Chapter 4:

Description of Existing Environment, Impacts, and Mitigation Measures

4. DESCRIPTION OF EXISTING ENVIRONMENT, IMPACTS, AND MITIGATION MEASURES

This chapter describes the existing physical environment within the East Maui, Upcountry Maui, and at the Central Maui agricultural fields. This chapter also identifies the potential impacts to the environment within these different areas and, where appropriate, provides mitigation measures to address adverse environmental impacts from the Proposed Action.

For the purposes of this DEIS, East Maui refers to the area potentially affected by the Proposed Action. Depending on the topic of discussion, it includes the following:

- The License Area comprised of 33,000 acres of State-owned land that is the subject of the Proposed Action and which contains most of the EMI Aqueduct System as well the streams subject to the CWRM D&O;
- The Collection Area, which includes the License Area, as well as approximately 17,000 acres of privately-owned land mauka and west of the License Area that contributes to water diverted by the EMI Aqueduct System; and,
- Areas generally makai of the EMI Aqueduct System, including a portion of the Hāna Highway, various undeveloped, agricultural and rural areas - including the Nāhiku community of which a portion is served by the MDWS with water from the EMI Aqueduct System, and the adjoining coastal waters.

Upcountry Maui is considered to be comprised of several communities, including Kula, Pukalani, Makawao Haʻikū, Hāliʻimaile, Waiakoa, Kēōkea, Waiohuli, ʻUlupalakua, Kanaio, Olinda, ʻŌmaʻopio, Kula Kai, and Pūlehu. Upcountry Maui also includes KAP and the 262-acre KAP expansion. The Upcountry Maui area considered in this DEIS is generally the area serviced by the portion of the Upcountry Maui Water System that gets water from the Kamole-Weir, Olinda, and Piiholo WTPs.

For the purposes of this DEIS, Central Maui is comprised of the approximately 30,000 acres of agricultural land that had been cultivated with sugarcane for over a century utilizing water from the EMI Aqueduct System. Geographically, what is referred to as Central Maui encompasses approximately 36,000 acres, but approximately 6,000 acres is comprised of uncultivated areas, including roads, gulches, and patches of uncultivated land as shown in Figure 4-1.

4.1 Physiography

4.1.1 Geology and Topography

Geologically, the island of Maui is part of a large volcanic mass that also includes the islands of Molokaʻi, Lānaʻi, and Kahoʻolawe. Historically, this mass was at one time a single island with an area of approximately 2,000 square miles. Maui itself consists of two separate shield volcanoes, West Maui (Mauna Kahalawai) and East Maui (Haleakalā).

East Maui

East Maui is located on the northern slopes of Haleakalā, which is now almost wholly covered by post-shield building stage alkali lavas. Formation of some of East Maui's more spectacular

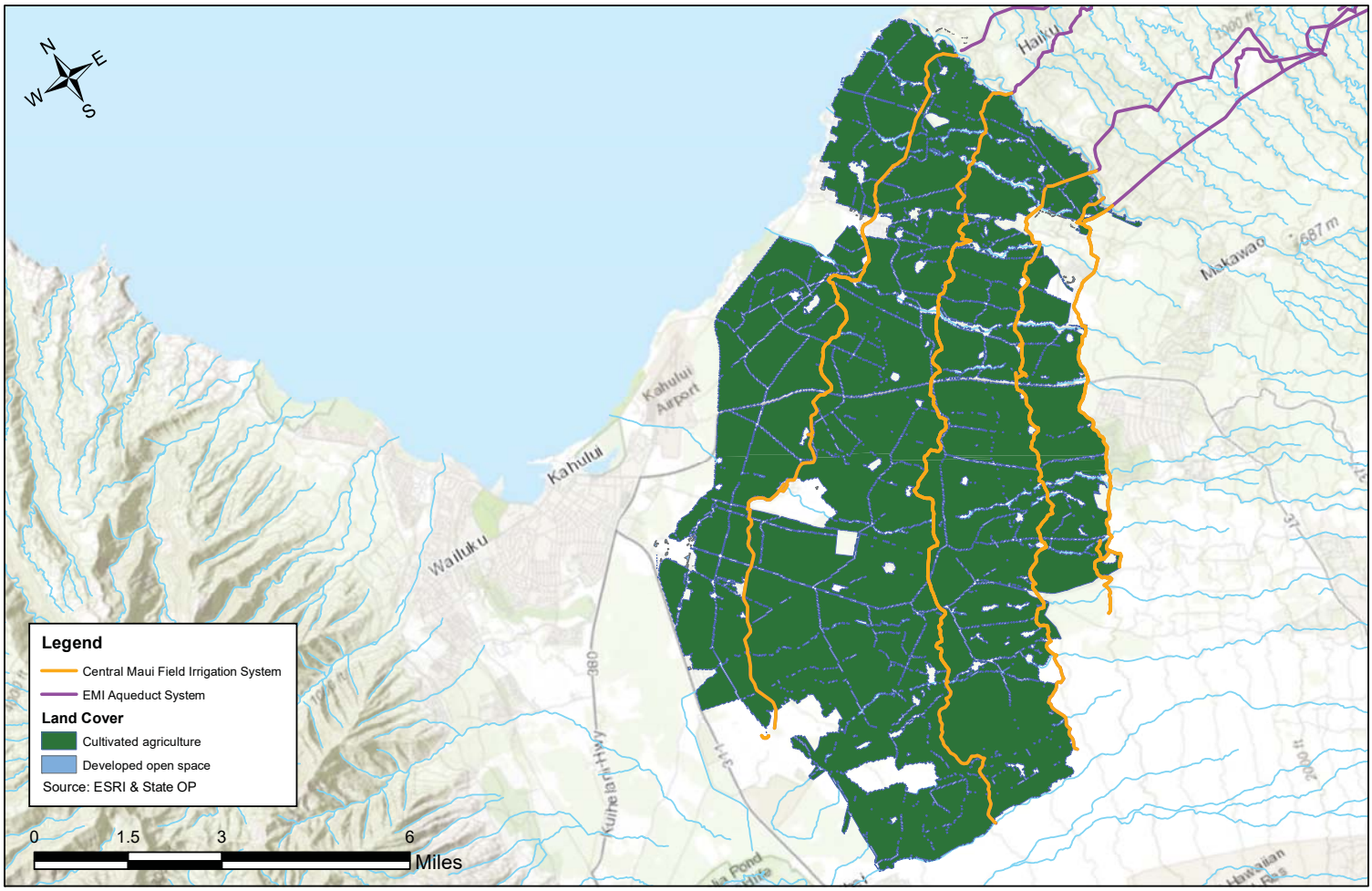


FIGURE 4-1

Central Maui Land Cover Map

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS

valleys, including the Keʻanae region, which is part of the License Area, began during the Honomanū Volcanic Series.

Three series of lava flows or Volcanic Series are found in East Maui, the Honomanū, Kula, and Hāna Volcanic Series. The oldest series, the Honomanū Volcanic Series forms the bulk of the Haleakalā volcanic dome and are present in exposures of tholeiitic olivine basalt to oceanite along the northern sea wall and valleys. The Honomanū Volcanic Series is overlain by alkalic lavas of the Kula Volcanic Series. Locally, the contact is marked by the presence of a thin layer of red ashy soil up to 15 cm thick, but elsewhere tholeiitic Honomanū Series lavas are interbedded with Kula alkalic olivine basalts over a transition zone 15 to 60 meters thick. Hawaiite is the predominant lithology of the Kula Volcanic Series, with lesser amounts of ankaramite and alkalic olivine basalt. Explosive eruptions were apparently fairly common at this time as large cinder cones are abundant in the Kula Series. A prolonged period of erosion marks the end of Kula volcanism. The Hāna Volcanic series then partially filled these deeper valleys and canyons and veneered the remainder of the mountain. Hāna lavas are andesitic, picritic and olivine basalts that carry minimal water except where they have buried earlier perennial streams.

The elevation in East Maui extends from approximately 2,000 meters above sea level at the highest point of the Collection Area down to sea level at the coastline (See Figure 4-2). The overall slope is gentle, retaining much of the shield volcano form of Haleakalā, but many deep ravines cutting through the overall formation have steep slopes, evidencing the high amount of rainfall on the island's windward exposure.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on geology or topography in the region are anticipated.

Upcountry Maui

Upcountry Maui is a region in Maui generally regarded as located on the western slope of Haleakalā, ranging in elevation from approximately 1,000 to 4,000 feet above sea level. For the purposes of this EIS, however, the area referred to as Upcountry Maui is generally the area served by the MDWS Upcountry Maui Water System, which is discussed in Section 2.2.3.1. (See Figure 4-3). While this service area generally lies within what is regarded as Upcountry Maui, it also extends to the coastline at the community of Haʻikū. The Kula Volcanic Series covers the entire northwest region of Haleakalā. Receiving far less rainfall than East Maui, Upcountry Maui retains much of the gently sloping volcanic shield formation and lacks the deep cut ravines characterizing East Maui.

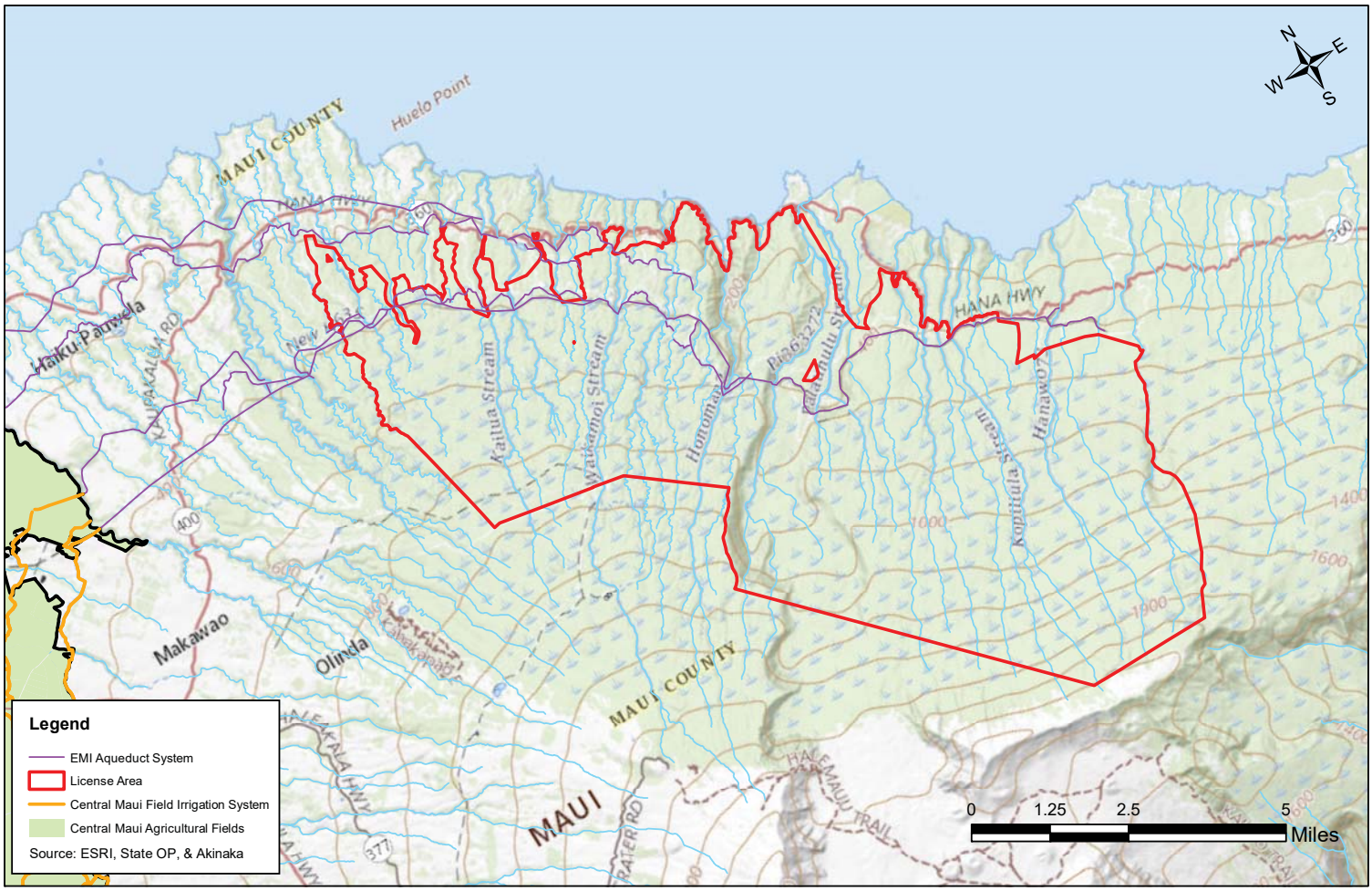


FIGURE 4-2

USGS East Maui Topography Map

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS

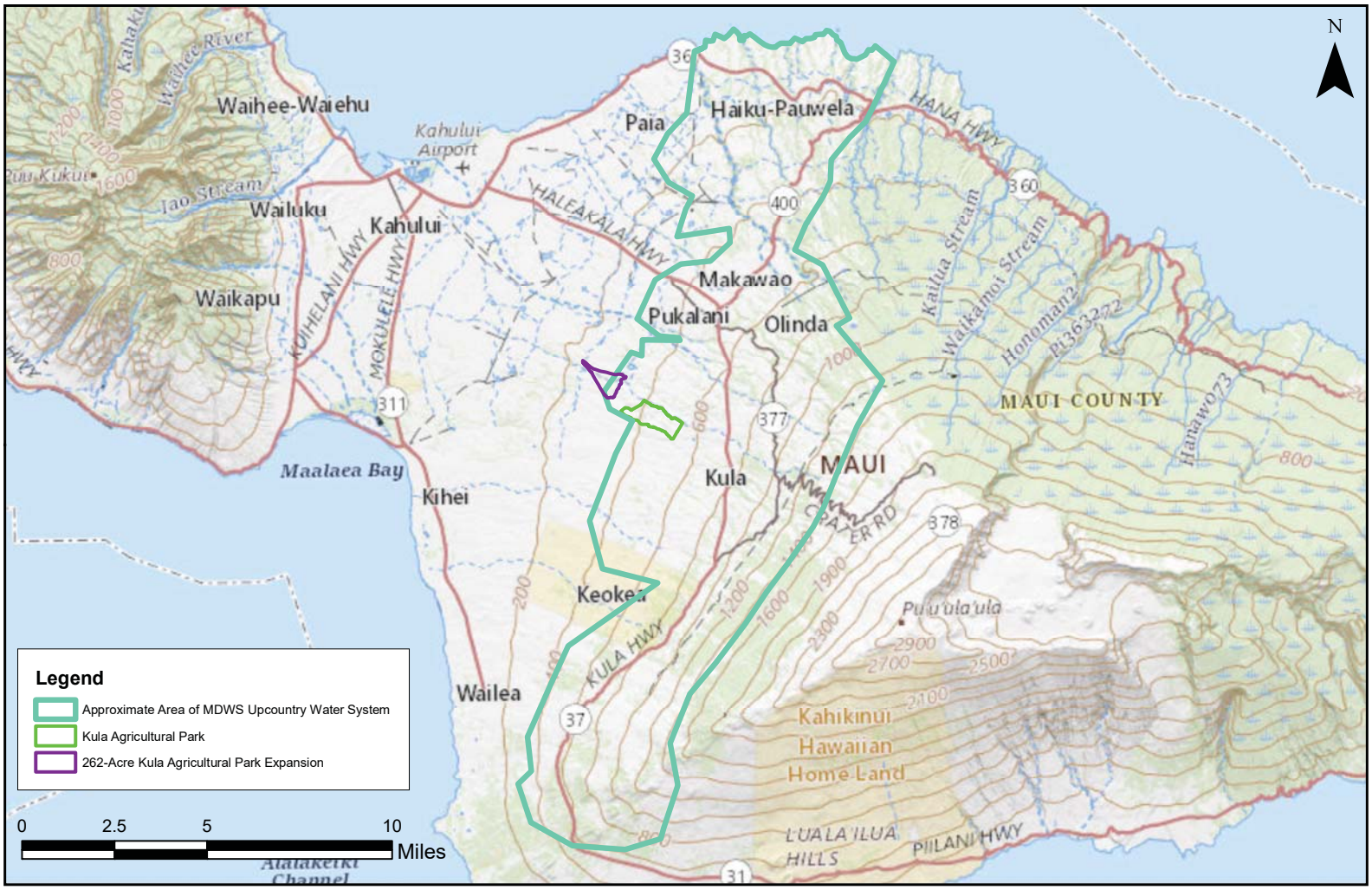


FIGURE 4-3

USGS Upcountry Maui Topography Map

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui, including agricultural users at KAP and the 262-acre KAP expansion. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on geology or topography in the region are anticipated.

Central Maui

The agricultural fields in Central Maui make up the majority of Maui's gently sloping isthmus. The isthmus is formed by nearly flat lying lava flows of Honomanū Basalt, interbedded with consolidated and unconsolidated sedimentary deposits. Beneath the isthmus, the Honomanū Basalt of Haleakalā overlies earthy sedimentary deposits and the older Wailuku Basalt of West Maui Mountain. The area has been cultivated from decades of sugar cultivation. The elevation of the agricultural fields in Central Maui range from sea level to approximately 400 meters above sea level (See Figure 4-4).

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on geology or topography in the region are anticipated.

Mahi Pono, the owner of the Central Maui agricultural fields, proposes to construct approximately 319,000 square feet of building space related to its agricultural operations such as washing and packing areas, storage, etc. Moreover, the former sugarcane fields would need to be cleared to allow for the transition to a diversified farm operation. Applicable best management practices (BMP) and erosion control measures will be implemented to ensure no adverse impact to the existing geology and topography.

4.1.2 Soils

East Maui

Soil information regarding the License Area in East Maui was provided by Cultural Surveys Hawai'i, Inc. (CSH) (2019). Soils in the License Area can be broken down into four areas: Huelo, Honomanū, Ke'anae, and Nāhiku. Below is a discussion regarding the soils within the four portions of the License Area.

According to the U.S. Department of Agriculture (USDA) (2001) Soil Survey Geographic (SSURGO) database and soil survey data gathered by Foote et al. (1972), soils within the

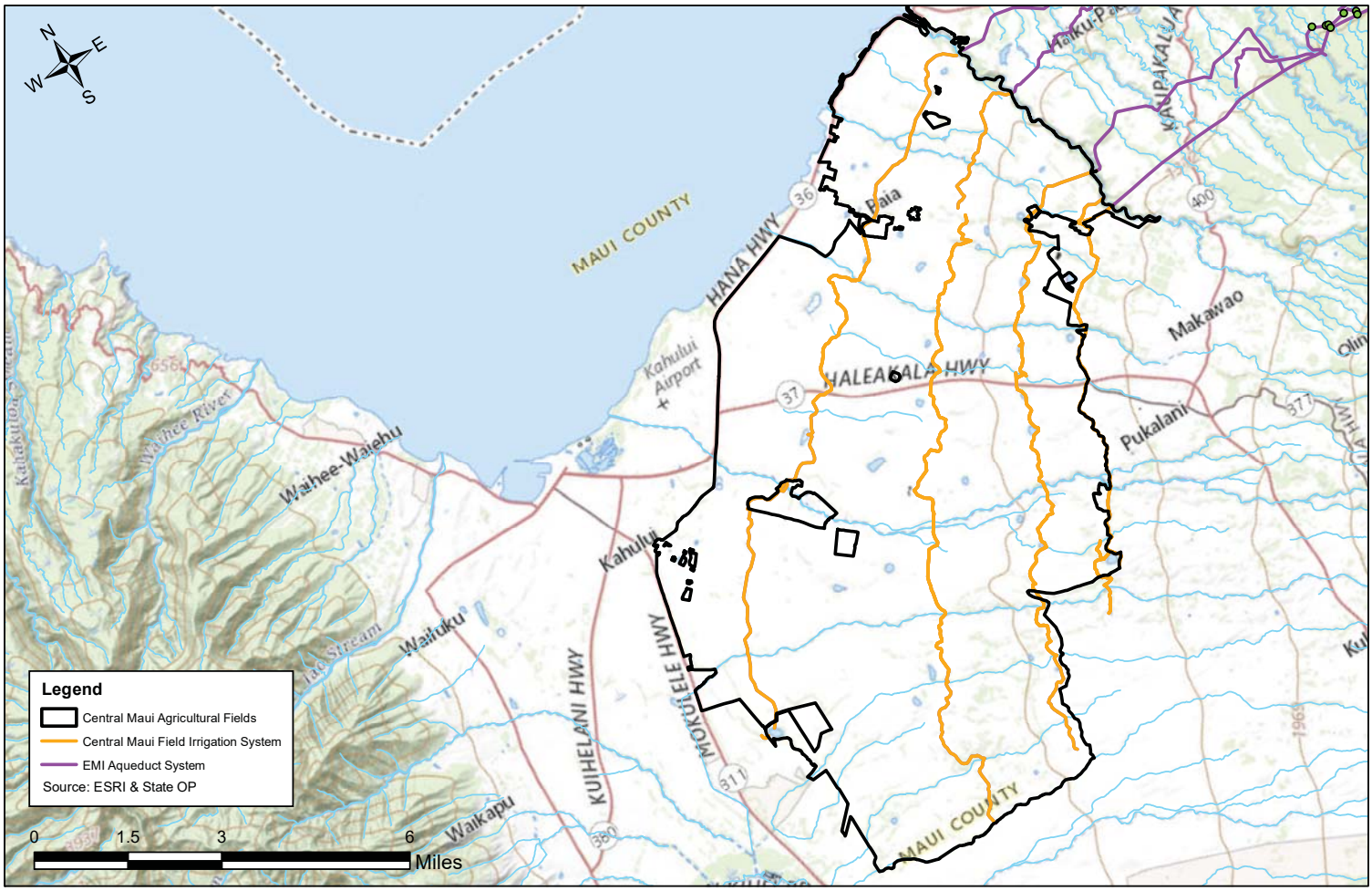


FIGURE 4-4

USGS Central Maui Topography Map

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS

Huelo portion of the License Area include Kailua silty clay (3 to 25 percent slopes) (KBID), Pauwela clay (15 to 25 percent slopes) (PfD), Rough broken land (rRR), Honomanu-Amalu association (rHR), Rough mountainous land (rRT), Amalu peaty silty clay (3 to 20 percent slopes) (rAMD), and water > 40 acres (W) (See Figure 4-5).

Kailua silty clay (3 to 25 percent slopes) (KBID) soils are described as follows:

> This soil is on low uplands. Included in mapping were areas of Honomanu and Makawao soils. Also included were small, steep areas near cinder cones.
> In a representative profile the surface layer is dark brown silty clay about 9 inches thick. The upper part of the subsoil, about 18 inches thick, is dark-brown and dark reddish-brown silty clay that has subangular blocky structure. The lower part of the subsoil is very dark gray silty clay loam. The substratum is soft, weathered basic igneous rock. The soil is very strongly acid in the surface layer and strongly acid or medium acid in the subsoil.
>
> Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. In places roots penetrate to a depth of 4 feet or more…
>
> This soil is used for pasture, woodland, and wildlife habitat. (Capability classification IVe, nonirrigated; pasture group 11; woodland group 8). (Foote et al. 1972:53)

Pauwela clay (15 to 25 percent slopes) (PfD) soils are described as follows:

> On this soil runoff is medium and the erosion hazard is moderate. Included in mapping were areas that are steep and moderately eroded. This soil is used for pasture and woodland. (Capability classification IVe, nonirrigated; pineapple group 8; pasture group 8; woodland group 7). (Foote et al. 1972:112)

Rough broken land (rRR) is described as follows:

> Rough broken land (rRR) consists of very steep land broken by numerous intermittent drainage channels. In most places, it is not stony. It occurs in gulches and on mountainsides on all the islands except O'ahu. The slope is 40 to 70 percent. Elevations range from nearly sea level to about 8,000 feet. The local relief is generally between 25 and 500 feet. Runoff is rapid, and geologic erosion is active. The annual rainfall amounts to 25 to more than 200 inches.
>
> These soils are variable. They are 20 to more than 60 inches deep over soft, weathered rock. In most places some weathered rock fragments are mixed with the soil material. Small areas of rock outcrop, stones, and soil slips are common. Included in mapping were areas of colluvium and alluvium along gulch bottoms.
>
> This land type is used primarily for watershed and wildlife habitat. In places, it is used also for pasture and woodland. The dominant natural vegetation in the drier areas consists of guava, lantana, natal redtop, Bermuda grass, koa haole,

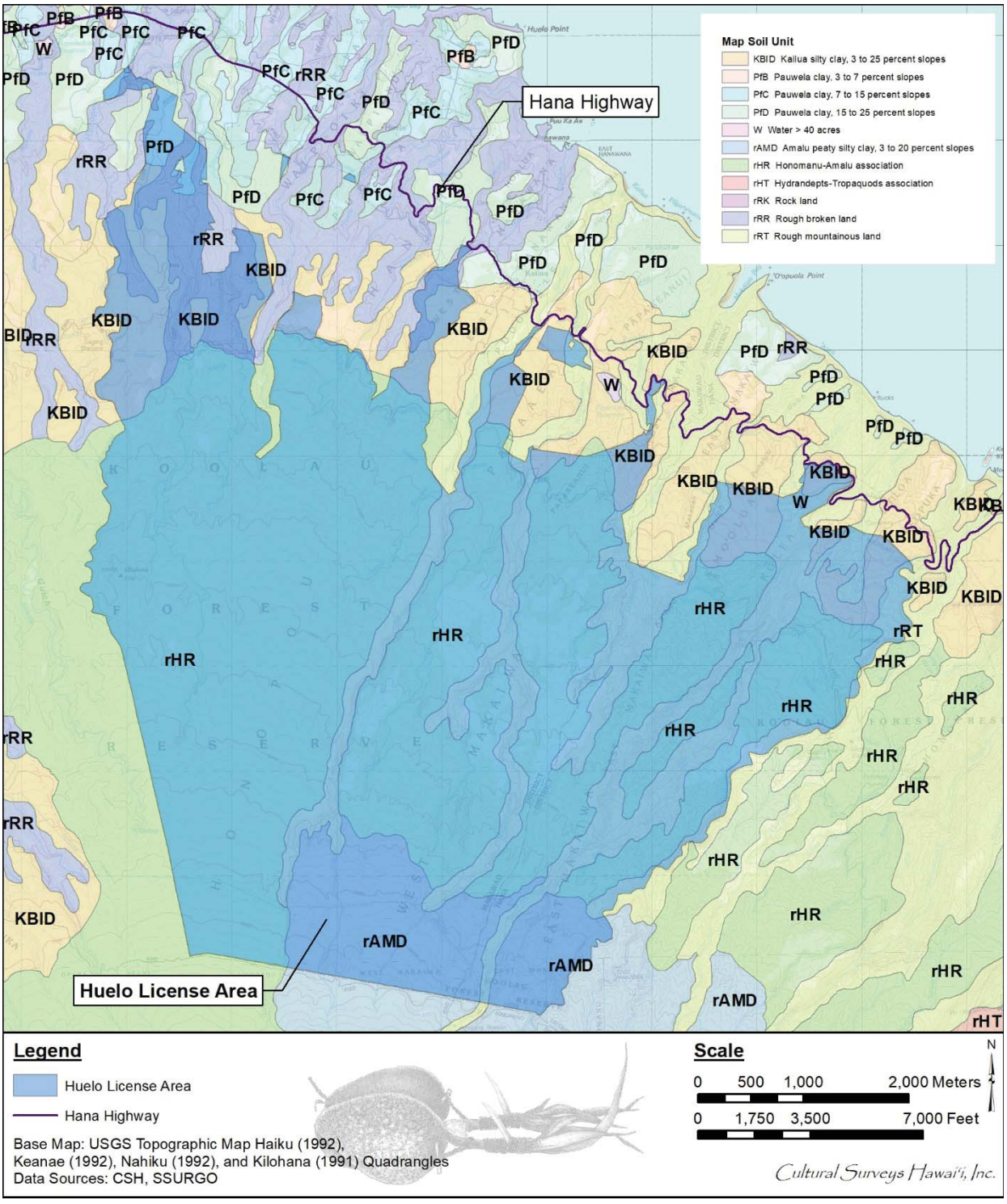


Figure 4-5. Overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972), indicating soil types within and surrounding the Huelo License Area (U.S. Department of Agriculture 2001)

Cultural Surveys Hawai‘i, Inc provided map that depicts soil within portions of License Area

and molasses grass. Ohia, kukui, koa, and ferns are dominant in the wetter areas. Puakeawe, aalii, and sweet vernal grass are common at the higher elevations. (Capability classification VIIe, nonirrigated). (Foote et al. 1972:119)

Honomanu-Amalu association (rHR) soils are described as follows:

> The soils in this association have the profiles described as typical of their respective series. The areas are almost inaccessible by vehicle or on foot. They are on gently sloping to moderately steep, intermediate uplands on East Maui. The Honomanu soils occupy the more sloping, better drained side slopes. The Amalu soils occur on the less sloping tops of ridges and interfluves. The Honomanu soils are well drained; the Amalu soils are poorly drained. Runoff is slow to very slow, and the erosion hazard is slight.
>
> Honomanu soils make up about 60 percent of the association, and Amalu soils about 40 percent. Included in mapping were small areas of Kailua soils and many small, very steep gulches. This association is used for water supply and wildlife habitat. It is covered with dense min forest vegetation. (Honomanu part is in capability classification IVe, nonirrigated; woodland group 8. Ama1u part is in capability classification VIIw, nonirrigated). (Foote et al. 1972:43)

Rough mountainous land (rRT) is described as follows:

> Rough mountainous land (rRT) occurs in mountainous areas on all islands in the survey area. Is consists of very steep land broken by numerous intermittent drainage channels. In most places it is not stony. Elevations range from nearly sea level to more than 6,000 feet. The annual rainfall amounts to 70 to more than 400 inches. Over much of the area, the soil mantle is very thin. It ranges from 1 inch to 10 inches in thickness over saprolite. In most places the saprolite is relatively soft and permeable to roots and water.
>
> The land surface is dominated by deep, V-shaped valleys that have extremely steep side slopes and narrow ridges between the valleys. In most places, the local relief exceeds 500 feet. The soil material on the narrow ridgetops is similar to that of the Amalu and Olokui series. Rock land, rock outcrop, soil slips, and eroded spots make up 20 to 40 percent of the acreage.
>
> This land type is used for water supply, wildlife habitat, and recreation. The natural vegetation consists of ohia, false staghorn fern, tree fern, yellow foxtail, lantana, kukui, and puakeawe. (Capability classification VIIIe, nonirrigated) (Foote et al. 1972:119)

Amalu peaty silty clay (3 to 20 percent slopes) (rAMD) soils are described as follows:

> This soil is on high ridges and mountaintops. Included in mapping were small areas of Honomanu and Olokui soils and of steep gulches. In a representative profile an organic layer of black peat, about 8 inches thick, overlies a layer of gray massive clay about 8 inches thick. The substratum is soft, weathered basic

> igneous rock capped by a horizontal ironstone sheet l/8 to 1 inch thick. The soil is extremely acid above the ironstone layer.
>
> Permeability is restricted by the ironstone sheet, which is impermeable except for cracks. Runoff is very slow, and the erosion hazard is no more than slight. Roots penetrate to a depth of 8 to 15 inches in places…
>
> This soil is used for water supply and wildlife habitat. (Capability classification VIIw, nonirrigated; woodland group 16). (Foote et al. 1972:28)

According to the USDA (2001) SSURGO database and soil survey data gathered by Foote et al. (1972), soils within the Honomanū portion of the License Area includes Kailua silty clay (3 to 25 percent slopes) (KBID), Stony alluvial land (rSM), Honomanu-Amalu association (rHR), Rough mountainous land (rRT), and Amalu peaty silty clay (3 to 20 percent slopes) (rAMD) (See Figure 4-6).

Stony alluvial land (rSM) soils are described as follows:

> Stony alluvial land (rSM) consists of stones, boulders, and soil deposited by streams along the bottoms of gulches and on alluvial fans. In most places, the slope is 3 to 15 percent. Elevations range from nearly sea level to 1,000 feet. The annual rainfall amounts to 15 to 200 inches.
>
> This land type is suited to pasture in the dry areas and to pasture and woodland in the wet areas. The natural vegetation consists of kiawe, klu, ilima, piligrass, and lantana in the dry areas and guava, kukui, hilograss, and Christmas berry in the wet areas. Improvement of this land is difficult because of the stones and boulders. (Capability classification VIIs, nonirrigated). (Foote et al. 1972:120)

According to the USDA (2001) SSURGO database and soil survey data gathered by Foote et al. (1972), soils within the Ke'anae portion of the License Area consists of Kailua silty clay (3 to 25 percent slopes) (KBID), Stony alluvial land (rSM), Honolua silty clay (7 to 15 percent slopes) (HwC), Honomanu-Amalu association (rHR), Rough mountainous land (rRT), Honomanu silty clay (5 to 25 percent slopes) (rHOD), and Hydrandepts-Tropaquods association (rHT) (See Figure 4-7).

Honolua silty clay (7 to 15 percent slopes) (HwC) is described as follows:

> This soil is on smooth interfluves on uplands. Included in mapping were small areas of Alaeloa and Olelo soils. Also included were small, gently sloping areas and small, eroded spots.
>
> In a representative profile, the surface layer is dark-brown silty clay about 12 inches thick. The subsoil, about 58 inches thick, is dark reddish-brown and reddish-brown silty clay that has subangular blocky structure. The substratum is soft, weathered basic igneous rock. The soil is strongly acid in the surface layer and subsoil.

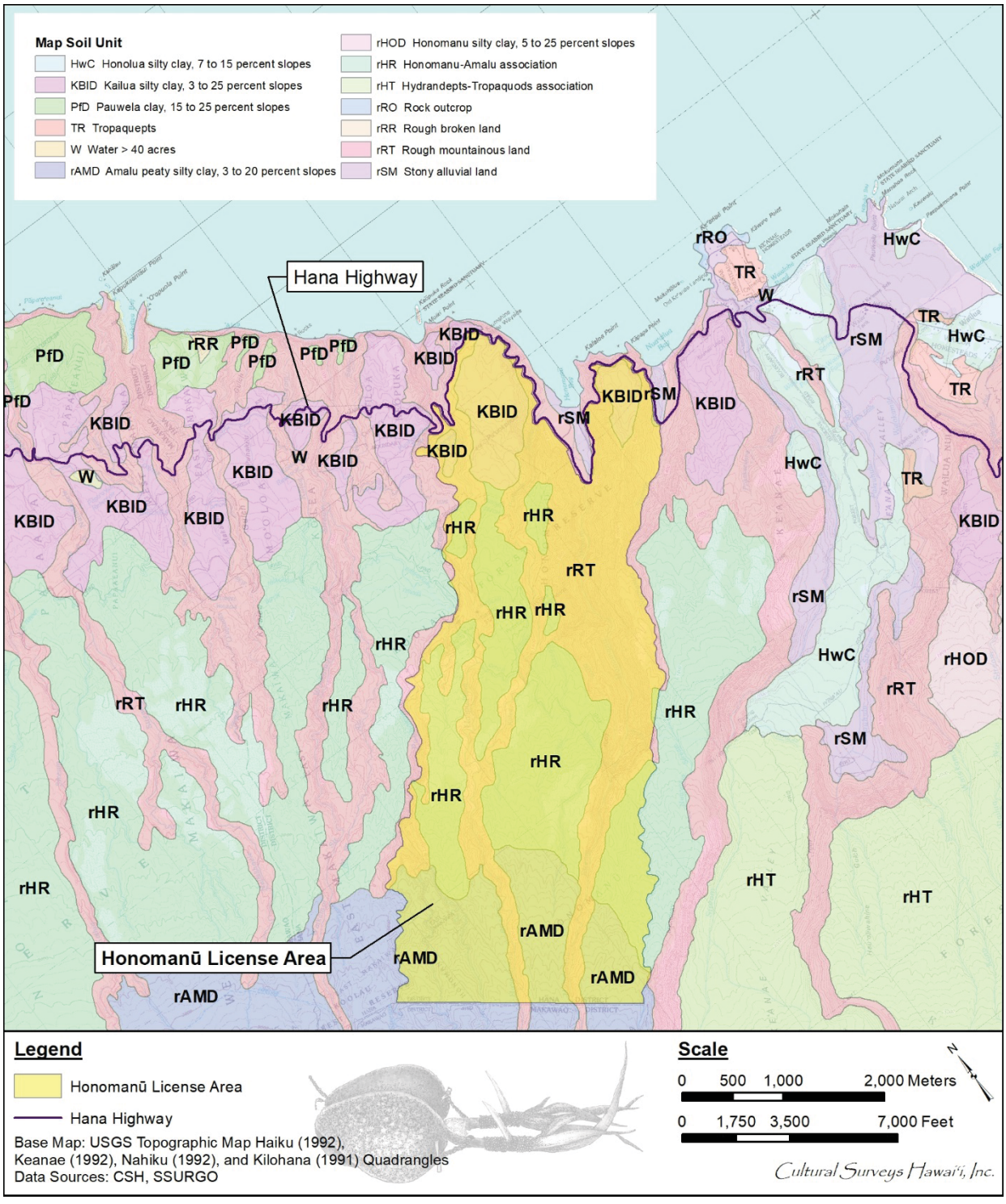


Figure 4-6. Overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972), indicating soil types within and surrounding the Honomanū License Area (U.S. Department of Agriculture 2001)

Cultural Surveys Hawai‘i, Inc provided map that depicts soil within portions of License Area

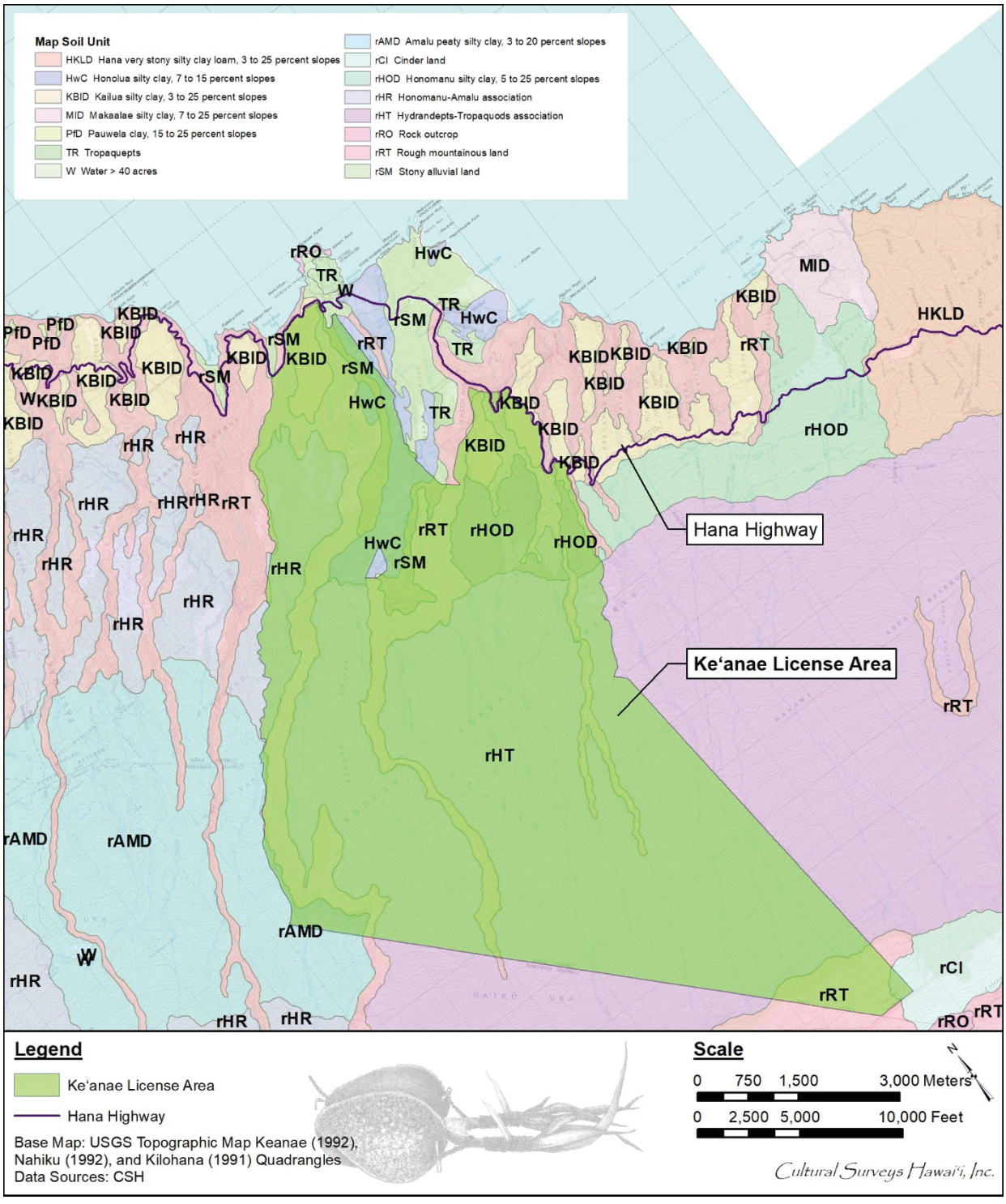


Figure 4-7. Overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972), indicating soil types within and surrounding the Keanae License Area (U.S. Department of Agriculture 2001)

Cultural Surveys Hawai‘i, Inc provided map that depicts soil within portions of License Area

> Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is about 1.2 inches per foot in the surface layer and about 1.4 inches per foot in the subsoil. In places roots penetrate to a depth of 5 feet or more…
>
> This soil is used for pineapple, pasture, and woodland. (Capability classification IIIe, nonirrigated; pineapple group 3; pasture group 8; woodland group 7). (Foote et al. 1972:42)

Honomanu silty clay (5 to 25 percent slopes) (rHOD) soils are described as follows:

> This soil is on the wettest parts of the northeastern slopes of Haleakalā. Included in mapping were small areas of Amalu and Kailua soils and rock outcrops.
>
> In a representative profile the surface layer is very dark brown silt loam and dark yellowish-brown silty clay about 11 inches thick, capped with an organic layer about 3 inches thick. The subsoil, about 26 inches thick, is dark yellowish-brown and brown silty clay that has subangular blocky structure. The substratum is dark yellowish-brown loam and fragmental basic igneous rock. The soil is extremely acid in the surface layer and subsoil.
>
> Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. In places roots penetrate to a depth of 4 feet or more…
>
> This soil is used for water supply and wildlife habitat. (Capability classification IVe, nonirrigated; pasture group 11; woodland group 8). (Foote et al. 1972:43)

Hydrandepts-Tropaquods association (rHT) soils are described as follows:

> Areas mapped as Hydrandepts-Tropaquods association (rHT) consist of well-drained to poorly drained soils on uplands. These soils are on the northern slopes of West Maui and the northern and eastern slopes of East Maui. They developed in volcanic ash and in material weathered from cinders and basic igneous rock. They are moderately sloping to steep. Elevations range from 1,000 to 6,000 feet: The annual rainfall amounts to 100 to 350 inches. The mean annual soil temperature is 60° F. This association is geographically associated with soils of' the Amalu, Honomanu, and Olelo series.
>
> Hydrandepts make up about 60 percent of the association, and Tropaquods 40 percent. Included in mapping were small areas of Rough mountainous land. Also included were small peat bogs.
>
> Hydrandepts are the steeper areas of the association. These are well drained to moderately well drained soils that are similar to those of the Honomanu series. The surface layer is high in organic-matter content. The subsoil is dark-brown or dark yellowish-brown, smeary silty clay loam or silty clay. The

> substratum consists of volcanic ash and cinders or weathered basic igneous rock. These soils dehydrate irreversibly into fine pebble size aggregates.
>
> Tropaquods are poorly drained soils that are similar to those of the Amalu and Olokui series. They have a peaty or mucky surface layer that overlies a dark gray to very dark gray, mottled layer. The mottled layer rests on an ironstone sheet ¼ to 1 inch thick. The ironstone is at a depth of 10 to 20 inches. It normally caps highly weathered basic igneous rock.
>
> The soils in this association have low bearing capacity and low shear strength. They are slippery and difficult to traverse. Because of their ability to absorb water and to transmit it rapidly, these soils are important for maintenance of ground water for domestic use and irrigation.
>
> This association is used for water supply and wildlife habitat. The natural vegetation consists of ohia, puakeawe, sedges, false staghorn fern, tree fern, and other rain forest vegetation. (Hydrandepts soils are in capability classification VIIe, nonirrigated. Tropaquods soils are in capability classification VIIw, nonirrigated). (Foote et al. 1972:46)

According to the USDA (2001) SSURGO database and soil survey data gathered by Foote et al. (1972), the soils within the Nāhiku portion of the License Area consists of Kailua silty clay (3 to 25 percent slopes) (KBID), Honomanu silty clay (5 to 25 percent slopes) (rHOD), Hana very stony silty clay loam (3 to 25 percent slopes) (HKLD), Rough mountainous land (rRT), Hydrandepts-Tropaquods association (rHT), and Cinder land (rCl) (See Figure 4-8).

