Survey, WRD
P. O. Box 50166
Honolulu, Hawaii 96850

Dear Mr. Kapustka:

WATER LICENSES - WASTE WATER 1984/85

During fiscal year 1984/85 waste water period, H.C.& S. Company did not waste water to recharge the Central Maui basal ground water.

Enclosed are the following tabulations to assist you in computing the water license yields:

1. Sale of water to County of Maui from E.M.I.'s Haiku Uka watershed.

2. Water pumped into the Koolau Ditch at Nahiku by Maui Pineapple Co., Ltd.

Very truly yours,

Robert L. Warzecha
Manager

RLW:cg

Enclosures

Copy: State of HI DLNR
A&BInc
HC&SCo
USGS Maui

EAST MAUI IRRIGATION COMPANY, LIMITED

SALE OF WATER to DEPARTMENT OF WATER SUPPLY, County of Maui

F.Y. 1984/85
(in M.G.D.)

1984	Olinda Reservoir Weir	*Olinda Lateral	TOTAL @ OLINDA	**PIIHOLO RESERVOIR
July	17.565	-	17.565	-
August	6.223	.086	6.309	15.038
September	4.023	-	4.023	-
October	8.243	.083	8.326	121.021
November	4.087	-	4.087	-
December	23.596	.018	23.614	49.385
1985				
January	22.360	-	22.360	18.930
February	24.809	.014	24.823	41.616
March	21.754	-	21.754	14.244
April	33.465	.027	33.492	28.915
May	26.602	0	26.602	26.278
June	28.550	.012	28.562	109.518
			221.517	424.945

*Olinda residents

**No meter, adjusted with water sales to consumers.

WATER PUMPED INTO KOOLAU DITCH @ NAHIKU

BY MAUI PINEAPPLE CO., LTD.

F.Y. 1984/85

(in M.G.D.)

Date	1984 July	Aug.	Sep.	Oct.	Nov.	Dec.	1985 Jan.	Feb.	Mar.	Apr.	May	June
1	0	.604	.548	.269	.411	.587	.562	.446	0	.419	.145	0
2	.434	.604	.548	.281	.624	.587	.562	.446	0	0	0	0
3	0	.610	.548	.276	.624	.558	.605	.446	0	.281	0	.538
4	0	.610	0	.261	.286	.558	.580	.457	0	.603	0	.615
5	.617	.610	.465	.459	.520	.555	.580	.457	0	.604	0	.621
6	.609	.610	0	.271	.417	.555	.580	.451	0	.604	0	.621
7	.482	.610	.565	.324	.466	.574	.547	.451	0	.603	0	.617
8	0	.443	0	.323	.452	.287	.547	.441	0	.217	0	.617
9	.419	.443	0	.297	.477	0	.528	.441	0	0	0	.617
10	.628	.565	.414	.335	.477	0	.528	.441	0	.624	0	.625
11	.615	.565	.397	.454	.477	.559	.520	.441	0	.623	0	.625
12	.615	.565	.382	.541	.549	.413	.520	.441	0	.480	0	.625
13	.624	.614	0	.429	.476	.322	.520	.555	0	.619	0	.625
14	.624	.614	.387	0	.472	.607	0	.439	0	.620	0	.586
15	.624	.546	0	.355	.472	.607	.508	.456	0	.647	0	.586
16	.620	.592	0	.248	.421	.607	.487	.456	0	.081	0	.586
17	.620	0	.343	.418	.421	.619	.487	.456	0	0	.610	.609
18	.616	0	.320	0	.421	.232	.495	.456	0	0	.153	.609
19	.616	0	.311	.450	.185	0	.495	.453	0	0	0	.609
20	.618	.494	.313	0	0	.620	.495	.448	.596	0	0	.609
21	.618	0	.308	0	.401	.566	.495	.448	.139	0	0	.591
22	.618	.266	.320	.618	.401	.566	.502	.545	0	.603	0	.591
23	.614	0	.292	.309	.401	.566	.533	.545	0	0	0	.591
24	.614	.509	.318	.614	.401	.301	.422	.545	0	0	0	.611
25	.590	.509	.317	.256	.401	0	.467	.227	0	.357	0	.612
26	.590	0	.283	.623	.429	0	.466	0	0	.621	0	.611
27	.583	.433	.327	.623	0	.623	.467	0	0	.621	0	0
28	.583	.433	.381	0	.629	.253	.466	0	0	.621	0	.285
29	.583	.604	.295	.419	.629	0	.466	==	.635	.646	0	0
30	.554	0	.274	.409	.587	.332	.492	==	.635	.646	0	0
31	.554	.548	==	.493	==	.562	.492	==	.635	==	0	==
TOTAL	15.882	13.001	8.656	10.355	12.927	12.616	15.414	11.388	2.640	11.140	.908	14.832

GRAND TOTAL 129.759

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
P.O. Box 50166
Honolulu, Hawaii 96850

November 6, 1985

Mr. Manabu Tagomori
Manager-Chief Engineer
Division of Water and Land Development
Department of Land and Natural Resources
P.O. Box 373
Honolulu, Hawaii 96809

Dear Manabu:

The enclosed table shows the yield for the various East Maui licenses and the amount of water wasted to recharge the Central Maui basal ground-water body during the fiscal year June 30, 1985.