Hana very stony silty clay loam (3 to 25 percent slopes) (HKLD) soils are described as follows:

> This soil is on smooth, low mountain slopes. Included in mapping were small areas of Honomanu soils. Also included were small, steep areas near cinder cones.
>
> In a representative profile, the surface layer is very dark-brown and very dark grayish-brown silty clay loam about 12 inches thick. The subsoil, about 22 inches thick, is dark-brown silty clay loam that has subangular blocky structure. The substratum is moderately weathered, pebble-size cinders overlying ʻaʻā lava. The soil is strongly acid to medium acid in the surface layer and slightly acid in the subsoil.
>
> Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard is slight to moderate. In places roots penetrate to a depth of 3 to 4 feet. The available water capacity is about 1.2 inches per foot in the surface layer and 1.4 inches per foot in the subsoil…
>
> This soil is used for pasture. (Capability classification VIs, nonirrigated; pasture group 11; woodland group 8). (Foote et al. 1972:37)

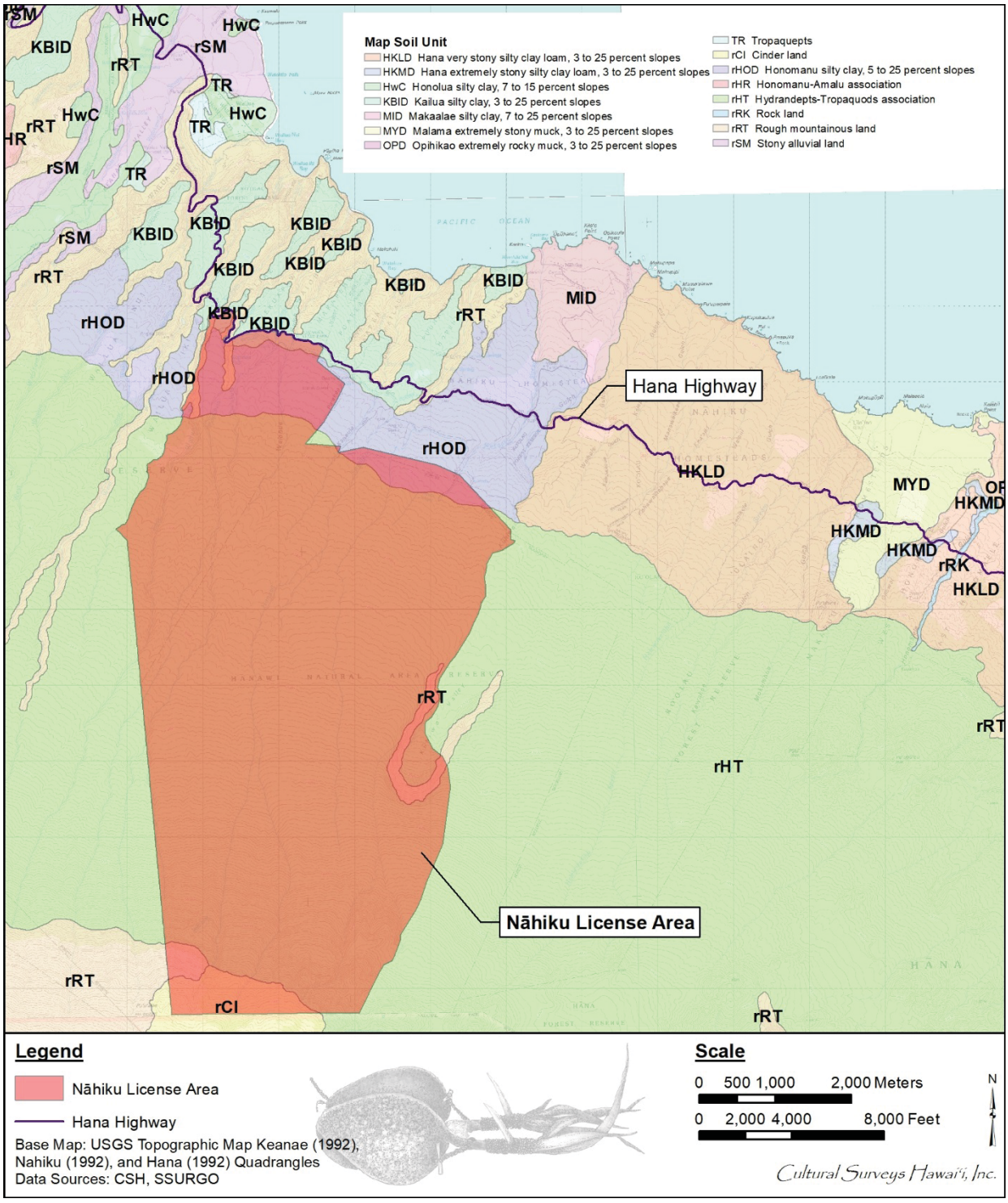


Figure 4-8. Overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972), indicating soil types within and surrounding the Nāhiku License Area (U.S. Department of Agriculture 2001)

Cultural Surveys Hawai‘i, Inc provided map that depicts soil within portions of License Area

Cinder land (rCl) is described as follows:

> Cinder land (rCl) consists of areas of bedded magmatic ejecta associated with cinder cones. It is a mixture of cinders, pumice, and ash. These materials are black, red, yellow, brown, or variegated in color. They have jagged edges and a glassy appearance and show little or no evidence of soil development.
>
> Cinder land occurs on the islands of Maui and Oʻahu. On Maui, it is mainly at elevations between 8,000 and 10,000 feet in the Haleakalā National Park. On Oʻahu, it is mainly at elevations between 200 and 2,000 feet, near Mount Tantalus. The annual rainfall amounts to 20 to 30 inches on Maui and 60 to 100 inches on Oʻahu.
>
> Although Cinder land commonly supports some vegetation, it has no value for grazing, because of its loose nature and poor trafficability; It is used for wildlife habitat and recreational areas. (Capability classification VIIIs, nonirrigated)

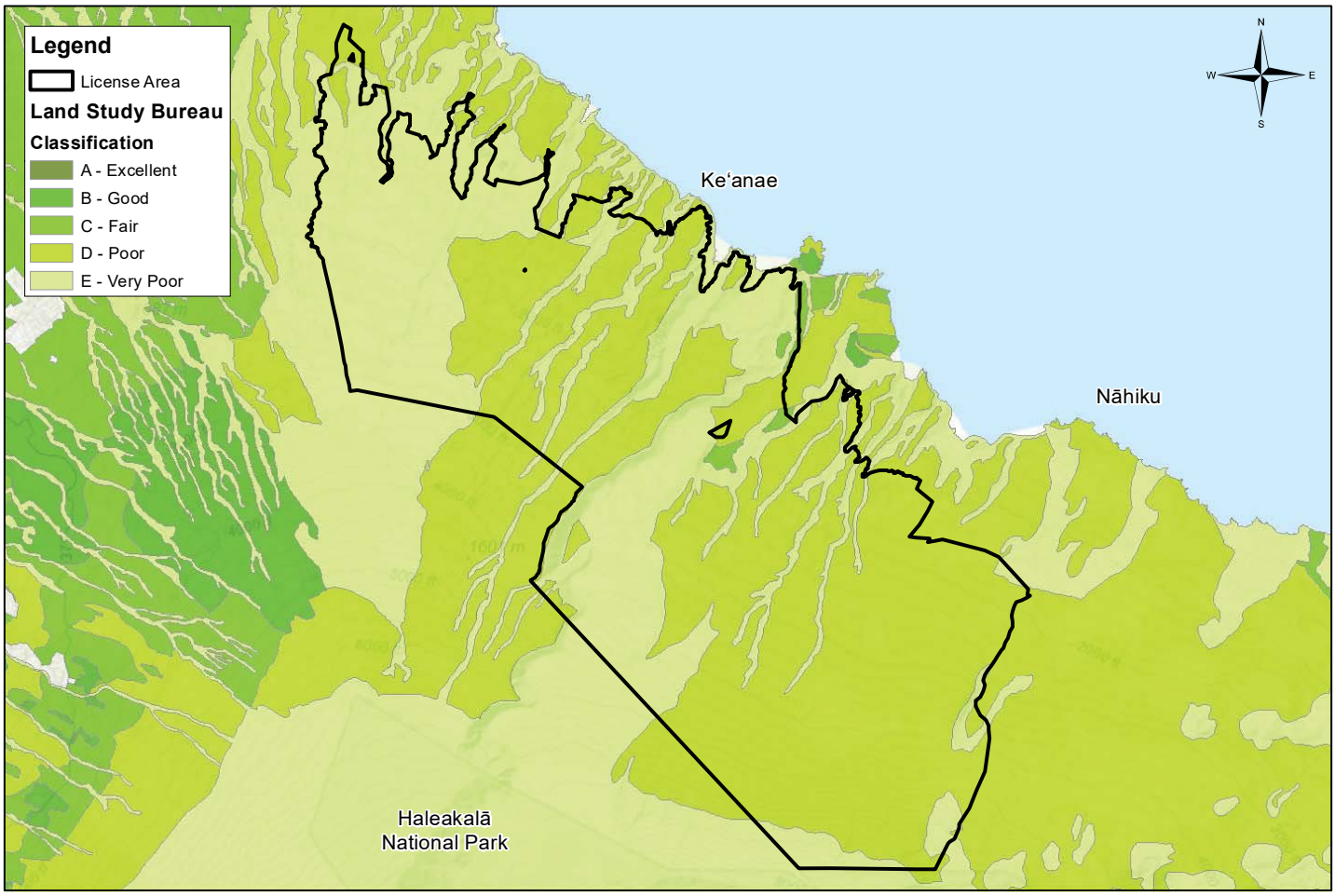
According to the Hawaiʻi Land Study Bureau (LSB) Detailed Land Classification, Island of Maui (LSB bulletin no. 7, 1967) and depicted online at the Hawaiʻi LSB Locator-ARC GIS by the Hawaiʻi Statewide GIS Program, Office of Planning, most of the soils in East Maui, including the License Area have been given an overall master productivity rating of E-Very Poor and D-Poor (See Figure 4-9). Pockets of soils within and makai of the Keʻanae portion of the License Area are rated C-Fair. Much of the land on the Keʻanae Peninsula and some in the Wailua area are rated B-Good.

The Agricultural Lands of Importance to the State of Hawaiʻi (ALISH) Classification System was developed and compiled in 1977 by the State Department of Agriculture with assistance from the U.S. Department of Agriculture - Natural Resources Conservation Service (NRCS), and the College of Tropical Agriculture, University of Hawaiʻi. This classification system was developed to identify three classes of agriculturally important lands for the State of Hawaiʻi as part of a national effort to inventory important farmlands. Lands not considered for classification within this system are those that are not generally considered suitable for agriculture.

The Hawaiʻi Classification System identifies three categories of land (equivalent NRCS categories in Parentheses): Prime Agricultural Lands (Prime Farmlands), Unique Agricultural Lands (Unique Farmlands), and Other Important Lands (Additional Farmland of Statewide and Local Importance). A general description of each land type classification is as follows:

- Prime Agricultural Lands – Land which has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically when treated and managed according to modern farming methods.

- Unique Agricultural Lands – Land that has a special combination of soil quality, location, growing season, moisture supply, and is used to produce sustained high quality and of high quality yields of a specific crop when treated and managed according to modern farming methods.



WILSON OKAMOTO CORPORATION

0 5,000 10,000 20,000 Feet

0 0.5 1 2 3 Miles

1 inch = 11,000 feet

Source: ESRI, State OP, & Akinaka

FIGURE 4-9

EAST MAUI LSB MAP

Proposed Lease for Nāhiku, Keʻanae, Honomanū and Huelo License Areas

- Land other than Prime or Unique Agricultural Land that is also of statewide or local importance to agricultural use.

According to the ALISH map, some of the coastal area makai of the License Area have been classified "Other Agricultural Land" with some of the land lying below the western end of the License Area classified "Prime Agricultural Land" (See Figure 4-10). The latter areas were formerly in sugarcane cultivation. Notably, the same areas on the Ke'anae Peninisula and in the Wailua area that received an overall productivity rating of B-Good by the LSB, were classified Unique Agricultural Land on the ALISH map.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on soils in the East Maui region are anticipated.

Upcountry Maui

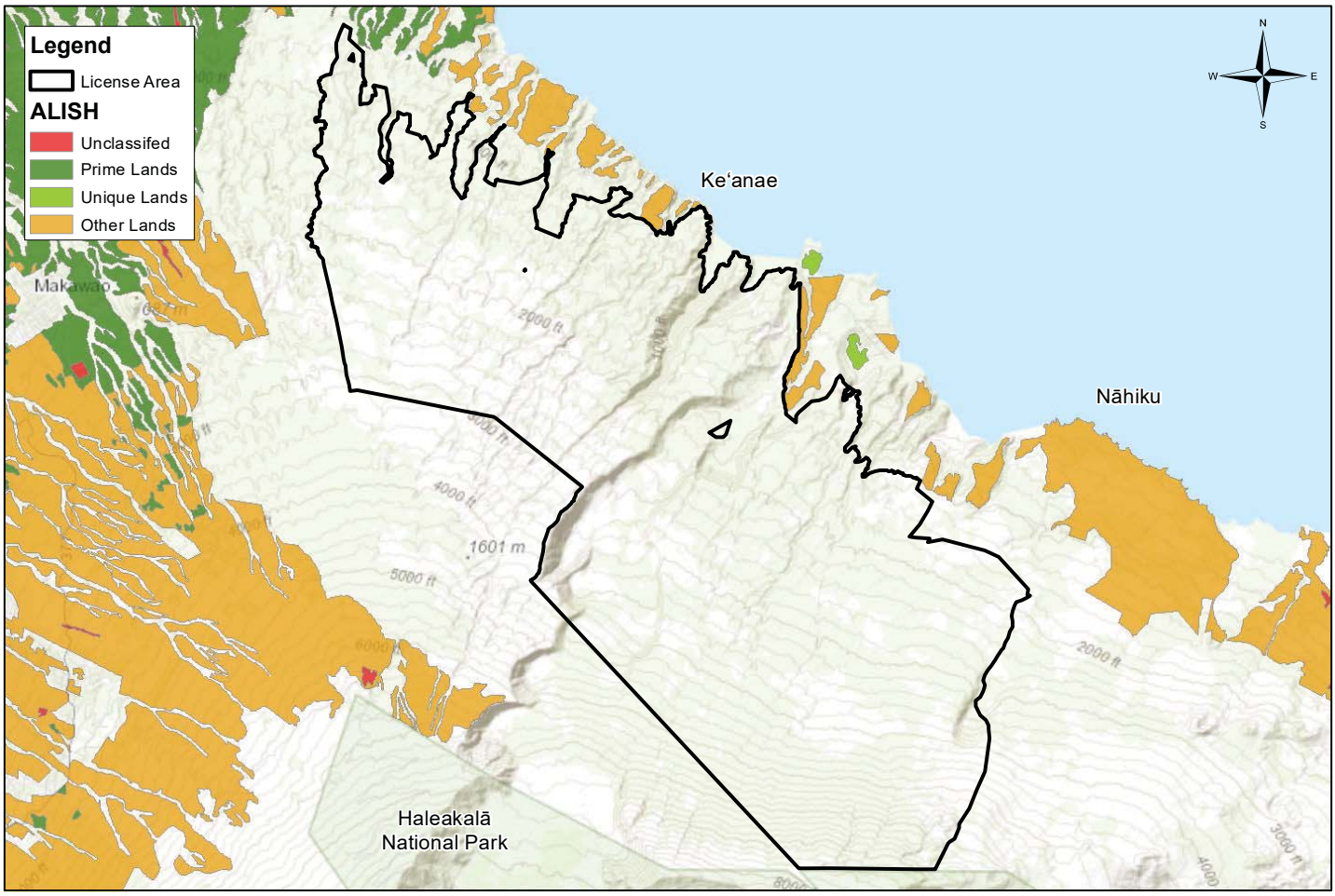
According to the USDA (2001) SSURGO database and soil survey data gathered by Foote et al. (1972), soils Upcountry Maui include the Haiku silty clay series (3 to 15 percent slopes), Hamakuapoko silty clay series (3 to 25 percent slopes), Haliimaile silty clay series (3 to 15 percent slopes) Kaipoioi loam series (7 to 40 percent slopes) Keahua silty clay loam series (3 to 25 percent slopes), Kula loam series (4 to 40 percent slopes), and water > 40 acres (W) (See Figure 4-11).

Haiku silty clay (3 to 7 percent slopes) (HaB) soils are described as follows:

> This soil has a profile like that of Haiku clay, 7 to 15 percent slopes, except for the texture of the surface layer. It is a dark brown clay about 14 inches thick. The subsoil, about 31 inches thick, is yellowish-red, dark reddish-brown, and dark-red clay or silty clay that has angular and angular blocky structure. The substratum is soft, weathered, basic igneous rock. The soil is very strongly acid in the surface layer and extremely acid and very strongly acid in the subsoil and substratum. Runoff is slow, and the erosion hazard is slight. Included in mapping were small, nearly level areas. This soil is used for pineapple and homesites. (Foote et al. 1972:32)

Haiku silty clay (7 to 15 percent slopes) (HaC) soils are described as follows:

> This soil has a profile like that of Haiku clay, 7 to 15 percent slopes, except for the texture of the surface layer. It is a dark brown clay about 14 inches thick. The subsoil, about 31 inches thick, is yellowish-red, dark reddish-brown, and dark-red clay or silty clay that has angular and angular blocky structure. The substratum is soft, weathered, basic igneous rock. The soil is very strongly acid



0 5,000 10,000 20,000 Feet

0 0.5 1 2 3 Miles

1 inch = 11,000 feet

Source: ESRI, State OP, & Akinaka

WILSON OKAMOTO CORPORATION

FIGURE 4-10

EAST MAUI ALISH MAP

Proposed Lease for Nāhiku, Keʻanae, Honomanū and Huelo License Areas

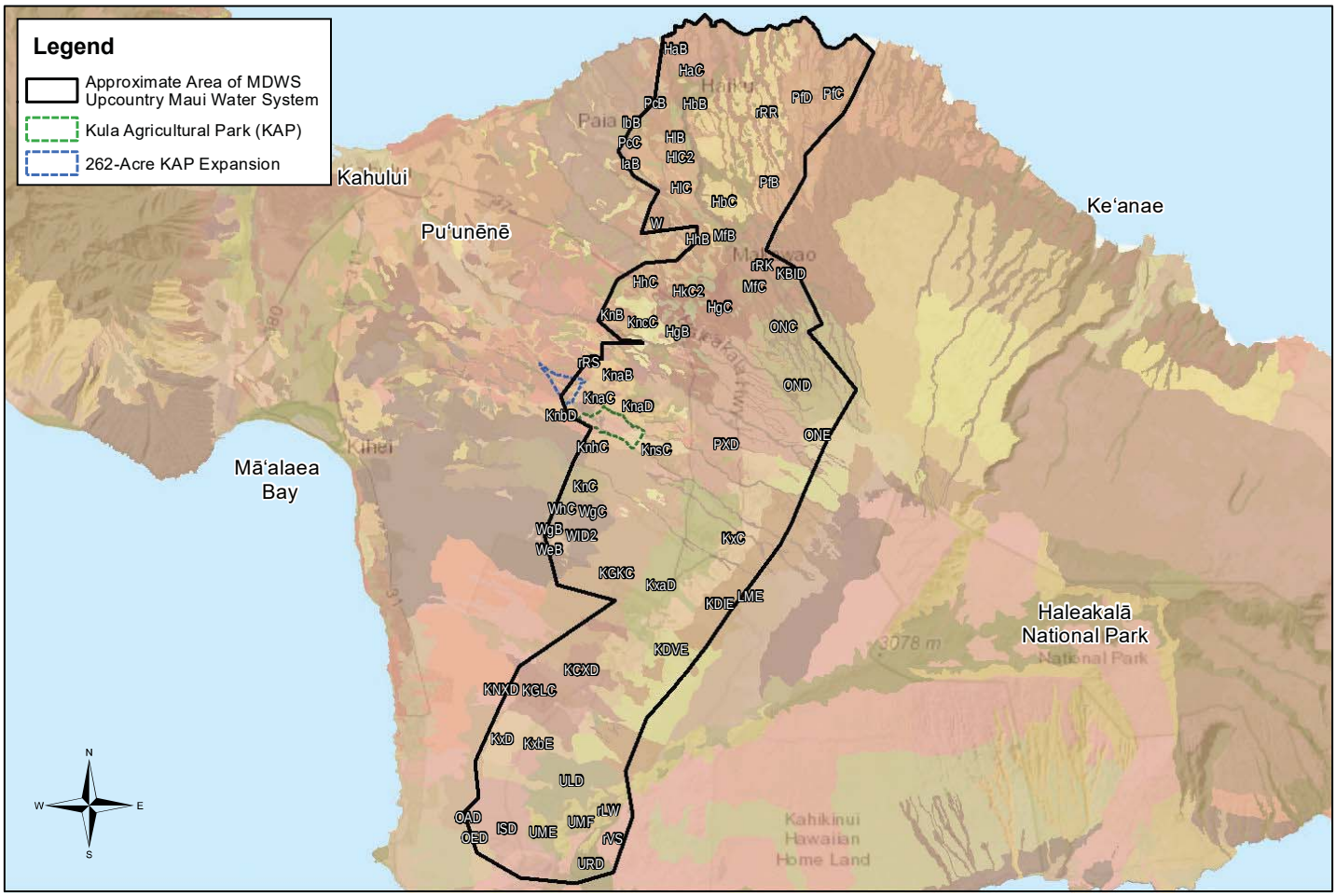


FIGURE 4-11

UPCOUNTRY MAUI SOILS MAP

Proposed Lease for Nāhiku, Keʻanae, Honomanū and Huelo License Areas

> in the surface layer and extremely acid and very strongly acid in the subsoil and substratum. This soil is used for pineapple. (Foote et al. 1972:32)

Haiku clay (3 to 7 percent slopes) (HbB) soils are described as follows:

> On this soil, runoff is slow and the erosion hazard is slight. Included in mapping were small, nearly level areas. This soil is used for pineapple, pasture, and homesites. (Foote et al. 1972:32)

Haiku Clay (7 to 15 percent slopes) (HbC) soils are described as follows:

> This soil occurs on uplands. Included in mapping were small areas of Paia and Pauwela soils. Also included were small eroded spots and small areas where the slope is as much as 25 percent.
>
> In a representative profile, the surface layer is dark-brown clay about 14 inches thick. The subsoil, about 31 inches thick, is yellowish-red, dark reddish-brown, and dark-red clay or silty clay that has subangular and angular blocky structure. The substratum is soft, weathered, basic igneous rock. The soil is very strongly acid in the surface layer and extremely acid and very strongly acid in the subsoil and substratum.
>
> Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is about 1.4 inches per foot in the surface layer and 1.3 inches per foot in the subsoil. In places roots penetrate to a depth of 3 feet or more. (Foote et al. 1972:32)

Hamakuapoko silty clay (3 to 7 percent slopes) (HlB) soils are described as follows:

> This soil is on smooth slopes in the uplands. Included in mapping were small areas of Haiku and Haliimaile soils. Also included were small, moderately steep areas.
>
> In a representative profile, the surface layer is dark-brown silty clay about 16 inches thick. The subsoil, about 35 inches thick, is dark-brown and very dark grayish brown silty clay that has subangular blocky structure. The substratum is soft, weathered basic igneous rock. The soil is extremely acid in the surface layer and strongly acid or very strongly acid in the subsoil.
>
> Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.2 inches per foot in the surface layer and 1.5 inches per foot in the subsoil. In places roots penetrate to a depth of 4 feet or more. (Foote et al. 1972:36)

Hamakuapoko silty clay (7 to 15 percent slopes) (HlC) soils are described as follows:

> On this soil, runoff is medium and the erosion hazard is moderate. Most of this soil is used for pineapple. A small acreage is used for pasture and homesites. (Foote et al. 1972:36)

Hamakuapoko silty clay (7 to 25 percent slopes, eroded) (HlC2) soils are described as follows:

> This soil has a profile like that of Hamakuapoko silty clay (3 to 7 percent slopes), except that it is eroded. In most places about 50 percent of the original surface layer has been removed by erosion. In a few places all of the surface layer and part of the subsoil have been lost. Runoff is medium to rapid, and the erosion hazard is severe. This soil is used for pineapple. (Foote et al. 1972:36)

Haliimaile silty clay (3 to 7 percent slopes) (HhB) soils are described as follows:

> This soil is on smooth uplands. Included in mapping were small areas of Keahua and Paia soils. In a representative profile, the surface layer is dark reddish-brown silty clay about 15 inches thick. The subsoil, to a depth of more than 60 inches, is dark reddish-brown silty clay and very dark grayish-brown clay. It has subangular blocky and angular blocky structure. The substratum is silt, weathered basic igneous rock. The soil is strongly acid in the surface layer and strongly acid to medium acid in the subsoil. Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.6 inches per foot in the surface layer and about 1.2 inches per foot in the subsoil. In places, roots penetrate to a depth of 5 feet or more. (Foote et al. 1972:35)

Haliimaile silty clay (7 to 15 percent slopes) (HhC) soils are described as follows:

> On this soil, runoff is medium and the erosion hazard is moderate. Included in mapping were small, cobbly areas and small, moderately steep areas. This soil is used for sugarcane, pineapple, and homesites. (Foote et al. 1972:36)

Haliimaile gravelly silty clay (7 to 15 percent slopes, eroded) (HkC2) soils are described as follows:

> This soil has a profile like that of Haliimaile silty clay (3 to 7 percent slopes), except that in most places about 50 percent of the original surface layer has been lost through erosion. In a few places, all the surface layer and part of the subsoil have been removed. Runoff is medium to rapid, and the erosion hazard is severe. (Foote et al. 1972:36)

Haliimaile silty clay loam (3 to 7 percent) (HgB) soils are described as follows:

> This soil has a profile like that of Haliimaile silty clay (3 to 7 percent slopes), except for the texture of the surface layer. Included in mapping were small eroded areas on knolls. The surface layer of the included areas contains few to

> many pebble-size rock fragments. This soil is used for pineapple, pasture, and homesites. (Foote et al. 1972:36)

Haliimaile silty clay loam (7 to 15 percent) (HgC) soils are described as follows:

> This soil has a profile like that of Haliimaile silty clay (3 to 7 percent slopes), except for the texture of the surface layer. Runoff is medium, and the erosion hazard is moderate. Included in mapping were small eroded areas on knolls. The surface layer of the included areas contains few to many pebble-size rock fragments. This soil was used for pineapple, pasture, and homesites. (Foote et al. 1972:36)

Iao silty clay (3 to 7 percent slopes) (IaB) soils are described as follows:

> This soil has a profile like that of Iao clay (3 to 7 percent slopes), except for the texture of the surface layer. The subsoil, about 45 inches thick, is very dark brown, dark-brown, and very dark grayish-brown clay and silty clay. The substratum is clayey alluvium. The soil is neutral in the surface layer and subsoil. This soil is used for sugarcane. (Foote et al. 1972:47)

Iao cobbly silty clay (3 to 7 percent slopes) (IbB) soils are described as follows:

> This soil has a profile like that of Iao clay (3 to 7 percent slopes), except for the texture of the surface layer and the content of the cobblestones. The subsoil, about 45 inches thick, is very dark brown, dark-brown, and very dark grayish-brown clay and silty clay. The substratum is clayey alluvium. The soil is neutral in the surface layer and subsoil. This soil is used for sugarcane and homesites. (Foote et al. 1972:47)

Io silt loam (7 to 25 percent slopes) (ISD) soils are described as follows:

> This soil is on smooth, low mountain slopes. Included in mapping were small areas of Kula and Oanapuka soils. Also included were small, cobbly areas and small, steep areas near cinder cones.
>
> In a representative profile, the surface layer is very dark brown silt loam about 10 inches thick. The subsurface layer is dark-brown silty clay loam about 7 inches thick. The subsoil, 10 to 30 inches thick, is dark-brown and dark reddish-brown clay loam that has subangular blocky structure. The substratum is black, unweathered, fine cinders and dark reddish-brown loam. The soil is neutral in the surface layer and mildly alkaline in the subsoil.
>
> Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is about 1.8 inches per foot in the surface layer and subsoil. In places roots penetrate to a depth of more than 25 inches. This soil is used for pasture, truck crops, and wildlife habitat. (Foote et al. 1972:47)

Kailua silty clay (3 to 25 percent slopes) (KBID) soils are described as follows:

> This soil is on low uplands. Included in mapping were areas of Honomanu and Makawao soils. Also included were small, steep areas near cinder cones.
>
> In a representative profile the surface layer is dark-brown silty clay about 9 inches thick. The upper part of the subsoil, about 18 inches thick, is dark-brown and dark reddish-brown silty clay that has subangular blocky structure. The lower part of the subsoil is very dark gray silty clay loam. The substratum is soft, weathered basic igneous rock. The soil is very strongly acid in the surface layer and strongly acid or medium acid in the subsoil.
>
> Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. In places roots penetrate to a depth of 4 feet or more. (Foote et al. 1972:53)

Kaimu extremely stony peat (7 to 25 percent slopes) (KCXD) soils are described as follows:

> This soil is on rough, undulating, relatively young ʻAʻā lava flows. Included in mapping were small areas of ʻIo and Kula soils. Outcrops of ʻAʻā lava are common.
>
> In a representative profile, the surface layer is extremely stony black peat about 8 inches thick. The substratum is fragmental ʻAʻā lava that has a little soil material in voids and cracks. The soil is neutral in reaction.
>
> Permeability is very rapid. Runoff is very slow, and the erosion hazard is no more than slight. In places roots penetrate to a depth of 2 feet. (Foote et al. 1972:53)

Kaipoioi loam (7 to 40 percent slopes) (KDIE) soils are described as follows:

> This soil is on smooth to rolling high mountain slopes. Included in mapping were small areas of Laumaia and Olinda soils and a few scattered rock outcrops.
>
> In a representative profile, the surface layer is black loam about 10 inches thick. The subsoil, about 51 inches thick, is black and very dark brown silt loam or silty clay loam that has subangular blocky structure. The substratum is ash and cinders. The soil is neutral in the subsoil.
>
> Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is about 2.6 inches per foot in the surface layer and about 1.6 inches per foot in the subsoil. In places roots penetrate to a depth of 60 inches or more. (Foote et al. 1972:54)

Kaipoioi very rocky loam (7 to 40 percent slopes) (KDVE) soils are described as follows:

> This soil is similar to Kaipoioi loam (7 to 40 percent slopes), except that rock outcrops cover 10 to 25 percent of the surface. Workability is very difficult. Included in mapping were small, very steep areas and small, eroded spots. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:54)

Kamaole very stony silt loam (3 to 15 percent slopes) (KGKC) soils are described as follows:

> This soil is on uplands. Included in mapping were small areas of Keawakapu and Kula soils. Also included were small areas where slopes have been removed. Outcrops of ʻAʻā lava are common.
>
> In a representative profile, the surface layer is dark-brown and dark reddish-brown silt loam and silty clay loam about 8 inches thick. The subsoil, about 12 inches thick, is dark reddish-brown silty clay that has subangular blocky structure. The substratum is fragmental ʻAʻā lava that has very little soil material in voids. The soil is medium acid and slightly acid in the surface layer and mildly alkaline in the subsoil.
>
> Permeability is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is about 1. Inches per foot in the surface layer and subsoil. In places roots penetrate to a depth of 2 feet. (Foote et al. 1972:59)

Kamaʻole extremely stony silt loam (3 to 15 percent slopes) (KGLC) soils are described as follows:

> This soil is similar to Kamaʻole very stony silt loam (3 to 15 percent slopes), except that stones cover 3 to 15 percent of the surface. Included in mapping were small areas of rock outcrop. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:59)

Keahua silty clay loam (3 to 7 percent slopes) (KnB) soils are described as follows:

> This soil is on uplands. Included in mapping were small areas of Haliimaile and Molokai soils, and small areas that are 20 to 40 inches deep over soft, weathered basic igneous rock. Also included were small areas of silty clay and some areas that are nearly level.
>
> In a representative profile, the surface layer is dark reddish-brown silty clay loam about 10 inches thick. The subsoil, about 50 inches thick, is dark reddish-brown silty clay loam and very dark gray clay loam that has subangular blocky structure. The substratum is dominantly soft, weathered basic igneous rock. The soil is slightly acid in the surface layer and slightly acid to neutral in the subsoil.

> Permeability is moderate. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.3 inches per foot of soil. In places, roots penetrate to a depth of 4 feet or more. (Foote et al. 1972:65)

Keahua cobbly silty clay loam (3 to 7 percent slopes) (KnaB) soils are described as follows:

> This soil has a profile like that of Keahua silty clay loam (3 to 7 percent slopes), except that it is cobbly on the surface. Included in mapping were small areas that are 20 to 40 inches deep over soft, weathered basic igneous rock. Also included were small areas of silty clay. This soil is used for sugarcane. A few acres are used for truck crops. (Foote et al. 1972:66)

Keahua cobbly silty clay loam (7 to 15 percent slopes) (KnaC) soils are described as follows:

> On this soil, runoff is low to medium and the erosion hazard is slight to moderate. Included in mapping were small areas that are 20 to 40 inches deep over soft, weathered basic igneous rock. This soil is used for sugarcane and pasture. A few acres are used for truck crops. (Foote et al. 1972:66)

Keahua cobbly silty clay loam (15 to 25 percent slopes) (KnaD) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is moderate. Included in mapping were small areas that are not cobbly. Also included were a few steep areas. This soil is used for sugarcane and pasture. (Foote et al. 1972:66)

Keahua very stony silty clay loam (7 to 25 percent slopes) (KnbD) soils are described as follows:

> This soil has a profile like that of Keahua silty clay loam (3 to 7 percent slopes), except that stones cover as much as 3 percent of the surface. Runoff is slow to medium, and the erosion hazard is slight to moderate. Included in mapping were small areas that are 20 to 40 inches deep over soft, weathered basic igneous rock. In a few places tones cover 3 to 15 percent of the surface. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:66)

Keahua silty clay loam (7 to 15 percent slopes) (KnC) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. This soil is used for sugarcane and pasture. Small acreages are used for pineapple and truck crops. (Foote et al. 1972:66)

Keahua silty clay (7 to 15 percent slopes) (KncC) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. Included in mapping were small areas that are 20 to 40 inches deep over soft, weathered basic igneous rock. This soil is used for pineapple, pasture, and homesites. (Foote et al. 1972:66)

Keahua cobbly silty clay (7 to 15 percent slopes) (KnhC) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. Included in mapping were small areas that are 20 to 40 inches deep over soft, weathered igneous rock. This soil is used for sugarcane and pasture. Small acreages are used for truck crops. (Foote et al. 1972:66)

Keahua stony silty clay (7 to 15 percent slopes) (KnsC) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. Included in mapping were small, moderately steep areas. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:66)

Keawakapu extremely stony silty clay loam (3 to 25 percent slopes) (KNXD) soils are described as follows:

> This soil is low on uplands. Included in mapping were small areas of Kamaʻole and Oanapuka soils.
>
> In a representative profile the surface layer, about 2 inches thick, is dark reddish-brown extremely stony silt loam that has platy structure. The subsoil, about 16 inches thick, is dark reddish-brown silty clay loam and silty clay that has prismatic and subangular blocky structure. The substratum is fragmental ʻAʻā lava that has a little soil material in the voids. The soil is neutral in the surface layer and subsoil.
>
> Permeability is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is about 1.5 inches per foot of soil. In places roots penetrate to a depth of 30 inches. (Foote et al. 1972:68)

Kula cobbly loam (12 to 20 percent slopes) (KxaD) soils are described as follows:

> This soil is on intermediate uplands. Included in mapping were small areas of Kaipoioi and Kamaole soils. Also included were small areas of gently sloping soils.
>
> In a representative profile, the surface layer is dark reddish-brown loam about 8 inches thick. The subsoil, about 46 inches thick, is dark reddish-brown loam, silt loam, and silty clay loam that has subangular blocky structure. The substratum is slightly weathered basic igneous rock. The soil is slightly acid in the surface layer and slightly acid to neutral in the subsoil.
>
> Permeability is moderately rapid. Runoff is medium, and the erosion hazard is moderate. The available water capacity is about 1.8 inches per foot of soil. In places roots penetrate to rock.

> This soil is used for pasture. Small areas are used for truck and orchard crops. Most of the cobblestones have been removed in areas where truck crops are grown. (Foote et al. 1972:78)

Kula loam (4 to 12 percent slopes) (KxC) soils are described as follows:

> This soil has a profile like that of Kula cobbly loam (12 to 20 percent slopes), except that it is nearly free of cobblestones. This soil is used for truck crops and pasture. (Foote et al. 1972:78)

Kula loam (12 to 20 percent slopes) (KxD) soils are described as follows:

> This soil has a profile like that of Kula cobbly loam (12 to 20 percent slopes), except that it is nearly free of cobblestones. Included in mapping were small, stony areas and a few rock outcrops, mainly on knolls and the sides of small gulches. This soil is used for pasture and truck crops. (Foote et al. 1972:78)

Kula loam (12 to 40 percent slopes) (KxbE) soils are described as follows:

> This soil has a profile like that of Kula cobbly loam (12 to 20 percent slopes), except that rock outcrops cover 10 to 25 percent of the surface. Runoff is medium, and the erosion hazard is moderate. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:78)

Laumaia loam (7 to 40 percent slopes) (LME) soils are described as follows:

> This soil is on complex, high mountain slopes. Included in mapping were small areas of Kaipoioi and Uma soils. Also included were small areas of eroded, extremely stony soils and rock outcrops.
>
> In a representative profile, the surface layer is very dark brown or black loam about 9 inches thick. The subsoil, about 33 inches thick, is very dark brown silty clay loam and silt loam that has subangular blocky structure or is massive. The substratum consists of hard, cemented layers of volcanic ash and cinders interbedded with loamy soil material. The soil is mildly alkaline in the surface layer and neutral to medium acid in the subsoil.
>
> Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard is slight to moderate. In places roots penetrate to a depth of 3 feet or more. (Foote et al. 1972:80)

Lava flows, Aa(rLW) soils are described as follows:

> Lava flows, Aa consists of areas of geologically recent lava flows on the island of Maui. The flows are a mass of clinker, hard, glassy, sharp pieces of lava on rough to undulating topography. The areas are difficult to traverse. Elevations range from nearly sea level to 8,000 feet. The annual rainfall amounts to 20 to 75 inches.

> This miscellaneous land type is used for water supply, wildlife habitat, and recreation. Vegetation is limited to lichens, a few grasses, herbs, shrubs, and scrubby trees. (Foote et al. 1972:80)

Makawao silty clay (3 to 7 percent slopes) (MfB) soils are described as follows:

> This soil is on smooth side slopes and intermediate slopes in the uplands. Included in mapping were small areas of Haiku and Kailua soils.
>
> In a representative profile, the surface layer is dark reddish-brown silty clay about 9 inches thick. The subsoil, about 30 inches thick, is dark reddish-brown silty clay that has subangular blocky structure. The substratum is soft, weathered basic igneous rock. The soil is strongly acid to medium acid in the surface layer and slightly acid in the subsoil.
>
> Permeability is moderately rapid. Runoff is slow, and the erosion hazard slight. In places roots penetrate to a depth of 5 feet or more. (Foote et al. 1972:89)

Oanapuka very stony silt loam (7 to 25 percent slopes) (OAD) soils are described as follows:

> This soil is on the lower uplands. Included in mapping were small areas of ʻIo and Makena soils.
>
> In a representative profile the surface layer, about 6 inches thick, is very dark brown and very dark grayish brown silt loam that has granular and subangular blocky structure. The subsoil, about 9 inches thick, is very dark grayish-brown silt loam that has prismatic structure. The substratum is dark yellowish-brown silt loam, loam, and stone-size ʻAʻā lava. The soil is medium acid to slightly acid in the surface layer, neutral in the subsoil, and neutral to mildly alkaline in the substratum.
>
> Permeability is moderately rapid. Runoff is low, and the erosion hazard is slight to moderate. The available water capacity is about 1.0 inch per foot of soil. In places roots penetrate to a depth of 4 feet or more. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:101)

Oanapuka extremely stony silt loam (7 to 25 percent slopes) (OED) soils are described as follows:

> This soil is similar to Oanapuka very stony silt loam (7 to 25 percent slopes) except that stones cover 3 to 15 percent of the surface area. Included in mapping were small areas of rock outcrop. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:101)

Olinda loam (4 to 12 percent slopes) (ONC) soils are described as follows:

> On this soil, runoff is slow and the erosion hazard is slight. Included in mapping were small, eroded spots. This soil is used for truck crops and pasture. Small acreages are used for orchards. (Foote et al. 1972:103)

Olinda loam (12 to 20 percent slopes) (OND) soils are described as follows:

> This soil is on smooth, intermediate to high mountain slopes. Included in mapping were small areas of Kaipoioi and Pane soils. In a few places small, eroded spots were included.
>
> In a representative profile, the surface layer is dark reddish-brown loam about 6 inches thick. The subsoil, about 5 inches thick, is dark reddish-brown and yellowish-red silty clay loam that has subangular blocky structure. Below this is yellowish-red and reddish-brown silty clay loam and gravelly silty clay loam. This is underlain by slightly weathered basic igneous rock. The soil is slightly acid in the surface layer and subsoil.
>
> Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is about 2.4 inches per foot in the surface layer and about 1.6 inches per foot in the subsoil. In places roots penetrate to a depth of 3 feet or more. (Foote et al. 1972:103)

Olinda loam (20 to 40 percent slopes) (ONE) soils are described as follows:

> This soil is subject to frequent fog and cloud cover. Small gullies are common. Runoff is medium to rapid, and the erosion hazard is moderate to severe. Included in mapping were small areas of rock outcrop and small, eroded spots. This soil is used for pasture. (Foote et al. 1972:104)

Paia silty clay (3 to 7 percent slopes) (PcB) soils are described as follows:

> This soil is on uplands. Included in mapping were small areas of Haliimaile and Molokai soils. Also included were small, nearly level areas.
>
> In a representative profile, the surface layer is dark reddish-brown silty clay and clay about 19 inches thick. The subsoil, about 41 inches thick, is dark reddish-brown clay that has angular and subangular blocky structure. The substratum is soft, weathered basic igneous rock. The soil is mildly alkaline in the surface layer and subsoil.
>
> Permeability is moderate. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.3 inches per foot in the surface layer and about 1.6 inches per foot in the subsoil. In places roots penetrate to a depth of 4 feet or more. This soil is used for sugarcane. Small acreages are used for homesites. (Foote et al. 1972:107)

Paia silty clay (7 to 15 percent slopes) (PcC) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. Included in mapping were small, moderately steep areas. This soil is used for sugarcane. (Foote et al. 1972:107)

Pane silt loam (7 to 25 percent slopes) (PXD) soils are described as follows:

> This soil is on rough side slopes and intermediate slopes in the uplands. Included in mapping were small areas of Haliimaile and Kaipoioi soils. Also included were small areas of moderately shallow soils and soils that have a gravelly surface layer. In addition, small areas where the topography is undulating were included.
>
> In a representative profile, the surface layer is dark reddish-brown silt loam about 8 inches thick. The subsoil, about 49 inches thick, is dark reddish-brown, reddish-brown, and dark-brown silt loam and loam that has prismatic and subangular blocky structure. The substratum is soft, weathered basic igneous rock. The soil is slightly acid in the surface layer and neutral in subsoil.
>
> Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is about 1.8 inches per foot in the surface layer and subsoil. (Foote et al. 1972:111)

Pauwela clay (3 to 7 slopes) (PfB) soils are described as follows:

> This soil is on smooth uplands. Included in mapping were small areas of Haiku and Kailua soils.
>
> In a representative profile, the surface layer is dark grayish-brown clay about 12 inches thick. The subsoil, about 21 inches thick, is dark reddish-brown clay that has angular blocky and subangular blocky structure. The substratum is soft, weathered basic igneous rock. The soil is very strongly acid to extremely acid in the surface layer and subsoil.
>
> Permeability is moderately rapid. Runoff is low, and the erosion hazard is slight. The available water capacity is about 1.3 inches per foot of soil. In places roots penetrate to a depth of 3 feet or more. This soil is used for pasture and water supply. Small acreages are used for pineapple and woodland. (Foote et al. 1972:111)

Pauwela clay (7 to 15 percent slopes) (PfC) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is light to moderate. This soil is used for pasture and water supply. Small acreages are used for woodland. (Foote et al. 1972:112)

Pauwela clay (15 to 25 percent slopes) (PfD) soils are described as follows:

> On this soil, runoff is medium and the erosion hazard is moderate. Included in mapping were areas that are steep and moderately eroded. This soil is used for pasture and woodland. (Foote et al. 1972:112)

Rock land (rRK) soils are described as follows:

> Rock land is made up of areas where exposed rock covers 25 to 90 percent of the surface. It occurs on all five islands. The rock outcrops and very shallow soils are the main characteristics. The rock outcrops are mainly basalt and andesite. This land type is nearly level to very steep. Elevations range from nearly sea level to more than 6,000 feet. The annual rainfall amounts to 15 to 16 inches.
>
> Rock land is used for pasture, wildlife habitat, and water supply. The natural vegetation at the lower elevations consists mainly of kiawe, klu, piligrass, Japanese tea, and koa haole. Lantana, guava, Natal redtop, and molasses grass are dominant at the higher elevations. This land type is also used for urban development. In many areas, especially on the island of Oʻahu, the soil material associated with the rock outcrops is very sticky and very plastic. It also has high shrink-swell potential. Buildings on the steep slopes are susceptible to sliding when the soil is saturated. Foundations and retaining walls are susceptible to cracking. (Foote et al. 1972:119)

Rough broken land (rRR) is described as follows:

> Rough broken land (rRR) consists of very steep land broken by numerous intermittent drainage channels. In most places, it is not stony. It occurs in gulches and on mountainsides on all the Islands except Oʻahu. The slope is 40 to 70 percent. Elevations range from nearly sea level to about 8,000 feet. The local relief is generally between 25 and 500 feet. Runoff is rapid, and geologic erosion is active. The annual rainfall amounts to 25 to more than 200 inches.
>
> These soils are variable. They are 20 to more than 60 inches deep over soft, weathered rock. In most places some weathered rock fragments are mixed with the soil material. Small areas of rock outcrop, stones, and soil slips are common. Included in mapping were areas of colluvium and alluvium along gulch bottoms.
>
> This land type is used primarily for watershed and wildlife habitat. In places, it is used also for pasture and woodland. The dominant natural vegetation in the drier areas consists of guava, lantana, natal redtop, Bermuda grass, koa haole, and molasses grass. ʻŌhiʻa, kukui, koa, and ferns are dominant in the wetter areas. Puakeawe, ʻaʻaliʻi, and sweet vernal grass are common at the higher elevations. (Capability classification VIIe, nonirrigated). (Foote et al. 1972:119)

Rough broken and stony land (rRS) soils are described as follows:

> This type of soil consists of very steep, stony gulches. The local relief is generally between 25 and 500 feet. Runoff is rapid, and geologic erosion is active. Elevations range from nearly sea level to 3,000 feet. The annual rainfall amounts to 20 to 40 inches.
>
> The soil material is generally less than 20 inches deep over saprolite or bedrock. About 3 to 25 percent of the surface is covered with stones, and there are a few rock outcrops. Included in mapping were small areas of colluvium and alluvium along the bottoms of gulches.
>
> This land type is used for pasture, wildlife habitat, and watershed. The dominant natural vegetation consists of lantana, koa, haole, klu, feather fingergrass, Bermuda grass, and 'ilima. (Foote et al. 1972:119)

Ulupalakua silt loam (7 to 25 percent slopes) (ULD) soils are described as follows:

> This soil is on smooth intermediate mountain slopes. Included in mapping were small areas of 'Io and Kaipoioi soils. Also included were small, very steep areas.
>
> In a representative profile the surface layer is very dark brown silt loam about 9 inches thick. The subsoil, about 24 inches thick, is dark reddish-brown silt loam and clay loam that has subangular blocky structure. The substratum is black, unweathered cinders. The soil is slightly acid in the surface layer and neutral to mildly alkaline in the subsoil.
>
> Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. In places roots penetrate to a depth of 3 feet or more. (Foote et al. 1972:122)

Uma loamy coarse sand (15 to 40 percent slopes) (UME) soils are described as follows:

> This soil is on smooth, intermediate mountain slopes. Included in mapping were small areas of Pu'u Pa and Ulupalakua soils. Also included were a few cinder cones and small areas of rock outcrop.
>
> In a representative profile, the surface layer, about 6 inches thick, is black loamy coarse sand that has granular structure. The substratum is black, unweathered cinders, 3 to 10 millimeters in size. The soil is mildly alkaline in the surface layer.
>
> Permeability is very rapid. Runoff is slow, and the erosion hazard is slight to moderate. In places, roots penetrate to a depth of about 1 foot. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:123)

Uma loamy coarse sand (40 to 70 percent slopes) (UMF) soils are described as follows:

> This soil is similar to Uma loamy coarse sand (15 to 40 percent slopes), except for the slope. The erosion hazard is severe. Included in mapping were small areas of outcrop and cinder cones. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:123)

Uma rocky loamy coarse sand (7 to 25 percent slopes) (URD) soils are described as follows:

> This soil is similar to Uma loamy coarse sand (15 to 40 percent slopes) except that rock outcrops cover 5 to 10 percent of the surface. Runoff is medium, and the erosion hazard is moderate. Included in mapping were small areas where there are few to many stones on the surface and in the profile. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:123)

Very stony land (rVS) soils are described as follows:

> This land type occurs on Maui, Moloka'i, and Lana'i. The slope ranges from 7 to 30 percent. Included in mapping were very steep gulches.
>
> On Maui, this land type consists of young 'A'ā lava that has a thin covering of volcanic ash that locally extends deep into cracks and depressions. It occurs as large areas, mainly on the upper slopes of Haleakalā at elevations between 4,000 and 9,000 feet. The annual rainfall amounts to 30 to 40 inches. The ash-covered areas support a stand of shrubs and grasses. Puakeawe, Yorkshire foggrass, and orchard grass are common at the higher elevations. Lantana, kiawe, Natal redtop, and pitted beardgrass are common at the lower elevations. This land type is used for pasture and wildlife habitat. Pasture improvement is very difficult because of the many stones. (Foote et al. 1972:124)

Waiakoa silty clay loam (3 to 7 percent slopes) (WeB) soils are described as follows:

> This soil has a profile like that of Waiakoa very stony silty clay loam (3 to 7 percent slopes), except that it is nonstony. Included in mapping were small, nearly level areas. This soil is used for sugarcane. Small acreages are used for pasture and homesites. (Foote et al. 1972:127)

Waiakoa very stony silty clay loam (3 to 7 percent slopes) (WgB) soils are described as follows:

> This soil is on smooth, low uplands. Included in mapping were small areas of Keahua and Keawakapu soils. Also included were small, nearly level areas.
>
> In a representative profile the surface layer is dark reddish-brown silty clay loam about 2 inches thick. The subsoil, about 23 inches thick, is dark reddish-brown and very dark grayish-brown silty clay loam that has prismatic structure or is massive. The substratum is very dark brown silty clay loam and hard, basic igneous rock. The soil is neutral in the surface layer and slightly acid to neutral in the subsoil.

> Permeability is moderate. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.5 inches per foot of soil. In places roots penetrate to bedrock. This soil is used for sugarcane, pasture, and wildlife habitat. (Foote et al. 1972:126)

Waiakoa very stony silty clay loam (7 to 15 percent slopes) (WgC) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:127)

Waiakoa extremely stony silty clay loam (7 to 15 percent slopes) (WhC) soils are described as follows:

> This soil is similar to Waiakoa very stony silty clay loam (3 to 7 percent slopes), except that stones cover 3 to 15 percent of the surface. Runoff is slow to medium, and the erosion hazard is slight to moderate. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:127)

Waiakoa extremely stony silty clay loam (3 to 25 percent slopes) (WlD2)

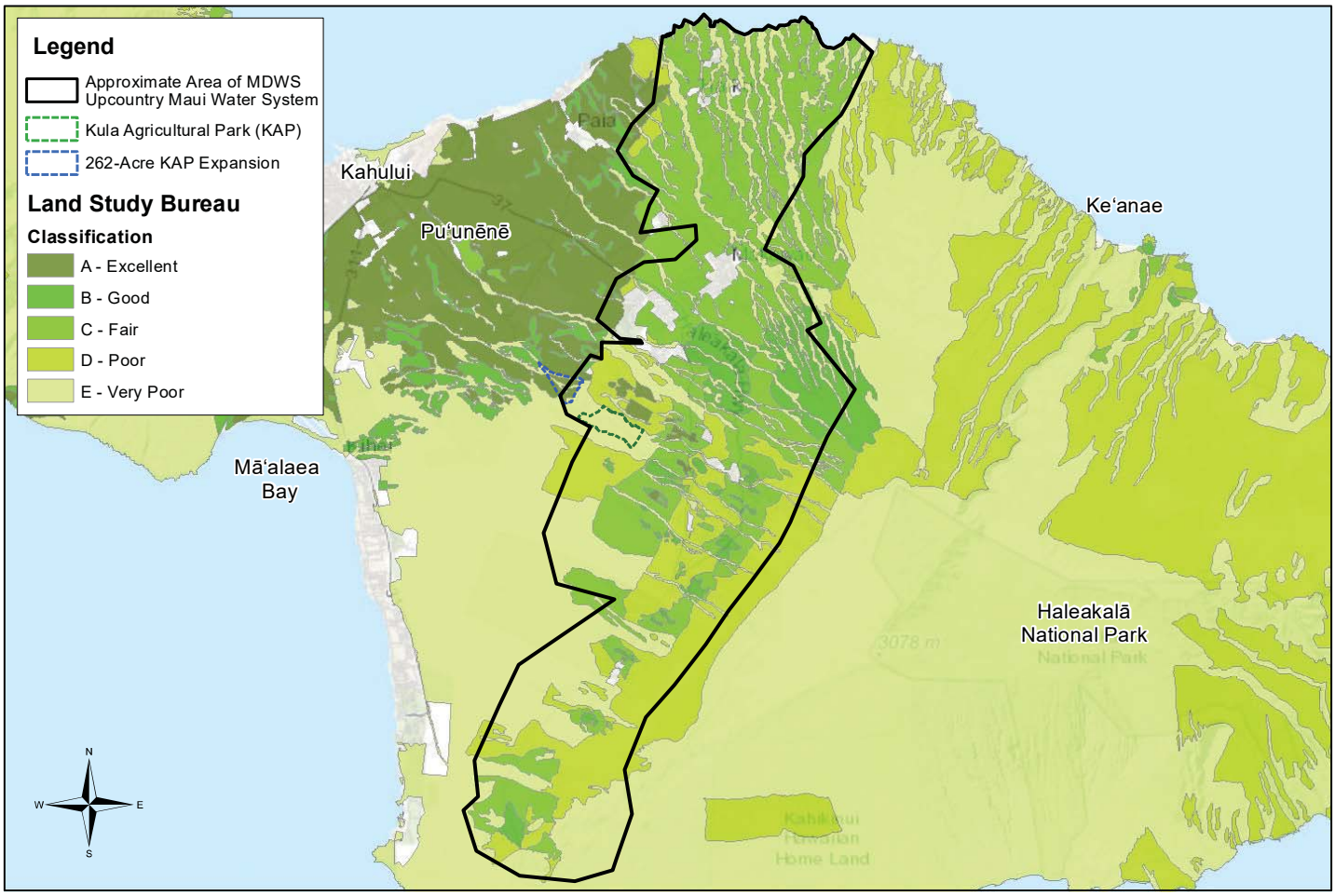
> This soil is similar to Waiakoa very stony silty clay loam (3 to 7 percent slopes), except that it is eroded and stones cover 3 to 15 percent of the surface. In most areas about 50 percent of the surface layer has been removed by erosion. Runoff is medium, and the erosion hazard is severe. Included in mapping were small, steep areas. Also included were a few cinder cones. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:127)

Water (W) soils are described as follows:

> Soils are labeled “W” when over 40 acres of land is 100 percent water.

According to the LSB Detailed Land Classification, Island of Maui (1967), much of Upcountry Maui has an overall productivity rating of C-Fair, which particularly dominates the lower elevation of the MDWS’s Upcountry Maui Water System service area around Haʻikū (See Figure 4-12). Areas mauka of Makawao - Pukalani have ratings of B-Good, as do pockets of land flanking the Kula Highway down to ʻUlupalakua Ranch. Some areas west and southwest of Pukalani are rated A-Excellent, including much of the proposed KAP expansion, which were formerly in sugar cultivation.

According to the ALISH map, most of Upcountry Maui above the approximately 1,000-foot msl elevation is classified Other Land (See Figure 4-13). Areas around Makawao - Pukalani are classified Prime Lands, as are lands in the lower portion of MDWS’s Upcountry Maui Water System service area around Haʻikū.



0 10,000 20,000 40,000 Feet

0 1 2 4 6 Miles

1 inch = 20,000 feet

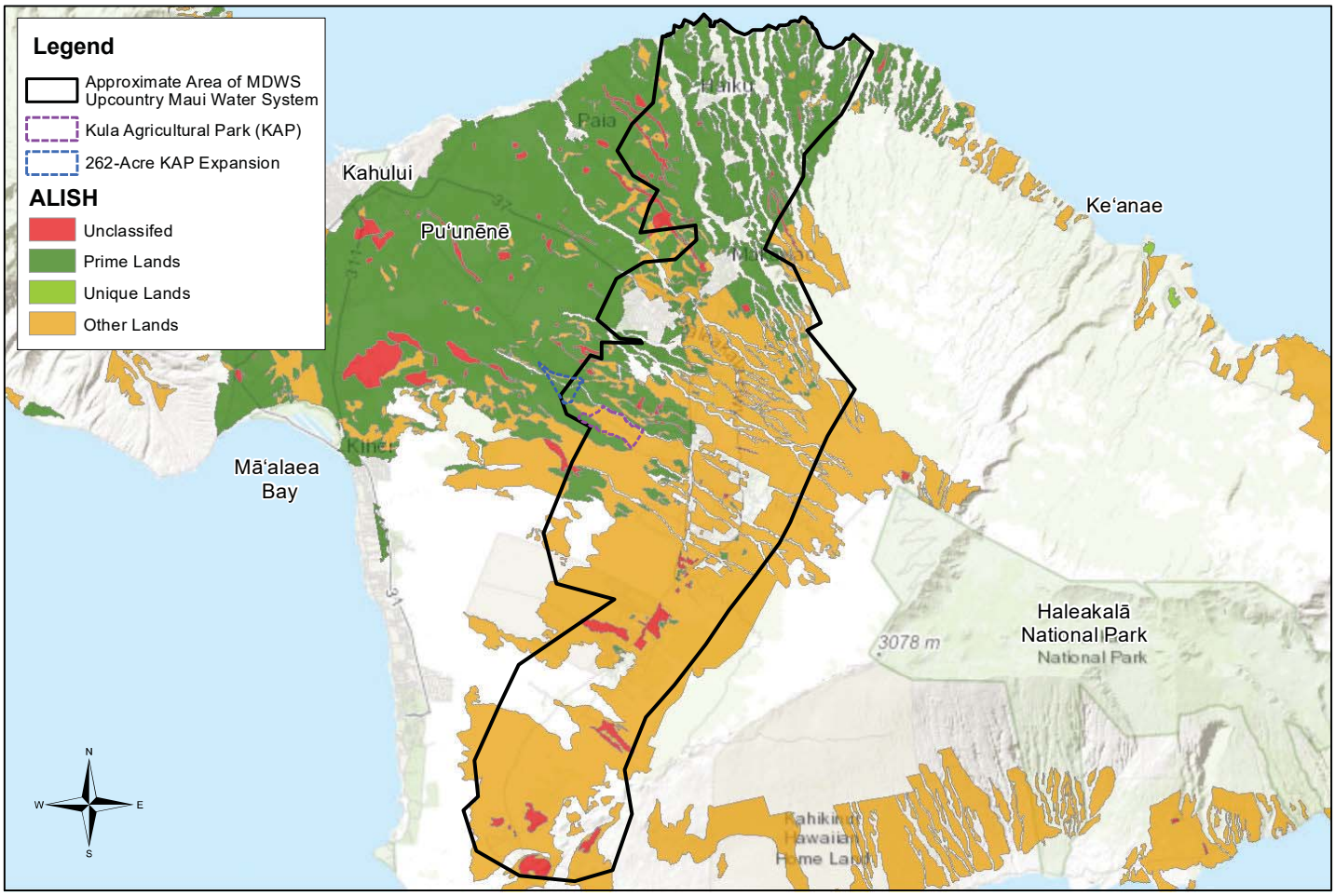
Source: ESRI, State OP, & Akinaka

WILSON OKAMOTO CORPORATION

FIGURE 4-12

UPCOUNTRY MAUI LSB MAP

Proposed Lease for Nāhiku, Keʻanae, Honomanū and Huelo License Areas



0 10,000 20,000 40,000 Feet

0 1 2 4 6 Miles

1 inch = 20,000 feet

Source: ESRI, State OP, & Akinaka

WILSON OKAMOTO CORPORATION

FIGURE 4-13

UPCOUNTRY MAUI ALISH MAP

Proposed Lease for Nāhiku, Keʻanae, Honomanū and Huelo License Areas

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on soils in the Upcountry Maui region are anticipated.

Central Maui

According to the USDA (2001) SSURGO database and soil survey data gathered by Foote et al. (1972), soils in Central Maui include 'Alae loam series (0 to 3 percent slopes), Haiku silty clay series (3 to 15 percent slopes), Hamakuapoko silty clay series (3 to 25 percent slopes), Haliimaile silty clay series (3 to 15 percent slopes) Kaipoioi loam series (7 to 40 percent slopes) Keahua silty clay loam series (3 to 25 percent slopes), Molokai silty clay series (0 to 15 percent slopes), Paia silty clay series (7 to 15 percent slopes), and Pulehu series (0 to 7 percent slopes) and water > 40 acres (W) (See Figure 4-14).

Alae cobbly sandy loam (0 to 3 percent slopes) (AcA) soils are described as follows:

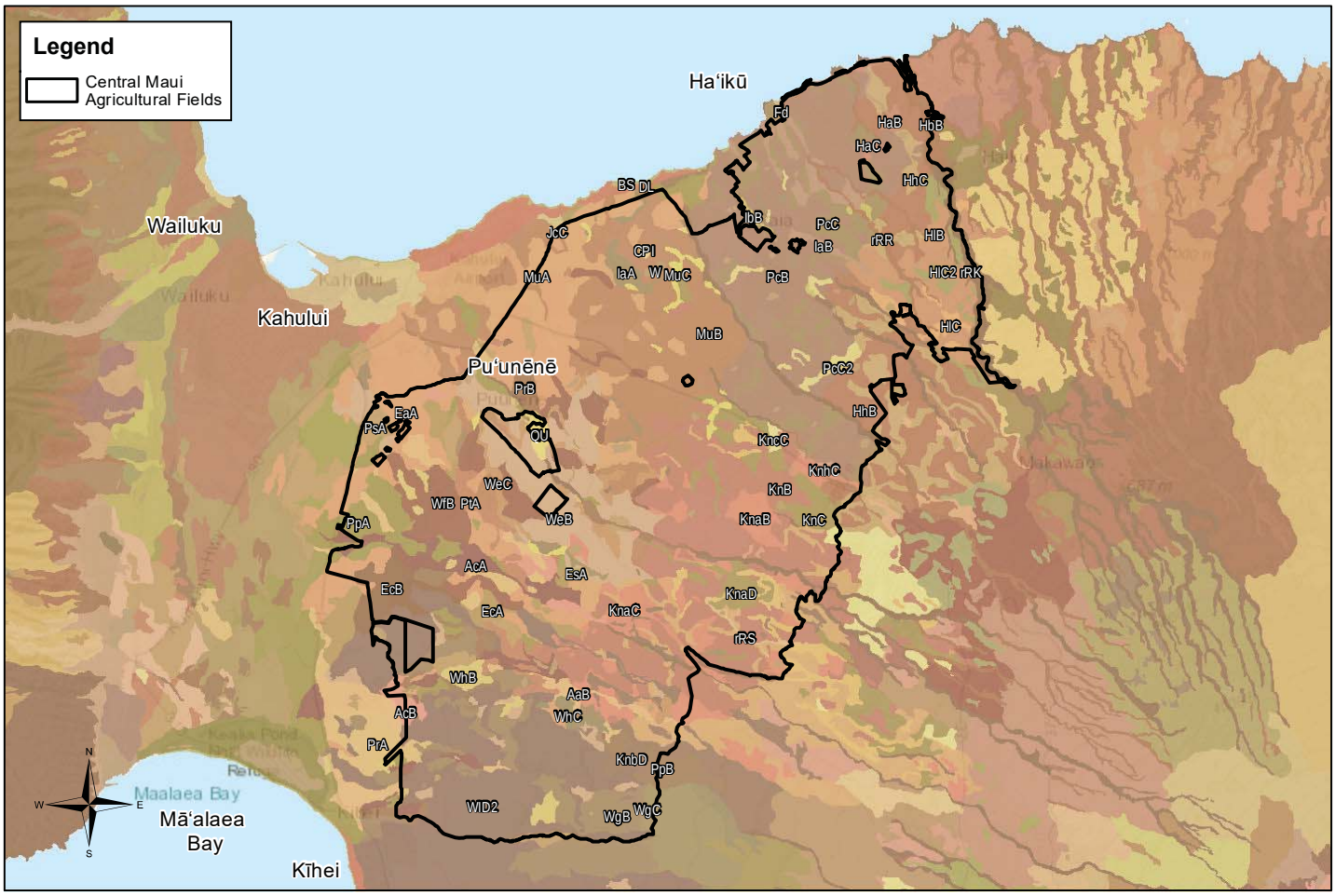
> This soil occurs on smooth alluvial fans. Included in mapping were small areas of Ewa and Pulehu soils. In a representative profile, the surface layer, about 7 inches thick, is very dark grayish-brown sandy loam and coarse and very coarse sand. The soil is neutral or mildly alkaline in the surface layer and mildly to moderately alkaline in the substratum.
>
> Permeability is rapid. Runoff is slow, and the erosion hazard is no more than slight. The available water capacity is about 1.2 inches per foot in the surface layer and 0.9 inch per foot in the substratum. In some places roots penetrate to a depth of 4 feet or more. (Foote et al. 1972:14; 25)

Alae cobbly sandy loam (3 to 7 percent slopes) (AcB) soils are described as follows:

> On this soil, runoff is slow and the erosion hazard is slight. This soil is used for sugarcane and pasture. (Foote et al. 1972:26)

Alae sandy loam (3 to 7 percent slopes) (AaB) soils are described as follows:

> This soil is similar to Alae cobbly sandy loam (0 to 3 percent slopes), except that there are no cobblestones on the surface. Runoff is slow, and the erosion hazard is slight. Included in mapping were small, nearly level areas. In places there are few to many pebble-size rock fragments in the surface layer. Most of this soils is used for sugarcane and pasture. A small acreage is used for truck crops. (Foote et al. 1972:26)



WILSON OKAMOTO CORPORATION

FIGURE 4-14

CENTRAL MAUI SOILS MAP

Proposed Lease for Nāhiku, Keʻanae, Honomanū and Huelo License Areas

Beaches (BS) soils are described as follows:

> Beaches occur as sandy, gravelly, or cobbly areas on all the islands in the survey area. They are washed and rewashed by ocean waves. The beaches consist mainly of light-colored sands derived from coral and seashells. A few of the beaches, however, are dark colored because their sands are from basalt and andesite.
>
> Beaches have no value for farming. Where accessible and free of cobblestones and stones, they are highly suitable for recreational uses and resort development. (Foote et al. 1972:28)

Cinder pit (CPI) or cinder land (rCl) soils are described as follows:

> Cinder land consists of areas of bedded magmatic ejecta associated with cinder cones. It is a mixture of cinders, pumice, and ash. These materials are black, red, yellow, brown, or variegated in color. They have jagged edges and a glassy appearance and show little or no evidence of soil development.
>
> Cinder land occurs on the islands of Maui and Oʻahu. On Maui, it is mainly at elevations between 8,000 and 10,000 feet, in the Haleakalā National Park. The annual rainfall amounts to 20 to 30 inches on Maui.
>
> Although Cinder land commonly supports some vegetation, it has no value for grazing, because of its loose nature and poor trafficability. It is used for wildlife habitat and recreational areas. (Foote et al. 1972:29)

Dune land (DL) soils are described as follows:

> Dune land consists of hills and ridges of sand-size particles drifted and piled by wind. The hills and ridges are actively shifting or are so recently fixed or stabilized that no soil horizons have developed. The sand is dominantly from coral and seashells. This miscellaneous land type occurs in coastal areas on the islands of Maui and Kauaʻi. Elevations range from nearly sea level to 150 feet. The annual rainfall amounts to 15 to 90 inches.
>
> This land type is used for wildlife habitat and recreational areas and as a source of liming material. Vegetation is sparse, but ironwood trees, koa haole, tropical almond, kiawe, and mixed grasses have gained a foothold in places. (Foote et al. 1972:29)

Ewa cobbly silty clay loam (0 to 3 percent slopes) (EcA) soils are described as follows:

> This soil has a profile like that of Ewa silty clay loam (3 to 6 percent slopes), except that it is cobbly on the surface. Runoff is very slow, and the erosion hazard is no more than slight. Most of this soil is used for sugarcane. A small acreage is used for pasture. (Foote et al. 1972:30)

Ewa cobbly silty clay loam (3 to 7 percent slopes) (EcB) soils are described as follows:

> This soil has a profile like that of Ewa silty clay loam (3 to 6 percent slopes), except that it is cobbly on the surface. Included in mapping were a few small, stony areas. Most of this soil is used for sugarcane. A small acreage is used for pasture. (Foote et al. 1972:30)

Ewa cobbly silty clay loam (0 to 3 percent slopes) (EsA) soils are described as follows:

> This soil has a profile like that of Ewa silty clay loam (3 to 6 percent slopes), except for the texture of the surface layer. Runoff is very slow, and the erosion hazard is no more than slight. This soil is used for sugarcane. (Foote et al. 1972:30)

Fill land (Fd) soils are described as follows:

> This land type consists mostly of areas filled with bagasse and slurry from sugar mills. A few areas are filled with material from dredging and from soil excavations. Generally, these materials are dumped and spread over marshes, low-lying areas along the coastal flats, coral sand, coral limestone, or areas shallow to bedrock. (Foote et al. 1972:31)

Haiku silty clay (3 to 7 percent slopes) (HaB) soils are described as follows:

> This soil has a profile like that of Haiku clay, 7 to 15 percent slopes, except for the texture of the surface layer. It is a dark brown clay about 14 inches thick. The subsoil, about 31 inches thick, is yellowish-red, dark reddish-brown, and dark-red clay or silty clay that has angular and angular blocky structure. The substratum is soft, weathered, basic igneous rock. The soil is very strongly acid in the surface layer and extremely acid and very strongly acid in the subsoil and substratum. Runoff is slow, and the erosion hazard is slight. Included in mapping were small, nearly level areas. This soil is used for pineapple and homesites. (Foote et al. 1972:32)

Haiku silty clay (7 to 15 percent slopes) (HaC) soils are described as follows:

> This soil has a profile like that of Haiku clay, 7 to 15 percent slopes, except for the texture of the surface layer. It is a dark brown clay about 14 inches thick. The subsoil, about 31 inches thick, is yellowish-red, dark reddish-brown, and dark-red clay or silty clay that has angular and angular blocky structure. The substratum is soft, weathered, basic igneous rock. The soil is very strongly acid in the surface layer and extremely acid and very strongly acid in the subsoil and substratum. This soil is used for pineapple. (Foote et al. 1972:32)

Haiku clay (3 to 7 percent slopes) (HbB) soils are described as follows:

> On this soil, runoff is slow and the erosion hazard is slight. Included in mapping were small, nearly level areas. This soil is used for pineapple, pasture, and homesites. (Foote et al. 1972:32)

Hamakuapoko silty clay (3 to 7 percent slopes) (HlB) soils are described as follows:

> This soil is on smooth slopes in the uplands. Included in mapping were small areas of Haiku and Haliimaile soils. Also included were small, moderately steep areas.
>
> In a representative profile, the surface layer is dark-brown silty clay about 16 inches thick. The subsoil, about 35 inches thick, is dark-brown and very dark grayish brown silty clay that has subangular blocky structure. The substratum is soft, weathered basic igneous rock. The soil is extremely acid in the surface layer and strongly acid or very strongly acid in the subsoil.
>
> Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.2 inches per foot in the surface layer and 1.5 inches per foot in the subsoil. In places roots penetrate to a depth of 4 feet or more. (Foote et al. 1972:36)

Hamakuapoko silty clay (7 to 15 percent slopes) (HlC) soils are described as follows:

> On this soil, runoff is medium and the erosion hazard is moderate. Most of this soil is used for pineapple. A small acreage is used for pasture and homesites. (Foote et al. 1972:36)

Hamakuapoko silty clay (7 to 25 percent slopes, eroded) (HlC2) soils are described as follows:

> This soil has a profile like that of Hamakuapoko silty clay (3 to 7 percent slopes), except that it is eroded. In most places about 50 percent of the original surface layer has been removed by erosion. In a few places all of the surface layer and part of the subsoil have been lost. Runoff is medium to rapid, and the erosion hazard is severe. This soil is used for pineapple. (Foote et al. 1972:36)

Haliimaile silty clay (3 to 7 percent slopes) (HhB) soils are described as follows:

> This soil is on smooth uplands. Included in mapping were small areas of Keahua and Paia soils. In a representative profile, the surface layer is dark reddish-brown silty clay about 15 inches thick. The subsoil, to a depth of more than 60 inches, is dark reddish-brown silty clay and very dark grayish-brown clay. It has subangular blocky and angular blocky structure. The substratum is silt, weathered basic igneous rock. The soil is strongly acid in the surface layer and strongly acid to medium acid in the subsoil. Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.6 inches per foot in the surface layer and about 1.2 inches per foot in the subsoil. In places, roots penetrate to a depth of 5 feet or more. (Foote et al. 1972:35)

Haliimaile silty clay (7 to 15 percent slopes) (HhC) soils are described as follows:

> On this soil, runoff is medium and the erosion hazard is moderate. Included in mapping were small, cobbly areas and small, moderately steep areas. This soil is used for sugarcane, pineapple, and homesites. (Foote et al. 1972:36)

Iao silty clay (0 to 3 percent slopes) (IaA) soils are described as follows:

> On this soil, runoff is slow and the erosion hazard is no more than slight. This soil is used for sugarcane. (Foote et al. 1972:46-47)

Iao silty clay (3 to 7 percent slopes) (IaB) soils are described as follows:

> This soil has a profile like that of Iao clay (3 to 7 percent slopes), except for the texture of the surface layer. The subsoil, about 45 inches thick, is very dark brown, dark-brown, and very dark grayish-brown clay and silty clay. The substratum is clayey alluvium. The soil is neutral in the surface layer and subsoil. This soil is used for sugarcane. (Foote et al. 1972:47)

Iao cobbly silty clay (3 to 7 percent slopes) (IbB) soils are described as follows:

> This soil has a profile like that of Iao clay (3 to 7 percent slopes), except for the texture of the surface layer and the content of the cobblestones. The subsoil, about 45 inches thick, is very dark brown, dark-brown, and very dark grayish-brown clay and silty clay. The substratum is clayey alluvium. The soil is neutral in the surface layer and subsoil. This soil is used for sugarcane and homesites. (Foote et al. 1972:47)

Jaucas sand, saline (0 to 12 percent slopes) (JcC) soils are described as follows:

> This soil occurs near the ocean in areas where the water table is near the surface and salts have accumulated. It is somewhat poorly drained in depressions but excessively drained on knolls. In the depressions there is normally a layer of silty alluvial material flocculated by the high concentration of soluble salts. The water table is normally within a depth of 30 inches.
>
> This soil is used for pasture, wildlife habitat, and urban development. Vegetation on the salty soil in the depressions consists of salt-tolerant plants. Kiawe grows profusely on the better drained soils on knolls. (Foote et al. 1972:49)

Keahua silty clay loam (3 to 7 percent slopes) (KnB) soils are described as follows:

> This soil is on uplands. Included in mapping were small areas of Haliimaile and Molokai soils, and small areas that are 20 to 40 inches deep over soft, weathered basic igneous rock. Also included were small areas of silty clay and some areas that are nearly level.

> In a representative profile, the surface layer is dark reddish-brown silty clay loam about 10 inches thick. The subsoil, about 50 inches thick, is dark reddish-brown silty clay loam and very dark gray clay loam that has subangular blocky structure. The substratum is dominantly soft, weathered basic igneous rock. The soil is slightly acid in the surface layer and slightly acid to neutral in the subsoil.
>
> Permeability is moderate. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.3 inches per foot of soil. In places, roots penetrate to a depth of 4 feet or more. (Foote et al. 1972:65)

Keahua cobbly silty clay loam (3 to 7 percent slopes) (KnaB) soils are described as follows:

> This soil has a profile like that of Keahua silty clay loam (3 to 7 percent slopes), except that it is cobbly on the surface. Included in mapping were small areas that are 20 to 40 inches deep over soft, weathered basic igneous rock. Also included were small areas of silty clay. This soil is used for sugarcane. A few acres are used for truck crops. (Foote et al. 1972:66)

Keahua cobbly silty clay loam (7 to 15 percent slopes) (KnaC) soils are described as follows:

> On this soil, runoff is low to medium and the erosion hazard is slight to moderate. Included in mapping were small areas that are 20 to 40 inches deep over soft, weathered basic igneous rock. This soil is used for sugarcane and pasture. A few acres are used for truck crops. (Foote et al. 1972:66)

Keahua cobbly silty clay loam (15 to 25 percent slopes) (KnaD) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is moderate. Included in mapping were small areas that are not cobbly. Also included were a few steep areas. This soil is used for sugarcane and pasture. (Foote et al. 1972:66)

Keahua very stony silty clay loam (7 to 25 percent slopes) (KnbD) soils are described as follows:

> This soil has a profile like that of Keahua silty clay loam (3 to 7 percent slopes), except that stones cover as much as 3 percent of the surface. Runoff is slow to medium, and the erosion hazard is slight to moderate. Included in mapping were small areas that are 20 to 40 inches deep over soft, weathered basic igneous rock. In a few places tones cover 3 to 15 percent of the surface. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:66)

Keahua silty clay loam (7 to 15 percent slopes) (KnC) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. This soil is used for sugarcane and pasture. Small acreages are used for pineapple and truck crops. (Foote et al. 1972:66)

Keahua silty clay (7 to 15 percent slopes) (KncC) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. Included in mapping were small areas that are 20 to 40 inches deep over soft, weathered basic igneous rock. This soil is used for pineapple, pasture, and homesites. (Foote et al. 1972:66)

Keahua cobbly silty clay (7 to 15 percent slopes) (KnhC) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. Included in mapping were small areas that are 20 to 40 inches deep over soft, weathered igneous rock. This soil is used for sugarcane and pasture. Small acreages are used for truck crops. (Foote et al. 1972:66)

Molokai silty clay loam (0 to 3 percent slopes) (MuA) soils are described as follows:

> The soil is on smooth slopes. In a representative profile the surface layer is dark reddish-brown silty clay loam about 15 inches thick. The subsoil, about 57 inches thick, is dark reddish-brown silty clay loam that has prismatic structure. The material at depths between 35 and 64 inches is moderately compact in place. The substratum is soft, weathered rock. The soil is slightly acid to neutral, except that areas used for pineapple are commonly very strongly acid or extremely acid in the surface layer.
>
> Permeability is moderate. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.3 inches per foot of soil. In places roots penetrate to a depth of 5 feet or more. This soil is used entirely for sugarcane on Maui. (Foote et al. 1972:96)

Molokai silty clay loam (3 to 7 percent slopes) (MuB) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. Included in mapping were a few small areas that are eroded to soft, weathered rock. This soil is used for sugarcane, pineapple, pasture, wildlife habitat, and homesites. (Foote et al. 1972:96)

Molokai silty clay loam (7 to 15 percent slopes) (MuC) soils are described as follows:

> This soil occurs on knolls and sharp slope breaks. Runoff is medium, and the erosion hazard is moderate. This soil is used for sugarcane, pineapple, pasture, wildlife habitat, and homesites. (Foote et al. 1972:97)

Paia silty clay (3 to 7 percent slopes) (PcB) soils are described as follows:

> This soil is on uplands. Included in mapping were small areas of Haliimaile and Molokai soils. Also included were small, nearly level areas.

> In a representative profile, the surface layer is dark reddish-brown silty clay and clay about 19 inches thick. The subsoil, about 41 inches thick, is dark reddish-brown clay that has angular and subangular blocky structure. The substratum is soft, weathered basic igneous rock. The soil is mildly alkaline in the surface layer and subsoil.
>
> Permeability is moderate. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.3 inches per foot in the surface layer and about 1.6 inches per foot in the subsoil. In places roots penetrate to a depth of 4 feet or more. This soil is used for sugarcane. Small acreages are used for homesites. (Foote et al. 1972:107)

Paia silty clay (7 to 15 percent slopes) (PcC) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. Included in mapping were small, moderately steep areas. This soil is used for sugarcane. (Foote et al. 1972:107)

Paia silty clay (7 to 15 percent slopes) (PcC2) soils are described as follows:

> This soil is similar to Paia silty clay (3 to 7 percent slopes), except that it is eroded. In most of the area, about 50 percent of the original surface layer has been lost. Runoff is medium, and the erosion hazard is moderate to severe. In places roots penetrate to a depth of 3 or 4 feet. This soil is used for sugarcane. (Foote et al. 1972:107)

Pulehu clay loam (0 to 3 percent slopes) (PsA) soils are described as follows:

> This soil is on alluvial fans and stream terraces and in basins. Included in mapping were small areas of 'Ewa, Mala, and Waiālua soils. Also included were small areas of gravelly, stony, and gently sloping soils.
>
> In a representative profile the surface layer is dark-brown clay loam about 21 inches thick. This is underlain by dark-brown, dark grayish-brown, and brown, massive and single grain, stratified loam, loamy sand, fine sandy loam, and silt loam about 39 inches thick. Below this is coarse, gravelly or sandy alluvium. The soil is neutral in the surface layer and neutral to mildly alkaline below the surface layer.
>
> Permeability is moderate. Runoff is slow, and the erosion hazard is no more than slight. The available water capacity is about 1.4 inches per foot in the surface layer and subsoil. In places roots penetrate to a depth of 5 feet or more. Low areas are subject to flooding. This soil is used for sugarcane, truck crops, and pasture. (Foote et al. 1972:115-116)

Pulehu silt loam (0 to 3 percent slopes) (PpA) soils are described as follows:

> This soil is similar to Pulehu clay loam (0 to 3 percent slopes), except that the texture is silt loam. This soil is used for sugarcane. Small acreages are used for homesites. (Foote et al. 1972:116)

Pulehu silt loam (3 to 7 percent slopes) (PpB) soils are described as follows:

> This soil is similar to Pulehu clay loam (0 to 3 percent slopes), except that the texture is silt loam. Runoff is slow, and the erosion hazard is slight. Included in mapping were small areas underlain by coral sand at a depth of 20 to 36 inches. This soil is used for sugarcane and pasture. (Foote et al. 1972:116)

Pulehu cobbly silt loam (0 to 3 percent slopes) (PrA) soils are described as follows:

> This soil is similar to Pulehu clay loam (0 to 3 percent slopes), except that the texture is silt loam and there are many cobblestones on the surface. In a few places cobblestones are common throughout the profile. Included in mapping were small areas underlain by coral sand at a depth of 20 to 36 inches. This soil is used for sugarcane and pasture. (Foote et al. 1972:116)

Pulehu cobbly silt loam (3 to 7 percent slopes) (PrB) soils are described as follows:

> This soil is similar to Pulehu clay loam (0 to 3 percent slopes), except that the texture is silt loam and the surface layer is cobbly. Runoff is slow, and the erosion hazard is slight. Included in mapping were small areas underlain by coral sand at a depth of 20 to 36 inches. This soil is used for sugarcane. Small areas are used for pasture. (Foote et al. 1972:116)

Pulehu cobbly clay loam (0 to 3 percent slopes) (PtA) soils can be described as follows:

> This soil is similar to Pulehu clay loam (0 to 3 percent slopes), except that it is cobbly. This soil is used for sugarcane. Small acreages are used for pasture. (Foote et al. 1972:116)

Quarry (QU) soils are described as follows:

> This soil type is made up of areas that are 100 percent quarry.

Rock land (rRK) soils are described as follows:

> Rock land is made up of areas where exposed rock covers 25 to 90 percent of the surface. It occurs on all five islands. The rock outcrops and very shallow soils are the main characteristics. The rock outcrops are mainly basalt and andesite. This land type is nearly level to very steep. Elevations range from nearly sea level to more than 6,000 feet. The annual rainfall amounts to 15 to 16 inches.
>
> Rock land is used for pasture, wildlife habitat, and water supply. The natural vegetation at the lower elevations consists mainly of kiawe, klu, piligrass,

> Japanese tea, and koa haole. Lantana, guava, Natal redtop, and molassesgrass are dominant at the higher elevations. This land type is also used for urban development. In many areas, especially on the island of Oʻahu, the soil material associated with the rock outcrops is very sticky and very plastic. It also has high shrink-swell potential. Buildings on the steep slopes are susceptible to sliding when the soil is saturated. Foundations and retaining walls are susceptible to cracking. (Foote et al. 1972:119)

Rough broken land (rRR) is described as follows:

> Rough broken land (rRR) consists of very steep land broken by numerous intermittent drainage channels. In most places, it is not stony. It occurs in gulches and on mountainsides on all the Islands except Oʻahu. The slope is 40 to 70 percent. Elevations range from nearly sea level to about 8,000 feet. The local relief is generally between 25 and 500 feet. Runoff is rapid, and geologic erosion is active. The annual rainfall amounts to 25 to more than 200 inches.
>
> These soils are variable. They are 20 to more than 60 inches deep over soft, weathered rock. In most places some weathered rock fragments are mixed with the soil material. Small areas of rock outcrop, stones, and soil slips are common. Included in mapping were areas of colluvium and alluvium along gulch bottoms.
>
> This land type is used primarily for watershed and wildlife habitat. In places, it is used also for pasture and woodland. The dominant natural vegetation in the drier areas consists of guava, lantana, natal redtop, Bermuda grass, koa haole, and molasses grass. ʻŌhiʻa, kukui, koa, and ferns are dominant in the wetter areas. Puakeawe, ʻaʻaliʻi, and sweet vernal grass are common at the higher elevations. (Capability classification VIIe, nonirrigated). (Foote et al. 1972:119)

Rough broken and stony land (rRS) soils are described as follows:

> This type of soil consists of very steep, stony gulches. The local relief is generally between 25 and 500 feet. Runoff is rapid, and geologic erosion is active. Elevations range from nearly sea level to 3,000 feet. The annual rainfall amounts to 20 to 40 inches.
>
> The soil material is generally less than 20 inches deep over saprolite or bedrock. About 3 to 25 percent of the surface is covered with stones, and there are a few rock outcrops. Included in mapping were small areas of colluvium and alluvium along the bottoms of gulches.
>
> This land type is used for pasture, wildlife habitat, and watershed. The dominant natural vegetation consists of lantana, koa, haole, klu, feather fingergrass, Bermuda grass, and ʻilima. (Foote et al. 1972:119)

Waiakoa silty clay loam (3 to 7 percent slopes) (WeB) soils are described as follows:

> This soil has a profile like that of Waiakoa very stony silty clay loam (3 to 7 percent slopes), except that it is nonstony. Included in mapping were small, nearly level areas. This soil is used for sugarcane. Small acreages are used for pasture and homesites. (Foote et al. 1972:127)

Waiakoa cobbly silty clay loam (7 to 15 percent slopes) (WeC) soils are described as follows:

> This soil has a profile like that of Waiakoa very stony silty clay loam (3 to 7 percent slopes), except that it is nonstony. Runoff is slow to medium, and the erosion hazard is slight to moderate. Included in mapping were small, moderately steep areas and small areas where cobblestones are on the surface. This soil is used for sugarcane. (Foote et al. 1972:127)

Waiakoa cobbly silty clay loam (3 to 7 percent slopes) (WfB) soils is described as follows:

> This soil is similar to Waiakoa very stony silty clay loam (3 to 7 percent slopes), except that it is cobbly on the surface. This soil is used for sugarcane. (Foote et al. 1972:127)

Waiakoa very stony silty clay loam (3 to 7 percent slopes) (WgB) soils are described as follows:

> This soil is on smooth, low uplands. Included in mapping were small areas of Keahua and Keawakapu soils. Also included were small, nearly level areas.
>
> In a representative profile the surface layer is dark reddish-brown silty clay loam about 2 inches thick. The subsoil, about 23 inches thick, is dark reddish-brown and very dark grayish-brown silty clay loam that has prismatic structure or is massive. The substratum is very dark brown silty clay loam and hard, basic igneous rock. The soil is neutral in the surface layer and slightly acid to neutral in the subsoil.
>
> Permeability is moderate. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.5 inches per foot of soil. In places roots penetrate to bedrock. This soil is used for sugarcane, pasture, and wildlife habitat. (Foote et al. 1972:126)

Waiakoa very stony silty clay loam (7 to 15 percent slopes) (WgC) soils are described as follows:

> On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:127)

Waiakoa extremely stony silty clay loam (3 to 7 percent slopes) (WhB) soils are described as follows:

> This soil is similar to Waiakoa very stony silty clay loam (3 to 7 percent slopes), except that stones cover 3 to 15 percent of the surface. Included in mapping were small, nearly level areas.

Waiakoa extremely stony silty clay loam (7 to 15 percent slopes) (WhC) soils are described as follows:

> This soil is similar to Waiakoa very stony silty clay loam (3 to 7 percent slopes), except that stones cover 3 to 15 percent of the surface. Runoff is slow to medium, and the erosion hazard is slight to moderate. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:127)

Waiakoa extremely stony silty clay loam (3 to 25 percent slopes) (WlD2)

> This soil is similar to Waiakoa very stony silty clay loam (3 to 7 percent slopes), except that it is eroded and stones cover 3 to 15 percent of the surface. In most areas about 50 percent of the surface layer has been removed by erosion. Runoff is medium, and the erosion hazard is severe. Included in mapping were small, steep areas. Also included were a few cinder cones. This soil is used for pasture and wildlife habitat. (Foote et al. 1972:127)

Water (W) soils are described as follows:

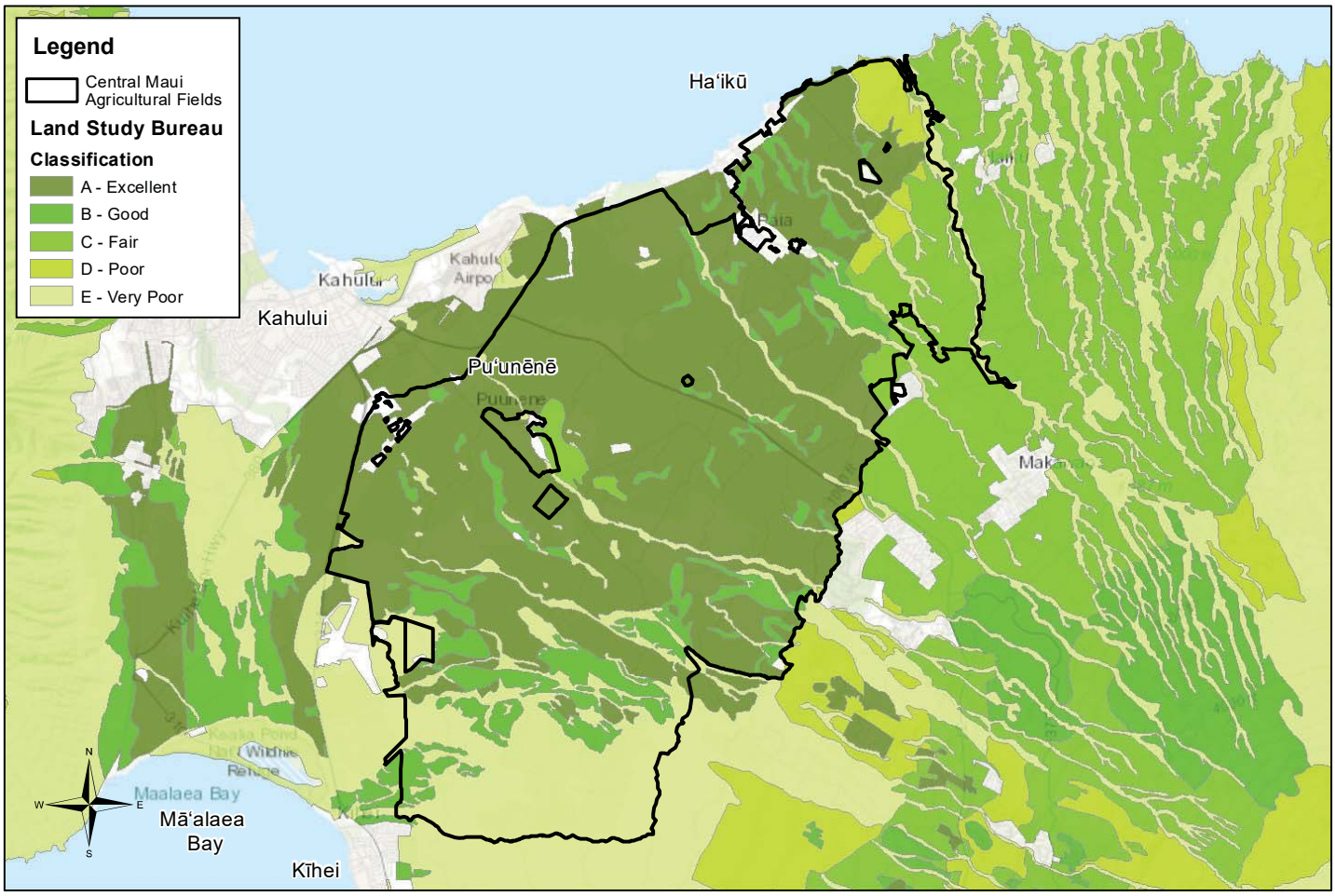
> Soils are labeled "W" when over 40 acres of land is 100 percent water.