Sincerely,

Stanley F. Kapustka
District Chief

Enclosure

cc: Mr. Richard Cox, Alexander & Baldwin, Inc.
Mr. Robert L. Warzecha, E.M.I. Co., Ltd.
Mr. George Gohara, USGS, Maui

EAST MAUI WATER LICENSE YIELD

FISCAL YEAR 1984-85

MEASUREMENT POINT	LEASE	YEAR MG	TOTAL MG	YIELD MG	* WATER WASTED MG	NET AFTER WASTING			
						TOTAL MG	Gov't %	Private MG	Gov't MG
Makapipi Tunnel			/ 848						
	Nahiku			ø 5,881	0	5,881	95.02	293	5,588
Koolau ditch at Nahiku		6,859	6,859						
	Keanae			11,712	0	11,712	79.19	2,437	9,275
Koolau ditch nr Keanae		18,571	18,571						
	Honomanu			9,024	0	9,024	47.39	4,748	4,276
Haipuaena boundary									
Kula diversion flume		173	27,595						
Spreckels ditch		5,473							
Koolau ditch		20,060							
Manuel Luis ditch		1,889							
	Huelo			19,015	0	19,015	64.49	6,752	12,263
Honopou boundary									
Olinda water sold by E.M.I. to Maui County		222	46,610						
Lower Kula pipeline		425							
Piiholo Reservair						45,632			
Wailoa ditch		31,461							
New Hamakua ditch		7,389							
Lowrie ditch		4,420							
Haiku ditch		2,693							

/ 12.6% of Koolau ditch at Nahiku less water pumped into ditch (6,859-130 = 6,729 mg)
ø Adjusted for water pumped into ditch (Maui Land & Pineapple Co. pumped 130 mg)
* Water wasted to recharge Maui basal body.

APPENDIX R-2:

HC&S Exhibit C-13

ALEXANDER & BALDWIN, INC.
HONOLULU - SAN FRANCISCO

EAST MAUI IRRIGATION COMPANY, LIMITED

A SUBSIDIARY OF ALEXANDER & BALDWIN, INC.
P. O. BOX H
PAIA, MAUI, HAWAII 96779

October 15, 1986

Mr. Manabu Tagomori
Manager-Chief Engineer
Division of Water & Land Development
Department of Land & Natural Resources
P. O. Box 373
Honolulu, Hawaii 96809

Dear Manabu:

WATER LICENSES - FISCAL YEAR 1985-86

WASTE WATER AND YIELDS: During fiscal year 1985-86 waste water period, Hawaiian Commercial and Sugar Co. did not waste any water to recharge the Central Maui basal ground water.

We submit the following tables:

1. East Maui Water License Yield
2. Sale of Water to County of Maui from E.M.I.'s Haiku Uka watershed.
3. Water pumped into the Koolau ditch at Nahiku by Maui Pineapple Co., Ltd.

We will wait for your acceptance of these figures before remitting the balance of payment for the Honomanu License yield.

Very truly yours,

Robert L. Warzecha
Manager

RLW:GH:cg

Encls

Copy to: M.J.Ching, A&B Hon
R.F.Cameron, HC&S
L.A.Wilkinson, HC&S

FILE: Waste Water
General ✓

EAST MAUI WATER LICENSE YIELD

FISCAL YEAR 1985-86

MEASUREMENT POINT	LEASE	YEAR MG	TOTAL MG	YIELD MG	* WATER WASTED MG	NET AFTER WASTING			
						TOTAL MG	Gov't %	Private MG	Gov't MG
Makapipi Tunnel			≠ 1,049						
	Nahiku			7,276	0	7,276	95.02	362	6,914
Koolau ditch at Nahiku		8,468	8,468						
	Keanae			15,740	0	15,740	79.19	3,275	12,465
Koolau ditch nr Keanae		24,208	24,208						
	Honomanu			12,783	0	12,783	47.39	6,725	6,058
Haipuaena boundary									
Kula diversion flume		300	36,991						
Spreckels ditch		7,837							
Koolau ditch		26,365							
Manuel Luis ditch		2,489							
	Huelo			26,951	0	26,951	64.49	9,570	17,381
Honopou boundary									
Olinda water sold by E.M.I. to County of Maui		296	63,942			62,750		19,932	42,818
Lower Kula pipeline Piiholo Reservoir		815							
Wailoa ditch		43,094							
New Hamakua ditch		9,035							
Lowrie ditch		7,182							
Haiku ditch		3,520							