According to the LSB Detailed Land Classification, Island of Maui (1967), the agricultural fields of Central Maui that were previously cultivated in sugarcane have an overall productivity rating of A-Excellent (See Figure 4-15). The southern end of the agricultural fields, which is at the farthest reach of the Central Maui field irrigation system is largely rated E-Very Poor with patches of B-Good. The northeastern end of the agricultural fields west of Maliko Gulch includes land rated C-Fair and D-Poor.

According to the ALISH map, the agricultural fields of Central Maui are predominantly classified Prime Land (See Figure 4-16).

Impacts and Mitigation Measures

Under the Proposed Action, the agricultural fields in Central Maui will be converted to a diversified agricultural farming operation by Mahi Pono. The soils in Central Maui have already been disturbed from over a century of sugarcane cultivation in the region. Mahi Pono's diversified agricultural operation will include soil preparation to remove the remnants of sugarcane and other vegetation from the fields as needed. These preparations include the application of effective micronutrients, plastic removal, pH adjustments, and the application of organic matter. Soils will be gathered and replaced or moved into other field locations, as needed, and activities such as soil amendment will follow in preparation for planting. The overall topography will not be significantly



WILSON OKAMOTO CORPORATION

0 5,000 10,000 20,000 Feet

0 0.5 1 2 3 Miles

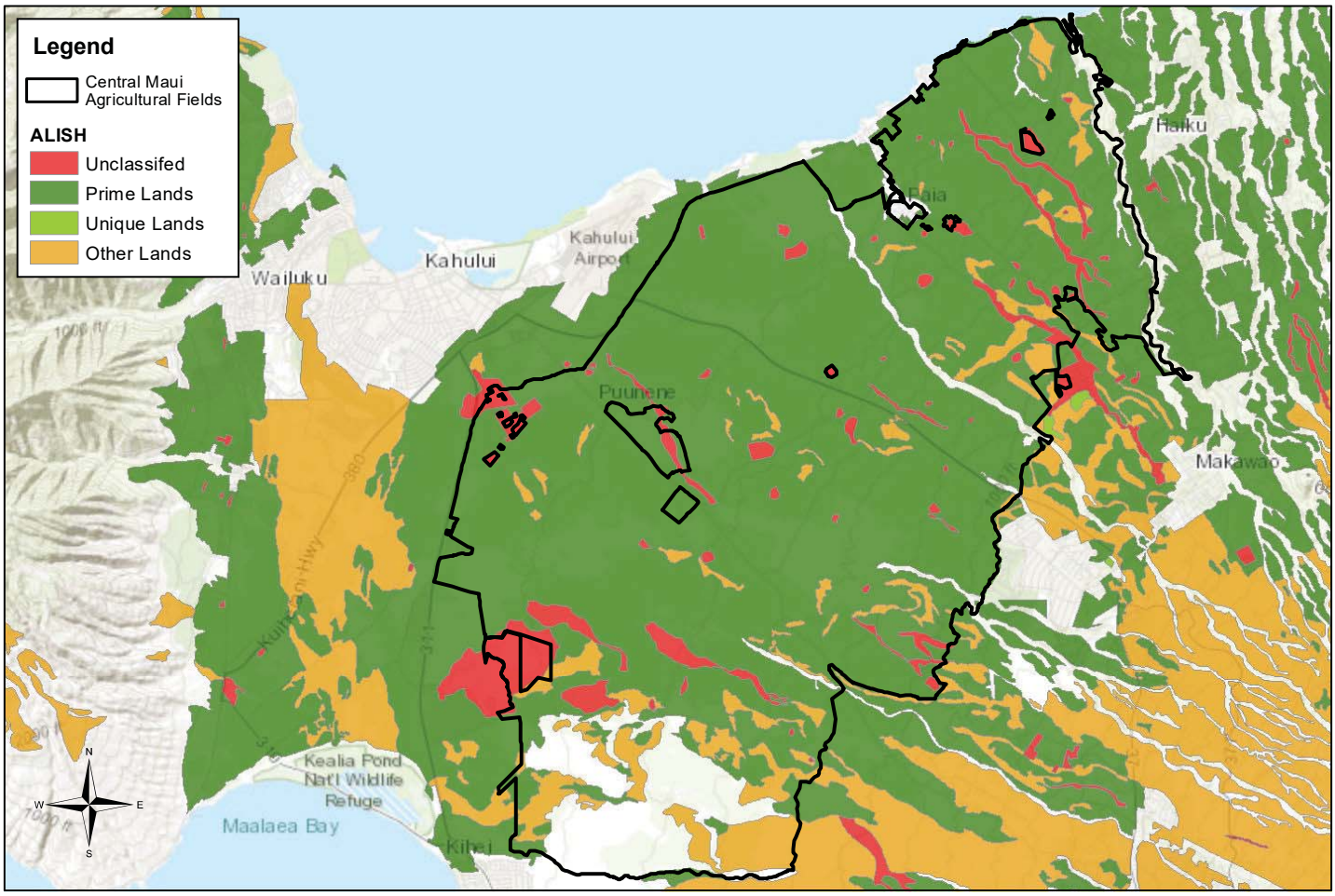
1 inch = 11,000 feet

Source: ESRI, State OP, & Akinaka

FIGURE 4-15

CENTRAL MAUI LSB MAP

Proposed Lease for Nāhiku, Keʻanae, Honomanū and Huelo License Areas



0 5,000 10,000 20,000 Feet

0 0.5 1 2 3 Miles

1 inch = 10,000 feet

Source: ESRI, State OP, & Akinaka

WILSON OKAMOTO CORPORATION

FIGURE 4-16

CENTRAL MAUI ALISH MAP

Proposed Lease for Nāhiku, Keʻanae, Honomanū and Huelo License Areas

modified and the configuration of the fields to prevent surface runoff and soil loss will be retained.

Mahi Pono proposes to construct approximately 319,000 square feet of building space related to its agricultural operations such as washing and packing areas, storage, etc. The construction of these facilities will minimally disturb soils. If soil disturbance of one-acre or more for new construction is required, it would be subject to the National Pollutant Discharge Elimination System Permit for stormwater runoff. Any discharges related to project construction or operation activities will comply with applicable State Water Quality Standards as specified in HAR Chapters 11-54 and 11-55 Water Pollution Control, DOH. Excavation and grading activities will be regulated by applicable provisions of the County's grading ordinance.

4.2 Hydrology

4.2.1 Surface Waters

East Maui

Surface waters within East Maui are predominantly characterized by the various streams, which are generally fed by abundant rainfall and groundwater discharge, flowing through the numerous valleys within the watersheds that comprise the region. The drainage pattern of the stream valleys on East Maui is radial from the summit of Haleakalā Volcano to the ocean. The streams within the License Area located within East Maui drain to the north. Regional valley development is in a relatively youthful stage as streams are eroding downward into the original volcano slope, forming steep-sided valleys and leaving nearly un-eroded upland areas (planezes) between the stream valleys. Streamflow consists of direct runoff and base flows which represent ground-water discharge to the stream.

Issuance of the proposed Water Lease involves the diversion of "government-owned" waters from several East Maui streams. To better understand the impact of the surface water diversion on native stream animals and their habitats, Trutta Environmental Solutions, LLC (Trutta) was contracted to develop a Hawaiian Stream Habitat Evaluation Procedure (HSHEP) model to assess impacts on 33 streams[1] associated with the proposed Water Lease. (Trutta, p. 11, 2019) (See Appendix A)

The HSHEP model was designed to quantify how various man-made changes affect native Hawaiian amphidromous stream animals and is based on statewide observations of these animals' distribution and habitat. The HSHEP model considers the primary impacts of surface water diversion, which include loss of instream habitat from constriction or diversion of stream

[1] The CWRM D&O was used to identify the streams to be studied. The CWRM D&O identified 36 streams associated with the License Area. Two of these streams, Kualani and ʻŌhiʻa streams were not included in the HSHEP model as they were not diverted by the EMI Aqueduct System and another, Palauhulu Stream, is a tributary of Piʻinaʻau Stream and thus was combined with Piʻinaʻau Stream for purposes of this study. The DEIS identifies 37 streams associated with the License Area. It includes Puakea Stream which was not mentioned in the CWRM D&O and therefore was not assessed in the HSHEP model. This resulted in 33 distinct streams impacted by the EMI Aqueduct System.

flow, creation of barriers to stream animal upstream movement and entrainment of downstream drifting larvae. (Trutta, p. 11, 2019)

The HSHEP modeling approach was developed for, applied on, and critically reviewed for use in Hawaiian streams. The HSHEP model approach has been used extensively in Hawai'i, including, among others, for instream flow decisions made by the CWRM for East and West Maui streams. (Trutta, p. 12, 2019) Using the HSHEP model, data on water depth, habitat type, substrate, and stream width can be converted into suitability criteria and estimates of overall habitat area. In addition to habitat measures, stream discharge was measured upstream and downstream of diversions to help document the proportion of flow diverted. (Trutta, p. 15, 2019)

The HSHEP model assumes that habitat quality and quantity are related to the number of animals using a habitat over the long term. (Trutta, p. 23, 2019) Habitat quality and quantity determine overall Habitat Units (HU) within the area of concern, and the HSHEP model is designed to, among other things, provide impact assessments of the changes of HU within the study area under different management scenarios. (Trutta, p. 24, 2019)

Habitat suitability indices were developed for the typical group of native freshwater fish and macroinvertebrates found in Hawaiian streams, namely: 'O'opu nākea (*Awaous stamenius*); 'O'opu alamo'o (*Lentipes concolor*); 'O'opu naniha (*Stenogobius hawaiiensis*); 'O'opu nōpili (*Sicyopterus stimpsoni*); 'O'opu akupa (*Eliotris sandwicensis*); 'Ōpae kala'ole (*Atyoida bisulcata*); 'Ōpae 'oeha'a (*Macrobrachium grandimanus*); and Hīhīwai (*Neritina granosa*).

In addition to the species listed above, three native damselflies (*Megalagrion xanthomelas*, *Megalagrion pacificum*, and *Megalagrion nesiotes*) and an introduced mosquito (Culex quinquefasiatus) habitats were also modeled to see how the water diversions may impact their population sizes. (Trutta, p. 26, 2019) In general, restoration of stream flow should improve damselfly habitat and decrease mosquito habitat where these species use instream habitats. Restoration of baseflow, however, will likely also improve habitat conditions for a number of introduced predator and competitor species of the native damselflies and thus may not, in itself, increase damselfly populations. (Trutta, p. 58, 59, 60, 2019)

Baseline Condition – Natural Flow

The EMI Aqueduct System has diverted water in its current configuration for nearly 100 years and baseline environmental condition studies (including the distribution and habitat of native stream animals) prior to its construction do not exist. Although there were no studies that describing East Maui stream biota conditions as they existed prior to the construction of the EMI Aqueduct System, the HSHEP model provides a means of estimating the naturally available habitat for stream species under natural conditions, i.e., no water diversions and no impacts on passage or entrainment of animals. (Trutta, p. 12, 2019) Trutta cautions, however, that suitable habitat (number of HU's), which is the focus of the HSHEP model, is not the only thing that may affect species populations. Other factors, such as pollution, disease, or competition with introduced species may also influence the distribution and densities of native animals. (Trutta, p. 66, 2019) This Natural Flow condition, while not, strictly speaking, a baseline condition in that it has not existed for at least 100 years, nevertheless sets the upper boundary for the HSHEP model. (Trutta, p. 41, 2019) In other words, the Natural Flow condition represents 100% of the HU in the 33 streams assessed. Trutta estimates a total of 1,982,176 HU for all the streams in the License Area. (Trutta, p. 57, 59, 60, 61, 2019)

Baseline Condition – Full Diversion
The lower boundary for the HSHEP model was full diversion by the EMI Aqueduct System in its current configuration as existed under sugar cultivation, which was the prevailing conditions for nearly 100 years. (Trutta, p. 41, 2019) The Full Diversion scenario assumes that all the diversions in the EMI Aqueduct System are fully open or diverting 100% of available low flows, roughly analogous to the stream's baseflow. The diversions in the EMI Aqueduct System were built to capture 100% of normal low flows plus some small amount of storm runoff. Hawaiian streams are "flashy", meaning discharge rises quickly in response to rainfall and then quickly falls back to low flow conditions. When low flow conditions persist and water needs call for all the low flow to be diverted, the streams can be dewatered below the diversions resulting in negative impacts on species habitat and passage. Although the Full Diversion condition has not existed for more than ten years, it is identified as a baseline condition in that it was the prevailing condition for nearly 100 years when sugarcane was in full production. (Trutta, p. 55-56, 2019) Under Full Diversion conditions, approximately 46% of the total HU remained; or conversely, Full Diversion conditions reduced the number of HU by approximately 54%.

2018 CWRM D&O – Setting the IIFS
This scenario represents the flow conditions as described in the CWRM D&O setting the IIFS, which included 24 streams and mandated restoration of flows in all but three streams. Four main types of flow restoration were mandated: Full-flow Restoration, Habitat-flow Restoration, Connectivity-flow Restoration, and No-Flow Restoration. The diversion amount was estimated as available flow after compliance with the CWRM D&O. (Trutta, p. 56, 2019)

The CWRM D&O ordered that flows in Makapipi, Waiohue, West Wailuāiki, Wailuānui, Waiokamilo, Piʻinaʻau (and its tributary Palahulu), Hanehoi (Huelo/Puolua), and Honopou streams be fully restored. The primary reason for Full-flow Restoration is not the improvement of instream habitat for stream animals, but for the downstream passage of water for customary and traditional uses on these priority streams identified as such by Native Hawaiian communities during the IIFS proceedings. Nevertheless, Full-flow Restoration does provide significant instream habitat benefits for the native amphidromous stream animals. According to the HSHEP model, these streams contain about one-third of the potential HU (under natural flow conditions) within the entire License Area. After Full-flow Restoration as defined in the CWRM D&O, 96.7% of native stream animal HUs for these streams are estimated to exist. (Trutta, p. 57, 2019)

Additional flow restoration in the Habitat-flow Restoration streams and the Connectivity-flow Restoration streams further increases the HUs existing in the License Area. Under the Full Diversion scenario (diverting 100% of available low flows), less than half of the Hus remained in the License Area; whereas under the CWRM D&O standards, the number of remaining HUs increases to nearly 60%. (Trutta, p. 59-61, 2019)

The License Area also includes streams that were not the subject of the CWRM D&O, but are diverted into the EMI Aqueduct system. The majority of these 13 non-IIFS streams are located on the western side of the East Maui stream group. Most of the non-IIFS streams have diversions at four levels; on the Wailoa and New Hamakua Ditches at higher levels, and on two of the Spreckels, Center, and Lowrie of Haiku Ditches at the lower levels. (Trutta, p. 61, 2019) Inasmuch as the non-IIFS streams were not included in the CWRM D&O, the 2018 IIFS scenario assumes these streams will be at Full Diversion conditions. (Trutta, p. 61, 2019)

Impacts and Mitigation Measures

Under the Proposed Action, it is assumed that the Water Lease would grant the right to collect government-owned waters from the License Area up to the maximum allowed under the CWRM D&O. Thus, under the Proposed Action, the number of HU within the entire License Area is decreased by approximately 40% from Natural Flow (no diversion) condition, but is increased by more than 10% over the Full Diversion condition. In other words, 60% of the total HU remains within the License Area. This ranges from 96.7% of the HU in the Full-flow Restoration streams to 15% remaining HU in the No-Flow Restoration streams (including the streams for which no IIFS was set in the 2018 CWRM D&O).

The HSHEP model results conclude that the Proposed Action would have a negative impact by reducing native stream animal habitat from Natural Flow (undiverted) conditions. However, in making decisions about instream flows, the CWRM must weigh the importance of the present or potential instream values with the importance of the present or potential uses of water for noninstream purposes, including the economic impact of restricting such uses. It is also its duty to establish IIFS that protect instream values to the extent practicable and to protect the public interest. The public interest includes not only protecting instream values but also preserving agricultural lands and assuring adequate water supplies for Maui. (CWRM D&O, p. 267, items b.-d.). Further explaining its decision-making process, the CWRM stated:

The Commission first evaluated each stream individually, looking at their flow characteristics, instream uses, habitat restoration potential for fish and other stream animals, recreation opportunities, and scenic values. We then looked at all of the affect streams in an integrated manner with consideration for the overall ecological ramifications of our decision. We used those factors to align instream flow standards with our public trust responsibilities.

The CWRM then considered offstream uses and weighed the importance of those uses against instream uses. In addition to the recognized public trust use for drinking water, the CWRM acknowledged the importance of diversified agriculture in Central Maui for both food sustainability and for ecological reasons. Expounding on its rationale the CWRM stated:

For over 100 years, the East Maui watershed forests have provided water for offstream uses that meet our consumptive needs and enable economic opportunities. These benefits provide additional impetus for sustainable management of the watershed. Therefore, the Commission considered the economic impact of our decision upon offstream uses, with a specific focus on supporting public uses such as drinking water, as well as diversified agriculture. We also considered factors that contribute to the operational capacity of the existing ditch system to deliver those offstream uses. Where necessary, changes were made to our original estimates of instream flow standards to accommodate reasonable and beneficial offstream uses.

(CWRM D&O at ii.)

> *Yet, we believe it to be reasonable and beneficial to use a portion of East Maui stream water for the development of diversified agriculture on Maui's central plains. Diversified agriculture has and should continue to provide economic benefits and can now make a larger contribution to Hawai'i's food sustainability. We are also concerned that leaving these lands in an un-cultivated state will increase wind-blown erosion that will damage Maui's near shore marine environment, air quality, and tourism competitiveness. The Commission's intent in this decision is to ensure that a sufficient amount of offstream water is available to support the cultivation of diversified agricultural crops on the lands designated as IAL in Central Maui.*
>
> (CWRM D&O at vi.)

Even with stream flow restoration and creation of wetted pathways to the ocean, entrainment of larvae at the diversions remains an issue and contributes to the loss of HU. Additional HU may be gained for the native stream species by decreasing entrainment at the diversion locations. Any action or modification of the diversion to decrease entrainment would increase the total restored HU without any additional water released to the stream. (Trutta, p. 59, 2019)

Upcountry Maui

Within Upcountry Maui there are no perennial streams (Draft Maui Island Water Use and Development Plan, March 2019). However, there are several intermittent streams such as Kailua Gulch, Waikapu Stream, Kulanihakoi Gulch, and Waipuilani Gulch.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM's D&O and any reservations in favor of the DHHL. No significant impacts on surface waters in the region are anticipated as the Proposed Action does not involve any uses of or changes to any Upcountry Maui streams.

Central Maui

Within the agricultural fields in Central Maui there are no perennial streams (Draft Maui Island Water Use and Development Plan, March 2019). However, there are 48 reservoirs throughout the agricultural fields that are used for water storage. These reservoirs are not lined and the water that is stored within the reservoirs seeps into the ground, recharging the Central Maui aquifers, as discussed more in Section 4.2.2 (Groundwater).

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in

compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on surface waters in the region are anticipated because there are no streams within Central Maui.

4.2.2 Groundwater

East Maui

East Maui hydrologic resources are largely controlled by the ability of surface geology to absorb the relatively abundant rainfall that is typical of the region. The geologic surfaces of East Maui are comprised of highly permeable lava flow remnants of the Hāna Volcanic Series, which allows for rainwaters to easily penetrate and recharge groundwater bodies in the region.

Fresh ground water in the subject License Area is found in two main forms: (1) as perched high-level water held up by relatively low-permeability geologic layers, and (2) as a freshwater lens floating on denser, underlying saltwater. The rocks beneath the contact between the Kula Volcanic Series and the underlying Honomanū Basalt and above the freshwater lens appear to be unsaturated. This is based upon observations that: (a) streams are dry or losing water where they are incised into the Honomanū Basalt, (b) the hydraulic conductivity of the Honomanū Basalt is too high to support a thick ground-water lens given the estimated recharge to the area, and (c) wells that penetrate through the contact have encountered conditions of cascading water from above the contact and dry lava tubes in the Honomanū Basalt (Draft Maui Island Water Use & Development Plan, March 2019).

East Maui is within the MDWS's Koʻolau Aquifer Sector which includes four aquifer systems: Haʻikū, Honopou, Waikamoi, and Keʻanae (See Figure 4-17).

The groundwater SY is the maximum rate that groundwater can be withdrawn without impairing the water source as determined by the CWRM. Generally, SY is conservatively set at the low end of the estimated range of predicted SY for an aquifer. Below are tables 4-1 and 4-2 that summarize each of the East Maui aquifer's SY and amount of groundwater pumped by MGD per use category.

While no groundwater is transferred from the Koʻolau 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.

Table 4-1 Sustainable Yields for Koʻolau Aquifer System Areas

Koʻolau aquifer system area	Aquifer code	Sustainable yield range (mgd)
Haʻikū	60401	27
Honopou	60402	25-26
Waikamoi	60403	40
Keʻanae	60404	83

Source: Draft Maui Island Water Use & Development Plan, March 2019

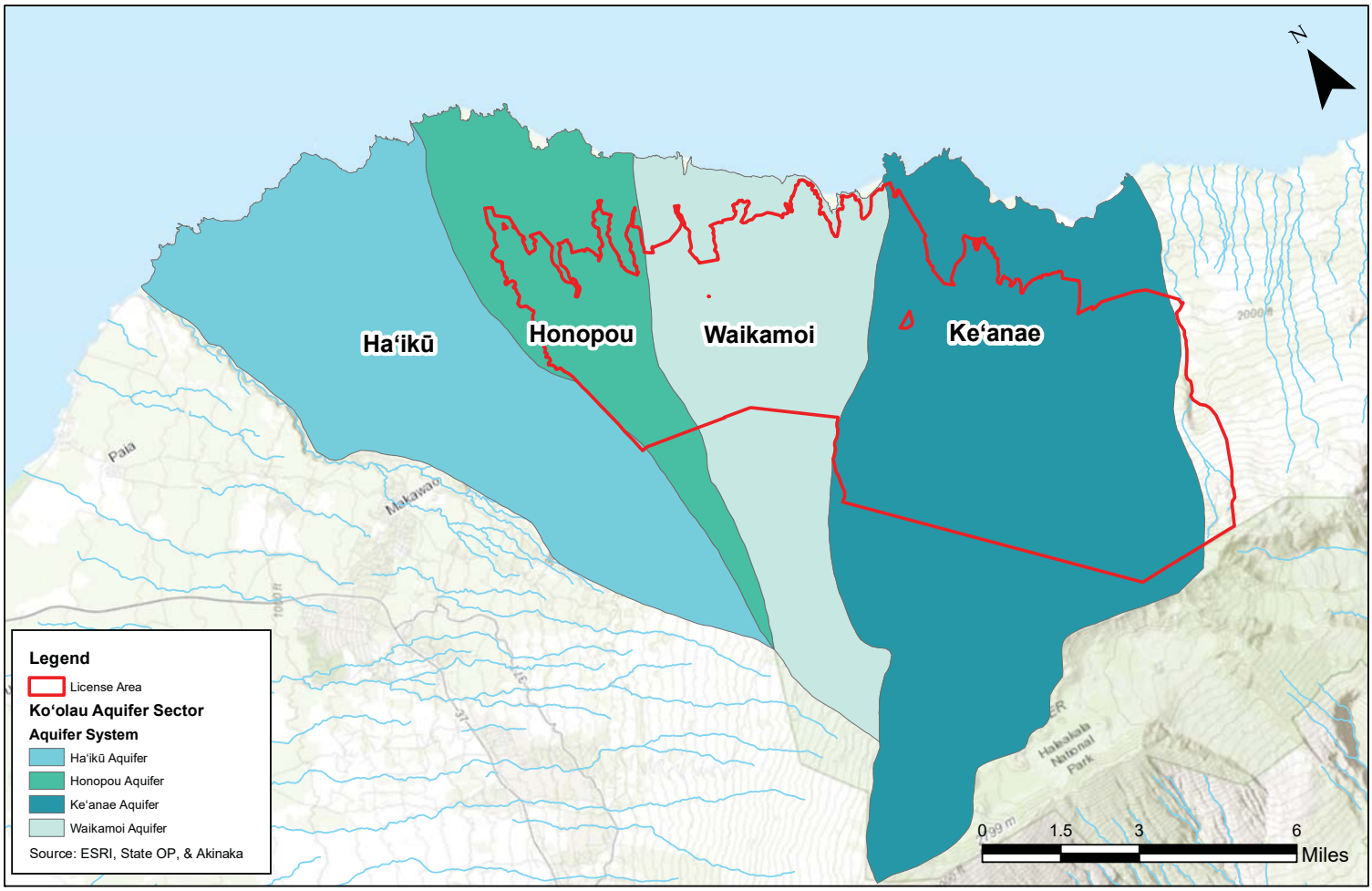


FIGURE 4-17

East Maui Aquifer Sector Map

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KEʻANAE, HONOMANŪ, AND HUELO LICENSE AREAS

Table 4-2 Pumpage in MGD by Well Type for Koʻolau Aquifer System Areas

Aquifer	Domestic	Industrial	Agriculture	Irrigation	Municipal county	Municipal private public	Municipal total	Total
Haʻikū	0.007	0	0.0139	0.0017	0.811	0.005	0.816	0.839
e	0.0007	0	0	0		0.0097	0.0097	0.0104
Waikamoi	0	0	0	0	0	0	0	0
Keʻanae	0	0	0	0	0.066	0	0.066	0.066
Koʻolau Total	**0.0078**	**0**	**0.0139**	**0.0017**	**0.877**	**0.0149**	**0.982**	**0.916**
% of Total	**0.85%**	**0%**	**1.52%**	**0.19%**	**95.81%**	**1.63%**	**97.44%**	**100%**

Source: Draft Maui Island Water Use & Development Plan, March 2019

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on groundwater in the region are anticipated. Groundwater levels are expected to be greater than historic levels due to increased recharge from stream restoration actions under the CWRM D&O.

Upcountry Maui

Upcountry Maui groundwater recharge replenishes aquifers and is fed mainly by precipitation and irrigation that infiltrates the ground surface and percolates beyond the root zone in the soil. Recharge is greatest in the inland mountainous regions.

Upcountry Maui is within the MDWS's Central Maui Aquifer Sector[2] which includes four aquifer systems: Pāʻia, Kahului, Kamaʻole, and Makawao aquifers (See Figure 4-18). Below are tables 4-3 and 4-4 that summarize each aquifer's SY and amount of groundwater pumped per category.

Table 4-3 Sustainable Yields for Central Aquifer System Areas

Aquifer system	Aquifer code	Sustainable yield range (mgd)	Sustainable yield (mgd)
Kahului	60301	1	1
Pāʻia	60302	7-8	7
Makawao	60303	7-20	7
Kamaʻole	60304	11-16	11
Total			**26**

Source: Draft Maui Island Water Use & Development Plan, March 2019

[2] Note that this aquifer sector is also the source for the irrigation wells serving the agricultural lands in Central Maui.

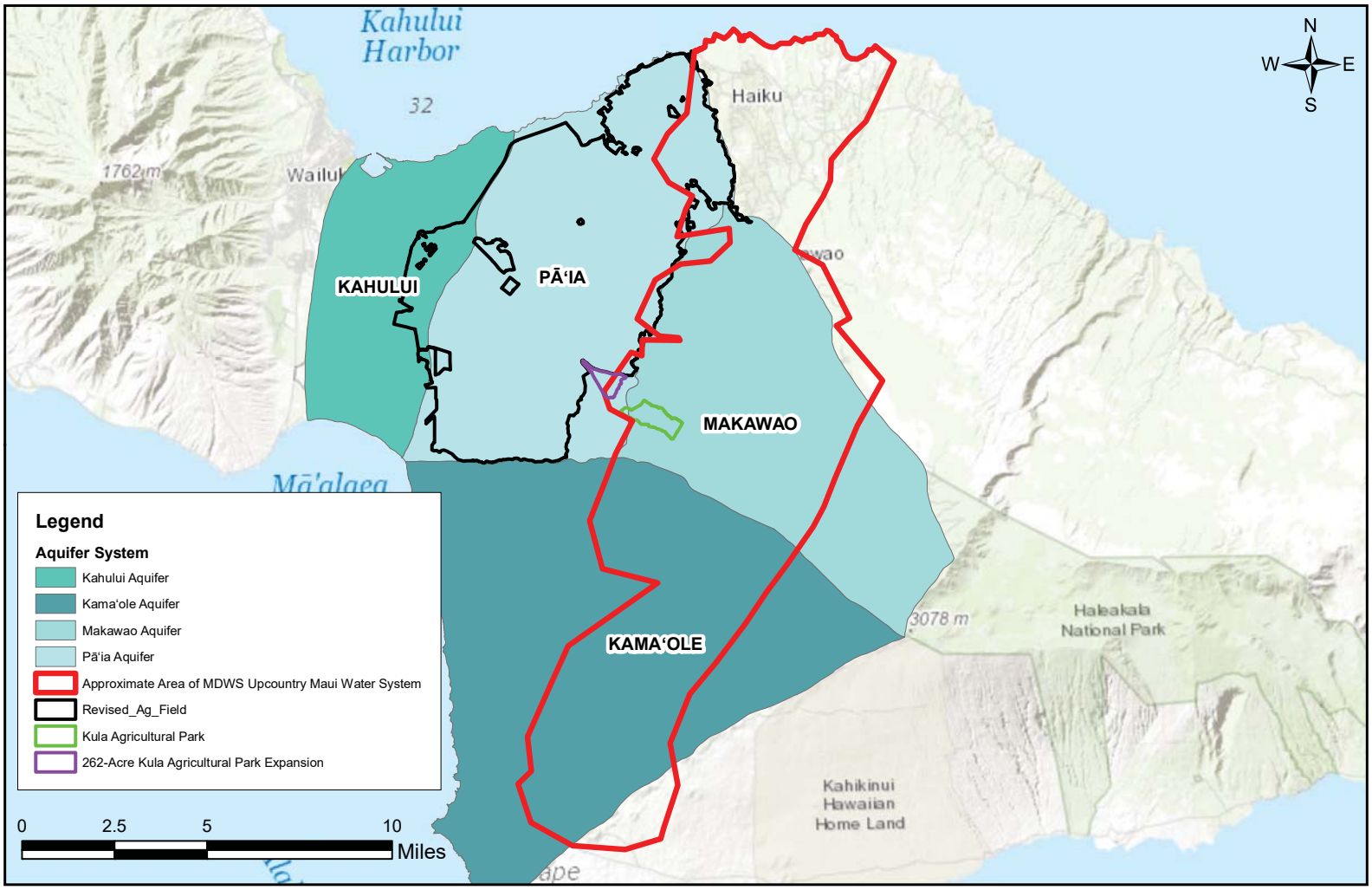


FIGURE 4-18

Central Maui Aquifer Sector Map

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS

Table 4-4 Pumpage in MGD by Well Type for Central Aquifer System Areas

Aquifer	Domestic	Industrial	Agriculture	Irrigation	Municipal	Military	Total
Kahului	0	0.208	28.222	0.476	1.093	0	29.999
Pāʻia	0	0	29.097	0.161	0.248	0	29.506
e	0	0	0	0.220	0.139	0	0.366
Kamaʻole	0	0	0	2.826	0.027	0	2.853
Central Total Pumpage	**0**	**0.208**	**57.319**	**3.683**	**1.507**	**0**	**62.724**
% of Total Pumpage	**0%**	**0.33%**	**91.39%**	**5.87%**	**2.40%**	**0%**	**100%**

Source: Draft Maui Island Water Use & Development Plan, March 2019

10-20 percent of water delivered through the Upcountry Maui Water System comes from a series of basal aquifer wells: the Haʻikū Well, Poʻokela Well, and the two Kaupakalua wells. The rest comes from surfaced water sources. These four wells account for a total of 4.9 mgd of water delivered. In times of emergency, the Upcountry Maui Water System can draw up to 1.5 mgd from the Hāmākua Poko Wells (CWRM D&O, FOF 809). However, there is concern over this water due to the presence of pesticides from former pineapple production.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL.

In the Proposed Action, the amount of water that can be conveyed by the EMI Aqueduct System will be limited to the amount available after the CWRM D&O is implemented, The CWRM D&O requires full restoration of ten streams, allows diversion in five streams only after flows exceed 64% of median flow and requires connective flows for seven streams. These instream flow requirements will limit the amount of water that can be diverted, particularly when streams in the License Area are naturally running low during seasonally dry weather conditions. Hence, the amount of water that can be diverted during dry weather conditions would be substantially less than when sugar was being cultivated. As a result, dependence on groundwater resources to supply Upcountry Maui during such conditions may increase and/or water conservation measures may be required. Future climate change could also exacerbate the frequency and length of periods of low rainfall. However, the Proposed Action contemplates a continued supply of surface water to the MDWS to supply Upcountry Maui and therefore no significant effect to Upcountry Maui groundwater resources is expected, and the impacts of the Proposed Action may be beneficial as the Proposed Action will limit the MDWS's need to call upon existing groundwater resources to provide water to Upcountry Maui.

Central Maui

Fresh groundwater in Central Maui occurs mainly in freshwater-lens systems and dike-impounded systems. A freshwater-lens system includes a lens-shaped freshwater body, an intermediate transition zone of brackish water, and underlying saltwater. The thickness of the transition zone depends on the extent of mixing between freshwater and saltwater. Within the study area, freshwater-lens systems are found in dike-free, high-permeability volcanic rocks and sedimentary deposits. A thick wedge of sedimentary deposits that forms a confining unit (caprock) over the high-permeability volcanic rocks near parts of the northeast coast of West Maui Mountain impedes the discharge of water from the freshwater-lens system. Where the coastal confining unit exists, water levels in the freshwater-lens system have exceeded 25 feet above sea level. Water levels in the freshwater-lens system in areas of West Maui that lack a coastal confining unit generally are lower than 5 feet above sea level, and those in the freshwater-lens system in the isthmus also are generally lower than 5 feet above sea level. The salinity of groundwater in the isthmus is determined primarily by irrigation and withdrawals for agricultural uses (USGS, 2007).

Dike-impounded groundwater systems occur near the caldera and rift zones of the volcanoes, where low-permeability dikes have intruded other rocks. Near-vertical dikes generally compartmentalize areas of more permeable volcanic rocks. Dikes impound water to thousands of feet above sea level in the interior of West Maui Mountain (USGS, 2007).

The agricultural fields within Central Maui are also is within the MDWS's Central Maui Aquifer Sector which includes four aquifer systems: Pāʻia, Kahului, Kamaʻole, and Makawao aquifers (See Figure 4-18). The Central Maui agricultural fields overlie the Pāʻia and Kahului aquifers. Table 4-3 above displays the SY for these four aquifer systems.

SY does not account for water transfers, including surface water conveyed to the Central Maui Aquifer Sector from the Koʻolau Aquifer Sector by the EMI Aqueduct System. Such imported water for irrigation flowing past the root zone of crops enters the aquifer from which it can be pumped and reused. According to the Draft Maui Island Water Use and Development Plan (March 2019), the "impact on 'available' groundwater that can be extracted from the Kahului and Pāʻia aquifers from irrigation return flow is highly uncertain since the cessation of sugarcane cultivation in 2016" (p. 18). The plan further notes that there are no monitoring wells in the Central Aquifer Sector to gage water level changes over time. Nevertheless a simulated scenario in a 2008 USGS study suggests that the complete removal of irrigation return recharge would decrease water levels and increase salinity in the Central Maui Aquifer Sector (Akinaka, 2019).

During sugarcane operation, HC&S pumped approximately 42.50 mgd of brackish groundwater to supplement surface water irrigation (Plasch, 2019). This is considerably more than the combined SY of 8 mgd the Pāʻia and for Kahului aquifers. More of the brackish water was used on the lower agricultural fields due to the cost of pumping groundwater to the higher-elevation agricultural fields.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action

continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL.

It is estimated that at full operation of diversified agriculture, approximately 85.22 mgd of water will be directed to the fields of Central Maui from near the MDWS's Kamole-Weir WTP. Of this amount, approximately 22.7% or approximately 19.34 mgd, is estimated to be lost through evaporation and seepage in unlined ditches and reservoirs located in the Central Maui agricultural fields. Some portion of this seepage would enter the Pāʻia and Kahului aquifers. The remaining 65.87 mgd would be used for irrigation and a portion of this amount would seep past the root zone and also enter the aquifers. It is estimated that 21.31 mgd of groundwater could be pumped out of the aquifers to supplement the surface water supply and that 22.7% of that amount, or 4.84 mgd, would also be lost to evaporation and seepage back into the aquifers. Additionally, a portion of the amount used for irrigation would also seep past the root zone and back into the aquifer.

Because so little is known about the relationship between system losses and irrigation return water and how much could be reused as groundwater, a definite statement about impacts on groundwater cannot be made. However, the use of East Maui surface water to irrigate the Central Maui fields has long supplemented the underlying aquifers, and a similar relationship will continue under the Proposed Action, essentially constituting a beneficial impact to the Central Maui aquifers, albeit at a smaller scale than when sugarcane was being cultivated.

4.2.3 Coastal Waters

East Maui

A stream and ocean water chemistry assessment was conducted by Sea Engineering, Inc. (SE) and Marine Research Consultants, Inc. (MRC) in 2018 (See Appendix B). Six representative streams systems along the coast of East Maui were investigated during different seasonal conditions, some presently having no diversion of water while others presently have diversion occurring. The study showed that streams on the coast of East Maui have a wide range of geographical/morphological characteristics. Flow in the streams is highly variable and dynamic, with much of the variability resulting from factors in the upland watershed, as well as diversion of stream water. The study concluded that the effects of stream water on marine waters is minor in these habitats, which is supported by the physical processes associated with relatively small input of stream water to the vastly larger ocean environment. The prevailing condition of extreme mixing by physical forces is the most important factor in diminishing the zone of influence of stream water in the marine setting.

Surface waters from the License Area discharge into coastal waters north of the License Area. The State DOH classifies these coastal waters as Class AA (See Figure 4-19). The stated objective of Class AA waters is, "that these waters remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-caused source or actions." (Water Quality Standards, Title 11, Chapter 54, HAR).

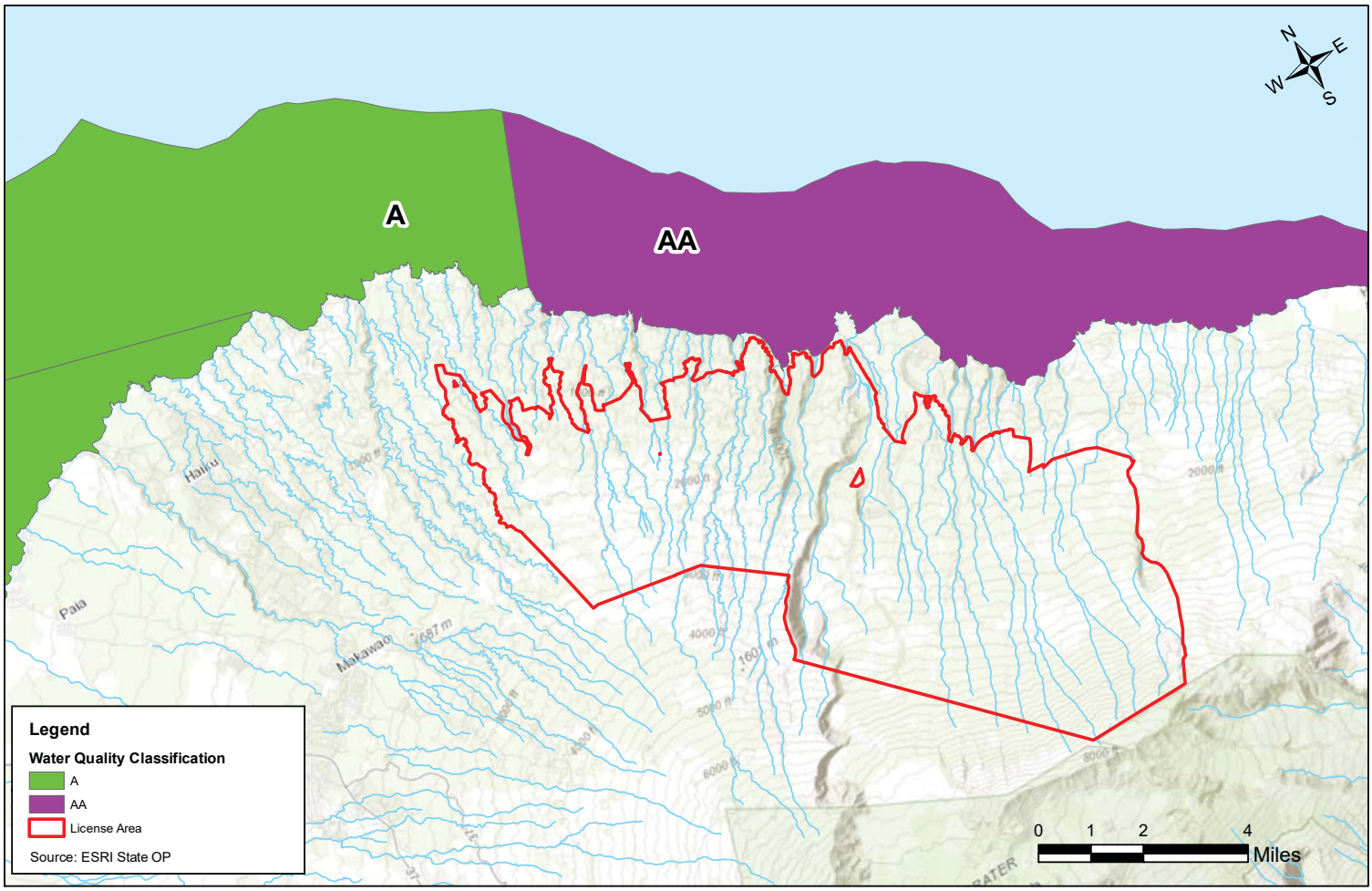


FIGURE 4-19

EAST MAUI WATER QUALITY CLASSIFICATION MAP

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS

However, due to continual, intense, wave energy, nearshore areas in East Maui do not constitute important habitats for coral reef communities and associated marine species (SE & MRC, 2019).

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on coastal water in the region are anticipated. The resulting stream flow into the ocean under the Proposed Action is predicted to be greater than historic flows in the decades prior to the CWRM D&O. However, the amount of stream flow from the License Area into the marine environment, beyond the narrow transition zone, has a minimal influence owing to the naturally occurring rapid and intense mixing. These processes should not be affected by changes in stream flow under the Proposed Action.

Upcountry Maui

The area known as Upcountry Maui is roughly located between the 1,000 to 4,000-foot elevation and is bounded on the west by the agricultural fields in Central Maui and extends out to Kēōkea in the South. There are no coastal waters located within the Upcountry Maui area, however, the service area for the MDWS Upcountry Maui Water System extends to the coast at the community of Haʻikū.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on coastal waters are anticipated as a result of the continued water service to Upcountry Maui.

Central Maui

Portions of the agricultural fields are near, but not abutting, some of Maui's coastal waters. This includes areas in the proximity of Maliko Bay, Hoʻokipa Beach Park, Pāʻia Bay, and Maʻalaea Bay.

The State DOH classified these coastal waters as Class A (See Figure 4-20). The stated objective of Class A waters is, "their use for recreational purposes and aesthetic enjoyment be protected. Any other use shall be permitted as long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters." (Water Quality Standards, Title 11, Chapter 54, HAR).

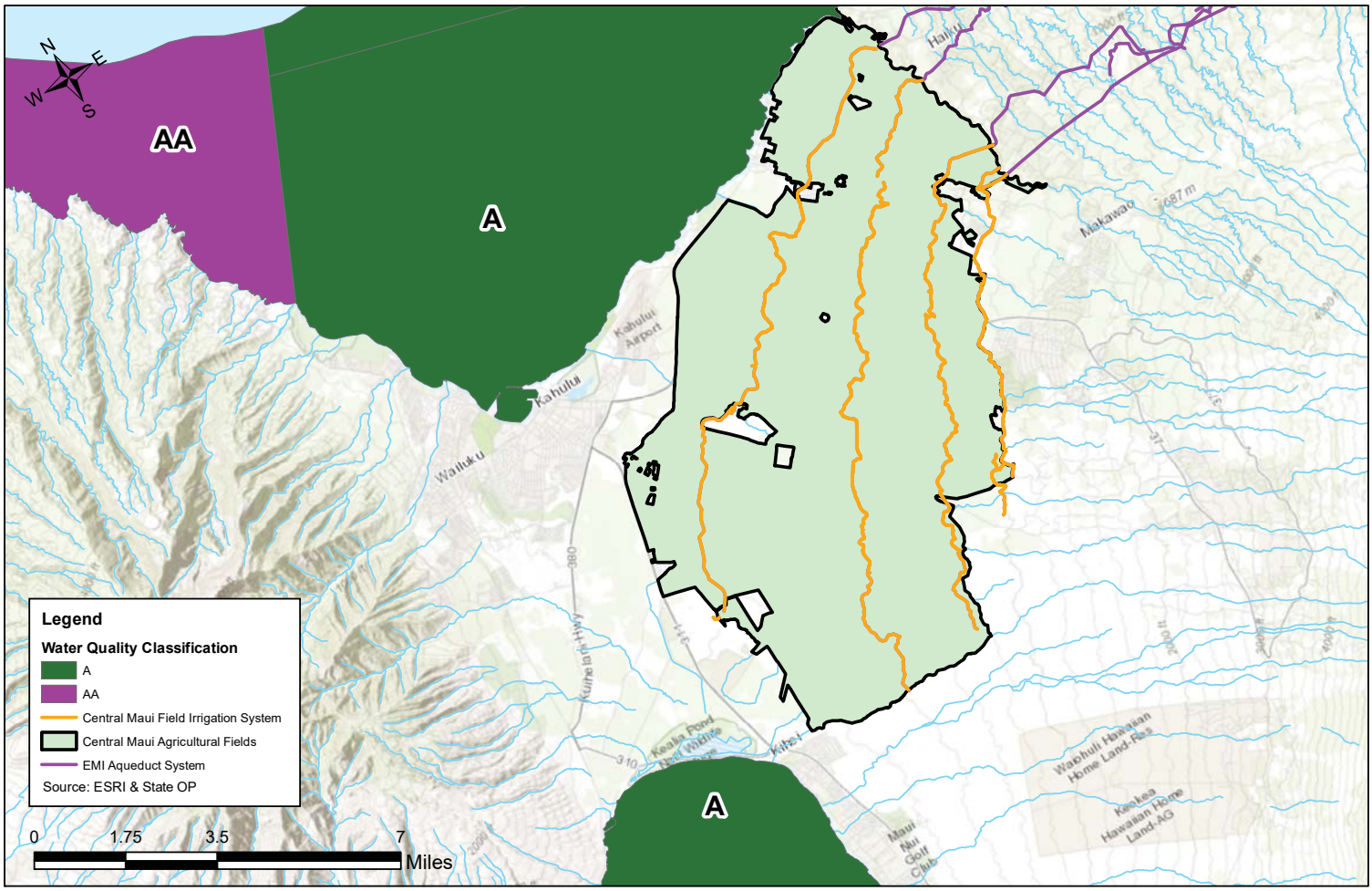


FIGURE 4-20

CENTRAL MAUI WATER QUALITY CLASSIFICATION MAP

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century, including the use of water through the EMI Aqueduct System to supply irrigation water to the Central Maui agricultural fields. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on coastal waters in the region are anticipated as the Proposed Action will reduce wind-blown erosion that could occur if the Central Maui fields were not in cultivation, and which could damage nearshore environments.

Moreover, Mahi Pono will apply BMP to manage runoff from the agricultural fields that are near coastal waters. Any discharges related to the operation activities within the Central Maui agricultural fields will comply with applicable State Water Quality Standards as specified in HAR, Chapter 11-54 and 11-55 Water Pollution Control, DOH.

4.2.4 Drainage

East Maui

Rainfall in East Maui percolates into the ground and surface flows through naturally formed drainage ways. Surface flows and, in some areas, resurfacing groundwater, feed into streams and eventually discharge into the Pacific Ocean. For more than a century, however the EMI Aqueduct System has diverted flows from East Maui streams for off-stream uses through EMI Aqueduct System. The system has been used to collect and transport water to meet consumptive needs and enable economic opportunities. The EMI Aqueduct System 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. Water diverted from the streams reduces flows downstream. Hāna Highway and other improved roadways that are downstream of the EMI Aqueduct System, include bridges and culverts as well as gutters and inverts to accommodate drainage to prevent or minimize ponding or flooding of the roadways.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on drainage in the East Maui region are anticipated. Since the closure of sugar cultivation, the amount of water diverted has been reduced, increasing base flow in diverted streams. While implementation of the Proposed Action will reduce overall streamflow in License Area streams, flow will be greater than when sugar was being cultivated. Surface water hydrology in East Maui is discussed in Section 4.2.1. Drainage facilities, however, are impacted when storm runoff reach extremely high levels. The Proposed Action and the other alternatives will have no discernible impact on such storm flows and their impact on drainage facilities.

Upcountry Maui

Rainfall in Upcountry Maui percolates into the ground so there are no perennial streams. During extremely wet weather conditions, storm runoff will surface flow through naturally formed drainage ways, including Kailua Gulch, Waikapu Stream, Kulanihakoi Gulch, and Waipuilani Gulch as intermittent streams. Improved roadways include drainage features to minimize ponding on road surfaces.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on drainage in the Upcountry Maui region are anticipated.

Central Maui

The Central Maui agricultural fields are designed and operated to efficiently utilize irrigation water from the EMI Aqueduct System so there is no surface runoff. Drainage facilities along improved roadways capture rainfall runoff.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant changes to existing drainage patterns or systems within Central Maui are anticipated. Irrigation water would be applied at rates that will not cause surface runoff. Severe rainfall can result in localized runoff or ponding but would be unrelated to the amount of irrigation water made available through the EMI Aqueduct System.

4.3 Natural Hazards

The Disaster Mitigation Act of 2000 (DMA 2000), 44 Code of Federal Regulations , Hazard Mitigation Planning, required states and counties to have approved hazard mitigation plans by November 1, 2004 to receive Pre-Disaster Mitigation funding. The development of State and local hazard mitigation plans is critical for maintaining eligibility for future Federal Emergency Management Agency (FEMA) mitigation and disaster recovery funding.

Given Hawai'i's vulnerability to natural hazards and history of disasters, the State has maintained and implemented a comprehensive, multi-hazard mitigation strategy to reduce loss of life and property damage. This strategy is embodied in the *State of Hawai'i Multi-Hazard Mitigation Plan, 2010 Update*. First adopted by Executive Order in 2004, the 2010 State of

Hawai'i Multi-Hazard Mitigation Plan meets a mandatory three-year review and update of State, county and industry capabilities and plans to address natural and man-made hazards.

The County of Maui's Multi-Hazard Mitigation Plan was formally approved in 2005, and updated in 2010 and 2015. The *2015 Multi-Hazard Mitigation Plan* provides an update to all sections of the County's mitigation plan, including hazard identification, asset identification, risk and vulnerability assessments, current mitigation activities and capabilities, mitigation strategy, and plan maintenance to meet requirements set forth by the DMA 2000.

Information from the respective State and County Multi-Hazard Mitigation Plans are included in this section as relevant to the impacted regions of the Proposed Action.

4.3.1 Climate and Climate Change

The topography of the island of Maui and the location of the north Pacific anticyclone relative to Maui affects its climate which is characterized by mild and uniform temperatures ranging from 64 degrees Fahrenheit (F) to 85 degrees F with a mean relative humidity of 66-69%, seasonal variation in rainfall, and great geographic variation in rainfall. The summer season runs from May through September and is generally warm and dry with predominantly northeast trade winds that blow 80-95% of the time. In contrast, the winter season runs from October through April and is associated with lower temperatures, higher rainfall, and less prevalent trade winds that blow 50-80% of the time.

The variation in mean annual rainfall with altitude is extreme on Maui, with differences of more than 130 inches within one mile of Pu'u Kukui in the West Maui Mountains, where average annual rainfall exceeds 355 inches per year. In contrast, mean annual rainfall at the coast in the dry leeward areas is less than 15 inches. At higher altitudes, precipitation is a combination of rainfall and fog drip where the montane forest canopy intercepts cloud water.

Regular trade winds are key in driving the Hawai'i's hydrological cycle, generating rainfall which helps maintain Maui's water supply. However, a recent study showed that Hawai'i's trade winds have decreased in frequency by approximately 30% over the past 37 years, from 291 days per year in 1973, to 210 days per year in 2009 (Garza et. al, 2012). The decrease in the trade winds could have serious implications for the Hawaiian Islands, including adversely impacting local agriculture, native ecosystems and endangered species, and the State's limited freshwater supply.

Overall, the State of Hawai'i is experiencing region-specific impacts that have been attributed to climate change, such as chronic flooding during king tides, severe shoreline erosion, changes in rainfall patterns, severity of storms and coral die off. While there is little consensus about the exact nature, magnitude, and timing of these changes, evidence indicates that there has been a rise in air and sea surface temperatures, a decrease in the prevailing northeasterly trade winds, a decline in average rainfall resulting in a decline in stream base flow, an increase in ocean acidity, and sea level rise (SOEST, 2014).

Research indicates that two centuries of unabated greenhouse gas (GHG) emissions, which includes carbon dioxide, methane, nitrous oxide, and fluorinated gases, from anthropogenic

sources is responsible for increases in global atmospheric temperatures and ocean warming over the past century.

A slight variation of climate patterns are observable throughout Maui. The impacted regions from the Proposed Action are assessed under this DEIS. The following is a description of the climate within the three main geographic areas assessed within this document; East Maui, Upcountry Maui, and Central Maui.

East Maui

The License Area is located along Maui's Koʻolau coastline. Mountains obstruct trade-wind air flow and create wetter climates on north and northeast facing mountain slopes. Persistent trade winds and orographic lifting of moist air result in recurrent clouds and frequent rainfall on windward slopes. When trade winds are present, the vertical development of clouds is restricted by the trade-wind inversion layer. The altitude of the inversion, however, varies over time and space and is affected by thermal circulation patterns, such as land and sea breezes. Most of Maui is usually immersed in the moist air layer below the inversion. On the windward slopes of Haleakalā, which includes the License Area, mean rainfall exceeds 200 inches per year. In the past, this region has experienced as much as 28 inches of rain in 24 hours. Monthly average rainfall is generally evenly distributed, and rainfall levels range from as much as 300 inches in the lands above Nāhiku, to a low of 75 inches found in regions above Keʻanae. On average, USGS data indicates rainfall ranges from 101-454 inches per year, making this region one of the wettest places in the State of Hawaiʻi.

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. Such rainfall patterns increase the amount of stormwater runoff flowing through the region, including through the streams within the License Area that reach the shoreline. The expected climatic changes in precipitation patterns and streamflow will influence the quantities and concentration of stormwater runoff entering the nearshore environments and coastal waters, resulting in increased sedimentation, impacting coral reefs. However, because of the continuous wave energy in shore areas in East Maui, nearshore areas in East Maui do not constitute important habitats for coral reef communities and associated marine species. (SE & MRC, 2019).

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on climate in East Maui are anticipated as a result of the Proposed Action. Moreover, because the EMI Aqueduct System is a gravity fed system it is extremely energy efficient and does not rely on non-renewable sources of energy for its operation.

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 for climatic changes.

Upcountry Maui

Upcountry Maui covers a large range of elevation and area. The average temperature varies at different elevations. As elevation increases, the average temperature decreases. The Leeward side of Upcountry Maui is mostly dry and sunny. The Windward Side of Upcountry Maui tends to be wetter than the Leeward Side. Average annual rainfall ranges from 16-20 inches per year on the Leeward Side to more than 240 inches per year on the Windward Side (Draft Maui Island Water Use and Development Plan, March 2019). The KAP receives an average amount of total rainfall of 15 to 25 inches per year.

Climate change trends may increase the potential for altered habitats and conditions. Warming air temperatures could cause ecosystems to shift upslope and decline in size. Changes in precipitation may affect Upcountry Maui's ecosystems and communities include flooding, erosion, drought, and fire. Changes vary from island to island, and even valley to valley. The overarching trend for the State has been a decrease in total rainfall. A decrease in total rainfall, without a reliable source of water delivery, would increase the demand for water in Upcountry Maui for both domestic and agricultural purposes. The demands of water could be potentially minimized through the implementation of water conservation measures, however, the extent to which such efforts would serve to counter reduced levels of water service is uncertain.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on climate in Upcountry Maui are anticipated.

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.

Central Maui

Central Maui's climate is typical of Leeward coastal lowlands receiving little rainfall annually, and is relatively dry. The northeast areas receive more rain than the central and southern areas of Central Maui. The average annual rainfall ranges from less than 10 inches in the southern part of the isthmus to over 40 inches in the northeastern areas. Central Maui receives considerable amounts of sunshine, with average daily insolation ranging from slightly less than 450 calories per square centimeter per day in mauka areas to over 500 calories near Kahului.

Climate change trends may suggest an increased potential for the agricultural fields in Central Maui to experience longer, more intense, periods of drought. The overarching trend for the State has been a decrease in total rainfall. A decrease in rainfall would result in less water being conveyed to the agricultural fields. The water conveyed to the agricultural fields in Central Maui also plays a major role in the recharge of the Central Maui aquifer. Periods of prolonged and intense drought would further strain the aquifers in Central Maui that depend upon the water conveyed through the EMI Aqueduct System for recharge.

Impacts and Mitigation Measures

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.

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.

4.3.2 Sea Level Rise

The present rate of global mean SLC is +3.4 ± 0.4 mm/year (Sweet, 2017), where a positive number represents a rising sea level. SLC appears to be accelerating compared to the mean of the 20th Century. Factors contributing to the measured rise in sea level include decreasing global ice volume and warming of the ocean. Sea level, however, is highly variable. The mean historical rate of sea level change (RSLC) is +2.21 ± 0.42 mm/yr based on monthly data for the period 1947 to 2017 (SE & MRC, 2019).

In 2017, the National Oceanic and Atmospheric Administration (NOAA) revised its sea level change projections through 2100 (2017 NOAA Report) taking into account up-to-date scientific research and measurements NOAA is projecting that global sea level rise as shown by their "Extreme" scenario could be as high as about 8 feet by 2100. NOAA's recent report also identifies specific regions that are susceptible to a higher than average rise in sea level. Hawai'i has thus far experienced a rate of sea level rise that is less than the global average; however, this is expected to change. Hawai'i is in the "far field" of the effects of melting land ice. This means that those effects have been significantly less in Hawai'i compared to areas closer to the ice melt. Over the next few decades, this effect is predicted to spread to Hawai'i, which will then experience sea level rise greater than the global average.

While the projections are based on the most current scientific models and measurements, discretion is necessary in selecting the appropriate scenario. Selecting the appropriate sea level change projection is a function of many parameters, including topography, coastal setting, criticality of infrastructure, potential for resilience, budget, and function.

An important conclusion of the regional climate assessment is that NOAA's revised *Intermediate* rate is recommended for planning and design purposes in Hawai'i. The *Intermediate* rate projects that sea level in Hawai'i will rise 4.2 feet by 2100. Given the recent upwardly revised projections and the potential for future revisions, consideration may also be given to the *Intermediate-High* rate for planning and design purposes, which projects that sea level in Hawai'i will rise 6.3 feet by 2100.

Sea level rise has the potential to impact beaches and shorelines in Hawai'i. Impacts may include beach narrowing and beach loss, loss of land due to erosion, and infrastructure damage due to inundation and flooding. The impacts from anomalous sea level events (e.g., king tides, mesoscale eddies, storm surge) are also likely to increase. A 2015 study found that, due to increasing sea level rise, average shoreline recession (erosion) in Hawai'i is expected to be nearly twice the historical extrapolation by 2050, and nearly 2.5 times the historical extrapolation by 2100 (Anderson et al., 2015).

The State of Hawaiʻi recently published the *Sea Level Rise Vulnerability and Adaptation Report for Hawaiʻi* (Hawaiʻi Vulnerability Report), which discusses the anticipated impacts of projected future sea level rise on coastal hazards, and the potential physical, economic, social, environmental, and cultural impacts of sea level rise in Hawaiʻi (Hawaiʻi Climate Change Mitigation and Adaptation Commission, 2017). The University of Hawaiʻi conducted numerical modeling to estimate the potential impacts from sea level rises of 0.5 feet, 1.1 feet, 2.0 feet, and 3.2 feet on coastal hazards including passive flooding, annual high wave flooding, and coastal erosion. These sea level elevations were identified using the predictions associated with the United Nations Intergovernmental Panel on Climate Change's 2014 reports for time marks at 2030, 2050, 2075, and 2100, respectively. These same elevations are correlated to the more recent and comprehensive scientific predictions made in the 2017 NOAA report, using the *Intermediate* rate, for time marks at 2025, 2043, 2064, and 2085, respectively. In summary, the 2017 NOAA Report provides state-of-the-science predictions for rates of sea-level rise, while the Hawaiʻi Vulnerability Report estimates projected coastal impacts at key sea level elevations in Hawaiʻi.

The projected increase in sea level rise has the potential to increase risk of storm surge-related flooding along the coast, expand areas at risk of coastal flooding, increase vulnerability of energy facilities located in coastal areas, flood transportation and telecommunication facilities, and cause saltwater intrusion into some freshwater supplies near the coast. Sea level rise will lead to more frequent and extensive coastal flooding.

East Maui

SE & MRC (2019) used the Pacific Islands Ocean Observing System (PacIOOS) data viewer to present the State sea level rise predictions for passive flooding impacts in East Maui. Presented below (Figure 4-21 through Figure 4-26) are the areas predicted to be passively flooded by a sea level rise of +3.2 ft. This sea level equates to the 2085 *Intermediate* rate sea level prediction by the 2017 NOAA report. Passive flooding assumes there are no changes to the existing surface of the land and sea floor, and elevated water levels are projected across existing elevations. The blue areas indicate existing dry land that would become submerged under +3.2 ft of sea level rise.

Additional impacts to the East Maui area from sea level rise include increased inundation from wave flooding and typically increased rates of coastal erosion, as discussed above. The State sea level rise vulnerability report did not assess impacts to the License Area related to wave inundation or coastal erosion. However, several results can be predicted for the region around the License Area based on existing conditions and empirical littoral response to progressively elevated water levels.

Typically, dynamic sediment coastlines, such as the cobble beaches and deltas at the East Maui stream mouths, respond to changes in water level, sediment supply, and wave energy in short time periods. Erosion or accretion along the shoreline becomes a function of the balance between these three primary factors. Rising seas, if all other factors are

Figure 4-21. PacIOOS +3.2 ft sea level rise passive flooding projection Oopuola Stream

Sea Engineering, Inc. & Marine Research Consultants, Inc provided map that depicts sea level rise within portions of East Maui.

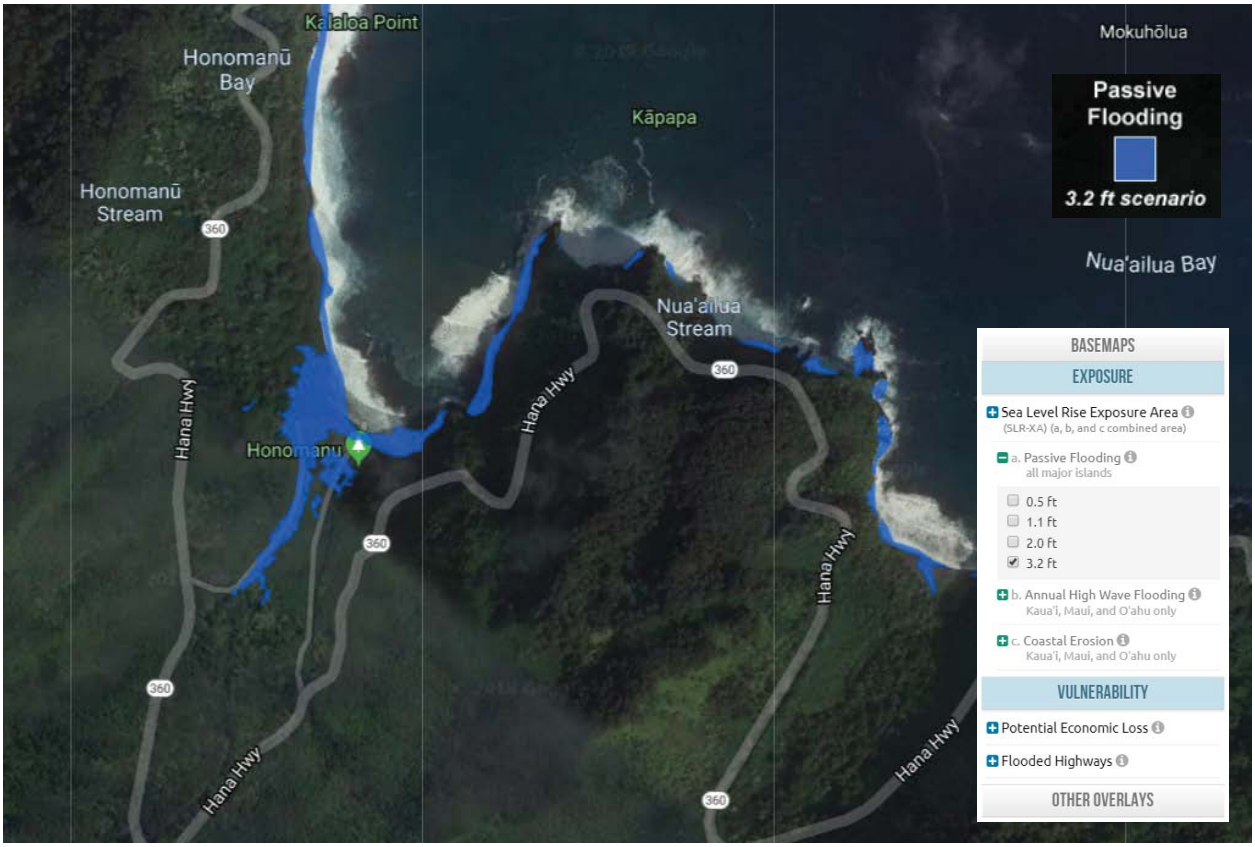


Figure 4-22. PacIOOS +3.2 ft sea level rise passive flooding projection Honomanu Stream

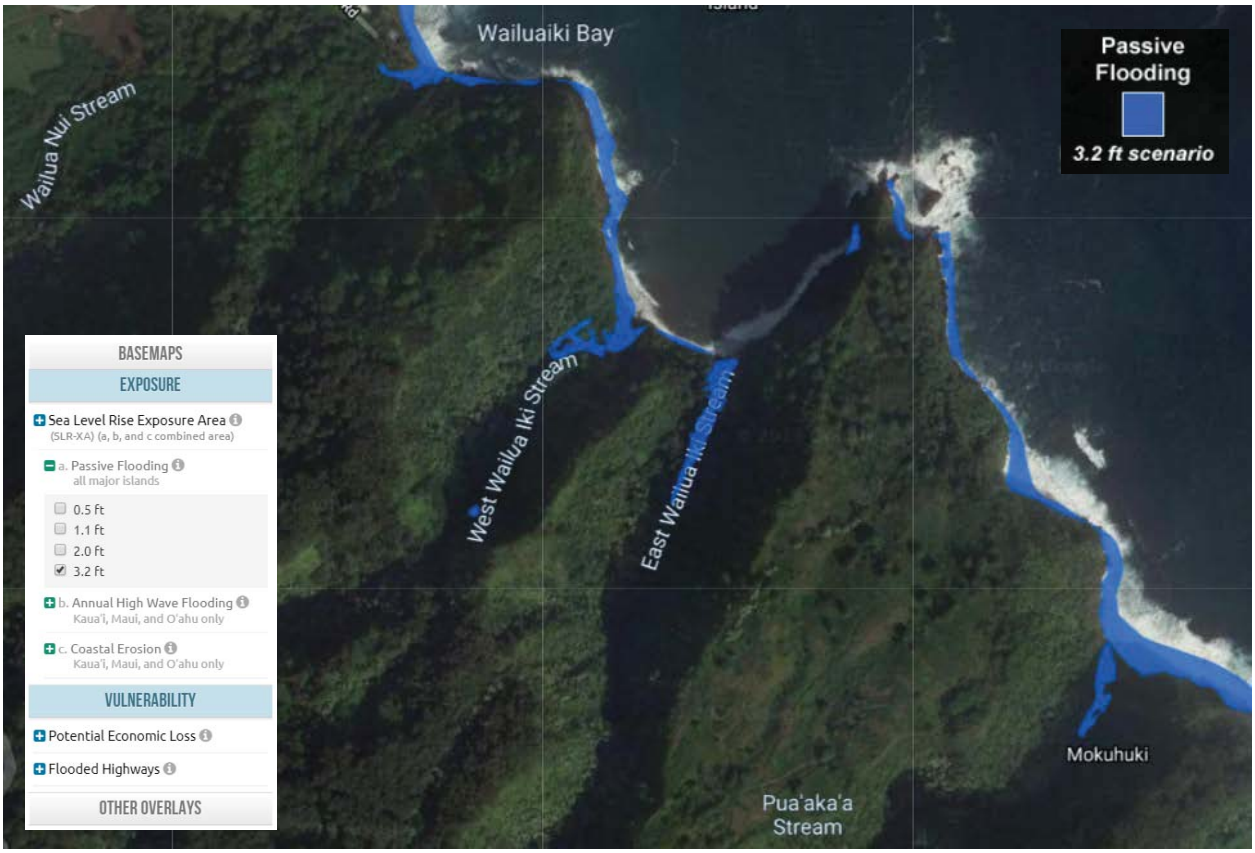


Figure 4-23. PacIOOS +3.2 ft sea level rise passive flooding projection East and West Wailua Iki streams

Sea Engineering, Inc. & Marine Research Consultants, Inc provided map that depicts sea level rise within portions of East Maui.

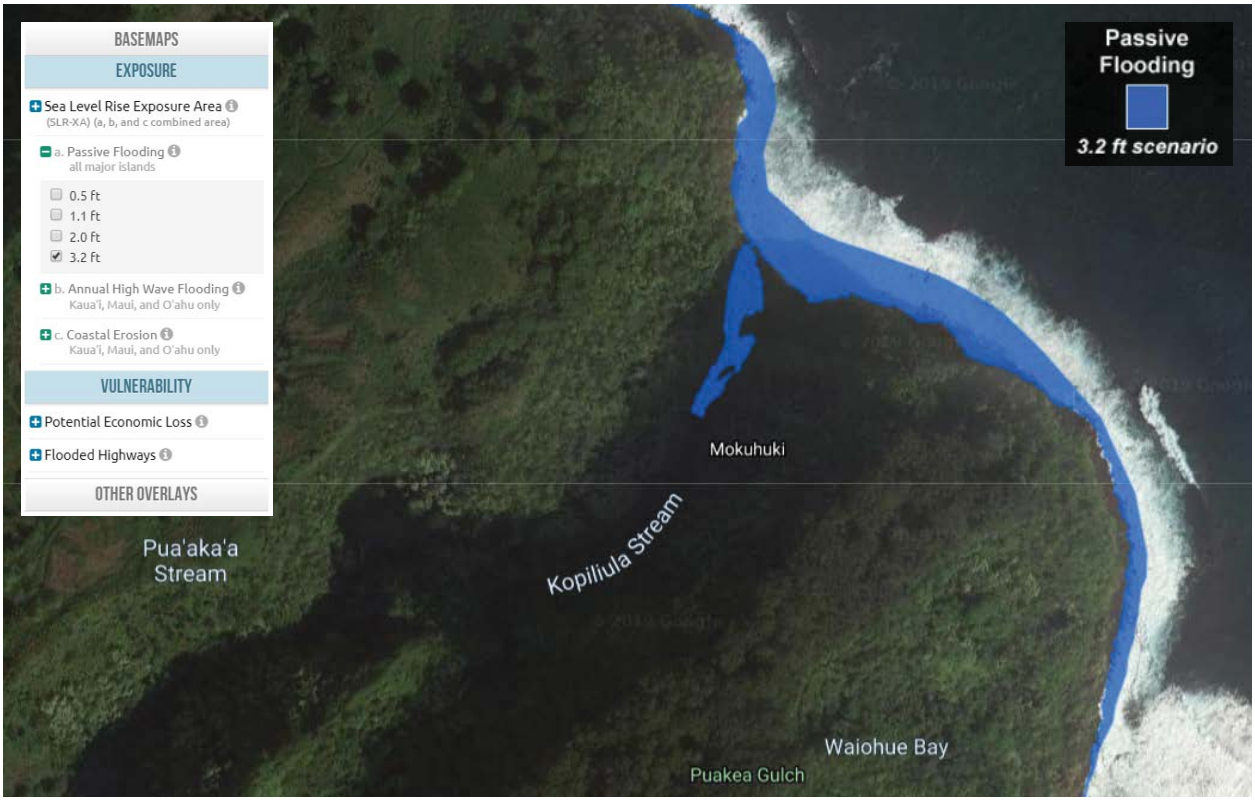


Figure 4-24. PacIOOS +3.2 ft sea level rise passive flooding projection Kopiliula Stream

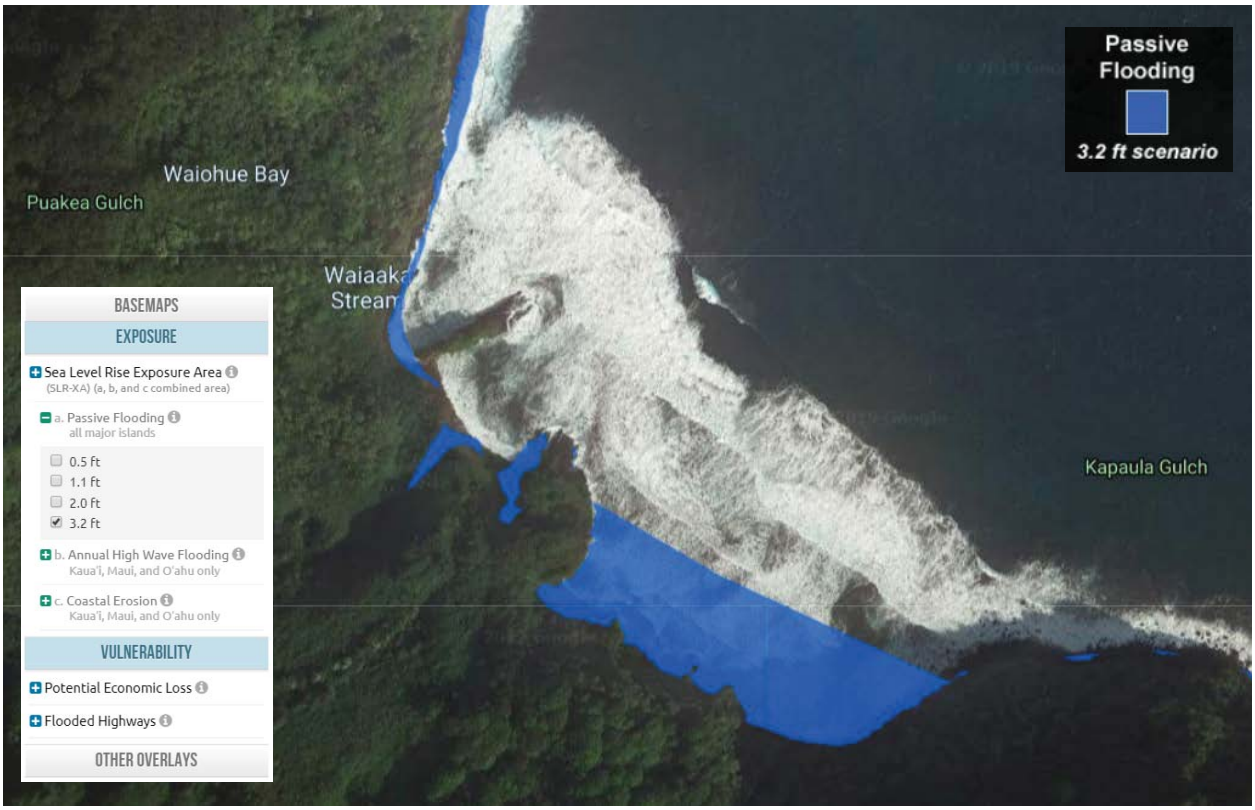


Figure 4-25. PacIOOS +3.2 ft sea level rise passive flooding projection Waiaaka Stream

Sea Engineering, Inc. & Marine Research Consultants, Inc provided map that depicts sea level rise within portions of East Maui.

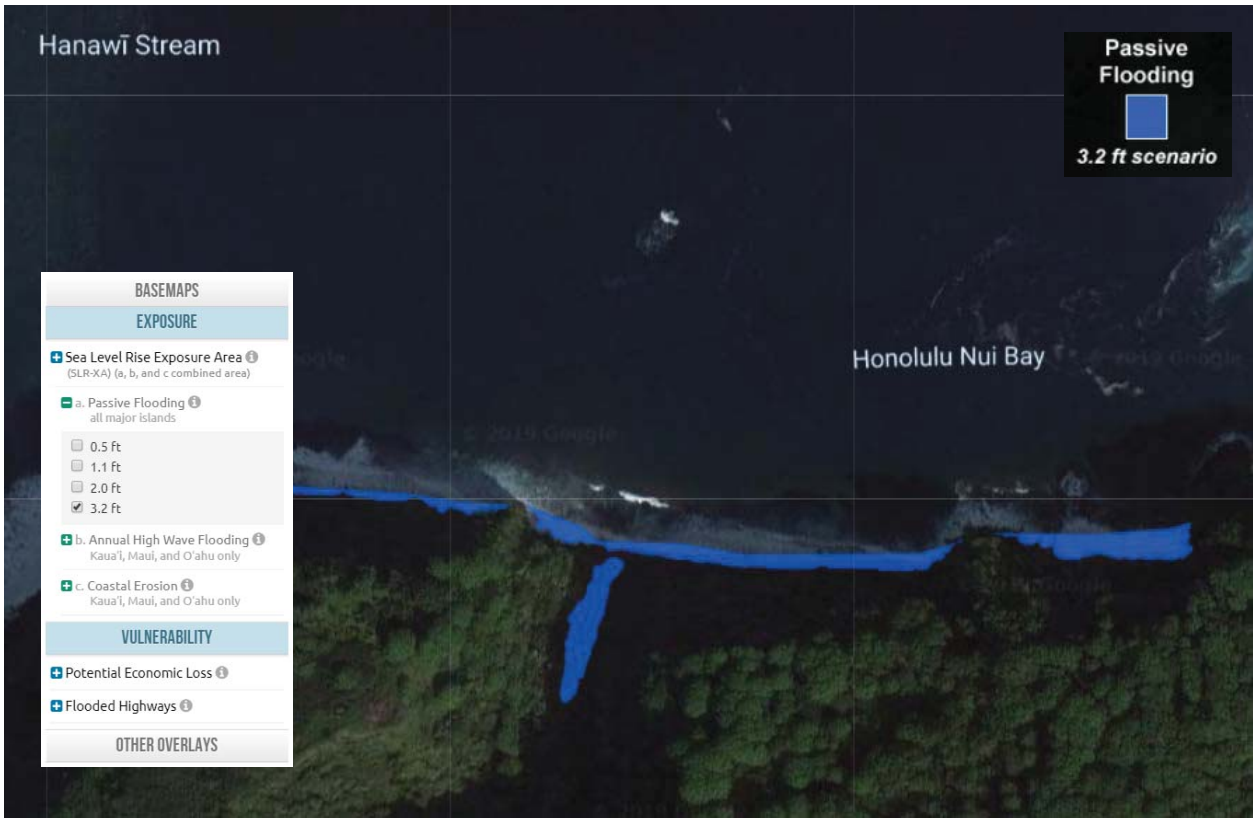


Figure 4-26. PacIOOS +3.2 ft sea level rise passive flooding projection Hanawi Stream

Sea Engineering, Inc. & Marine Research Consultants, Inc provided map that depicts sea level rise within portions of East Maui.

static, will typically result in the coastal landform rising up and moving landward, as the makai portions of the active profile are eroded to provide the volume required to elevate the entire landform. Storm and seasonally high waves provide the energy required to reshape the landform, carrying sediment higher on the profile.

Rising seas will likely result in the deltaic beaches, bars, and storm berms at the East Maui streams to rise in elevation, while also migrating landward. Storm and seasonal waves, which are typically depth limited by their interaction with the seafloor near the stream mouths, will also likely increase in size and possibly frequency as sea level rises and climate changes. Storm and seasonal wave inundation will migrate inland with the dynamic landforms. The predicted increase in frequency of heavier rain events and flooding may counter the landward migration of these features to some degree, as additional sediment is provided to the deltaic features during flood events. The net change to the License Area stream mouths, beaches, bars, and storm berms, resulting from the estimated +3.2 ft of sea level rise is expected to be a landward regression of the landforms combined with an increase in elevation (SE & MRC, 2019).

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts from sea level rise in East Maui are anticipated as a result of the Proposed Action.

Upcountry Maui

Upcountry Maui is roughly located between the 1,000 to 4,000 foot elevation and is bounded in the west by the agricultural fields in Central Maui and extends out to Kēōkea in the South. There are no coastal waters located within the Upcountry Maui area. The service area for the MDWS Upcountry Maui Water System, however, extends to the coast at the community of Haʻikū. But, the system itself does not extend to the shoreline so it will not be directly impacted by sea level rise.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant sea level rise impacts in Upcountry Maui are anticipated.

Central Maui

The PacIOOS viewer shows areas predicted to be passively flooded by a sea level rise of +3.2 ft (See Figure 4-27). This sea level equates to the 2085 *Intermediate* rate sea level prediction by the 2017 NOAA report. Passive flooding assumes there are no changes to the existing surface of the land and sea floor, and elevated water levels are projected across existing elevations. The blue areas indicate existing dry land that would become submerged under +3.2 ft of sea level rise. The agricultural fields in Central Maui appear to not be impacted by sea level rise.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts from sea level rise in Central Maui are anticipated.

4.3.3 Flood and Tsunami Hazard

Floods are caused by heavy rainfall associated with tropical rain storms. In Hawaiʻi, streams originate in steep mountains and flow relatively quickly to the ocean, often triggering flash floods in coastal areas. Coastal plains and stream flood plains in the vicinity of the License Area are susceptible to flooding, which can be exacerbated where development impedes or prevents infiltration of the water into the ground.

Tsunami are a series of very long waves triggered by a water-displacing disturbance of the seafloor, either resulting from an earthquake, volcanic eruption, or underwater landslide. These waves travel rapidly and can cause significant damage to coastal areas. Tsunami have such enormous energy that waves can reach far inland with great force.

East Maui

According to the FEMA Flood Insurance Rate Maps (FIRM), the License Area is predominantly designated as Zone “X”, “Areas determined to be outside the 0.2% annual chance floodplain.” (See Figure 4-28) A number of adjacent parcels along the makai edge of the License Area lie in areas designated as Zone “A”, “Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies.” However, flooding in East Maui generally caused by freshets.

According the Tsunami Evacuation Zone maps for Maui, the entire License Area is outside of the tsunami evacuation zones (See Figure 4-29). There are area below the Keʻanae and Honomanū portions of the License Area that are within the tsunami evacuation and extreme tsunami evacuation zone.

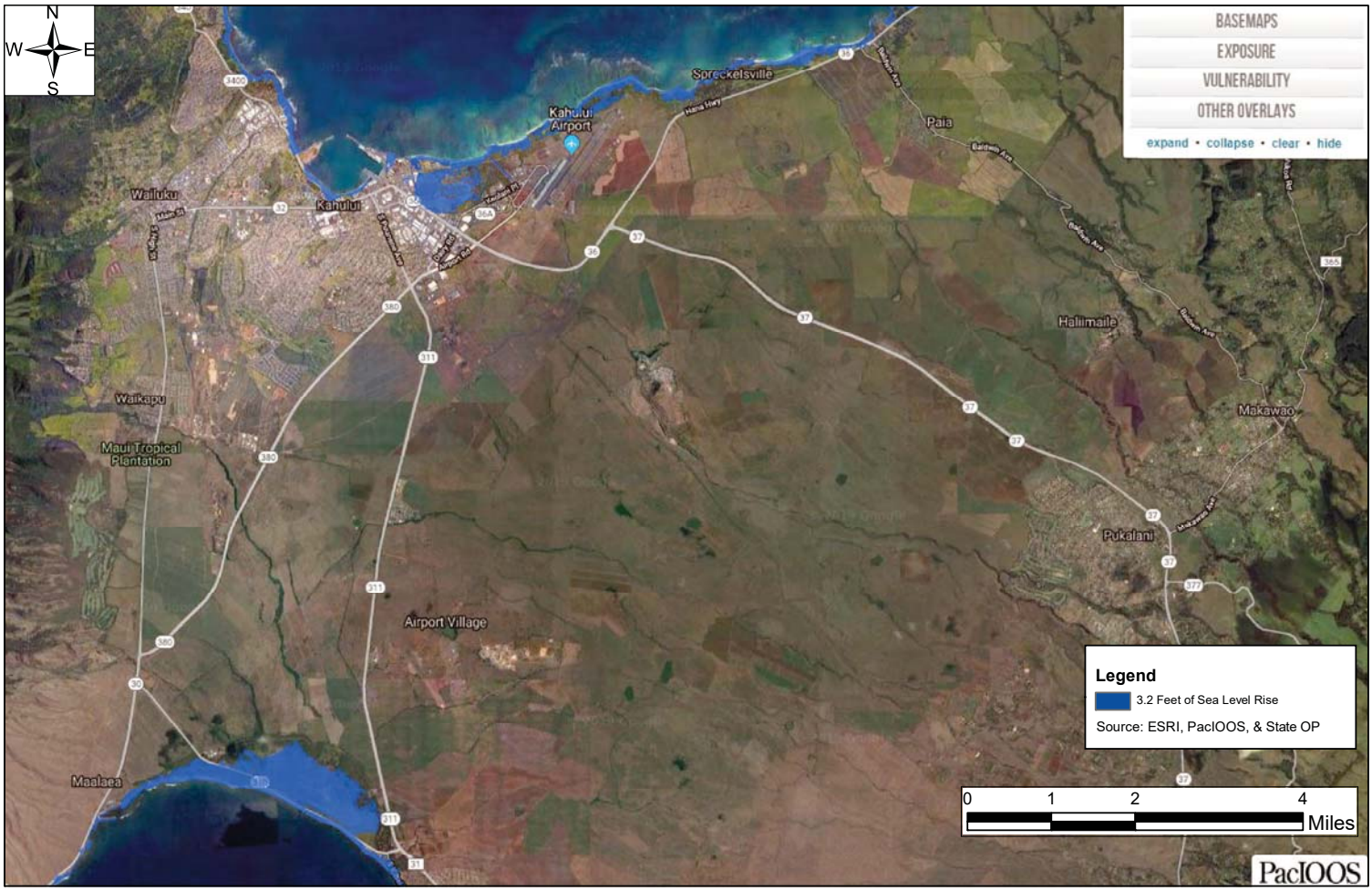
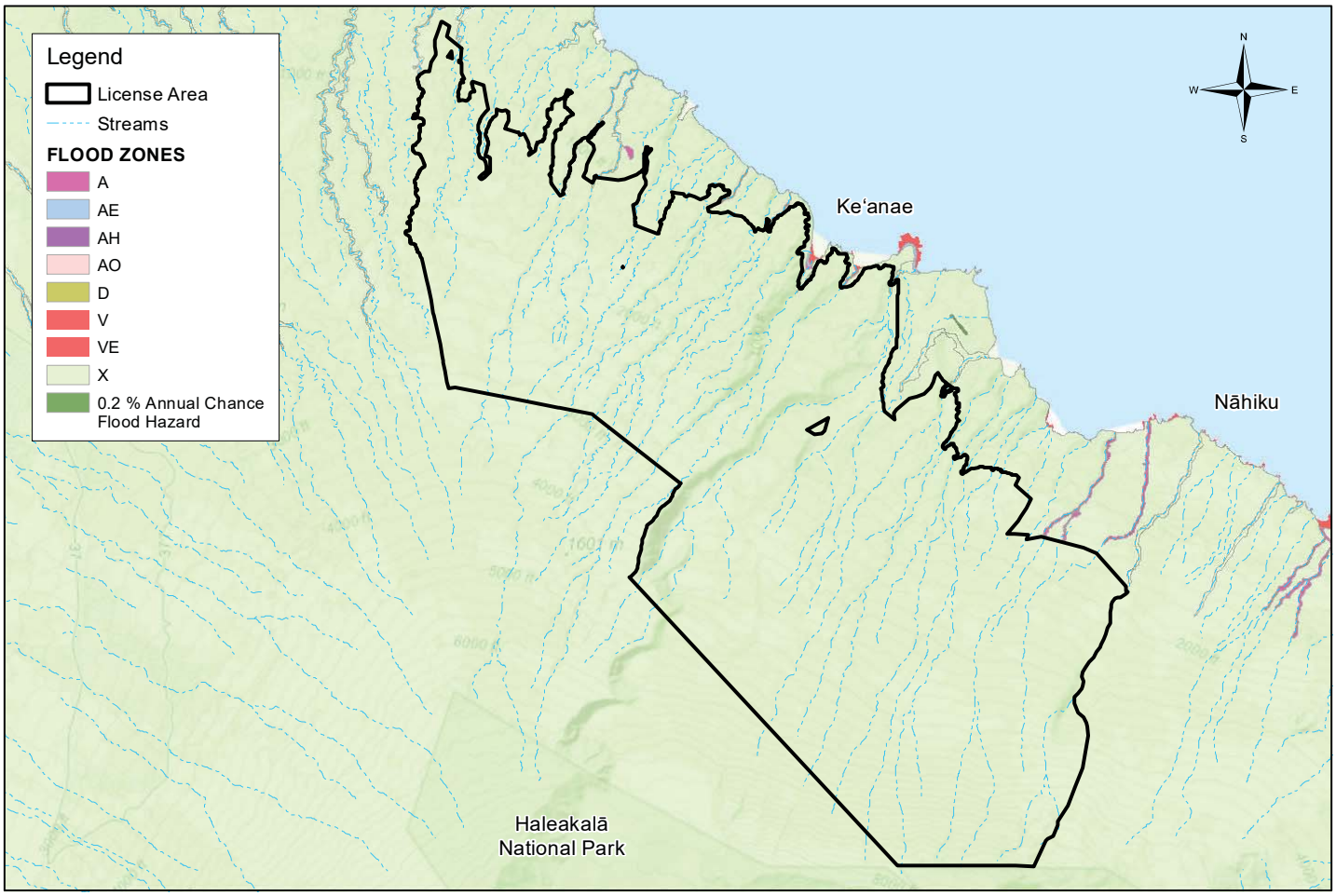


FIGURE 4-27

CENTRAL MAUI 3.2 FEET OF SEA LEVEL RISE MAP

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS



WILSON OKAMOTO CORPORATION

0 5,000 10,000 20,000 Feet

0 0.5 1 2 3 Miles

1 inch = 11,000 feet

Source: ESRI, State OP, & Akinaka

FIGURE 4-28

EAST MAUI FLOOD INSURANCE RATE MAP

Proposed Lease for Nāhiku, Ke'anae, Honomanū and Huelo License Areas

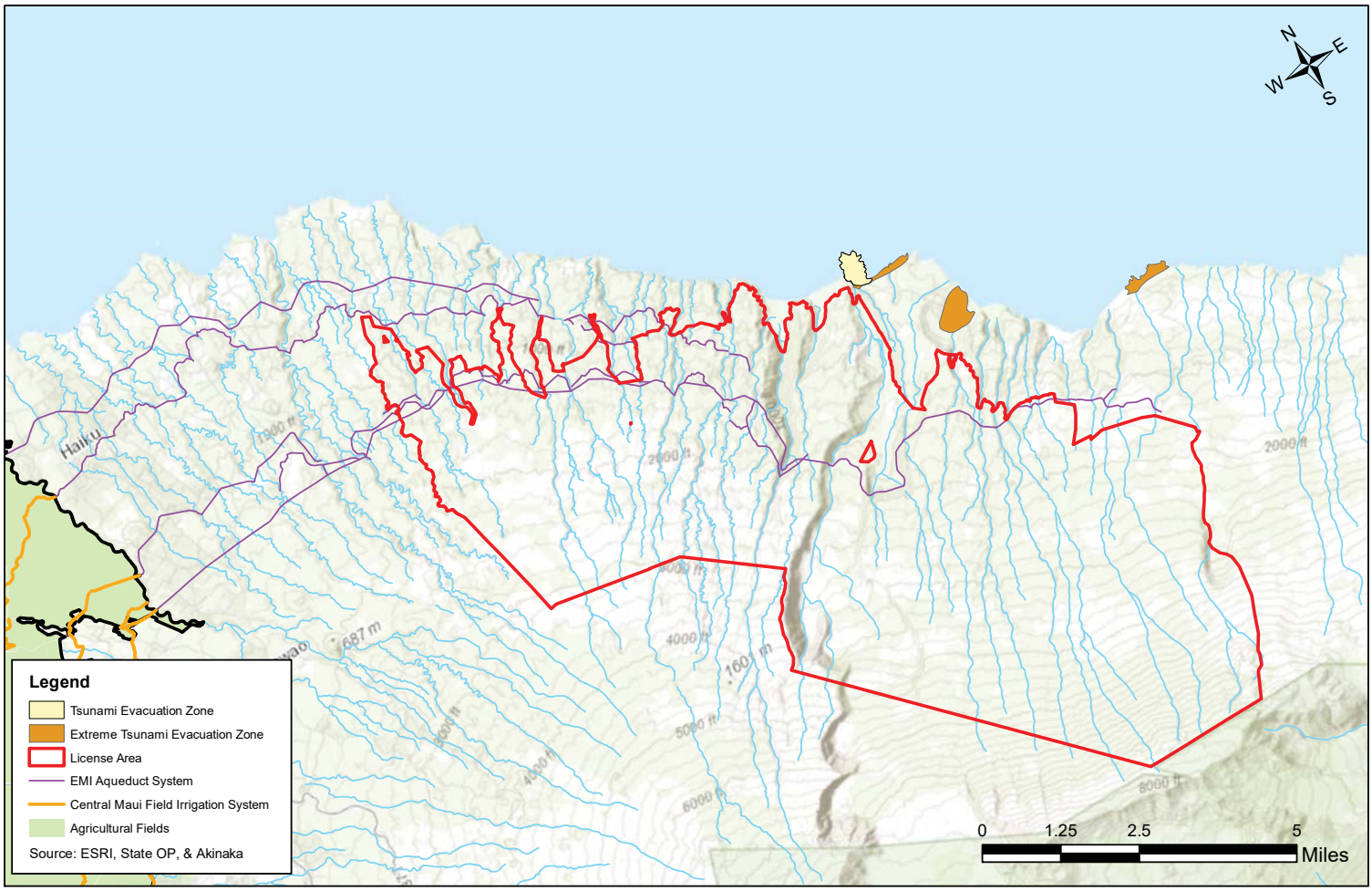


FIGURE 4-29

EAST MAUI TSUNAMI EVACUATION MAP

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on flooding or tsunami in East Maui are anticipated.