≠ 12.6% of Koolau ditch at Nahiku less water pumped into ditch (8,468 -143 = 8,325 mg)
ø Adjusted for water pumped into ditch (Maui Land & Pineapple Co. pumped 143 mg.)
* Water wasted to recharge Maui basal body.

EAST MAUI IRRIGATION COMPANY, LIMITED

SALE OF WATER to DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI

F.Y. 1985/86
(in M.G.D.)

1985	Reservoir Weir	*Olinda Lateral	TOTAL @ OLINDA	**PIIHOLO RESERVOIR
July	23.956	-	23.956	40.501
August	33.479	.032	33.511	134.451
September	28.488	-	28.488	10.063
October	22.829	.033	22.862	165.964
November	29.588	-	29.588	27.418
December	23.075	.025	23.100	90.625
1986				
January	21.860	-	21.860	21.361
February	11.452	.026	11.478	104.301
March	13.722	-	13.722	23.310
April	23.506	.046	23.552	42.107
May	36.796	0	36.796	67.748***
June	27.301	.033	27.334	86.874
			296.247	814.723

*Olinda residents meters

**No meter, adjusted with water sales to consumers.

***From Apr. 30, metered at Olinda Rd.

WATER PUMPED INTO KOOLAU DITCH @ NAHIKU

BY MAUI PINEAPPLE CO., LTD.

F.Y. 1985/86

(In M.G.D.)

Date	1985 July	Aug.	Sept.	Oct.	Nov.	Dec.	1986 Jan.	Feb.	Mar.	Apr.	May	June
1	.518	.593	.638	.026	.552	0	.569	.229	.530	.627	0	0
2	.528	.603	.638	.613	0	0	.569	.370	.530	0	0	.649
3	.172	.602	.614	.613	.538	0	.569	.558	.508	.559	0	0
4	0	.602	.614	.618	.613	0	.569	.558	.508	0	0	.609
5	0	.602	.591	.618	.610	0	.569	.551	.478	0	0	.612
6	0	.602	.577	.618	.612	0	.562	.551	.477	0	0	.611
7	0	.597	.578	.614	.612	0	0	.545	.464	0	0	.611
8	.598	0	.577	.614	.615	0	0	.545	.463	0	0	.611
9	.598	0	.558	.613	.615	0	0	.545	.463	0	.533	.612
10	.587	0	.558	.613	.615	.424	0	.557	.459	0	.609	.612
11	.587	.498	.545	.161	0	0	0	.557	.458	0	.608	.611
12	.559	.633	.545	.539	0	0	0	.076	.548	0	.605	.611
13	.559	.633	.546	.616	.563	0	.614	.532	0	0	.605	.606
14	.559	.635	.545	.614	.563	0	.614	.519	0	0	.604	.556
15	.622	.635	.545	.205	.630	0	.616	.520	0	0	.604	0
16	.622	.639	.545	.613	.630	.396	.616	.520	0	0	.605	.359
17	.004	.117	.545	.557	.629	.570	.620	.520	.514	0	.605	.615
18	.594	0	.570	0	.590	0	.621	.537	.514	.600	.101	.242
19	.644	.629	0	0	.590	.608	.621	.505	.188	.599	0	0
20	.644	.628	.613	0	.613	.606	.546	.505	0	.599	.601	0
21	.644	.630	.613	.617	.613	.606	.546	.511	0	.601	.610	0
22	.647	.630	.613	.617	.100	.606	.563	.511	0	0	.611	0
23	.647	.633	.612	.622	0	.599	.563	.511	0	0	.610	.453
24	.647	.633	.612	.622	.402	.626	.605	.501	0	0	.610	0
25	.648	.633	.609	.624	.310	.576	.604	.501	0	.609	.609	0
26	.060	.634	.609	.624	0	.576	.604	.495	.558	.609	.058	0
27	0	.635	.609	.156	0	.420	.581	.495	0	.609	.517	0
28	0	.635	.609	.390	0	.420	.581	.530	0	0	.622	0
29	0	.641	.609	.625	0	.420	.560	===	0	0	.622	0
30	0	.638	.637	.620	0	.569	.560	===	0	0	0	.429
31	0	.638	===	.620	===	.569	.612	===	.676	===	0	===
	11.688	16.228	17.074	15.002	11.615	8.591	14.654	13.855	8.336	5.412	10.949	9.409

GRAND TOTAL..... 142.813

APPENDIX R-3:

HC&S Exhibit C-14

ALEXANDER & BALDWIN, INC.
HONOLULU - SAN FRANCISCO

EAST MAUI IRRIGATION COMPANY, LIMITED

A SUBSIDIARY OF ALEXANDER & BALDWIN, INC.
P. O. BOX H
PAIA, MAUI, HAWAII 96779

October 20, 1987

Mr. Manabu Tagomori
Manager-Chief Engineer
Division of Water & Land Development
Department of Land & Natural Resources
P. O. Box 373
Honolulu, Hawaii 96809

Dear Manabu:

WATER LICENSES - Fiscal Year 1986-87

WASTE WATER AND YIELDS: During fiscal year 1986-'87 waste water period, Hawaiian Commercial and Sugar Company did not waste any water to recharge the central Maui basal ground water.

We submit the following tables:

1 -East Maui Water License Yield

2 -Sale of Water to County of Maui from E.M.I.Co.'s Haiku Uka watershed.

3 -Water pumped into the Koolau Ditch at Nahiku by Maui Pineapple Co., Ltd.

Very truly yours,

Robert L. Warzecha
Manager

GH:cg

Encls

Copy: M. J. Ching
R. F. Cameron
~~E. A. Wilkinson~~
W. Paty, Chrmn, DLNR

File - Waste wtr.
- Wtr. Lic: - Gen'l. ✓

EAST MAUI WATER LICENSE YIELD

FISCAL YEAR 19 86-87

MEASUREMENT POINT	LEASE	YEAR MG	TOTAL MG	YIELD MG	* WATER WASTED MG	NET AFTER WASTING TOTAL MG	Gov't %	Private MG	Gov't MG
Makapipi Tunnel			≠1,202						
	Nahiku			ø8,340	0	8,340	95.02	415	7,925
Koolau ditch at Nahiku		9,660	9,660						
	Keanae			18,971	0	18,971	79.19	3,948	15,023
Koolau ditch nr Keanae		28,631	28,631						
	Honomanu			13,224	0	13,224	47.39	6,957	6,267
Haipuaena boundary									
Kula diversion flume		345	41,855						
Spreckels ditch		9,092							
Koolau ditch		30,165							
Manuel Luis ditch		2,253							
	Huelo			33,215		33,215	64.49	11,795	21,420
Honopou boundary									
Olinda water sold by E.M.I. to County of Maui		311	75,070						
Lower Kula pipeline Piiholo Reservoir		777							
Wailoa ditch		48,377							
New Hamakua ditch		12,455							
Lowrie ditch		8,356							
Haiku ditch		4,794							

≠ 12.6% of Koolau ditch at Nahiku less water pumped into ditch (9,660 - 118 = 9,542 mg)
ø Adjusted for water pumped into ditch (Maui Land & Pineapple Co. pumped 118 mg.)
* Water wasted to recharge Maui basal body.

EAST MAUI IRRIGATION COMPANY, LIMITED

SALE OF WATER to DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI

FISCAL YEAR 1986/87

(in M.G.D.)

1986	Reservoir Weir	Olinda Residents' Meters (2)	TOTAL @ OLINDA	PIIHOLO RESERVOIR
July	31.938	-	31.938	76.180
August	18.964	.055	19.019	86.007
September	38.928*	-	38.928	83.964
October	25.141	.031	25.172	96.413
November	24.330	0	24.330	59.790
December	25.141	.020	25.161	46.184
1987				
January	25.141	-	25.141	44.996
February	22.708	.018	22.726	43.244
March	25.141	0	25.141	75.767
April	24.330	.049	24.379	54.636
May	25.141	0	25.141	41.989**
June	24.330	.027	24.357	67.530
		.30	311.433	776.700

*8/13/86 - Weir & recorder removed for construction of treatment plant. Consumption estimated @ .811 mgd.

**5/20/87 - From this date, consumption estimated due to broken meter.

WATER PUMPED INTO KOOLAU DITCH @ NAHIKU

By Maui Pineapple Co., Ltd.

FISCAL YEAR 1986/87

(in M.G.D.)