Upcountry Maui

According to the FEMA FIRM, Upcountry Maui is predominantly designated as Zone "X", "Areas determined to be outside the 0.2% annual chance floodplain." (See Figure 4-30). Moreover, according the Tsunami Evacuation Zone maps for Maui, Upcountry Maui is entirely outside of the tsunami evacuation zones (See Figure 4-31). A small portion of Maliko Bay within the MDWS Upcountry Maui Water System service area lies within the Tsunami Evacuation Zone.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on flooding or tsunami in Upcountry Maui are anticipated.

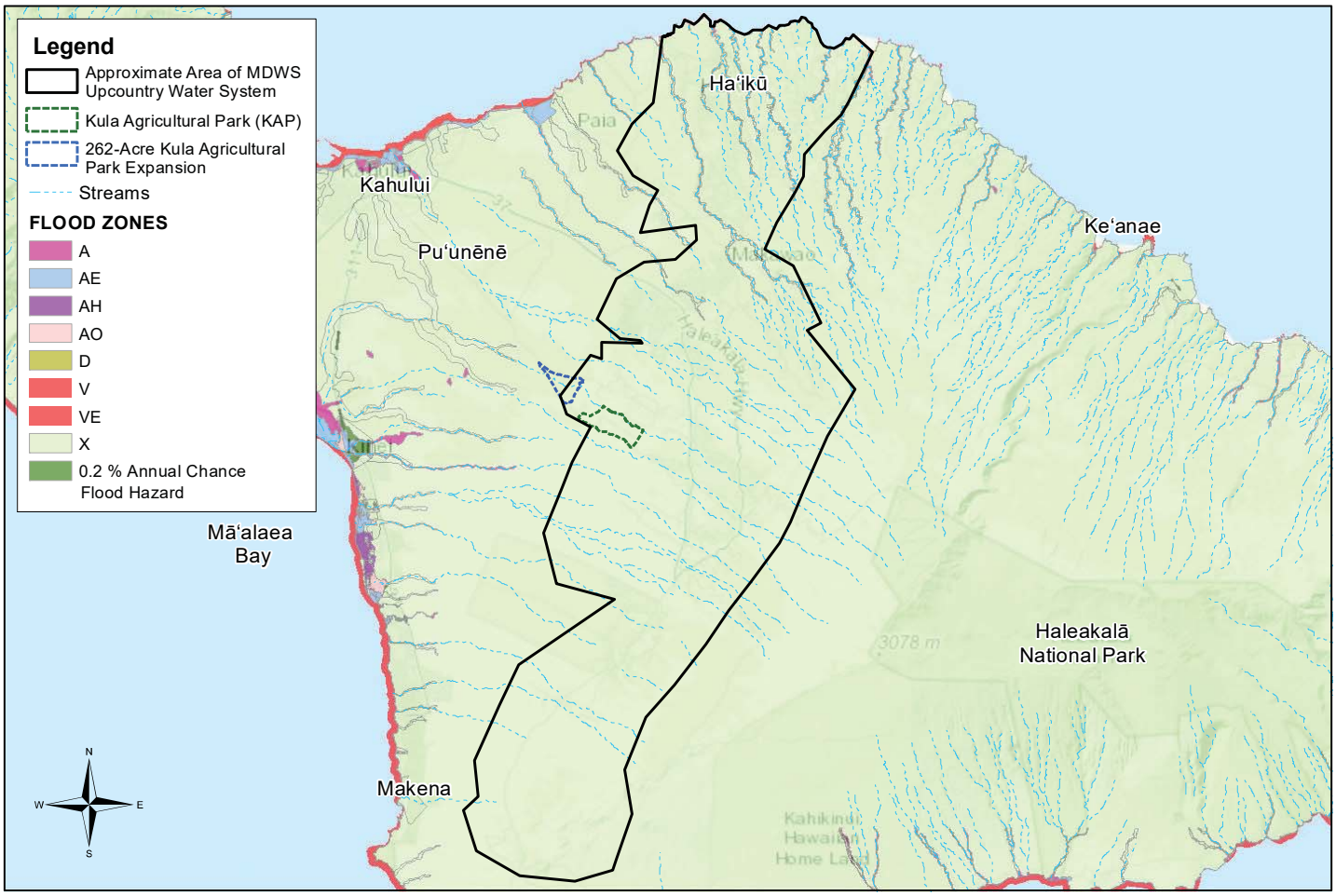
Central Maui

According to the FEMA FIRM, Central Maui is predominantly designated as Zone "X", "Areas determined to be outside the 0.2% annual chance floodplain." (See Figure 4-32) A number of adjacent parcels along the makai edge of Central Maui lie in areas designated as Zone "AE", "Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies," and Zone "VE", "Areas subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action."

According the Tsunami Evacuation Zone maps for Maui, the majority of the agricultural fields in Central Maui are outside of the tsunami evacuation zone. However, there are portions of the agricultural fields in the vicinity of Kihei, Pāʻia and Kahului that are within the tsunami evacuation zone (See Figure 4-33).

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for



0 10,000 20,000 40,000 Feet

0 1 2 4 6 Miles

1 inch = 20,000 feet

Source: ESRI, State OP, & Akinaka

WILSON OKAMOTO CORPORATION

FIGURE 4-30

UPCOUNTRY MAUI FLOOD INSURANCE RATE MAP

Proposed Lease for Nāhiku, Keʻanae, Honomanū and Huelo License Areas

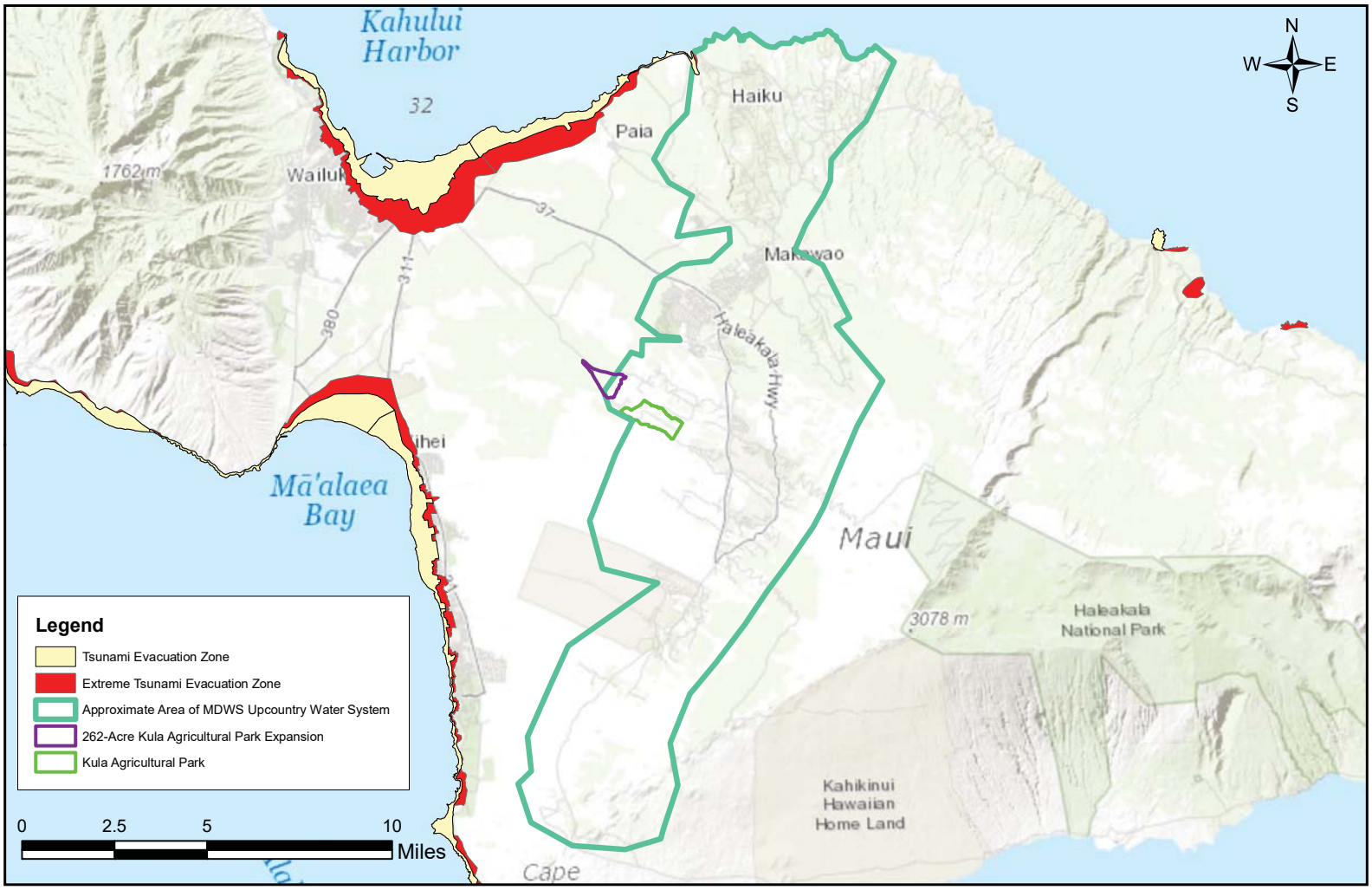
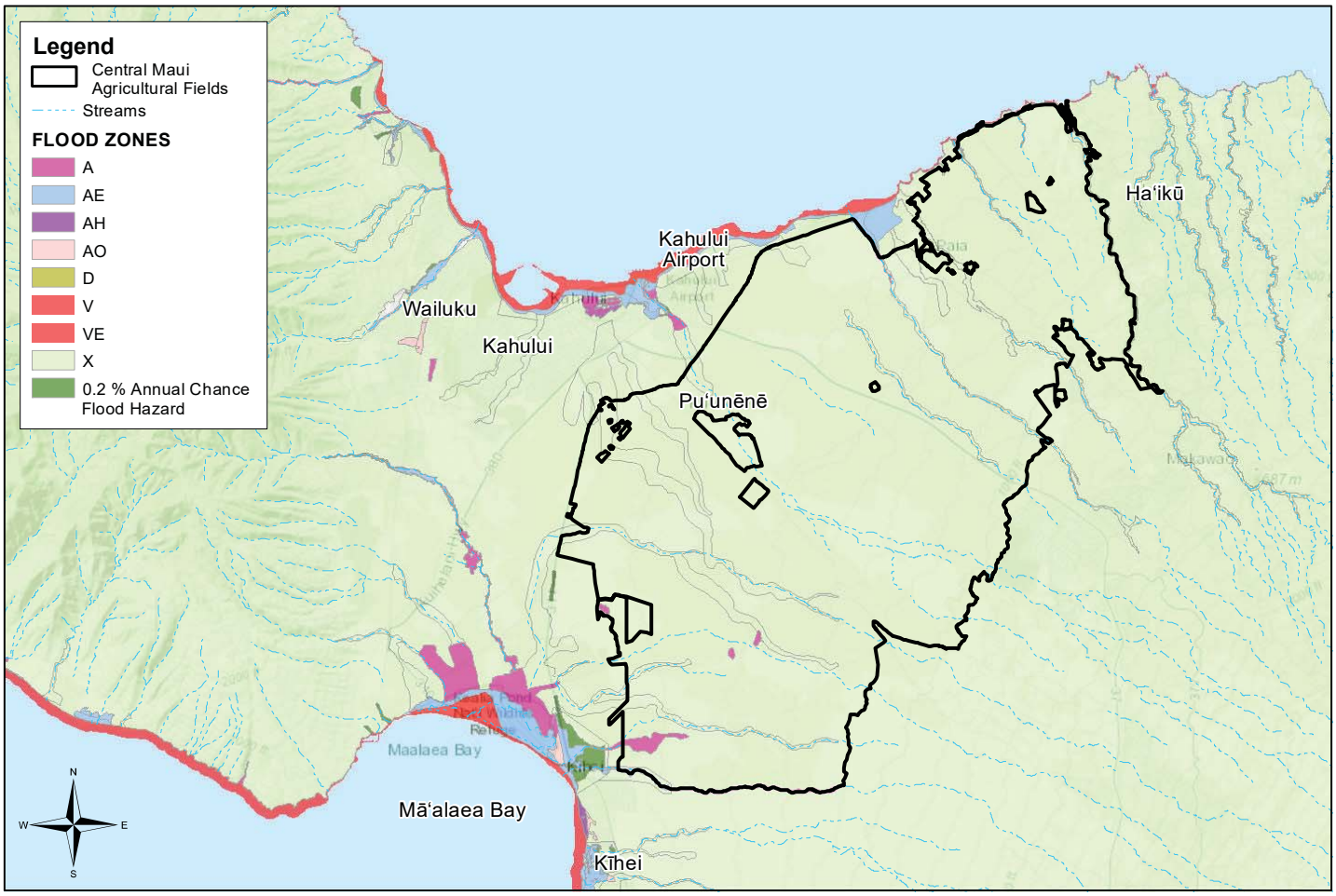


FIGURE 4-31

UPCOUNTRY MAUI TSUNAMI EVACUATION MAP

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS



0 5,000 10,000 20,000 Feet

0 0.5 1 2 3 Miles

1 inch = 12,500 feet

Source: ESRI, State OP, & Akinaka

WILSON OKAMOTO CORPORATION

FIGURE 4-32

CENTRAL MAUI FLOOD INSURANCE RATE MAP

Proposed Lease for Nāhiku, Ke'anae, Honomanū and Huelo License Areas

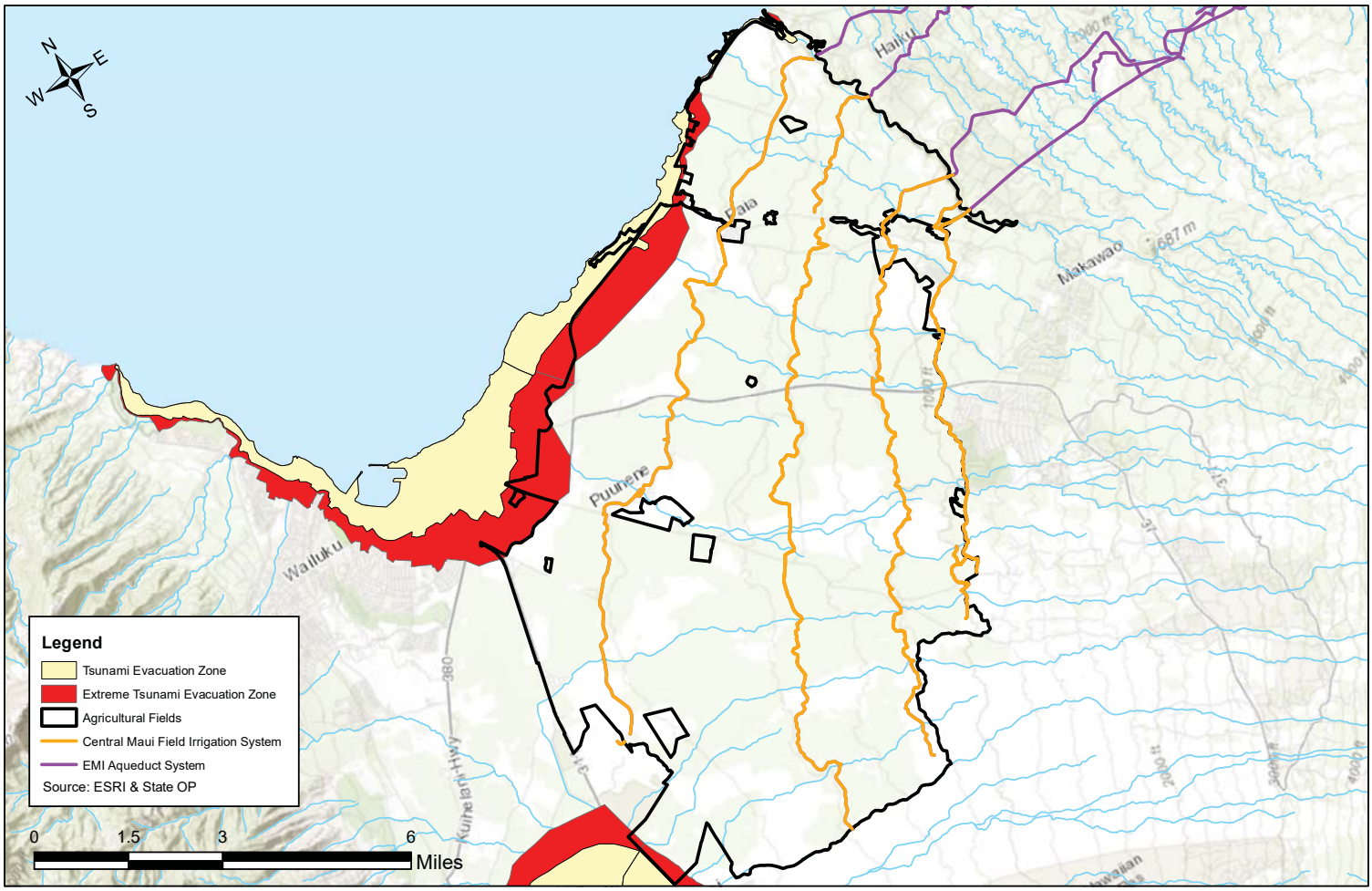


FIGURE 4-33

CENTRAL MAUI TSUNAMI EVACUATION MAP

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS

the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on flooding or tsunami in Central Maui are anticipated.

4.3.4 Hurricanes and Wind Hazard

The island of Maui is exposed to hurricanes as result of its unique, varied topographic features and orientation. According to the *State of Hawai'i Hazard Mitigation Plan* (2018), eight hurricanes have affected the Hawaiian Islands and 12 others have posed a threat, since 1950.

About 90% of the deaths that occur along coastlines as a result of hurricanes are caused not by wind, but by storm surge. Storm surge flooding is water that is pushed up onto otherwise dry land by onshore winds. Friction between the water and the moving air creates drag that, depending upon the distance of water (fetch) and velocity of the wind, can pile water up to depths greater than 20 feet (6.1 m) from the shoreline inland. The storm surge is the most dangerous part of a hurricane as pounding waves create very hazardous flood currents. Worst-case scenarios occur when the storm surge occurs concurrently with high tide.

As a hurricane nears land, the surge of water, topped by battering waves, can move ashore along an area of the coastline into low lying coastal areas. Stream flooding is much worse inland during the storm surge because of backwater effects. Due to differences in atmospheric pressure, tidal stage, coastal topography, and location relative to the eye of the hurricane it is difficult to predict how hurricane-induced storm surge may impact a specific location.

Not all of identified hurricane and strong wind storm threats make landfall in Hawai'i, and actual hurricane strikes in Hawai'i are relatively rare in modern record. More commonly, near misses that generate large swell and moderately high winds causing varying degrees of damage are the hallmark of hurricanes passing close to the islands.

A tropical storm's strong winds and intense low pressure can generate storm surge along coastal communities. While not all tropical storms will have devastating impacts or create significant levels of storm surge, the surge index record shows a significant positive trend between warmer years and extreme events. Surge levels will vary because of situational factors, and projected changes in hurricane surge levels above the mean sea level in Hawai'i are more likely to increase than decrease with global warming (i.e., results range from a 10 percent reduction to 50 percent increase with a 2.8 degree Celsius temperature increase). In addition, Hawai'i is expected to see an additional increase from warmer temperatures, as the storm track may shift north toward the Central North Pacific. Warming ocean waters raise sea level though thermal expansion and have the potential to strengthen the most powerful tropical cyclones.

East Maui

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action

continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts from hurricanes and wind hazards are expected. The EMI Aqueduct System has been in place for nearly 100 years and has withstood wind impacts.

Upcountry Maui

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. The Proposed Action does not include any construction in Upcountry Maui that would be at risk in the event of hurricanes and wind hazards.

Central Maui

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. In Central Maui the Proposed Action largely entails diversified agriculture, which will not present a risk in the event of hurricanes or wind hazards. Construction related to the Mahi Pono farm plan (e.g. solar farm, agricultural processing facilities) is limited, and will be built to all appropriate standards to address risks related to hurricanes and wind hazards.

4.3.5 Seismic Hazard

Earthquakes in the Hawaiian Islands are associated with volcanic eruptions or tectonic movements. Volcanic hazards in the area are considered minimal due to the extinct status of former volcanoes.

Seismic hazards are those related to ground shaking. Landslides, ground cracks, rock falls and tsunamis are all seismic hazards. Engineers and other professionals have created a system of classifying seismic hazards on the basis of the expected strength of ground shaking and the probability of the shaking actually occurring within a specified time. The results are included in the Uniform Building Code (UBC) seismic provisions.

The UBC seismic provisions contain six seismic zones, ranging from 0 (no chance of severe ground shaking) to 4 (10% chance of severe shaking in a 50-year interval). The entire County of Maui is located within Zone 2B.

Volcanic hazards are not a concern on the island of Maui due to the dormant status of Haleakalā. In Hawaiʻi most earthquakes are linked to volcanic activity, unlike other areas where a shift in tectonic plates is the cause of an earthquake. Each year, thousands of earthquakes occur in Hawaiʻi, the vast majority of them so small they are detectable only with highly sensitive instruments. However, moderate and disastrous earthquakes have also occurred.

The 1938 Maui Earthquake, with a magnitude of 6.7-6.9 on the Richter scale and an epicenter six (6) miles north of Maui, created landslides and forced the closure of the road to Hāna.

Damaged water pipes and ground fractures also were reported in Lāhainā. More recently, on October 16, 2006, a 6.7 magnitude earthquake struck on the underwater segment of the major rift zone of the Hualalai volcano on the northwest side of the Island of Hawaiʻi. The earthquake caused rockslides and some damage to roadways on Maui.

East Maui, Upcountry Maui, and Central Maui

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation, and the continued conveyance of water to the MDWS. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. For Upcountry Maui, the Proposed Action does not entail any new construction, and therefore maintains status quo with respect to seismic hazards. In Central Maui, the 30,000 acres of fields will be used for farming, as it has been for over a century, and the Proposed Action is not anticipated to present any new risks with respect to seismic hazards.

4.4 Natural Environment

4.4.1 Flora

A terrestrial flora and fauna biological survey was prepared by SWCA Environmental Consultants (SWCA) in 2019 included as Appendix C. Flora and fauna surveys were conducted by a combination of ground (automotive and pedestrian) and aerial (helicopter) surveys to determine whether vegetation types and species previously listed in past surveys and mapping efforts are still present within the License Area and the agricultural fields in Central Maui. The flora and fauna surveys were conducted from November 28, 2017, to December 1, 2017 (ground surveys) and on January 5, 2018 (aerial survey). Below is a summary of the report pertaining to the East Maui and Central Maui regions.

East Maui

The License Area encompasses a major portion of the Koʻolau Forest Reserve. A transect of the forested region from Pōhaku Palaha at the upper boundary of the License Area at the 8,105 foot elevation to the Hāna Highway near Kailua would identify the following plant communities: high elevation grassland; mesic native shrubs; mesic ʻōhiʻa forest; wet ʻōhiʻa forest with native shrubs; tree ferns and matted ferns; wet sedge-rush-native shrubs with scattered ohia and other native trees; and mesic exotic trees with scattered planted stands of eucalyptus and paper bark (DLNR, 1986). The steeper valley slopes within the region are dominated by wet habitat matted ferns as well as native and exotic shrubs and scattered ʻōhiʻa. Koa-ʻōhiʻa forests are found in two widely separated, mid-elevation locales, one above Honopou Stream, and the other adjacent to Hanawī Stream. A 7,500 acre portion of the Nāhiku License Area is part of the State of Hawaiʻi Natural Area Reserve System. This area does not encompass any portion of the EMI Aqueduct System. The U.S. Fish and Wildlife Service (USFWS) has identified 21 endangered or threatened plants with final designated Critical Habitat within or near the vicinity of the License Area (See Figure 4-34). None of these species were observed during ground or aerial surveys; however, it is very likely, given the size and range of vegetation cover types that occur in the License Area, that many of these species could or do exist in the area, particularly in higher elevations on steep cliffs and gulches inaccessible to grazing ungulates were observed during the field surveys.

The 18 species with designated critical habitat that fall within the License Area are: *Bidens campylotheca* spp. *waihoiensis* (koʻokoʻolau, koʻolau, Endangered); *Clermontia samuelii* (ʻōhā wai, ʻōhā, hāhā, Endangered); *Cyanea asplenifolia*, *Cyanea copelandii* spp*. haleakalaensis*, *Cyanea hamatiflora* spp*. hamatiflora*, *Cyanea kunthiana*, *Cyanea maritae*, *Cyanea mceldowneyi* (hāhā, Endangered); *Melicope balloui*, *Melicope ovalis* (alani, Alani kuahiwi, Endangered); *Huperzia mannii* (no Hawaiian name, Endangered) *Cyanea duvalliorum*, *Phyllostegia pilosa* (no Hawaiian name, Endangered); *Melicope balloui* (alani, alani kuahiwi, Endangered); *Cyanea horrida*, *Geranium hanaense*, *Geranium multiflorum* (nohoanu, hinahina, Endangered);*Wikstroemia villosa* (ʻākia, kauhi, Endangered)

SWCA's survey found that the License Area comprises primarily open and closed ʻōhiʻa (*Metrosideros polymorpha*) forest. This type of vegetation accounts for over 60% of the vegetation in the surveyed areas of East Maui. Open ʻōhiʻa forests tended to have native species such as ʻōhiʻa, pāpala kēpau (*Pisonia grandis*), and lapalapa (*Cheirodendron trigynum*) co-dominating with invasive species such as African tulip tree (*Spathodea campanulata*) and Formosa koa (*Acacia confusa*). The midstory was often a co-dominant mixture of native and non-native as well, with natives such as hāpuʻu fern (*Cibotium* sp.) and koa (*Acacia koa*) blending with invasive species such as shoebutton ardisia, mule's foot fern (*Angiopteris invecta*), and strawberry guava. The understory frequently consisted of uluhe with a mixture of non-native herbaceous species along the margins, including glorybush (*Tibouchina herbacea*), white ginger (*Hedychium coronarium*), Koster's curse, Spanish needle, and Job's tears.

Non-native (Alien) Forest accounts for 23% of the vegetation in the License Area and includes *Eucalyptus*, *Casuarine*, *Falcataria*, *Araucaria*, *Fraxinus*, *Melaleuca*, *Psidium*, and *Grevillea* spp. Paperbark (*Melaleuca quinquenervia*) and eucalyptus (*Eucalyptus* spp.), likely

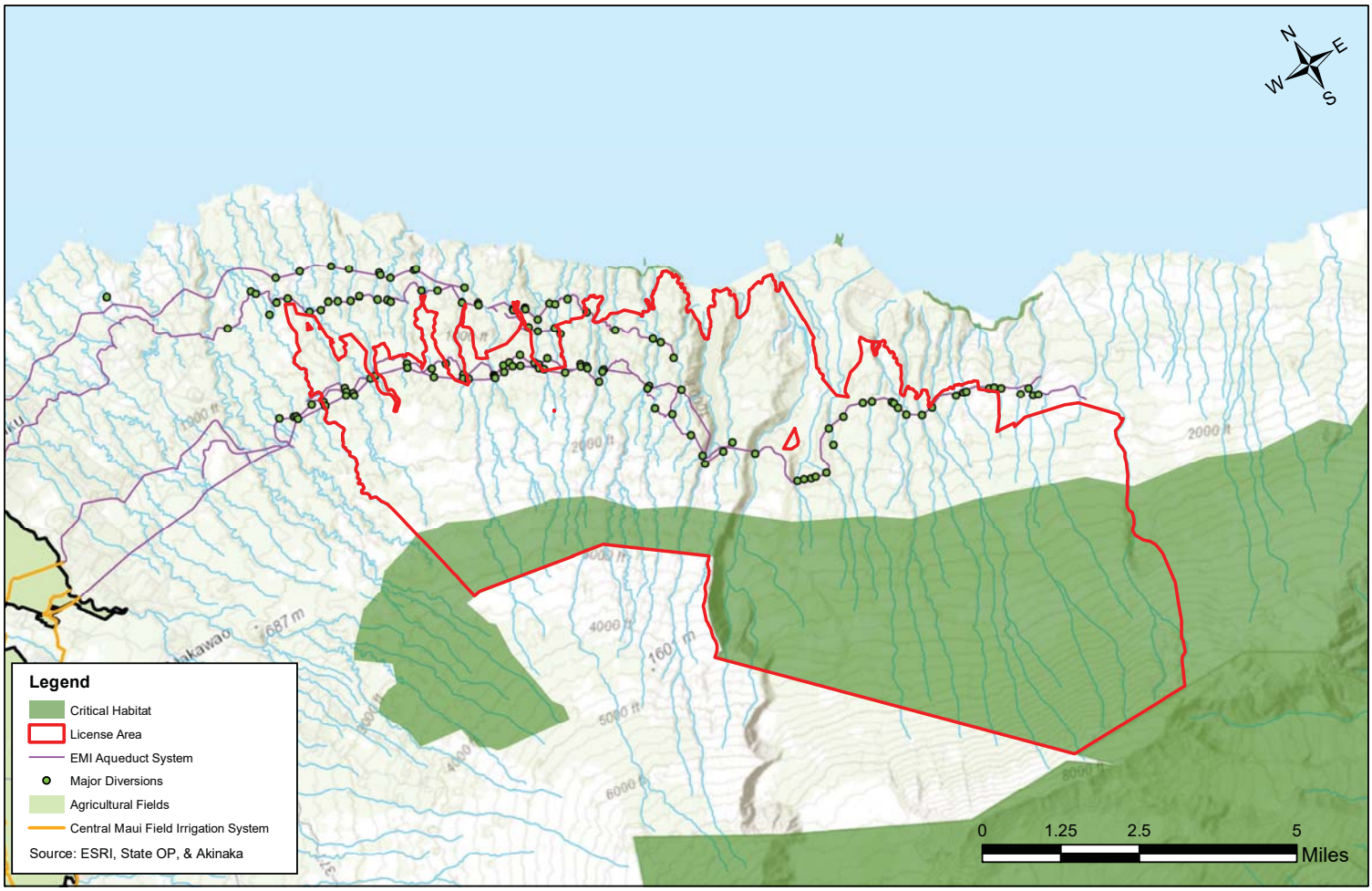


FIGURE 4-34

CRITICAL HABITAT MAP

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS

introduced as forestry species, were found during the ground surveys to be the predominant overstory species in this vegetation type. Shoe button ardisia (*Ardisia elliptica*) and strawberry guava (*Psidium cattleianum*) were common throughout the midstory, and understory species included a variety of non-native grass species such as basket grass (*Oplismenus hirtellus* spp. *Hirtellus*), Job's tears (*Coix lachrymal-jobi*), and bristly foxtail (*Setaria verticillata*), in addition to herbaceous species such as Koster's curse (*Clidemia hirta*), Spanish needle (*Bidens pilosa*), and tick trefoil (*Desmodium triflorum*). 'Ie'ie (*Freycinetia arborea*), a native liana, and laua'e haole (*Phlebodium aureum*), a non-native epiphytic fern, can occasionally be seen twining through the midstory in this vegetation type.

Uluhe-dominated slopes were seen on ground surveys occurring adjacent to 'ōhi'a forest on relatively steep slopes up and downhill from access roads. These areas were characterized by a generally monotypic understory layer of uluhe with the sporadic presence of native shrubs and trees, including 'ōhi'a, pāpala, kēpau, and lapalapa, but also the less commonly seen native species 'ōhā wai nui (*Clermontia arborescens* spp. *waihiae*).

Wet cliff areas are less likely to be impacted by feral pigs are human activities due to their steepness, and thus are more likely to contain threatened or endangered plant species. However, no threatened, endangered, or candidate plants were seen in these areas during the ground surveys, but some less-commonly seen species were noted, including a *Cyrtandra* species (likely *Cyrtandra grayi*), and 'ōhā wai nui. Fern species tend to dominate these areas, most notably *Cyclosorus parasiticus*. *Machaerina*, a native sedge, was also frequently seen.

Impacts and Mitigation Measures

In general, no impacts to flora resources in East Maui are anticipated from the Proposed Action. The Proposed Action does not require vegetation removal except for routine maintenance purposes, therefore the amount of each vegetation cover type currently present would remain substantially the same. The Proposed Action allows for the diversion of water by the existing EMI Aqueduct System for water delivery purposes, and this action in and of itself would have no impact on terrestrial flora or fauna resources. However, the presence of the EMI Aqueduct System and associated access roads increases fragmentation in otherwise continuous habitat patches, but because the Proposed Action involves the use of roads and a system that has been in place for over 90 years, no habitat fragmentation is expected from the Proposed Action.

However, to the extent that maintenance activities are undertaken within the License Area in pristine areas, such as on cliffsides, nears waterfalls, or in other native species dominated areas, the following avoidance and minimization measures are recommended:

- A qualified biological monitor should be on site to ensure that no listed or candidate species are impacted.

- The monitor should have familiarity with the plants of the area, including special-status species, familiarity with natural communities of the area, including special-status natural communities, experience conducting floristic field surveys, and experience with analyzing impacts of development on native plant species and natural communities

- To avoid the introduction or transport of new invasive plant species into more pristine portions of the License Area during EMI Aqueduct System maintenance activities, all equipment and vehicles arriving from outside the License Area should be washed and inspected prior to any maintenance activities on cliff sides, near waterfalls, and in other native species–dominated areas in the License Area. Such washing and inspecting should be done at a designated location.

- Construction materials arriving from outside Maui should also be washed and/or visually inspected (as appropriate) for excessive debris, plant materials, and invasive or harmful non-native species (plants, amphibians, reptiles, and insects). When possible, any raw materials used in maintenance activities should be purchased from a local supplier on Maui to avoid introducing non-native species not present on the island. Inspection and cleaning activities should be conducted at a designated location. The inspector must be a qualified botanist/entomologist able to identify invasive species that are of concern relevant to the point of origin of the equipment, vehicle, or material.

Upcountry Maui

The areas in Upcountry Maui that are served by the MDWS using water obtained through the EMI Aqueduct System were not assessed by SWCA. These areas are highly altered urban and agricultural environments maintained by imported water.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on flora in the Upcountry Maui region are anticipated as a result of the Proposed Action.

Central Maui

The vegetation located in Central Maui consists almost exclusively of the Agricultural vegetation type, with Alien Forest and Alien Grassland along the margins and Water features (with hydrophytic vegetation at their margins) spread throughout. No special-status plant species were found during ground surveys of Central Maui.

Agricultural vegetation type makes up 83% of the Central Maui area and consists almost entirely of fallow sugarcane (*Saccarum officinarum*) fields, some with sugarcane remaining and some where the sugarcane had been harvested at the time of SWCA's survey. Corn (*Zea mays*) and Sunn hemp (*Crotalaria juncea*) were also being cultivated in some fields. Weedy plants seen within the fields included castor bean (*Ricinus communis*), Mexican poppy (*Argemone mexicana*), *Sida rhombifolia*, cheeseweed (*Malva parviflora*) and golden crown-beard (*Verbesina encelioides*). The non-native ruderal vines little bell (*Ipomoea triloba*), bitter

melon (*Momordica charantia*), and *Macroptilium atropurpureum* can be seen twining throughout.

Non-native grasses such as swollen fingergrass (*Chloris barbata*), Guinea grass, and pitted beardgrass (*Bothriochloa pertusa*) were found on the margins of most agricultural fields in Central Maui. Mixed in with these grasses was a variety of ruderal herbaceous species, similar to those found within the agricultural fields.

Non-native species of Alien Forest vegetation include *Pittosporum pentandrum*, Koa haole (*Leucaena leucocephala*), Christmas berry (*Schinus terebinthifolius*), and kiawe (*Prosopis pallida*). This suite of species can be found in the Service Area around abandoned buildings, on the margins of fallow fields, and occasionally along ditches and other water features.

Holding ponds and irrigation ditches are found sporadically throughout the agricultural portions of Central Maui and provide habitat for a number of non-native hydrophytic plant species, including sourbush (*Pluchea carolinensis*), primrose willow (*Ludwigia octovalvis*), and California grass (*Urochloa mutica*). Koa haole, *Pittosporum pentandrum*, Christmas berry, Java plum (*Syzygium cumini*), and common ironwood (*Casuarina equisetifolia*) can be found on uphill slopes near these water features, with maunaloa vine (*Canavalia cathartica*) occasionally twining in the under- and mid-story.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. Some beneficial impacts on flora in the Central Maui region are anticipated. Central Maui had been in sugarcane production for many years. Production of a single crop over a large area, such as sugarcane, provides a monoculture environment for flora, leading to population increases of certain, often weedy and generalist, species. Increasing the diversity of crops, as is proposed with the Mahi Pono farm plan, increases the niches in which flora can establish and would therefore be beneficial to some flora because the agricultural lands would provide an increased diversity of foraging, breeding, and nesting resources. In general, increased diversity in croplands could lead to an increased diversity of flora.

4.4.2 Fauna and Invertebrates

Ground and aerial surveys were done by SWCA between November 2017 and January 2018, as set forth in the Terrestrial Flora and Fauna Technical Report prepared by SWCA (See Appendix C). Fauna surveys consisted of both ground and aerial surveys and consisted of visual observations (aided by 10 × 42–millimeter (mm) binoculars) and auditory vocalization identifications. All birds, mammals, reptiles, amphibians, fish, and invertebrate species seen or heard and any sign (scat or tracks) were noted. In the report, the term fauna, or wildlife, applies to any mammals, birds, reptiles, or amphibians with the potential to occur in the vicinity. Below is a summary of the report.

East Maui

The vast majority of the License Area is in the Forest wildlife habitat type (approximately 29,626 acres), with 2,770 acres in the Shrubland wildlife habitat type, with smaller areas being in the Grassland, Cliff, Rocky, Developed/Agricultural (1 acre), or Stream habitat types.

Introduced mammals observed include cow (*Bos taurus*), feral pig (*Sus scrofa*), and feral cat (*Felis catus*). No other mammals were observed during the ground surveys, although rat (*Rattus* spp.), mongoose (*Herpestes javanicus*), and mouse (*Mus musculus*) could be expected to occur.

No terrestrial reptiles or amphibians are native to Hawaiʻi. No terrestrial reptiles or amphibians were detected during the ground surveys.

The birds observed in the License Area are species commonly found in low- to mid-elevation mesic and wet forest areas on the northern slope of Haleakalā Volcano. In all, nine bird species were documented, six of which are protected by the Migratory Bird Treaty Act (MBTA). Of these, three species—ʻapapane (*Himatione sanguinea*), Hawaiʻi ʻamakihi (*Chlorodrepanis virens wilsoni*), and ʻiʻiwi (*Drepanis coccinea*)—are endemic to Hawaiʻi; one is a migratory shorebird and two are non-native introductions. The ʻiʻiwi is the only federally and state-listed bird that was detected during ground surveys and was identified by vocalizations. In addition to ʻiʻiwi, the federally and state-listed Maui parrotbill (*Pseudonestor xanthophrys*) and crested honeycreeper (*Palmeria dolei*) are known to occur in mesic and wet forest above approximately 3,937 feet (1,200 meters [m]).

Twelve invertebrates were observed during the surveys, consisting of the Blackburn's damselfly (*Megalagrion blackburni*), Hawaiian upland damselfly (*Megalagrion hawaiiense*), citrus swallowtail butterfly (*Papilio xuthus*), Monarch butterfly (*Danaus plexippus*), housefly (*Musca domestica*), smaller lantana butterfly (*Strymon bazochii*), mud dauber (*Sceliphron caementarium*), wandering glider (*Pantala flavescens*), green darner (*Anax junius*), Aedes mosquito (*Aedes* sp.), walking stick (*Sipyloidea sipylus*), and witch moth (*Ascalapha odorata*). All these invertebrates are common in East Maui.

In total, the species observed in the License Area, and the species that the USFWS lists as potentially occurring, and their status, are listed in Table 4-5.

Table 4-5 East Maui Special Status Species

Species	Status	Observed / Potential for Occurrence
Birds		
ʻApapane (*Himatione sanguinea*)	Endemic Protected under MBTA	Observed in the License Area
Hawaiʻi ʻamakihi (*Chlorodrepanis virens wilsoni*)	Endemic Protected under MBTA	Observed in the License Area
Chestnut munia (*Lonchura atricapilla*)	Non native	Observed in the License Area
ʻIʻiwi (*Drepanis coccinea*)	Federally threatened State threatened Protected under MBTA	Observed in the License Area

Japanese white-eye (*Zosterops japonicas*)	Non native	Observed in the License Area
Melodious laughing thrush (*Garrulax canorus*)	Non native	Observed in the License Area
House finch (*Haemorhous mexicanus*)	Non native Protected under MBTA	Observed in the License Area
Northern cardinal (*Cardinalis cardinalis*)	Non native Protected under MBTA	Observed in the License Area
Pacific golden-plover (*Pluvialis fulva*)	Migrant Protected under MBTA	Observed in the License Area
Crested honeycreeper (*Palmeria dolei*)	Endangered	Known to occur in the License Area.
Maui parrotbill (*Pseudonestor xanthophrys*)	Endangered	Known to occur in the License Area.
Hawaiian duck (*Anas wyvilliana*)	Endangered	May occur in License Area
Hawaiian goose or nēnē (*Branta sandvicensis*)	Endangered	Known to occur in License Area
Hawaiian petrel (*Pterodroma sandwichensis*)	Endangered	May occur in License Area
Newell's shearwater (*Puffinus auricularis newelli*)	Threatened	May occur in License Area
Band-rumped storm petrel (*Oceanodroma castro*)	Proposed endangered	May occur in License Area
Mammals		
Hawaiian hoary bat (*Lasiurus cinereus semotus)*	Endangered	Likely to occur in License Area
Reptiles		
Green sea turtle (*Chelonia mydas*)	Threatened	Unlikely to occur In License Area
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered	Unlikely to occur In License Area
Invertebrates		
Flying earwig Hawaiian damselfly (*Megalagrion nesiotes*)	Endangered	Known to occur in License Area
Orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*)	Endangered	May occur in License Area
Pacific Hawaiian damselfly (*Megalagrion pacificum*)	Endangered	Known to occur in License Area
Yellow-faced bee (*Hylaeus anthracinus*)	Endangered	Unlikely to occur in License Area

Yellow-faced bee (*H. assimulans*)	Endangered	Unlikely to occur in License Area
Yellow-faced bee (*H. longiceps*)	Endangered	Unlikely to occur in License Area

Impacts and Mitigation Measures

The Proposed Action is not anticipated to impact fauna or invertebrate species in the License Area. No activities other than some degree of maintenance of the EMI Aqueduct System or access roads, is planned for the area, and it is anticipated that maintenance activities would only take place sporadically. Therefore, while the presence of vehicles and humans for maintenance activities could disrupt the normal behavior of wildlife and temporarily displace individuals from roadside habitat, due to the very occasional maintenance activities, it is expected that wildlife would resume normal behavior shortly after the passage of the vehicle or completion of the maintenance activity. The Proposed Action would not increase human noise and activity above current levels. The presence of human noise and activity would have a negligible effect on wildlife in the East Maui License Area.

Nevertheless, to minimize potential impacts to fauna, the following measures should be implemented:

- Regular on-site staff should be trained to identify special-status species with the potential to occur on-site and should know the appropriate measures to be taken if they are present.
- If a downed tree must be removed from a road, trail, or other passageway, it will be inspected for the presence of active bird nests, specifically the nest of an MBTA-protected species that may have been present prior to the tree falling. If an active nest is found, it should be protected in place until the chicks fledge.
- If tree trimming occurs in the ʻiʻiwi, Maui parrotbill and crested honeycreeper range (as defined in Section 5.2.5) from November to June, a qualified biologist should survey the trees for active nests of these species.
- If a Hawaiian goose is observed in the area during construction activities, all activities within 100 feet (30 m) of the species should cease, and work should not continue until the species leaves the area on its own accord.
- If a Hawaiian goose nest is discovered, all activities within 150 feet (46 m) of the nest should cease, and the USFWS should be contacted. Work should not resume until directed by the USFWS.
- If tree removal occurs during the bat breeding season (June 1 to September 15), direct impacts could occur to juvenile bats that are too small to fly but too large to

be carried by a parent. To minimize this impact, no trees taller than 15 feet (4.6 m) should be trimmed or removed between June 1 and September 15.