Date	1986 July	Aug.	Sept.	Oct.	Nov.	Dec.	1987 Jan.	Feb.	Mar.	Apr.	May	June
1	.540	.614	.614	.531	0	0	0	.580	.590	0	0	0
2	.614	.614	.591	.531	0	0	0	.587	.558	0	0	0
3	0	.614	.591	.553	0	0	0	.588	.558	0	0	.592
4	0	0	.590	.553	.606	0	0	.581	.600	0	0	.593
5	0	.553	.571	.553	.599	0	.581	.581	.600	.542	0	0
6	0	.615	.571	0	.599	0	.581	.592	.617	.589	0	0
7	0	.615	.571	0	.619	0	.607	.592	.618	.589	0	0
8	0	.612	.138	.551	.619	.392	.607	.593	.618	.590	0	0
9	0	.153	.560	.601	.077	.588	.576	.578	.525	.590	0	0
10	0	0	.561	.611	0	.601	0	.577	.526	.589	0	0
11	0	0	.561	.611	0	.175	0	.580	.567	.590	0	0
12	0	.564	.545	.611	0	0	0	.580	.567	.589	0	0
13	0	.613	.545	.609	0	0	0	.400	.539	.594	0	0
14	0	.051	.545	.609	0	0	0	.481	.539	.593	0	0
15	0	0	.539	.447	0	.554	0	.481	.539	.166	0	0
16	.198	0	.539	.619	0	.604	0	0	.565	0	0	0
17	0	0	.529	0	0	.602	0	0	.565	0	0	0
18	0	.615	.529	.520	.565	.602	0	0	.574	0	0	0
19	0	.615	.533	.624	.229	.050	0	0	.574	.503	0	0
20	0	.614	.533	0	0	.561	0	0	.583	.591	.586	0
21	.614	.614	.533	.576	.622	.561	0	0	.583	.590	.586	0
22	.614	.617	.552	.619	.622	.606	.526	0	.583	.365	.586	0
23	.095	.617	.551	.618	.622	.606	.529	.490	.553	.583	.586	0
24	0	.617	.569	.610	.608	.606	.530	.490	.553	.592	0	0
25	.562	.618	.569	.609	.608	.606	.199	.537	.561	.592	0	0
26	.614	.618	.547	.203	.606	.606	0	.537	.561	.247	0	0
27	.613	.619	.547	0	.606	.606	0	.590	0	0	0	0
28	.615	.619	.546	0	.050	.606	.577	.590	0	0	0	0
29	.615	.614	.564	.579	0	.606	.576	----	.411	0	0	0
30	.612	.614	.525	.578	0	0	.580	----	.538	0	0	0
31	.612	.614	----	.590	----	0	.580	----	.342	----	0	----
	6.918	14.243	16.259	14.116	8.257	10.138	7.049	11.605	16.107	10.084	2.344	1.185

GRAND TOTAL 118.305

APPENDIX R-4:

HC&S Exhibit C-15

ALEXANDER & BALDWIN, INC.
HONOLULU - SAN FRANCISCO

EAST MAUI IRRIGATION COMPANY, LIMITED

A SUBSIDIARY OF ALEXANDER & BALDWIN, INC.
P. O. BOX H
PAIA, MAUI, HAWAII 96779

August 22, 1988

Mr. Manabu Tagomori
Manager-Chief Engineer
Division of Water & Land Development
Department of Land & Natural Resources
P. O. Box 373
Honolulu, Hawaii 96809

Dear Manabu:

file ✓ WATER LICENSES - Fiscal Year 1987-88

WASTE WATER AND YIELDS: During fiscal year 1987-88 waste water period, Hawaiian Commercial and Sugar Company did not waste any water to recharge the central Maui basal ground water.

We submit the following tables:

1 - East Maui Water License Yield

2 - Sale of Water to County of Maui from E.M.I.Co.'s Haiku Uka watershed

3 - Water pumped into the Koolau Ditch at Nahiku by Maui Pineapple Co., Ltd.

Very truly yours,

Robert L. Warzecha
Manager

CH:mc
encls.
cc: M. J. Ching w/encls.
R. F. Cameron
W. Paty, Chrmn, DLNR

File Copy

EAST MAUI IRRIGATION COMPANY, LIMITED

SALE OF WATER to DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI

FISCAL YEAR 1987/88

(in M.G.D.)

1987	Reservoir Weir	Olinda Residents' Meters (2)	TOTAL @ OLINDA	PIIHOLO RESERVOIR
July	25.141 *	-0-	25.141	69.781 **
August	21.416 *	.062	21.478	80.744 **
September	40.933	-0-	40.933	77.472
October	43.444	.045	43.489	78.685
November	28.987	-0-	28.987	42.893
December	30.716	.045	30.761	33.229
1988				
January	26.428	-0-	26.428	34.851
February	38.152	.040	38.192	51.091
March	40.129	-0-	40.129	51.962
April	32.715	.027	32.742	51.314
May	41.295	-0-	41.295	63.771
June	23.836	.029	23.865	44.460
			393.440	680.253

*8/13/86 - Weir & recorder removed for construction of treatment plant. Consumption estimated @ .811 mgd.

**5/20/87- From this date, consumption estimated due to broken meter.

EAST MAUI WATER LICENSE YIELD

FISCAL YEAR 1987 - 88

MEASUREMENT POINT	YEAR MG	TOTAL MG	*WATER WASTED MG	NET AFTER WASTING			
				TOTAL MG	GOV'T %	PRIVATE MG	GOV'T MG
HONOPOU BOUNDARY		66,594	0	66,594	70.00	19,978	46,616
Olinda water to County of Maui	393						
Lower Kula pipeline Piiholo Reservoir	680						
Wailoa Ditch	ø43,711						
New Hamakua Ditch	10,973						
Lowrie Ditch	6,641						
Haiku Ditch	4,196						

ø Adjusted for water pumped into ditch (Maui Land & Pineapple Co. pumped 114 mg.)

* Water wasted to recharge Maui basal body.

WATER PUMPED INTO KOOLAU DITCH @ NAHIKU

By Maui Pineapple Co., Ltd.

FISCAL YEAR 1987/88

(in M.G.D.)

Date	1987 July	Aug.	Sept.	Oct.	Nov.	Dec.	1988 Jan.	Feb.	Mar.	Apr.	May	June
1	-0-	.593	.541	.192	.576	-0-	.481	-0-	.580	-0-	-0-	.574
2	-0-	.593	.538	-0-	.581	-0-	-0-	-0-	.574	-0-	-0-	.574
3	-0-	.593	.538	-0-	.581	-0-	-0-	.585	.573	-0-	.569	.574
4	-0-	.593	.540	.333	.573	.561	-0-	.585	.576	-0-	.549	.574
5	-0-	.591	.540	.581	.573	.561	-0-	.587	.576	-0-	.549	.574
6	-0-	.591	.539	.581	.576	-0-	-0-	.587	.576	-0-	.574	.576
7	-0-	.571	.540	.581	.576	-0-	-0-	.587	.578	-0-	.573	.216
8	-0-	.571	.213	.581	.576	-0-	-0-	.587	.578	-0-	.573	-0-
9	-0-	-0-	.493	.580	.466	-0-	-0-	.587	.577	-0-	.271	-0-
10	-0-	.589	.493	.580	-0-	-0-	-0-	.588	.576	-0-	.271	.574
11	-0-	.589	-0-	.580	.572	.572	-0-	.588	.574	-0-	-0-	.574
12	-0-	.589	-0-	.576	.572	.119	-0-	.578	.574	-0-	-0-	.335
13	-0-	.589	-0-	.576	.575	-0-	-0-	.120	.574	.557	-0-	.571
14	-0-	.587	.325	.579	.575	-0-	-0-	-0-	-0-	.557	-0-	.571
15	-0-	.587	.557	.579	.575	-0-	-0-	-0-	-0-	.582	-0-	.574
16	-0-	.587	.559	.558	.576	-0-	-0-	-0-	-0-	.582	-0-	.574
17	.587	.588	.559	.558	.264	-0-	-0-	-0-	-0-	.582	-0-	.575
18	.587	.588	.087	.558	-0-	-0-	-0-	.351	-0-	.583	.572	.575
19	.587	.583	.475	.562	-0-	-0-	.533	.578	-0-	.583	.530	.575
20	-0-	.583	.600	.562	-0-	-0-	.578	.578	-0-	.584	.624	.575
21	-0-	.556	.329	.376	-0-	-0-	.578	.578	.613	.584	.600	.575
22	-0-	.556	.584	-0-	-0-	-0-	.580	.590	-0-	.587	-0-	.573
23	-0-	.556	.583	-0-	-0-	.577	.580	-0-	-0-	.587	-0-	.573
24	-0-	.540	.583	-0-	-0-	.577	.580	-0-	-0-	.587	-0-	.574
25	-0-	.540	.586	-0-	-0-	.577	.578	-0-	-0-	-0-	.572	.574
26	-0-	.546	.586	-0-	-0-	.577	-0-	-0-	-0-	-0-	.477	.574
27	.588	.546	.586	.576	-0-	.577	-0-	-0-	-0-	-0-	.869	-0-
28	.589	.544	.347	.578	-0-	.577	-0-	-0-	-0-	-0-	-0-	-0-
29	.588	.544	.577	.577	-0-	.577	-0-	.578	-0-	-0-	-0-	-0-
30	.588	.544	.580	.576	-0-	.577	-0-	-----	-0-	-0-	-0-	-0-
31	.593	.541	-----	.576	-----	.577	-0-	-----	-0-	-----	-0-	-----
	4.707	17.168	13.478	12.956	8.787	7.006	4.488	9.232	8.099	6.955	8.173	13.178