- The use of barbless top-strand wire is recommended for all fence construction to avoid entanglement of Hawaiian hoary bat.
- A qualified biologist should work closely with the USFWS and monitor Endangered Species Act-listed damselflies to ensure activities do not have a negative impact.

INVERTEBRATES

No significant, direct, adverse impacts to invertebrate species (flying earwig Hawaiian damselfly, Pacific Hawaiian damselfly, and orange black Hawaiian damselfly (collectively Hawaiian damselflies)) are anticipated within the License Area under the Proposed Action. The Proposed Action involves use of surface water in compliance with the CWRM D&O. Under the CWRM D&O, habitat for Hawaiian damselflies would increase in 19 streams and decrease in three streams. An anticipated indirect effect, however, is that the restoration of flows in those streams will also improve habitat conditions for a number of introduced predator and competitor species of the Hawaiian damselflies, and therefore the population of Hawaiian damselflies may not increase under the Proposed Action (or any alternative that involves an increases in stream flows as required under the CWRM D&O).

Under the Proposed Action, habitat for the southern house mosquito (*Culex quinquefasiatus* [mosquito]) should decrease overall because increased streamflow will reduce standing water that provides breeding habitat for the species. A reduction in mosquito habitat is expected to be beneficial to the Hawaiian honeycreeper (*Passeriformes drepanididae*) because of a reduction in the likelihood, abundance, and potential for transmission of avian malaria, which is a vector-borne disease.

Nevertheless, to minimize potential impacts to invertebrate species, the following measures should be implemented:

- A survey for potential larval host plants for Blackburn's sphinx moth (particularly tree tobacco) should be conducted by biologists before construction/vegetation clearing. Results of the survey should be provided to the USFWS.
- If host plants are found, surveys for Blackburn's sphinx moth should be performed according to the most recent USFWS guidance, and preferably during the wet season (January to April), roughly 4 to 8 weeks following a significant rainfall event. Results of the survey should be provided to the USFWS. Any necessary follow-up actions should be coordinated with the USFWS.
- A qualified biologist should work closely with the USFWS and monitor Endangered Species Act-listed damselflies to ensure activities do not have a negative impact.

Upcountry Maui

The areas in Upcountry Maui that are served by the MDWS using water obtained through the EMI Aqueduct System were not assessed in the biological report by SWCA. These areas are

highly altered urban and agricultural environments and the Proposed Action would continue the ability for MDWS to receive surface water from the EMI Aqueduct System.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on fauna and invertebrate species in Upcountry Maui are anticipated.

Central Maui

The birds observed in Central Maui are species commonly found in disturbed, low-elevation areas. 24 birds were documented, 13 of which are protected by the MBTA, three of which are also federally and state listed, two are endemic; two are migrant waterfowl; one is a migrant shorebird; one is an indigenous waterbird, and four are non-native introductions.

Mammals detected in Central Maui during the surveys include feral pig (*Sus scrofa*), and feral cat (*Felis catus*). No other mammals were observed during the ground surveys, although rat (*Rattus* spp.), mongoose (*Herpestes javanicus*), and mouse (*Mus musculus*) could be expected to occur.

Twelve invertebrates were observed during the surveys, consisting of the Blackburn's damselfly (*Megalagrion blackburni*), citrus swallowtail butterfly (*Papilio xuthus*), Monarch butterfly (*Danaus plexippus*), housefly (*Musca domestica*), smaller lantana butterfly (*Strymon bazochii*), mud dauber (*Sceliphron caementarium*), wandering glider (*Pantala flavescens*), green darner (*Anax junius*), Aedes mosquito (*Aedes* sp.), walking stick (*Sipyloidea sipylus*), and witch moth (*Ascalapha odorata*). All these invertebrates are common in Central Maui.

In total, the species observed in Central Maui, or that the USFWS lists as potentially occurring, is provided in Table 4-6.

Table 4-6 Central Maui Special Status Species

Species	Status	Observed / Potential for Occurrence
Birds		
Black-crowned night-heron (*Nycticorax*)	Indigenous Protected under MBTA	Observed in Central Maui
Cattle egret (*Bubulcus ibis*)	Non native Protected under MBTA	Observed in Central Maui
Chestnut munia (*Lonchura atricapilla*)	Non native	Observed in Central Maui
Chicken (*Gallus domesticus*)	Non native	Observed in Central Maui
Common myna (*Acridotheres tristis*)	Non native	Observed in Central Maui

Green-winged teal (*Anas crecca*)	Migrant Protected under MBTA	Observed in Central Maui
Grey francolin (*Francolinus pondicerianus*)	Non native	Observed in Central Maui
Japanese white-eye (*Zosterops japonicas*)	Non native	Observed in Central Maui
Mallard (*Anas platyrhynchos*)	Migrant Protected under MBTA	Observed in Central Maui
Mourning dove (*Zenaida macroura*)	Non native Protected under the MBTA	Observed in Central Maui
Hawaiian coot (*Fulica alai*)	Endangered Protected under MBTA	Observed in Central Maui
Hawaiian stilt (*Himantopus mexicanus knudseni*)	Endangered Protected under MBTA	Observed in Central Maui
House finch (*Haemorhous mexicanus*)	Non native Protected under MBTA	Observed in Central Maui
House sparrow (*Passer domesticus*)	Non native	Observed in Central Maui
Java sparrow (*Lonchura oryzivora*)	Non native	Observed in Central Maui
Pacific golden-plover (*Pluvialis fulva*)	Migrant	Observed in Central Maui
Red-crested cardinal (*Paroaria coronate*)	Non native	Observed in Central Maui
Spotted dove (*Streptopelia chinensis*)	Non native	Observed in Central Maui
Zebra dove (*Geopelia striata*)	Non native	Observed in Central Maui
Hawaiian duck (*Anas wyvilliana*)	Endangered	May occur in Central Maui
Hawaiian goose or nēnē (*Branta sandvicensis*)	Endangered	Known to occur in Central Maui
Hawaiian petrel (*Pterodroma sandwichensis*)	Endangered	May fly over Central Maui at night. Not likely to land or nest in Central Maui
Newell's shearwater (*Puffinus auricularis newelli*)	Threatened	May fly over Central Maui at night. Not likely to land or nest in Central Maui
Band-rumped storm petrel (*Oceanodroma castro*)	Proposed endangered	May fly over Central Maui at night. Not likely to land or nest in Central Maui
Mammals		
Hawaiian hoary bat (*Lasiurus cinereus semotus)*	Endangered	Likely to occur in Central Maui
Reptiles		

Green sea turtle (*Chelonia mydas*)	Threatened	Not likely to occur
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered	Not likely to occur
Invertebrates		
Blackburn's sphinx moth (*Manduca blackburni*)	Endangered	May occur in Central Maui
Yellow-faced bee (*Hylaeus anthracinus*)	Endangered	Not likely to occur
Yellow-faced bee (*H. assimulans*)	Endangered	Not likely to occur
Yellow-faced bee (*H. longiceps*)	Endangered	Not likely to occur

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on fauna in the region are anticipated

However, associated with the Proposed Action is the use of the surface water to supply the agricultural fields in Central Maui. For over a century the Central Maui fields largely produced a single crop (sugarcane) over a large area, providing a monoculture environment for flora and fauna, leading to population increases of certain, often weedy and generalist, species. Increasing the diversity of crops increases the niches in which fauna can establish and would be beneficial to some fauna because the agricultural lands would provide an increased diversity of foraging, breeding, and nesting resources. In general, increased diversity in croplands could lead to an increased diversity of and fauna (SWCA, 2019).

The extent of "development" that could impact fauna resources within Central Maui under the Proposed Action is largely limited to the planting of new crops and other farming activities. Under the Proposed Action, the Mahi Pono farm plan would require converting former sugarcane lands to about 15,950 acres of cropland, 4,700 acres of irrigated pasture, and 9,100 acres of unirrigated pasture. The conversion would require removing remaining sugarcane plants, adding amendments to enrich the soil, planting windbreaks around fields, modifying field irrigation systems, installing fencing, and planting crops. The farm plan also requires an estimated 319,000 square feet of building space related to its agricultural operations such as washing and packing areas, storage, and related uses accessory to agriculture. In addition, 37.5 mW solar farm within approximately 250 acres is planned.

- Regular on-site staff should be trained to identify special-status species with the potential to occur on-site and should know the appropriate measures to be taken if they are present.
- If a downed tree must be removed from a road, trail, or other passageway, it will be inspected for the presence of active bird nests, specifically the nest of an MBTA-protected species that may have been present prior to the tree falling. If an active nest is found, it should be protected in place until the chicks fledge.
- If a Hawaiian stilt or Hawaiian coot is observed in the area during construction activities, all activities within 100 feet (30 m) of the species should cease, and work should not continue until the species leaves the area on its own accord.
- If a Hawaiian goose nest is discovered, all activities within 150 feet (46 m) of the nest should cease, and the USFWS should be contacted. Work should not resume until directed by the USFWS.
- If felling of standing trees occurs during the bat breeding season, direct impacts could occur to juvenile bats that are too small to fly but too large to be carried by a parent. To minimize this impact, no trees taller than 15 feet (4.6 m) should be trimmed or removed between June 1 and September 15.
- The use of barbless top-strand wire is recommended for all fence construction to avoid entanglement of Hawaiian hoary bat.
- A survey for potential larval host plants for Blackburn's sphinx moth (particularly tree tobacco) should be conducted by biologists before construction/vegetation clearing. Results of the survey should be provided to the USFWS. If host plants are found, surveys for Blackburn's sphinx moth should be performed according to the most recent USFWS guidance, and preferably during the wet season (January to April), roughly 4 to 8 weeks following a significant rainfall event. Results of the survey should be provided to the USFWS. Any necessary follow-up actions should be coordinated with the USFWS.

To minimize potential impacts to seabirds, the following measures should be followed:

Construction activity should be restricted to daylight hours as much as practicable during the seabird peak fallout period (September 15 to December 15) to avoid the use of nighttime lighting that could attract seabirds.

- All outdoor lights should be shielded to prevent upward radiation. This has been shown to reduce the potential for seabird attraction. A selection of acceptable, seabird-friendly lights can be found online at the Kauai Seabird Habitat Conservation Program website: http://www.kauai-seabirdhcp.info/lighting-homes-businesses/
- Outside lights not needed for security and safety should be turned off from dusk through dawn during the fledgling fallout period (September 15 to December 15).

4.5 Historic and Archaeological Resources

East Maui

An HRS Section 6E-7 and Section 6E-42 historic preservation review letter dated January 25, 2017 (Log No. 2017.00026; Doc. No. 1701GC08) sent from the State Historic Preservation Division (SHPD) to the DLNR Land Division requested that, pursuant to HAR § 13-284-5(b)(5)(A) and (C), an archaeological inventory survey (AIS), as well as an architectural inventory survey, be required prior to the issuance of the Water Lease and that these surveys also be proceeded by inventory plans.

In response to those letters, additional information regarding the proposed Water Lease was provided to the SHPD with the understanding that the proposed Water Lease will not involve any construction or significant ground disturbance within undisturbed areas, and that the potential impact of flooding from the removal or modification of select diversions will not be greater than periodic naturally occurring flooding events due to freshets. A subsequent HRS § 6E-8 historic preservation review letter (Log No. 2017.00026; Doc. No. 1706MBF11) sent from the SHPD to the DLNR Land Division on October 6, 2017 updated the prior correspondence to no longer request the completion of an AIS plan or an AIS in the License Area in conjunction with the proposed Water Lease.

Mason Architects prepared a Historic Structure Assessment (HSA) in support of the EIS (See Appendix D). The objective of the HSA is to make an evaluation, and assist SHPD in making a determination on the potential impact to historic properties. Due to the immense size of the EMI Aqueduct System, the HSA only documents 20 aqueduct features, which includes 19 stream diversions that collect water, and one ditch water throw-out get that discharges water out of the ditch system. Within these features, there were also 31 individual sluice gates documented during the field survey.

The EMI Aqueduct System is comprised of approximately, 388 separate intakes, 24 miles of ditches, 50 miles of tunnels, various flumes, weirs, aqueducts, small dams, and stream diversion intakes. The aqueduct system was developed by Samuel T. Alexander and Henry P. Baldwin beginning in 1876, and started operating in 1878 with 17 miles of open ditch, transporting water to four plantations in Central Maui. The ditch continued to expand in the late 1800s into what it is currently, however, the ditch system has not significantly expanded since 1923.

Mason Architects documented 20 EMI Aqueduct System features during their May 2018 field survey and 31 sluice gate examples. Of these features, 19 were stream diversions, the most common of which (i.e. 14 of the 19 stream diversions surveyed) was "Type A Stream Diversion." The "Type A Stream Diversion" operates by using a dam across the stream bed equipped with a sluice gate to impound water. When the sluice gate is closed, water is impounded behind the dam, such that it can flow out of the impounded pool, and into the ditch system through the intake. When the sluice gate is open, water is able to flow through the dam and is not impounded to a level to reach the intake for the ditch system. A variation (Type A Variation Stream Diversion) of this feature was also documented in Mason Architects field study. This diversion operates with a stilling wall that separates the impounded pool from the intake. When the sluice gate is closed, water will flow overtop the stilling wall and into the intake of the ditch system. Some of the stilling walls have perforations to allow for water to flow

through the walls as well. Another variation is a sluice gate at the intake, and when the sluice gate is open, water can flow through the intake into the ditch system.

"Type B Stream Diversion", accounted for three (3) out of the 19 stream diversion features. "Type B Stream Diversion" operates by using a weir across the stream bed to impound water to a level that will reach the intake. There are sluice gates at the intake, and when they are open, water is able to flow into the intake into the ditch system. When the sluice gates are closed, water is prevented from entering the intake, and flows over the weir, and continues downstream. There was an instance where the intake channel had an additional throw-out gate for the discharge of excess water that would make its way back into the stream.

"Type C Stream Diversion" accounted for two (2) out of the 19 stream diversion features documented. "Type C Stream Diversion" operates by using a weir across the stream bed to impound water that feeds into the intake. The feature does not have a sluice gate, and always open for water to flow into the intake. The intake channel has a throw-out sluice gate to control how much water is entering the ditch, and when it is open, water returns back to the stream.

Mason Architects also documented a throw-out sluice gate ("Type D Ditch Water Throw-out") located in the ditch system that would discharge water into a gulch.

During the field survey, there were also various types of sluice gates documented such as ratchet, geared, threaded-shaft, and a board adjusted sluice gates. A sluice gate is a panel of metal, wood boards, or plastic boards that slides vertically in grooves that are set in the sides of the waterway channel. Four types of sluice gates were noted during the field work. Three types use various mechanisms, such as a ratchet, a gear, or a threaded shaft, to move a solid panel vertically in slots set in the channel, and one type is defined by a series of horizontal boards that are slid up and down vertically in slots in the channel. These are explained in more detail in the study (See Appendix D).

The main purpose of this study was to determine the historical significance of the EMI Aqueduct System. It was determined that the system is eligible to be place on the National Register of Historic Places (NRHP) under National Register Criterion A, for its role in supporting the development of the sugar industry on Maui, and Criterion C, as an extensive engineering design that exemplifies the characteristics, technology, and pattern of features common to irrigation ditch systems in Hawai'i. Because of their overall size, large, linear resources such as irrigation ditches like the EMI Aqueduct System are susceptible to cumulative impacts on integrity, such as those brought about by numerous repair modifications. Therefore, the EMI Aqueduct System's integrity was not assessed. However, analysis of the sluice gates, demonstrated that they tend to maintain their historic integrity. For example, they retain their original location in a natural and agricultural setting, and they also retain much of their historic materials (concrete and stone). Their overall original design and workmanship appear intact. Integrity of feeling and association are likewise retained. Some show weathering and corrosion from the wet conditions, while some show minor repairs made.

CSH prepared an archaeological literature review and field inspection (LRFI) report in December 2018 (See Appendix E). The LRFI was designed to determine the likelihood that historic properties (any building, structure, object, district, area, or site over 50 years old) may

be affected by the Proposed Action and, based on findings, consider cultural resource management recommendations.

CSH archaeologists completed a combined pedestrian and vehicular inspection of portions of the License Area between May 15 and May 18 of 2018. Fieldwork also included the inspection of License Area's access road network by four-wheel drive vehicle followed by the pedestrian inspection of various ditch trails and the locations surrounding 21 sluice gates throughout the EMI Aqueduct System. The inspection was guided by EMI personnel who provided access through locked gates and navigation of the EMI Aqueduct System.

Documentation of the fieldwork included descriptions and photographs of any potential findings as well as descriptions of the natural and built environment observed throughout the License Area. No previous historic properties have been recorded in this area and no potential historic properties, apart from infrastructure related to the EMI Aqueduct System, were observed during the field inspection.

The LRFI also includes traditional background research including a review of place names, legendary accounts, and documentation of pre-Contact land use with Hāmākua Loa Moku and Ko'olau Moku. Over 150 place names were documented and indicate an abundance of resources in the region and associations with past cultural practices and land use. The background research included a review of previous archaeological studies on file with SHPD; review of documents at Hamilton Library at the University of Hawai'i, the Hawai'i State Archives, the Mission Houses Museum Library, the Hawai'i Public Library, and the Archives of the Bishop Museum; study of historic photographs at the Hawai'i State Archives and the Archives of the Bishop Museum; study of historic maps at the Survey Office of the DLNR; and study of online historic newspaper databases. Historic maps and photographs from the CSH library were also consulted. In addition, Māhele records were examined from the Waihona 'Aina (2000) database.

The following is a brief discussion and summary of the CSH LRFI report and the archaeology-focused research within the context of the traditional background and history of the License Area in East Maui.

Traditional Background of the East Maui Region

The License Area includes multiple ahupua'a (land division usually extending from mountain to sea) in the modern judicial districts of Makawao and Hāna, and the traditional moku (district) of Hāmākua Loa and Ko'olau (See Figure 4-35).

According to Mary Pukui et. al (1974), the literal translation Hāmākua Loa is "very long corner." Within Hāmākua Loa, there are several place names in the various ahupua'a that make up the moku that are recorded by Pukui et. al (1974). Majority of the historical and traditional information, however, is related to the adjacent moku of Ko'olau. A literal translation of Ko'olau is "windward" (Pukui et. al, 1974). The name Ko'olau was applied to the districts located on the windward side of many of the Hawaiian Islands.

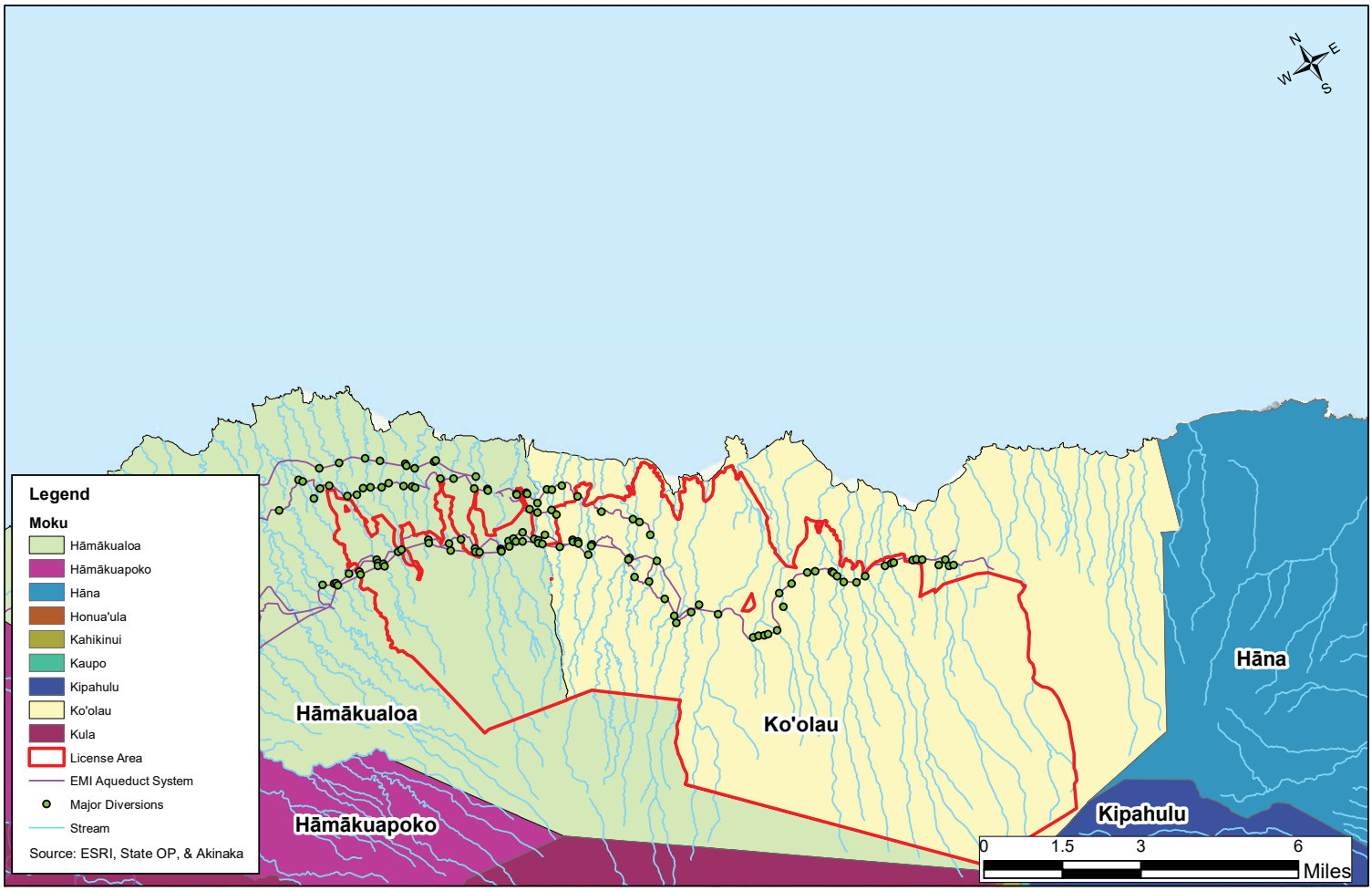


FIGURE 4-35

TRADITIONAL MOKU MAP

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS

Prior to the unification of the Hawaiian archipelago, Maui and Hawaiʻi were often engaged in warfare and there are storied accounts of the actions of passing armies in their disputes over control of the resources and region of East Maui. Even the neighboring ahupuaʻa in the region were warring over resources until Kiha-a-piʻilani united the island with the help of ʻUmi-a-līloa from Hawaiʻi Island.

There are legends of the gods Kāne and Kanaloa visiting the region causing fresh water to spring up, leaving their mark on the area. There is the myth of Kana, who is the son of the goddess Hina, who is said to have resided in East Maui. Kana along with his brother, Niheu, saved their mother Hina from Hāʻupu, after she was abducted from Kapepeʻekauila. There is the story of ʻAiʻai receiving his fishing powers from his father, Kūʻula, and setting up new fishing grounds around the Hawaiians Islands, including the East Maui region. The demigod Maui made the Koʻolau region of Maui Island famous as this was the part of the island where Maui chose to ascend to the top of Haleakalā to snare the sun so that his mother Hina could dry her kapa (tapa). Many of the natural resources and natural phenomena, such as the flora and fauna, rain and lighting, were believed to be kinolau (physical manifestations) of gods, goddesses, and nature spirits of Hawaiian antiquity creating unique cultural landscapes. The famous shark god of Koʻolau, Hiʻu, is said to reside in a cave near Keʻanae wharf.

Over 150 place names were documented throughout the East Maui region. The place names indicate the intimate relationship that Native Hawaiians had with the natural environment. The place names found throughout East Maui indicate that the lands were widely used for multiple purposes relevant to Native Hawaiian subsistence, habitation, and history. The land bears names associated with agriculture, domestic, and recreational uses of the local streams and pools. Sometimes these place names are references to the actions of historic individuals, and at other times to the deeds of legendary or mythological figure, but often are rich with symbolic associations to the point of encompassing a comprehensive history of a place that can combine all these elements. Tables within CSH's report contain the documented place names of Hāmākua Loa and Koʻolau Moku (See Appendix E).

In the East Maui region, 39 heiau (shrine/ceremonial structure) were recorded by Walker (1931) in the vicinity of the License Area (Walker sites 64-102) (See Figure 4-36). However, only 20 of the 39 were able to be identified by Walker, while the remaining 19 were presumably destroyed by the time Walker surveyed the area. The heiau structure itself was an architectural feature as well as social institution of Hawaiian society, and like many social institutions has served several functions over time. How heiau were used depended largely on the communities they served, the times during which they were actively built and used, and the types of subsistence practiced by the Native Hawaiians who used them. Today, within the modern Makawao District, containing the traditional moku of Hāmākua Loa, 10 heiau were identified. Six of the ten identified structures (Walker Sites 64, 67,68,74,77, and 78) were observed to be largely intact, and generally larger in size compared to those located east towards Hāna. Within the modern district of Hāna, containing the traditional moku of Hāna and Koʻolau, five (5) of the 11 heiau were observed and largely still intact. The most renowned heiau of the 39 in East Maui may be Piʻilanihale, built by Kiha-a-piʻilani. The heiau was the tallest in the Hawaiian Islands and built to house the royal Piʻilani bloodline.

Evidence from the abundance of land divisions, place names, and heiau are suggestive that the period of habitation in East Maui between initial establishment and western contact was

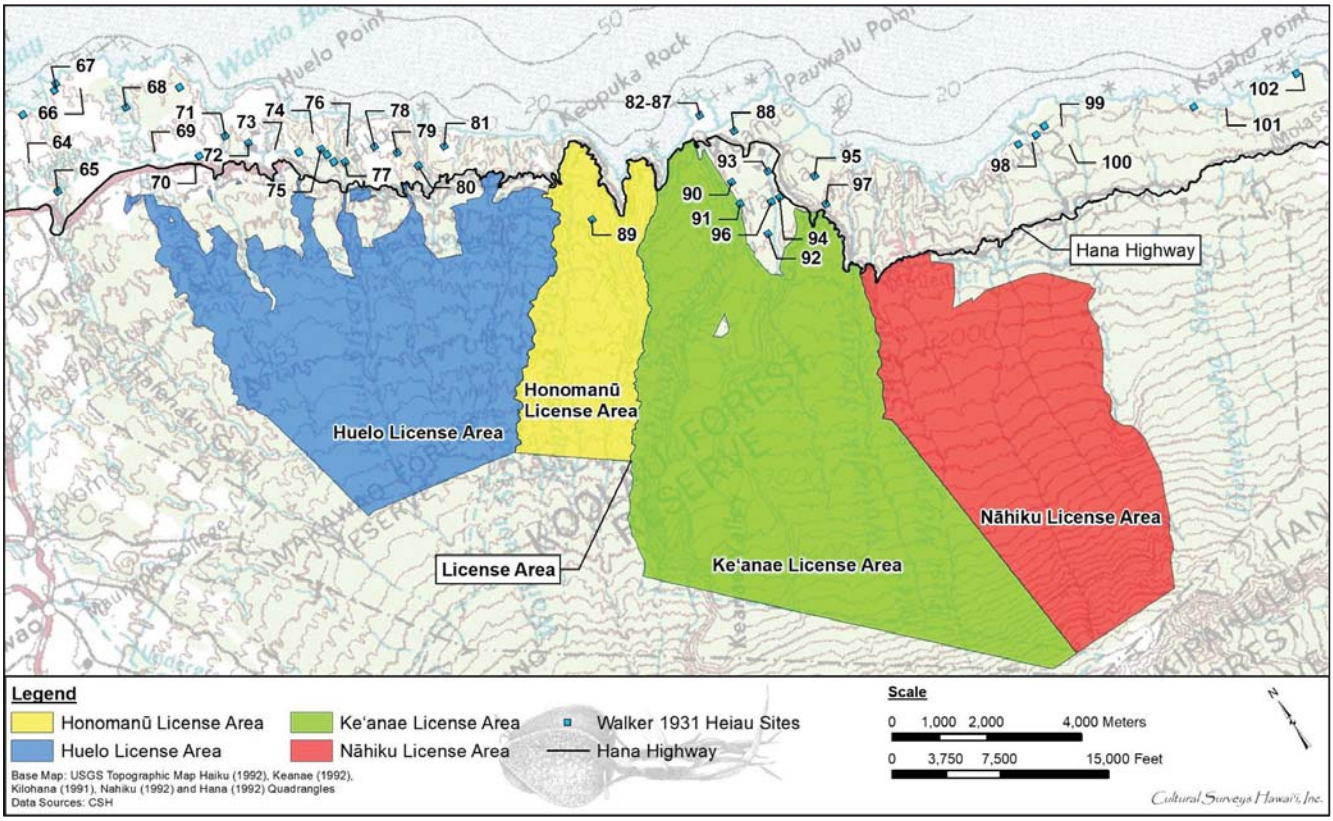


Figure 4-36 Portions of the 1992a Haiku, 1992c Keanae, 1991 Kilohana, 1992d Nahiku, and 1992b Hana U.S. Geological Surey 7.5-minute topographic quadrangle series showing Walker *heiau* sites 64 through 102 with overlay of project License Areas (U.S. Geological Survey 1991, 1992a, b, c, d)

Cultural Surveys Hawai‘i, Inc provided map that depicts Walker's 1931 Heiau Sites in the vicinity and within the License Area.

extensive. Evidence suggests that there were not many taro terraces throughout the region as the geography is not favorable due to the gulches and not many flats. However, where possible, especially in Keʻanae, taro terraces were cultivated. There is evidence that many of the stream beds were lined with stream taro well into the uplands and dry agriculture was utilized above the coastal area. The East Maui region is extremely fertile, and with an abundance of water resources, it was productive and supported a large population.

Post-Contact History of East Maui

Early historic background research within the report presented a regional perspective of the earliest Western accounts recorded in the East Maui region including Captain James Cook's brief stop in Hāna in 1778, the arrival of the British ship, the Iphigenia at Hāna in 1788, the role of East Maui in the 1790 Kaua o Kawaʻanui (Battle of Great Canoes), and the arrival of the first missionaries to East Maui in the early 1800s.

One of the earliest impacts of European contact on the Native Hawaiians was the spread of Old World diseases into island populations. With the arrival of Captain Cook in the late 1770s came the initial introduction of venereal disease and possibly respiratory ailments (Kirch, 2012). The number of rampant diseases was to increase steadily alongside the number of traders, merchants, and visitors arriving from distant shores. Although there is serious debate about the Native Hawaiian population at first contact with Europeans, making an exact figure for the depopulation of Native Hawaiians by disease is difficult to grasp, the known effects of the introduction of foreign disease make a population reduction from 500,000 in 1779 to 130,000 fifty years later seem feasible (Kirch, 2012). There were several outbreaks of small pox, leprosy, tuberculosis, influenza, and cholera documented that ravaged the Native Hawaiian population, as well as the foreign population that was settling Hawaiʻi.

The most significant change in land-use in the Hawaiian Islands came with the Māhele of 1848 which changed the communal land system to one of private ownership. The foundation for private land ownership set by the Māhele of 1848 began a marked pace of development across the entire island chain, and Maui was no exception to the age of Western development. The Māhele enabled many foreigners and foreign nationals to acquire land for the establishment of ranching and plantation operations, including the infrastructure projects that were aimed at supporting these land-intensive industries (aqueducts, roads, etc.). Within the Māhele records for the License Area there are over 85 claims for terrestrial agricultural features such as loʻi (irrigated taro terraces), pākanu (garden, planting enclosure), ʻauwai (artificial irrigation canals, used to feed loʻi), kula (fields, open pasture), pali (cliff, precipice, or steep hill suitable for cultivation of select plants), kīhāpai (small cultivated patch or orchard), moʻo (ridge for similar purpose as pali), and pōʻalima (small agricultural patches tended in traditional times solely for chiefly tribute) (Pukui and Elbert 1986). There are also kuleana claimed for their naturally occurring vegetation and the right of tenants to collect these resources, such as ʻie (aerial roots of the ʻieʻie vine, used in plaiting, basketry, and wicker weaving), olonā (shrub with fibrous bark used in fishnets, baskets, and to construct tī leaf raincoats and capes), wauke (paper mulberry used in making tapa cloth), hala (pandanus tree) and wildly occurring kalo (taro) and sweet potato (Pukui and Elbert 1986:50,94,256,286). Lastly are the kuleana claims over aquatic resources such as off-shore fisheries (documented as "sea" in LCA awards) and muliwai (river mouth, freshwater pool behind a shoreline sand bar) that are naturally occurring and not man made (Pukui and Elbert 1986). The Māhele also marked a turning point in Hawaiʻi's history as

Western commercial interests and travelers began their influence on the remote region of East Maui and elsewhere.

By 1850, lands belonging to Hawaiian aliʻi were sold to help pay commutation fees owed by their awardees and for simple cash profits from selling so-called unused land. Makaʻāinana (commoners) that had historically lived on and cultivated these lands were inadvertently dispossessed of their homes and arable plots that lied within the sold portions of land. In acknowledgement of this dispossession, the Board of Commissioners passed resolutions authored by the Privy Council through the legislature in 1850 that aided in the protection of the rights of tenant farmers whose homes and plots were essentially owned by overarching Land Commission Award (LCA) awardees.

The earliest records of Western industry in East Maui included L. L. Torbert's potato plantation at Honuaʻula and the beginning of the construction of ditches, tunnels, and siphons to transport the waters of East Maui to the central isthmus for commercial sugarcane agriculture. The Hawaiian Islands attracted a new generation of managers, professionals, and entrepreneurs who would reshape the landscape for western enterprises and pursuits. Samuel T. Alexander and Henry P. Baldwin were prominent in this movement. With the ratification of the Treaty of Reciprocity with the United States in 1876, the future success of sugar in the Hawaiian Islands seemed assured. At that time, several small plantations in the districts east of Wailuku and Kahului and north of Makawao developed new plans to expand the growing of sugar. On September 30, 1876, the government of Hawaiʻi gave permission to the plantations of Maui to take water from the principal six streams of the region and convey the water by ditch to their fields, for an annual rental of $100 (Kuykendall 1967:64). The project of the system by which mountain water was brought from East Maui was completed on schedule and, in July 1877, the first water began flowing through the ditch to the Haʻikū Plantation. The transfer of water sparked the rise of the commercial sugar industry on Maui and prompted the expansion of the aqueduct system to include a present-day estimate of 50 miles of tunnels, 24 miles of ditches, 13 inverted siphons, approximately 400 intakes, eight reservoirs, 62 miles of private roads, and a solar-powered radio telemetry system to monitor ditch flows (ASCE 2001).

Rubber plantations in portions of East Maui soon followed sugar with the start of the Nāhiku Rubber Company, Koʻolau Rubber Company, American-Hawaiian Rubber Company, and the planting of rubber by the Nāhiku Sugar Company throughout the early 1900s. Ultimately a decline in the price of rubber doomed the Maui rubber industry.

Additional research into the history of East Maui included a summary of the development of the community of Keʻanae, the construction of the Hāna Belt Road and subsequent designation of the corridor as an historic district, and a review of modern land use in the region focused on the activities of the more than 700,000 tourists that travel annually throughout this region.

Previous archaeological research included a summary of approximately 45 archaeological studies conducted in the vicinity of the current License Area including early island-wide surveys, studies specific to the Hāna Highway, and studies conducted in the vicinity of each license area. In general, these studies document the rich archaeological landscape along the coast of the region and extending upward into many of the stream valleys. Findings include agricultural complexes, habitation areas, heiau, trails, walls, historic structures and remnants,

WWII-era structures, and other associated artifacts and deposits. Few of these previous studies are within or overlap with the CSH's LRFI.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the continued operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on historic and archeological resources in the region are anticipated as the Proposed Action does not involve any significant new ground disturbance. The Proposed Action does not entail partial or total destruction or alteration of historic properties, or detrimental alteration of the surrounding environment, detrimental visual, spatial, noise or atmospheric impingement, nor does it propose increasing public access within the License Area, which could bring about resulting damage to the EMI Aqueduct System. Nor does the Proposed Action involve the deterioration or destruction of the EMI Aqueduct System.

However, due to the CWRM D&O, some of the sluice gates must be removed from the stream diversion of particular streams, regardless of whether the Water Lease is issued or not. The effect of the removal of the sluice gates is minimal, as they do not drastically alter the overall physical appearance of the historic EMI Aqueduct System. Documentation of the sluice gates with photos and location sketch plans conforming to the Historic American Engineering Survey (HAER) standards where sluice gates are to be removed or altered is proposed. Many of the sluice gates are unique to a particular stream, and documentation will ensure that nothing is lost over time.

Upcountry Maui

CSH LRFI only surveyed portions of the License Area within East Maui. The EMI Aqueduct System conveys water to Upcountry Maui to the MDWS to meet domestic and agricultural water demands. Upcountry Maui is a highly altered urban environment and the Proposed Action does not propose any new actions in Upcountry Maui.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on historic and archeological resources in Upcountry Maui are anticipated as the Proposed Action does not involve any construction or any ground disturbance.

Central Maui

Central Maui has been in agricultural production well over 100 years. The EMI Aqueduct System conveys water to the agricultural fields to Central Maui and has done so for over 100 years to support agricultural operations.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on historic and archeological in Central Maui are anticipated as the agricultural fields in Maui have been subject to agricultural activities for over a century.

4.6 Cultural Resources and Practices

East Maui

CSH prepared a Cultural Impact Assessment (CIA) for the Proposed Action dated June 2019 (See Appendix F). The CIA was prepared in conjunction with CSH's LRFI discussed in Section 4.5.[3] The purpose of the CIA is to comply with the State of Hawai'i's environmental review process under HRS Chapter 343, which requires consideration of the Proposed Action's potential effect on cultural beliefs, practices and resources. The CIA also aids in supporting the Proposed Action's historic preservation review under HRS Chapter 6E and HAR Title 13, Chapters 275 and 284.

The CIA included examination of cultural and historical resources, including Land Commission documents, historic maps, and previous research reports with the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal, and other resources, accessing religious sites, or agricultural pursuits as may be indicated in the historic record. The CIA reviewed previous archaeological work at and near the License Area that may be relevant to reconstructions of traditional land use activities; and to the identification and description of cultural resources, practices, and beliefs associated with the parcel. Consultation and interviews with knowledgeable parties regarding cultural and natural resources and practices at or in the vicinity of the License Area; present and past uses of the License Area; and/or other practices, uses, or traditions associated with the License Area and environs.

Cultural documents, primary and secondary cultural and historical sources, previous archaeological reports, historic maps, and photographs were reviewed for information pertaining to the study area. Research was primarily conducted at the CSH library. Other archives and libraries including the Hawai'i State Archives, the Bishop Museum archives, the University of Hawai'i at Mānoa's Hamilton Library, Ulukau, The Hawaiian Electronic Library (Ulukau.org 2004), the SHPD library, the State of Hawai'i Land Survey Division, the Hawaiian Historical Society, and the Hawaiian Mission Houses Historic Site and Archives are also

[3] Information and discussions presented from CSH's LRFI in Section 4.5 was not repeated in this discussion to avoid repetition.

repositories where CSH cultural researchers gather information. Information on Land Commission Awards (LCAs) were accessed via the Waihona ʻAina (2000) Māhele database, the Office of Hawaiian Affairs (OHA) (2015) Papakilo Database, and the Ava Konohiki (2015) Ancestral Visions of ʻĀina website.

CSH's consultation efforts utilized previous contact lists, in-house database of kūpuna (elders), kamaʻāina (native born), cultural practitioners, lineal and cultural descendants, Native Hawaiian Organizations (NHO; includes Hawaiian Civic Clubs and those listed on the Department of Interior's NHO list), and community groups. CSH also contacted agencies such as SHPD, OHA, and the appropriate Island Burial Council regarding the License Area located for their response to identify lineal and cultural descendants, individuals, and or NHO with cultural expertise and or knowledge of the License Area.

CSH contacted a total of 136 parties including the County of Maui, other agencies, the DHHL beneficiaries, NHOs such as Aha Moku o Maui, Inc., Kuloloia Lineage-I Ke Kai o Kulolia, Waiehu Kou Phase 3 Association and knowledgeable community members. NHOs consulted included: Aha Moku o Maui, Inc. (Keʻeaumoku Kapu and Kyle Nakanelua); Kuloloiʻa Lineage – I Ke Kai o Kuloliʻa (Les Kuloloiʻa); Waiehu Kou Phase 3 Association (Roy Oliveira); Moku o Kaupō (Jade Alohalani Smith); and Aha Moku o Kahikinui (Donna Sterling).

Of the 136 parties consulted, a total of 15 people/agencies responded to the consultation letter. Three people participated in formal interviews. CSH initiated its outreach effort in November 2017 which included letters, phone calls, emails, and in-person interviews. Below is a list of individuals and agencies who shared their manaʻo (thoughts, opinions) and ʻike (knowledge) about the License Area:

1. Dr. Kamanaʻopono Crabbe, Ka Pouhana – OHA
2. Pomaikaʻi Crozier. Conservation Manager – Puʻu Kukui Watershed Preserve
3. Skippy Hau, Kamaʻāina (native born) and Aquatic Biologist – Division of Aquatic Resources – State of Hawaiʻi
4. Garrett Hew, Kamaʻāina, Upcountry Maui farmer, and former East Maui Irrigation (EMI) employee
5. Robert Hobdy, Retired naturalist and forester
6. Roslyn Lightfoot, Director – Alexander & Baldwin Sugar Museum
7. Kyle Nakanelua, Kamaʻāina, Aha Moku o Maui, and kalo (taro; Colocasia esculenta) farmer
8. Jerry Sakugawa, Upcountry Maui farmer
9. Sandy Takeshita, Upcountry Maui farmer
10. Mahealani Wendt, Member of Nā Moku Aupuni o Koʻolau Hui
11. Mavis Oliveira-Medeiros, Kamaʻāina of Hāna
12. Dawn Lono, Long-time resident of Hāna
13. Shane Sinenci, holds the County Council seat for the East Maui residency area
14. Dorothy "Aunty Dottie/Kumu Kamalu" Kahoʻokele and ʻOhana Kamaʻāina of Nāhiku
15. Moses "Moke Boy" Bergau, Kamaʻāina of Nāhiku

In addition, CSH asked permission to use declarations made by members of the community and of Nā Moku Aupuni o Koʻolau that were given to the CWRM in late 2014, a couple of years prior to the issuance of the CWRM D&O, which was issued on June 20, 2018. Although the

declarations are part of the public domain, CSH nevertheless attempted to contact each individual to obtain approval to include these declarations in the CIA. Below is a list of individuals who approved use of their declaration as part of the CIA:

1. Dan Clark
2. Jonah Jacintho
3. Lezley Jacintho
4. Kaui L. Kanakaʻole
5. Pualani Kimokeo
6. Davianna McGregor, Ph.D.
7. Lurlyn Scott
8. Earl Smith, Sr.
9. Ty Kāwika Tengan
10. Edward Wendt
11. Emily Wendt

The following is a brief discussion and summary of CSH's CIA report within the context of the License Area in East Maui, as well as information gathered from the community consultation and declarations, participants voiced and framed the following concerns in a cultural context.

In summary the background research of the CIA yielded the following results, in approximate chronological order:

1. The License Area encompass the following ahupuaʻa: Honopou, Mokupapa, Waipiʻoiki, Waipiʻonui, Hanehoi, West Hanawana, East Hanawana, Puʻuomālie, Pāpaʻaʻea, West Makaīwa, East Makaīwa, Honomanū, Keʻanae, Wailuānui, Wailuāiki, Koʻolau, and Paʻakea.

2. Makapipi, Hanawī, and Kapāʻula in the Nāhiku License Area; Waiaʻaka, Paʻakea, Puakea, Waiohue, Kopiliʻula, Puaʻakaʻa Tributary, East Wailuāiku, West Wailuāiki, Wailuānui (Waikani Waterfall), Kualani (or Hāmau), Waiokamilo, ʻŌhiʻa (or Waianu), Palauhulu (Hauoli Wahine and Kano Tributaries), Piʻinaʻau in the Keʻanae License Area; Nuaʻailua, Honomanū, Punalaʻu (Kōlea and Ulunui Tributaries), Haʻipuaʻena in the Honomanū License Area; and Puohokamoa, Wahinepeʻe, Waikamoi (Alo Tributary), Kōlea, Punaluʻu, Kaʻaiea, ʻOʻopuola (Makanali Tributary), Puehu, Nāʻiliʻilihaele, Kailua, Hanahana (Ohanui Tributary or Hanawana or Hanauna), Hoalua, Hanehoi, Huelo (Puolua Tributary), Waipiʻo, Mokupapa, Hoʻolawa (Hoʻolawa ili and Hoʻolawa nui Tributaries), and Honopou (Puniawa Tributary) in the Huelo License Area.

3. According to moʻolelo, in "The Epic Tale of Hiʻiakaikapoliopele," retold by Hoʻoulumāhiehie, Hiʻiaka and her friend Wahineʻōmaʻo sail to Maui and travel to the windward side of the island. They stop in Wailua Iki Ahupuaʻa where they encounter a group of people celebrating the hula. The hālau was filled with men, women, and children (Hoʻoulumāhiehie 2008:199). Hiʻiaka sees her cousin Kapokūlani (Kapo) in hopes of being invited in to eat and rest. Hiʻiaka offers a chant and this is when Kapo notices her ʻohana. It should be noted that Kapo is a goddess of sorcery on Maui where she acts as an akua noho.

4. Kihapiʻilani is the son of the aliʻi nui Piʻilani. Kihapiʻilani is known for his lelekawa skills and for building a stone paved road around the island of Maui (Beckwith 1970). According to legend, Kihapiʻilani fled from his brother and took up residence in Makawao but kept his identity a secret. He left Makawao after he was accused of being lazy and stayed in Kalauaʻama in Haʻikū to obtain sweet potato growing skills. He later took his skill set to Kalaniwai and Wailuku.

5. In the legend of Kāne and Kanaloa, the two demi-gods are in search for water to accompany their appetite for ʻawa. One of the first places the pair travel to is in the mountains of Keʻanae where Kāne thrusts his kauila wood staff into the ground and a spring appears. According to author, Martha Beckwith, two holes can be seen across from ʻŌhia Gulch (1970:65).