GRAND TOTAL 114.227

APPENDIX R-5:

1985 Isohyetal Study

DIVISION OF WATER AGREED AT 70 GOVT 30 PRIVATE WITH MANABU TABAMORI 12/2/87 Meredith, Tom Tamke & RLW

COMPARISON OF PRIVATE AND STATE WATER OWNERSHIP
AS CALCULATED BY THE METHODS DESCRIBED

		Private	State
(1)	1949 Isohyetal Study	26.782%	73.218%
(2)	1985 D.L.N.R. Study	25.650%	74.350%
(3)	1985 EMI Study	26.258%	73.742%
(4)	1985 EMI Re-study	26.316%	73.684%
(5)	Actual Yield - 1949 Data	30.540%	69.460%
(6)	Actual Yield - 1985 Data	30.200%	69.800%
(7)	1985 DLNR RESTUDY	27.39 %	72.61 %
Notes:	AGREEMENT w/Manabu T. 12/2/87	30.00	70.00

(1) 1949 isohyetal calculations by license area and combined.

(2) 1985 isohyetal calculations for one license by D.L.N.R.

(3) 1985 isohyetal calculations for one license by EMI Co.

(4) 1985 isohyetal claculations by four individual licenses and combined, by EMI Co.

(5) Actual water yield calculated by license using 1949 isohyetal study.

(6) Actual water yield calculated by license using 1985 isohyetal study [(4) above].

(7) 1985 RESTUDY AS PRESENTED AT DEC 24, 1986 HEARING

ACTUAL TOTAL WATER YIELD BY LICENSE

PERIOD 1970-85

	Nahiku	Keanae	Honomanu	Huelo	Total
1970-71	8,502	18,996	11,607	22,681	61,786
1971-72	5,228	11,086	6,703	17,479	40,496
1972-73	7,094	16,201	10,484	25,985	59,764
1973-74	5,698	12,625	6,817	14,272	39,412
1974-75	6,532	14,569	7,882	20,264	49,247
1975-76	6,923	15,819	8,597	23,515	54,854
1976-77	5,805	13,705	8,537	21,213	49,260
1977-78	5,684	14,010	7,774	22,238	49,706
1978-79	8,232	17,949	12,552	25,668	64,401
1979-80	8,495	16,950	13,654	15,748	54,847
1980-81	5,233	12,521	6,850	20,192	44,796
1981-82	7,697	16,427	13,366	17,370	54,860
1982-83	7,515	16,064	10,990	27,027	61,596
1983-84	7,597	16,069	10,379	27,588	61,633
1984-85	5,881	11,712	9,024	19,015	45,632
				TOTAL	792,290

ACTUAL YIELD STATE WATER BY LICENSE
USING 1949 ISOHYETAL STUDY

PERIOD 1970-75

	Nahiku 95.02%	Keanae 79.19%	Honomanu 47.39%	Huelo 64.49%	Total	% Govt.
1970-71	8,079	15,043	5,501	14,627	43,250	70.00
1971-72	4,968	8,779	3,177	11,272	28,196	69.63
1972-73	6,741	12,830	4,968	16,758	41,297	69.10
1973-74	5,414	9,998	3,231	9,204	27,847	70.66
1974-75	6,207	11,537	3,735	13,068	34,547	70.15
1975-76	6,578	12,527	4,074	15,165	38,344	69.90
1976-77	5,516	10,853	4,046	13,680	34,095	69.21
1977-78	5,401	11,095	3,684	14,341	34,521	69.45
1978-79	7,822	14,214	5,948	16,553	44,537	69.16
1979-80	8,072	13,423	6,471	10,156	38,122	69.51
1980-81	4,972	9,915	3,246	13,022	31,155	69.55
1981-82	7,314	13,009	6,334	11,202	37,859	69.01
1982-83	7,141	12,721	5,208	17,430	42,500	69.00
1983-84	7,219	12,725	4,919	17,792	42,655	69.21
1984-85	5,588	9,275	4,276	12,263	31,402	68.82
				TOTAL	550,327	69.46

ACTUAL YIELD STATE WATER BY LICENSE
USING 1985 ISOHYETAL STUDY

PERIOD 1970-85

	Nahiku ~~95.05%~~ 95.65 %	Keanae ~~23.67%~~ 83.67 %	Honomanu 49.35%	Huelo 61.18%	Total	% Govt.
1970-71	8,132	15,894	5,462	13,876	43,364	70.18
1971-72	5,001	9,276	3,308	10,694	28,279	69.83
1972-73	6,785	13,555	5,174	15,898	41,412	69.29
1973-74	5,450	10,563	3,364	8,732	28,109	71.32
1974-75	6,248	12,190	3,890	12,398	34,726	70.51
1975-76	6,622	13,236	4,243	14,386	38,487	70.16
1976-77	5,552	11,467	4,213	12,978	34,210	69.45
1977-78	5,437	11,722	3,836	13,605	34,600	69.61
1978-79	7,874	15,018	6,194	15,704	44,790	69.55
1979-80	8,125	14,182	6,738	9,635	38,680	70.52
1980-81	5,005	10,476	3,380	12,353	31,214	69.68
1981-82	7,362	13,744	6,596	10,627	38,329	69.87
1982-83	7,188	13,441	5,424	16,535	42,588	69.14
1983-84	7,267	13,445	5,122	16,878	42,712	69.30
1984-85	5,625	9,799	4,453	11,633	31,510	69.05
				TOTAL	553,010	69.80

COMPARISON OF PRIVATE AND STATE WATER OWNERSHIP
AS CALCULATED BY THE METHODS DESCRIBED

		Private	State
(1)	1949 Isohyetal Study	26.782%	73.218%
(2)	1985 D.L.N.R. Study	25.650%	74.350%
(3)	1985 EMI Study	26.258%	73.742%
(4)	1985 EMI Re-study	26.316%	73.684%
(5)	Actual Yield - 1949 Data	30.540%	69.460%
(6)	Actual Yield - 1985 Data	30.200%	69.800%

Notes:

(1) 1949 isohyetal calculations by license area and combined.

(2) 1985 isohyetal calculations for one license by D.L.N.R.

(3) 1985 isohyetal calculations for one license by EMI Co.

(4) 1985 isohyetal claculations by four individual licenses and combined, by EMI Co.

(5) Actual water yield calculated by license using 1949 isohyetal study.

(6) Actual water yield calculated by license using 1985 isohyetal study [(4) above].

COMPARISON OF PRIVATE AND STATE WATER OWNERSHIP
BASED ON 1949 AND 1985 ISOHYETAL STUDIES BY LICENSEE

	PRIVATE OWNERSHIP	STATE OWNERSHIP
	NAHIKU LICENSE	
1949	4.98%	95.02%
1985	4.35%	95.65%
	KEANAE LICENSE	
1949	20.81%	79.19%
1985	16.33%	83.67%
	HONOMANU LICENSE	
1949	52.61%	47.39%
1985	50.65%	49.35%
	HUELO LICENSE	
1949	35.51	64.49%
1985	38.82	61.18%
	TOTAL	
1949	26.78%	73.22%
1985	26.32%	73.68%

APPENDIX S:

Historical Industrial Use Table

Appendix S Historical Industrial Use

Water Users	Source / Delivery Point	Water User's Location	Relationship to EMI / A&B / Mahi Pono	Use
HC&D, LLC and subtenant Maui Paving (Camp 10 Puunene Quarry)	Haiku Ditch & 702 Cistern South of Pulehu Rd	3-8-001-001 3-8-003-004 3-8-003-021	Tenant	Restrooms, concrete batching, fire suppression, and dust control
Imua Energy Maui, LLC, dba Maui EKO Systems LLC (Tenant of County Central Maui Landfill)	Pumped from Haiku Ditch	3-8-003-019	Gov't Tenant	General Use for Compost Operation
HC&S Mill Area Fire Suppression	702 Cistern	3-8-006-001 CPR #1	A&B - Owned	Fire suppression for ag offices & Puunene Post Office
New Leaf Ranch (Non-Profit)	702 Cistern	3-8-006-029	Tenant	Irrigation water for non-profit providing ag-related work opportunities and training as mental health & substance use dependency treatment
Maui Demolition & Construction Landfill (Decoite Trucking)	Reservoir 91	3-8-005-002	Tenant	Tank & Standpipe for Irrigation & Dust Control
Costo Maddela	Haiku Ditch	3-8-001-001	Tenant	Pasture & Animal Water
Harriet, Michael, & Jordan Santos	Kauhikoa Ditch	2-5-001-018 & 019	Tenant	Pasture & Animal Water
Leonard Pagan	Kauhikoa Ditch	2-5-002-001	Tenant	Pasture & Animal Water
Harry Cambra	Kauhikoa Ditch	2-5-003-026, 027, 036, 037, 038	Tenant	Pasture & Animal Water

Proposed Lease (Water Lease) for the
Nāhiku, Keʻanae, Honomanū, and Huelo
License Areas

Corrected Final Environmental Impact Statement

WILSON OKAMOTO
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INNOVATORS • PLANNERS • ENGINEERS