6. ʻAiʻai, son of Kuʻula the Fish God, instructed his friends to venture into the deep waters off of Wailua Nui Ahupuaʻa and kill the giant heʻe that lived there. Canoes were drawn and people came down ready. ʻAiʻai brough the hokeo and leho that his father gave him. The canoes and people sailed out. It was here that Kuʻula and Hina were called upon for their assistance and the hokeo and leho were taken out and lowered into the ocean. The heʻe was attracted by the radiance the leho brought out but due to its overwhelming size, scared the people. ʻAiʻai's friend brought a stone with him and at the right time, shoved the stone into the head of the squid. The weight of the stone sunk the heʻe and one of the men cut off one of the tentacles of the squid. When the heʻe died it turned into stone and a formation resembling a squid can be seen just outside of Wailua Nui (Thrum 1907:234-235).

7. Of the 230 structures that Walker (1931) surveyed on Maui, 39 of the recorded heiau (Walker Sites 64 through 102) were documented in this portion of East Maui. Of the 39 documented heiau sites, only one lies within the License Area. This heiau is named Puʻu o Koholā and was presumed to be located within the current Honomanū License Area. Puʻu o Koholā was listed as "destroyed/not found" by Walker (1931).

8. The Alaloa (Long Road) of Kihapiilani or the Kihapiilani Highway, was constructed during the sixteenth century during the reign of Kihapiʻilani. The chief is credited with completed the paved road from Hāna to Wailuku, which was initiated by his father, Piʻilani (Fleming 1933). The road provided a means of trade, commerce, and war time protection.

9. Honomanū Valley was once the site of a large Hawaiian community. The residents of this area utilized the bay for canoe fishing and the uplands for agricultural terracing and house sites (Handy and Handy 1978). Another account states that many burials can be found in the upper reaches of the valley (Sterling 1998:109).

10. Keʻanae Peninsula is a lava plain that extends a mile into the ocean from Keʻanae Valley. This area is known for loʻi cultivation and still continues to celebrate a traditional Native Hawaiian lifestyle today (Handy 1940).

11. The earliest estimation of occupation along the coastal region of East Maui is approximately AD 1200.The abundance of traditional land divisions and place names

between Hāmākua Loa and Hāna suggest habitation was extensive after initial establishment.

12. Documentation regarding Native Hawaiian tenancy reveal that ocean resources were just as important as products of the land for sustenance. The preferred method of fishing was open ocean fishing for the people who lived along the coast of East Maui. In waters of ten or more fathoms deep, the favored technique was kākā or kūkaula.

13. It has been noted that there was some rivalry between the ahupuaʻa of Keʻanae and neighboring Wailua Nui. This rivalry gave way to larger political battles concerning rule of Maui Island between the sons of Piʻilani (Kamakau 1992:22-29) and later the consolidation of power and unification of the Hawaiian Islands under Kamehameha (Group 70 International Inc. et al. 1995).

14. In 1778, after Captain James Cook's ships returned from their North American explorations, the crew stopped in Hāna and encountered Hawaiians for the first time on board their ships (Cordy 2000:294).

15. Prior to the establishment of the Hāna protestant mission in 1837, missionaries would visit East Maui once or twice a year. Hāna was considered to be "one of the most isolated places in these islands, remote and difficult to access". The journey was made by horseback to Keʻanae then traveled by canoe for the remainder of the trip.

16. Māhele documentation exhibits that occupancy was dense in East Maui, especially in the Honopou, Mokupapa, and Keʻanae regions. According to records, the land was used for traditional crops including loʻi kalo, kula, potato growing, olonā, ʻie, wauke, koa, ʻulu, and ʻōhiʻa. In addition, many streams, ʻauwai, and loko iʻa were claimed as well. A unique trait to this area was that specific areas including the sea shore, pali, government roads, and streams that contained ʻōpae and ʻoʻopu were also claimed.

17. The Māhele of 1848 set the precedence of private land ownership across the entire Hawaiian Island chain and Maui was no exception to the age of Western development. The Māhele enabled foreigners and foreign nationals to acquire land for the establishment of ranching and plantation operations, including any infrastructure projects that were to support these land intensive industries.

18. With the decline of the whaling industry in the mid- to late-1800s, the Hawaiian Islands attracted a new generation of entrepreneurs. Samuel T. Alexander and Henry Perrine Baldwin were prominent in this movement. Alexander was credited with using irrigation for improving sugarcane and banana yields, while Baldwin's father had been granted 2,675-acres of land in northwest Maui.

19. In 1867, Samuel T. Alexander proposed a massive construction project to bring mountain water from the streams of East Maui to the Central Maui isthmus, where many sugar crops were experiencing drought. This would later be known as the EMI Aqueduct System.

20. The digging of the irrigation ditch from East Maui to Central Maui was a great feat. Hundreds of men were employed at a time with food, shelter, and tools supplied to them. The work required brute strength as heavy timber for flumes would need to be transported from the main road to the upper reaches of the forest (Thrum 1877:39-42). The crew dealt with torrential rains and landslides. Sometimes workers hacked their way through the thick forests and were required to descend sheer cliffs by way of rope.

21. In July of 1877, the first water began to flow through the ditch and reached Haiku Plantation 24 hours later. Approximately 60 million gallons of water per day ran through the ditch system. The system cost $80,000, which was paid for by Castle & Cooke.

22. The EMI Aqueduct System has been in use for over 134 years and continues to collect water today for private and municipal entities. The EMI Aqueduct System contains 50 miles of tunnels, 24 miles of open ditches, inverted siphons and flumes, 388 intakes, eight reservoirs, and a solar powered radio telemetry system to monitor ditch flow. The catchment begins at roughly 1,300 ft. elevation and delivers water to Central Maui at an elevation of 1,150 ft., covering 18 miles from its western to eastern extent (ASCE 2001).

In summary, the information gathered from the community consultation, participants voiced the following concerns not related to the cultural context:

1. Community participant Skippy Hau noted that "not all lands belong to the State" and recommends that private lands should and need to be identified by signs and safe parking areas. In addition, many visitors and tour groups assume that most lands belong to the State resulting in illegal trespassing. Also noted that rental cars regularly block Hāna Highway creating and blocking traffic.

2. 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.

3. In addition, 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.

4. Participant Kyle Nakanelua's recommendations for this project was simply, "Follow the law! Support the law! File for your permit. There's a policy and there's procedures. Adhere to the policy and follow the procedures. And stop trying to circumvent it [the law] because you smart. You know, just be honest, be transparent."

In summary, the information gathered from the community consultation, participants voiced the following concerns related to the cultural context:

1. Mr. Hau states that native gathering rights should be addressed. The gathering of ʻōpae (general name for shrimp), ʻoʻopu (general name for fishes included in the families Eleotridae, Gobiidae, and Blennidae), and hīhīwai (endemic grainy snail; Neritinu graposa) continue throughout East Maui streams that are being diverted.

2. Mr. Hau adds that State lands should be open to the public for hunting and gathering. The general public should have access for recreational activities such as hiking, scenic viewing, and swimming at waterfalls.

3. Mr. Robert Hobdy voiced his concerns, which include that the EIS study should:
    a. Provide adequate stream flow to support diversified agriculture in the Hamakualoa and Koʻolau region.
    b. Provide adequate stream flow to support indigenous fish, shrimp, and mollusk species in the Hamakualoa and Koʻolau region.

4. Participant Kyle Nakanelua is concerned with the act of diverting water. He explicitly states that "when those places dry up that adversely impacts the way of life, the cultural practice if you will" and it "adversely impacts the people's way of life that live there."
    a. To support this claim, Mr. Nakanelua states that ʻōpae was once prevalent in the streams that flowed through their family property named Lakini. He relates that when he began to regularly clean the property his grandmother would still catch ʻōpae. He adds that today there is no ʻōpae but there are prawns. When CSH asked if ʻōpae was being overpicked, he replied "no" because "we were the only one there." He also does not think the introduction of prawns is to blame but believes "that the flow of water is impactual" and has seen the water decline since 1989.

5. A 2014 declaration provided by Dan Clark from Keʻanae stated he needs cool, fast running water for optimal kalo production. Due to low stream flow results, there has been an increase in disease to his kalo, which decreases production.

6. Jonah Jacintho states in his 2014 declaration that due to a lack of stream flow, fish populations have decreased therefore he cannot fish as much. To increase the population of ocean fish, fresh water is integral for spawning and nutrients. He also added that more water in stream beds would also increase ʻoʻopu, prawn, and hīhīwai populations.

7. In Lezley Jacintho's 2014 declaration, she states that due to lack of stream flows, her kalo production has declined due to root rot and other diseases. She adds that stream flow output is also important in the spawning of different species of fish. The lack of stream flow affects her gathering rights as a Native Hawaiian and her ʻohana (family). Native species such as ʻoʻopu needs fresh water to travel back upstream, which compromises their reproduction. Fish, hīhīwai, ʻōpae, and ʻoʻopu populations are also scarce and many families cannot gather these resources causing them to move away. Another concern Ms. Jacintho voiced is stagnate water, which causes leptospirosis and other bacteria.

8. Kauʻi Kanakaʻole voices in her 2014 declaration the Papaku Makawalu framework, which incorporates traditional Hawaiian knowledge and moʻolelo (stories) and connects it with wahi (place). Papaku Makawalu consists of three Papa or houses of knowledge (earth, atmospheric, and the living). In this case, Ms. Kanakaʻole points out that without water, all three Papa could not exist. She shares moʻolelo on Oʻopuola Stream, Makapīpī Stream, Kaʻaiea Stream, and ʻŌhiʻa Stream. She points out that ʻŌhiʻa Stream was known for its healing powers and that the people of this area understood that this water was "special, sacred, kapu (taboo) and only to be used in unique circumstances."

9. Pualani Kimokeo states in her 2014 declaration that due to a lack of stream flow there is an increase in pocket rot and "guava seed," which she describes as a growth on the taro. There are also apple snails in her loʻi kalo, which she states like the warm water. She points out that farmers in Keʻanae have to compete for water.

10. In Earl Smith, Sr.'s 2014 declaration, he states that he recalls gathering ʻōpae, hīhīwai, and ʻoʻopu from Hanawī, Makapīpī, and Oneʻo Streams. He can only find these species in Hanawī Stream. Near the coast, he would fish for moi (threadfish; Polydactylus sexfilis), aholehole (Hawaiian flagtail; Kuhlia sandvicensis), manini (reef surgeonfish; Acanthurus triostegus), and enenue (chub; Kyphosus bigibbus) but has noticed a depletion of fish. He attributes this to a lack of stream flow that empties in the ocean.

11. In Edward Wendt's 2014 declaration, he states that he gathers and fishes in the streams to provide a protein source for his family, neighbors, and kūpuna (elders) who may be unable to gather for themselves. He also enjoys teaching traditional fishing practices and values to students. However, due to the lack of adequate stream flow, Mr. Wendt is unable to teach students how to mālama (to take care of) streams, fish, and gather. The diminished stream flow has negatively impacted the muliwai, fisheries, and his loʻi kalo. Invasive species such as the apple snail and African tulip tree have infringed his loʻi kalo.

Based on information gathered from the cultural and historical background, and the community consultation, significant cultural resources were identified within the License Area, as well as outside of the License Area. It should be acknowledged that although some of the impacted cultural resources exist outside of the License Area, what takes place within the License Area directly affects these cultural practices and resources. At present, there is documentation and testimony indicating traditional and customary Native Hawaiian rights are currently being exercised within the License Area. Cultural resources, practices, and beliefs were identified as currently existing within the License Area. In addition, East Maui, which includes the License Area and beyond the License Area, maintains a rich subsistence and cultural history.

The earliest initial occupation in East Maui is estimated at 1200 AD (Haun et al. 2004). The abundance of traditional land divisions and wahi pana spanning from Hāmākua Loa to Hāna suggest that habitation continued to increase after initial establishment. Xamanek Researches conducted an AIS in 2000 of a parcel near the muliwai of Hanawana Stream. A charcoal sample from the study yielded a radiocarbon date of AD 1425 to 1665. In conjunction with moʻolelo and kaʻao, such material evidence indexes the importance of East Maui and its natural resources in supporting early inhabitants and traditional practices. Throughout this

analysis, an effort is made to ground physical evidence within traditional cultural frameworks or knowledge systems. That is, understandings of East Maui's ecological processes and anthropogenic activities have been informed by various traditional sources, including moʻolelo, mele, or oli. As pointed out by anthropologist Laura Nader and reiterated by Dr. Kathleen Kawelu, "science is not free of culture; rather, it is full of it" (Kawelu 2015:6; Nader 1996: xiii). Several moʻolelo, unique to East Maui, do indeed provide key insights into the socio-cultural and socio-economic realities of pre-Contact life. Ka Moʻolelo o Hiʻiakaikapoliopele relates how Hiʻiaka stopped in Wailua Iki and stumbled upon a crowd celebrating hula in a hālau filled with men, women, and children. This moʻolelo exhibits the popularity of hula in this area as well as a burgeoning population in East Maui.

Piʻilani, Mōʻī of Maui, ordered to have a hand-fitted, basalt block road constructed, which connected Wailuku to Hāna. This road served as a trail for residents and was also accessed during times of war. During the last half of the eighteenth century, war occurred frequently. The road, along with canoe landings and inhabited places, were common sites for robbery and death for makaʻāinana. After Piʻilani's death, his son Kihapiʻilani continued the construction of the road, extending through Kaupō and across Haleakalā. It was called the Alaloa of Kihapiʻilani, also known as the King's Road. The amount of labor that went into the Alaloa suggests that there was a large population of able-bodied men to complete the trail. The caloric demands of such a workforce would have no doubt been significant, suggesting that a large amount of food also was available to sustain the workers.

East Maui was and still is an ideal place to cultivate kalo based on the rich soils and the amount of rain that occurs per year. The License Area contains various tributaries. Wet patches were and still exist in the makai regions, while dryland kalo was planted in the mauka areas. Keʻanae and Wailua Nui continue to be thriving regions within the License Area that still practice traditional taro farming.

ʻŌlelo noʻeau, mele, and oli all attest to the abundance of water, in addition to the resources available from the ocean and uplands. However, documents such as LCAs and associated maps exhibit the expansive population of East Maui during The Māhele. Although most of the LCAs are outside of the License Area, it is important to point out that the water that runs through the License Area leads to these kuleana parcels, many of which are still kuleana properties held by the same families today. Land use was inventoried during The Māhele. Common uses and kuleana include residence, farming (loʻi, kula, kīhāpai, pōʻalima, specific patches for olonā and hala), associated farm structures (pig pens), water ways (ʻauwai, fishponds, streams, beaches, and the sea), forests, and infrastructure (government road, trails, foot paths). Land use records indicate that almost every property had at least one loʻi kalo with some of the highest concentrations in the Huelo and Keʻanae license areas, the latter still being an active community that continues the practice. Although quantity of water matters for the community, it is also about velocity. Mr. Kyle Nakanelua relates the importance of having "a really crisp and vigorous flow" to the water because "that's what keeps everything stimulated and alive" which contributes to having a healthy stream and flow. Having water that is cold and constantly running are vital components of farming wet land kalo.

In addition to kalo, pohole or the fiddlehead fern is also a staple in the diet for residents of East Maui along with watercress, ʻulu, bananas, lūʻau, etc. Traditional subsistence is important to those who live in this remote area of East Maui as it not only is a reliable food source but

ensures a healthy diet. Plants such as pohole and watercress are aquatic plants, which need an abundant amount of fresh, running water for optimal growth. Pohole is a wild plant that needs to be foraged and is widespread throughout the License Area. Pohole that is growing in or adjacent to tributaries that have limited and/or diverted water are most likely impacted gathering grounds.

The water source for the East Maui streams came from the backside of Haleakalā, which supplies the streams with fresh water, providing an ecosystem for aquatic life. Fresh, brackish, and ocean resources were and continue to be an important food source for Native Hawaiians (McGregor 2007:109). Habitation patterns model settlement near the ocean, which alludes that Native Hawaiians settled close to their food sources such as the ocean and in areas that were viable for kalo growth. Native Hawaiian author and historian Samuel Kamakau relates that the people of Koʻolau worshipped sharks "in order to be saved from being eaten by a shark when they went fishing" (Kamakau 1991:78). The favored method of fishing off of East Maui was the kākā and kūkaula methods. The kākā method required a hook and line and was utilized at a depth of 200 fathoms. The kūkaula method also used hook and line but was employed at 50+ fathoms. Through interviews, informal discussions with community members, and CWRM declarations, it is evident that residents within and in the vicinity of the License Area rely heavily on fresh and salt water resources as a food source.

Many community members stated that they formerly utilized stream fauna as a food source, however, due to the stream water being limited and/or diverted in conjunction with invasive species, it is now deemed an unreliable food source. ʻOʻopu, ʻōpae, and hīhīwai were staples to East Maui resident's diets. Kūpuna who lived near the streams in the 1920s and 1930s also caught and ate ʻōhua and hinana, which were prevalent in tributaries. East Maui residents and those who intimately know the mauka regions of East Maui know where to gather these limited aquaculture resources. For example, State of Hawaiʻi Aquatic Biologist, Skippy Hau, shared that at one time ʻōpae could be found in streams spanning from mauka to makai. Today ʻōpae can be found only in the mountain areas where stream water is cooler but have mostly adapted to inconsistent stream flows. Mr. Hau also shared that hīhīwai, one of the slowest migrating animals, utilize heavy rains and flash flooding to transport larvae into the ocean, so they can migrate upstream again over a period of time. However, fresh water is also needed to assist in this process. Although, "the natural environment has a built-in capacity to respond and adapt to traumas and shocks (system resilience)," this is not infinite. Diverted streams, whereby the mauka-makai connection is severed, strain the resiliency of the stream's ecosystem by inhibiting reproduction rates of freshwater animals as well as growth patterns.

In addition, salt water resources are also being compromised by limited fresh water being emptied into the ocean, which is a vital component for propagation. Mr. Earl Smith, Sr. would fish for moi, aholehole, manini, and enenue but has since observed a considerable decline in populations and relates this to the lack of fresh water entering the ocean. Mr. Jonah Jacintho also related that a lack of stream flow inhibits nutrients from mauka traveling makai, which creates warmer waters and an unfavorable ecosystem for fish, mollusks, and other ocean life to replenish. Although the License Area is not adjacent to the ocean, the ocean is directly affected because the fresh water that runs throughout the License Area is limited and/or being diverted. Modifications to flow, such as diversion, invariably result in a dramatic decline in ocean life by restricting nutrients that are carried via tributaries and emptied into the ocean, which are needed for healthy conditions and growth patterns.

However, the SE & MRC report (2019) provided some important information regarding the interactions of streams and the ocean in East Maui contrasting the statements made above. Of particular significance is that the effects of stream water on marine waters must be considered minor in these habitats. This result is supported by the physical processes associated with relatively small input of stream water to the vastly larger ocean environment. The prevailing conditions of extreme mixing by physical forces is the most important factor in diminishing the zone of influence of stream water in the marine setting. In all cases where it was possible to sample across the boundary where streams flowed to the ocean, there were sharp gradients reflecting the intense mixing of stream water to background ocean levels. Observations of the habitats in these transition zones indicated that they were composed primarily of sand and barren rock. Owing to continual, intense wave energy, these nearshore areas do not constitute important habitats for coral reef communities and associated marine species. Beyond the narrow transition zone, the influence of stream water is minimal owing to rapid and intense mixing. These processes should not be affected by changes in stream flow related to seasonal variation or diversions.

Based on the cultural and historical background presented above, in conjunction with archaeological evidence, oral histories, declarations, and interviews throughout East Maui, the CIA determined that there are specific valued natural and cultural resources within the License Area. There is evidence of identified traditional and customary cultural practices associated with natural and cultural resources that are regularly exercised within the License Area, which includes the following activities and resources:

1. Foraging, traditional, and generational gathering of freshwater species for personal consumption. These species include but are not limited to ʻōpae, ʻoʻopu, pūpūloʻi (also known as pūpū Pākē or Chinese snail), crayfish, prawns, and hīhīwai.

2. Foraging, traditional, and generational gathering of plants that may be in or adjacent to tributaries for personal consumption. These species include but are not limited to pohole and watercress.

3. Traditional and generational gathering of introduced plants that can be cultivated or foraged. These species include but are not limited to ʻulu, bananas, wild kalo, wild lūʻau, guava, ʻuala, ʻawapuhi, tī, oranges, hāhā, avocado, puakenikeni, and medicinal plants for lāʻau lapaʻau.

4. Traditional and generational gathering of plants that can only be foraged. This includes but is not limited to pepeiao, various types of ferns (ornamental), and hau.

5. Traditional and generational gathering of rocks that are used for traditional food preparation. These activities include but are not limited to imu and the production of stone tools for traditional food preparation (i.e., pōhaku kuʻi ʻai).

6. Traditional and generational fishing and gathering methods utilized for the shoreline and offshore. Species gathered include but are not limited to limu (seaweed), ʻopihi (limpets), lobster, enenue, kole, ulua, moi, aholehole, ʻanae, kumu, tako, moanakali,

ʻōmilu, ʻūʻū/menpachi (soldierfish; Holocentridae), ʻāweoweo (Bulleye; Priacanthus meeki), pāpio, paʻananu, ʻōʻio, uhu, lae, kala, black crab, hāʻukeʻuke, and kūpipi.

It should be noted that the information gathered from the consultation process was gathered prior to the issuance of the CWRM D&O, and much of the information was taken from declarations that were submitted to CWRM several years ago in support of setting the IIFS.

Impacts and Mitigation Measures

Based on information gathered from the cultural and historical background, and the community consultation, significant cultural resources were identified within the License Area, well as outside of the License Area. It should be acknowledged that although some of the impacted cultural resources exist outside of the License Area, what takes place within the License Area directly affects these cultural practices and resources. At present, there is documentation and testimony indicating traditional and customary Native Hawaiian rights are currently being exercised within the License Area. Cultural resources, practices, and beliefs were identified as currently existing within the License Area.

CSH has identified potential impacts and made the following recommendations.

1. Impact: Participants expressed their concern for clarification on stream flow, water diversion, and climate statistics with the following questions:
    - How much water is being diverted at each location of intakes, ditches, dams, pipes, and flumes?
    - How much water is being diverted from East Maui to Central Maui?
    - Is climate change accounted for?

    CSH Recommendation: It is recommended that these questions be addressed by qualified professionals who possess an understanding of stream flow mechanics, water diversion, and climate statistics within the License Area.

    For the purposes of this DEIS, diversion quantities from the CWRM D&O were used to estimate the maximum amount of water to be diverted by the EMI Aqueduct System from the License Area. Water that is being diverted out of the License Area is measured at Honopou Stream (refer to Section 2.1.2 for more details). Climate change is addressed in Section 4.3.1.

2. Impact: Several community participants voiced their concern regarding indigenous freshwater species that may be impacted by the act of diverting water. These species include but are not limited to ʻōpae, ʻoʻopu, pūpūloʻi (also known as pūpū Pākē, or Chinese snail), crayfish, prawns, and hīhīwai (endemic grainy snail; Neritinu graposa), which are still gathered regularly by residents for personal consumption. Furthermore, community participants shared their concern of water not exiting stream beds and flowing into the ocean. This estuary environment creates an ecosystem where freshwater and saltwater species spawn and travel back upstream (such as e) or continue to grow in the ocean. Specific streams mentioned by community participants where this impact is identified include: Wahinepeʻe, Puohokamoa, Haʻipuaʻena, Honopou (Puniawa Tributary), Punalaʻu (Kōlea and Ulunui Tributaries), Honomanū,

Nuaʻailua, Piʻinaʻau, Waiokamilo, Wailuānui (Waikani Waterfall), Kopiliʻula, Paʻakea, Kapāʻula, Hanawī, Makapipi, Waiohue, Waikamoi (Alo Tributary), Hanehoi, Palauhulu (Hauoli Wahine and Kano Tributaries), ʻŌhiʻa (or Waianu), Kualani (or Hāmau), East Wailuāiki, West Wailuāiki, Puaʻakaʻa Tributary, and Waiaʻaka. It is understood that these streams were subject to the CWRM D&O decision.

CSH Recommendation: It is recommended that a biologist or similar qualified professional provide an assessment of the impacts of water diversion to indigenous freshwater species (ʻōpae, ʻoʻopu, and hīhīwai) within the License Area. The application of the CWRM D&O has the potential to reduce or eliminate this cultural impact. Nine of the streams mentioned by community participants where this impact is identified have been fully restored in accordance with the CWRM D&O. These include Honopou (Puniawa Tributary), Piʻinaʻau, Waiokamilo, Wailuānui (Waikani Waterfall), Makapipi, Waiohue, Hanehoi, Palauhulu (Hauoli Wahine and Kano Tributaries), and West Wailuāiki Streams.

Trutta and SWCA prepared reports in support of the DEIS assessing the impacts of the Proposed Action, particularly impacts on indigenous freshwater species, and terrestrial flora and fauna. The impacts of the Proposed Action to freshwater species are discussed in Section 4.2.1 and the impacts to terrestrial flora and fauna are discussed in Sections 4.4.1 and 4.4.2. Moreover, the two reports are appended to the DEIS (See Appendix A and Appendix C).

3. Impact: A majority of participants who are taro farmers voiced their concern of the lack of water needed to maintain a healthy and productive loʻi kalo or taro patch. A cold, vigorous flow of water is needed for the production of kalo. Without an ample amount of water continuously flowing, many taro crops have been subject to invasive species such as the apple snail, root rot, and growths. Many taro farmers are unable to continue their traditional and generational cultural practice. Specific streams mentioned by community participants where this impact is identified include: Honopou (Puniawa Tributary), Waikamoi (Alo Tributary), Wahinepeʻe, Puohokamoa, Haʻipuaʻena, Punalaʻu (Kōlea and Ulunui Tributaries), Honomanū, Nuaʻailua, Piʻinaʻau, Palauhulu (Hauoli Wahine and Kano Tributaries), ʻŌhiʻa (or Waianu), Waiokamilo, Kualani (or Hāmau), Wailuānui (Waikani Waterfall), West Wailuāiki, East Wailuāiki, Kopiliʻula, Puaʻakaʻa, Paʻakea, Waiaʻaka, Kapāʻula, Hanawī, Makapipi, and Waiohue. However, these streams were subject to the CWRM D&O decision.

   Recommendation: It is recommended that a botanist, ethnobotanist, or similar qualified professional provide an assessment of the ideal conditions of water flow and water temperature needed for kalo growth in comparison to the current water flow and water temperature of impacted areas in order to understand and address the stated impact. The application of the CWRM D&O has the potential to reduce or eliminate this cultural impact. Eight of the streams mentioned by community participants where this impact is identified have been fully restored in accordance with the CWRM D&O. Honopou (Puniawa Tributary), Piʻinaʻau, Palauhulu (Hauoli Wahine and Kano Tributaries), Waiokamilo, Wailuānui (Waikani Waterfall), West Wailuāiki, Makapipi, and Waiohue.

The CWRM's approach does not automatically set precedents for other areas, but provides a model of water use that integrates traditional culture with modern natural resource management (CWRM COL 138-145, 2018).

4. Impact: While no human burials have been identified by previous archaeological studies within or immediately adjacent to the License Area, historical research indicates that Honomanū Valley and other areas throughout East Maui once held a sizable population. LCA documentation indicates that there were settlements along the coast, however, a pedestrian survey was also conducted where there was evidence of habitation in the higher reaches of the valley (E. M. Fredericksen and Fredericksen 1998b).

   Recommendation: It is recommended that any personnel involved in access, maintenance, or any other related activities within the License Area be informed of the possibility of inadvertent cultural finds, including human remains. In the event that any potential historic properties are inadvertently discovered within the License Area, these discoveries should be reported immediately to the SHPD. In the event that iwi kūpuna and/or cultural finds are encountered, consultation with lineal and cultural descendants of the area is also recommended.

Upcountry Maui

No changes to Upcountry Maui are planned as part of the Proposed Action. The EMI Aqueduct System conveys water to Upcountry Maui to the MDWS to meet domestic and agricultural water demands. Upcountry Maui is a highly altered urban environment.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on cultural resources and practices in Upcountry Maui are anticipated.

Central Maui

CSH's CIA only assessed the License Area within the greater East Maui region. The EMI Aqueduct System conveys water to the agricultural fields to Central Maui and has done so for over 100 years to support agricultural operations. The agricultural fields have been cultivated for over a century to grow sugarcane and there are no known cultural practices that occur or cultural resources within the agricultural fields in Central Maui.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action will allow the continued use of Central Maui for agricultural production, with a

significant change in that the prior monocrop sugarcane will be replaced by diversified agriculture. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on cultural resources and practices in Central Maui are anticipated.

4.7 Socio-Economic Characteristics

4.7.1 Population / Demographics

The County of Maui consists of three major islands, Maui the "Valley Island", Moloka'i the "Friendly Island", and Lana'i, the "Pineapple Island". Demographic and other information pertaining to the License Area within East Maui was reviewed from the U.S. Census 2010 for Maui County and is shown in Table 4-6.

The resident population of the County of Maui has demonstrated a substantial increase over the last two decades with the 1995 resident population of 117,895 increasing to 151,300 persons in 2010. Forecasts for 2020 reflect an island-wide population of 174,450 persons.

The proportion of Native Hawaiians and Pacific Islanders (25.8 percent) in Ke'anae, Wailuānui, and Nāhiku is significantly high in comparison to the Makawao District (8.3 percent) and Maui Island (9.5 percent). These communities also had the third highest proportion of White residents in the project area at 42.8 percent, while 45.9 percent of the Makawao District was White, compared to the 35.1 percent island-wide. The proportion of Asians (2.1 percent) in Ke'ane, Wailuānui, and Nāhiku is significantly low compared to Makawao District's 15.8 percent and Maui Island's 29.7 percent.

The Olinda census-designated place (CDP) had the highest proportion of workforce (ages 25 to 64) with a combined 63 percent, followed by the Ha'ikū-Pa'uwela CDP workforce at 61 percent, and Kula CDP at 60 percent. Kēōkea had the highest proportions of children under 18 years of age (26.2 percent) followed by Makawao, Pukulani, and Hāli'imaile (24 percent).

Table 4-7
Demographic Characteristics

Subject	Ke'anae Wailuānui Nāhiku	Makawao District (Partial) CDPs							
		Ha'ikū-Pa'uwela	Hāli'imaele	Kēōkea	Kula	Makawao	Olinda	Pukalani	Total Maui Island
RACE									
Native Hawaiian and Pacific Islander	25.8%	7.1%	11.8%	25.8%	4.2%	8.4%	3.2%	9.5%	9.6%
Asian	2.1%	8.1%	35.0%	8.7%	16.3%	15.9%	7.6%	23.9%	29.7%
White	42.8%	59.4%	20.5%	29.0%	56.3%	38.2%	71.1%	33.2%	35.1%
Black or African American	0.4%	0.3%	0.1%	0.7%	0.5%	0.4%	0.2%	0.4%	0.8%

American Indian and Alaska Native	0.5%	0.5%	0.1%	0.6%	0.4%	0.6%	1.3%	0.3%	0.4%
Some Other Race	1.1%	1.1%	2.5%	0.7%	1.2%	1.0%	0.8%	1.8%	2.1%
Two or More Races	27.4%	23.4%	30.0%	34.7%	21.2%	35.5%	15.8%	30.9%	22.8%
AGE									
Population	1,056	8,118	964	1,612	6,452	7,184	1,084	7,574	167,207
Under 18	21.0%	23.0%	24.0%	26.2%	20.0%	24.2%	18.7%	24.0%	21.8%
18-24	5.6%	7.0%	7.6%	7.0%	5.2%	8.1%	5.2%	7.3%	8.8%
25-44	22.2%	28.3%	28.4%	25.4%	20.7%	27.0%	26.3%	25.1%	27.0%
45-64	39.1%	32.7%	26.7%	30.1%	39.1%	29.9%	36.3%	31.3%	29.6%
65 and older	12.1%	9.0%	13.4%	11.3%	15.0%	10.8%	13.6%	12.4%	12.8%
Median age	-	39.6	37.9	38.7	47.7	38.4	44.9	40.5	39.6

Source for Makawao District: ***Maui County Data Book: 2015****, Table 1.3.6 Summary Characteristics of Persons by Race Census Designated Places, Maui County For Keʻanae, Wailuānui and Nāhiku, information was extracted as the net value between the Hāna CT 301 and the Hāna CDP.*

East Maui

East Maui encompasses the License Area and consists primarily of rural residences. According to the Draft Maui Island Water Use and Development Plan (March, 2019), this region had a population of 11,892 residents in 2015. This population is projected to increase by 3.6 percent to 12,321 by 2035.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. In general, the Proposed Action will maintain existing conditions, subject to the requirements under the CWRM D&O and any reservations in favor of the DHHL. No significant direct adverse impacts on demographics or population in East Maui is anticipated to result from the Proposed Action. Operation of the EMI Aqueduct System would allow for the implementation and cultivation of Mahi Pono's diversified agricultural plan in Central Maui, which would serve to directly and indirectly stimulate economic activity on the island of Maui and potentially drive population growth, which could conceivably impact population in East Maui.

Upcountry Maui

In 2017, there were an estimated 37,128 residents and 14,178 households within the Upcountry Maui Water System service area.

The County of Maui projects that the population in the Upcountry Maui Service Area will grow to 43,675 in 2030 (CWRM D&O, p. 210). This would translate to an estimated 16,678 households.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. In general, the Proposed Action will maintain existing conditions, subject to compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant direct adverse impacts on demographics or population within the Upcountry Maui are anticipated to result from the Proposed Action; continued water supply to Upcountry Maui should not reduce or stimulate population growth. Operation of the EMI Aqueduct System would allow for the implementation and cultivation of Mahi Pono's diversified agricultural plan, which would serve to directly and indirectly stimulate economic activity on the island of Maui and potentially drive population growth.

Central Maui

There are no residences within the agricultural fields in Central Maui.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. In general, the Proposed Action will maintain existing conditions, subject to the limitations imposed by the CWRM D&O and any reservations in favor of the DHHL. No significant direct adverse impacts on demographics or population within Central Maui are anticipated to result from the Proposed Action. Operation of the EMI Aqueduct System would allow for the implementation and cultivation of Mahi Pono's diversified agricultural plan in Central Maui, which would serve to directly and indirectly stimulate economic activity on the island of Maui and potentially drive population growth.

4.7.2 Social Characteristics

Earthplan was contracted by WOC to prepare a Social Impact Assessment (SIA) in support of the DEIS (See Appendix G). Earthplan's SIA assesses how the Proposed Action affects the human environment. While there are many facets to the human environment, the social context is basically framed by relationships. The social aspects of an area relate to people living and interacting with other people. The SIA explores how changes in the physical environment of a community or neighborhood caused by a proposed land development may affect the neighborhood as a social environment.

Earthplan conducted seven focus group discussions in November 2018 to discuss the how the Proposed Action might affect the participants' interests, interest and participation in previous lease- and water-related events, such as the CWRM D&O proceedings, media coverage and participation in the scoping meetings subsequent to the publication of the EISPN related to the Proposed Action. After the November 2018 focus group sessions A&B sold the Central Maui agricultural fields to Mahi Pono. To gauge how community issues may be affected by the change in ownership and agricultural operations, Earthplan conducted interviews with a cross section of key community leaders in April 2019.

The November focus groups were conducted, as follows:

- Two focus groups with Upcountry Community Associations, including Kula, Pukalani, and Makawao Community Associations
- Farmers and ranchers
- Mālamalama Maui (a two-year community project to use arts and culture)
- Huelo/Haʻikū residents and farmers
- Environment and sustainability
- Keʻanae and Wailuānui (Koʻolau Moku) residents, farmers, and cultural practitioners

Collectively, 64 people signed in at the seven focus group meetings. However, the actual number of participants is higher because some who arrived after the session started did not sign in. Four people participated in two sessions to share their views from different perspectives.

From the seven focus group discussions, a set of common topics were raised by the participants related to the Proposed Action. These topics were:

- Relationship to A&B, the EMI Aqueduct System, and the proposed Water Lease
- Community Interaction
- Legal Proceedings
- How changes may affect participants personally or other people they know
- Credible basis for the 30-year Water Lease application
- Suspicion that the 30-year Water Lease will eventually support urbanization
- Change in Upcountry Water System
- Maintenance of the EMI Aqueduct System
- Balance in water resource allocation
  - Water is a public trust
  - Support for sustainable local agriculture
  - Hawaiian system of water use in agriculture is balance
  - Need for more farmers in East Maui
  - The need for resolution for downstream users in watershed areas

In April 2019, Earthplan, contacted community leaders who helped convene the November 2018 focus group meetings and other community leaders who may provide insight not

represented in the November 2018 focus group meetings, to gather input in light of the sale to Mahi Pono and Mahi Pono's stated intention to pursue diversified agriculture in Central Maui.

These April 2019 interviews were not intended to be statiscally analyzed. Rather, they were intended to stimulate discussion about the recent changes. A total of 18 people were interviewed, who represented a broad cross section of community interests and involvement. The following presents a profile of those interviewed:

- Nine of those interviewed participated in the November 2018 focus group meetings. The other nine people were invited initially-contacted interviewees or were referred to the interviewer as possible interests that may not have been represented in the November 2018 focus group sessions.

- Eight people are actively involved in farming and ranching. Some are subsistence farmers, while others raise flowers and livestock in businesses they own. Several have leadership positions in organizations that support ranching and farming.

- Eight people are business owners or executives. Their businesses are related to real estate, a restaurant, flowers, livestock, and macadamia nuts.

- Eight people are active in community organizations that advocate for and address various community needs and interests. Their efforts are related to the community planning, resource management, the arts, education, religiion, affordable housing and economic opportunity.

- Six people are community leaders in geographic-specific organizations in Keʻanae, Hāna, Haʻikū, and Kula.

- Three people in leadership roles in environmental and sustainability organizations

Topics brought up from the 18 interviews were:

- Strong desire for continued agriculture in Central Maui

- Optimism that Mahi Pono would be able to bring environmentally friendly large scale diversified farming

- Recognition of the need for water to support agriculture

- Opportunities to re-evaluate ways to achieve balance among water user groups

- Opportunity for food self-sufficiency and reduction of food import

- Concerns and challenges associated with the Proposed Action
    - Enough water to support Mahi Pono's farm plan
    - Legislative proceedings related to State water leases
    - BLNR responsibility and accountability

- Public trust, the need for more information on water needs, and amount of time needed to secure proper permits
- Agricultural exportation may take precedence over local market
- Use of chemicals
- EMI Aqueduct System conditions
- Source of labor
- Lack of clarity on how individual ranchers will be incorporated in Mahi Pono's farm plan
- The need for consistent, transparent communication and to make things "pono" with the East Maui Native Hawaiian communities

From November 2018 to April 2019, perceptions of the participants generally changed from being pessimistic to being optimistic with the change in land ownership from A&B to Mahi Pono. However, some concerns raised in the November 2018 focus group meetings still persist today.

Below is a summary of Earthplan's focus group meetings and interviews conducted in November 2018 and April 2019 respectively. It should be noted that these were and are perceptions of the participants that represent the existing conditions at the time the SIA was conducted related to each geographic region being assessed in this DEIS. Some of their perceptions may conflict with what is presented and discussed elsewhere within this DEIS.

East Maui

November 2018 Focus Group Meetings

A focus group with residents and farmers from Huelo and Haʻikū was convened on November 15, 2018 at Hale Akua in Huelo. Most of these participants live in the Huelo watershed area owned by the State of Hawaiʻi. They generally lived downstream of the EMI Aqueduct System and many live and farm in areas adjacent to streams that are subject to the CWRMʻs D&O.

As landowners and farmers downstream of the EMI Aquduct 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.

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 Haʻikū have very limited rights to watershed 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.

The Environmental and Sustainability focus group meeting brought up discussions relevant to East Maui. At the time, it was reported that the public has very limited access to EMI Aqueduct System as EMI maintains locked gates. The EMI Aqueduct System upkeep is unknown and the participants suspect that much of the EMI Aqueduct System is in disrepair. They believe that the State should have its own maintenance access for community-based monitoring. Such community access should also allow for cultural practices.

A focus group was held with residents, farmers, and cultural practitioners on November 16, 2018 at Keʻanae School. The prevalent theme in this focus group meeting was the foundational impact of generational change and legacy. Participants shared an inherent personal angst that permeated ethnic identities and communal cultural practices.

This focus group repeatedly cited instances of multiple 'ohana generations that had to deal with the transition from full stream flow to EMI stream diversions. Participants stressed that wai (water) is life, the starting point for Hawaiian culture in all forms, including food, soft fiber, medicine. The wai from streams contain food sources and fed kalo patches and agricultural activities. In the past, keiki (children) played in streams and intimately learned about nature and the ecosystem. Participants personally experienced these activities and it pained them that their ability to pass this legacy on to their children and grandchildren has been hindered by EMI stream diversions.

Kupuna participants noted that getting water back in the steams has been occurring over decades, starting with their own kupuna. Several people said, “We are weary of this fight.” Further, this group was unique in having many young people; they acknowledged the sacrifices of their kupuna and are prepared to fight for their children, again stressing the multi-generational effect of water leases in East Maui.

Another perspective that was a common theme is the natural order of the environment. It was often noted that Hawaiian cultural practices are based on using the environment in its natural state. As one person said, "We are servants of nature." They described the ahupua'a land system and the 'auwai (ditch/canal) that fed their agricultural fields in a systematic way.

They stressed that the flow of streams into the ocean has also been an integral part of cultural resources. Stream fish, shrimp and mollusks need the interaction between streams and nearshore waters and this allows for healthy ecosystems and productive food gathering.

Without exception, participants in this focus group wanted to see streams restored and diversion structures entirely removed. While they felt that releasing the kalo streams as initially done by A&B in 2016 and as now required under the CWRM D&O is a step in the right direction, they believed that continued stream diversions in this area need to end.

Regardless of changes in stream diversion and restoration, participants believed that the EMI Aqueduct System infrastructure is not being maintained or managed. There were stories of the need for better maintenance, including downstream scouring in flooding conditions, dry streams with only intermittent release from gates, and washed out bridges.

One recollection is of a site visit with County officials of the EMI Aqueduct System. The road was so overgrown that vehicle almost drove into the ditch. When one person exited the vehicle, he stepped into the ditch and water reached his knees.

Another instance of ineffective stream management is related to mosquitos, which became more prevalent during times when stream flow was low due to diversions. The population of mosquito fish, which ate the mosquitos, eventually decreased as the ponds dried up. Additionally, the population of toads, which also controlled mosquitos, decreased with EMI's increased spraying of Roundup, a chemical weed killer.

Participants reported that EMI staffing has decreased to eight people and they were not hopeful that maintenance and management would improve in the near future.

April 2019 Interviews

"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.

There was disagreement as to the source of water and how the water is allocated. Further, interviewees sometimes felt that A&B's efforts towards the Water Lease was self-serving and divisive. Nevertheless, people were hopeful that this contentious environment was coming to an end with Mahi Pono as the new owner. Those interviewed expressed willingness to explore options regarding water if community needs, such as local farming / ranching, food self-sufficiency, and so on, can be met.

As expressed in the November 2018 focus groups, many felt that, as a public trust, stream water from State watershed lands should not be diverted for private purposes.

It was pointed out that State watershed stream water used in the EMI Aqueduct System is one of four sources of water that can be used. Other sources reportedly include water from watershed lands owned by EMI, Central Maui water wells on lands now owned by Mahi Pono, and the West Maui Ditch System.

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."

Impacts and Mitigation Measures

The social impact of diverting water from East Maui is generational, one that has affected livelihoods, family cohesion, the ability to integrate with environment for food gathering and recreation, resource stewardship, and personal connections or disconnections with values inherent in the lifestyles of East Maui residents.

East Maui residents, farmers and cultural practitioners have been advocating for the reduction of stream diversions and the return of full stream flows. Focus group participants and interviewees stressed that previous water leases have had significant impact on their culture, social well-being and generational ability to thrive in East Maui.

While the CWRM D&O addresses or mitigates that impact to some degree, the proposed Water Lease would still affect streams in their area. The Proposed Action is viewed as a continuation of taking East Maui water to support a private for-profit company. The Proposed Action is not seen by some participants as part of a solution, but rather as an extension of past wrongs. Participants vowed to continue to oppose the proposed Water Lease, and advocate the removal of all diversion structures from the kalo and community streams designated for full restoration. They also noted that

East Maui streams have been flowing well since sugar cultivation ceased. They were very concerned that once active steam diversion resumes, stream flow in the majority of East Maui streams will be lessened and again restricted.

For East Maui farmers, the proposed Water Lease would continue to divert water from streams not designated for full restoration, although some are mandated to have partial restoration to support the stream habitat. When active diversion resumes, it is expected that an overall decrease in stream flow will occur in East Maui when compared to current conditions, but there will be an overall increase in stream flow compared to when sugar was fully operational in Central Maui.

EMI has indicated that it is modifying or removing several diversion structures to complete restoration of diverted streams that have been designated for full flow. This has positive social value for East Maui because it represents progress in stream restoration. Stream restoration addresses physical mitigation and will support cultural and food gathering practices. EMI is also moving its focus to streams in Huelo as a part of its stream abandonment project, specifically Hanehoi Stream. There are other stream diversions in these areas that may require further, more complicated designs that may need more time.

In the April 2019 follow-up interviews, there was hope that Mahi Pono would address problems with physical infrastructure by improving stewardship of the EMI Aqueduct System. EMI has been increasing the size of its crew and continue to evaluate the needs for further employees to maintain both the EMI Aqueduct System and the associated access roads and trails. It was stressed, however, that, while physical and environmental mitigation is crucial, there is still a fundamental need to rectify social, cultural and emotional impacts that have developed for over one hundred years. Although Mahi Pono did not cause these impacts, the company has inherited a legacy that is generational and needs to be addressed to help these East Maui communities move forward.

Two areas of mitigative measures are recommended for consideration, should the proposed Water Lease be granted by the BLNR. These measures are intended to establish an ongoing working relationship between the community, Mahi Pono and EMI, and related public agencies, as well as continue resolution with East Maui communities.

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.

A starting point for identifying stakeholder groups could be the interviewees and focus group participants that participated in Earthplan's SIA and their networks.

It is recommended that interest groups are equitably 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 Water Lease 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.

Specifically for the Keʻanae – Wailuānui community to move past historical impacts, there needs to be established a point of departure. Mitigation needs to go beyond the physical restoration of streams. It needs to address the social context and include apology and reconciliation. This needs to be done within a cultural foundation that binds the community together, and key players, including Mahi Pono, public agencies and elected officials. The manner and forum for this process should be defined by the cultural leaders integral with the process.

Upcountry Maui

November 2018 Focus Group Meetings

The focus group meeting with the Kula and Pukalani Community Associations was convened on November 12, 2018 at the Kula Community Center. A separate session was held with the Makawao Community Association on November 13, 2018 at the Makawao Elementary School.

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.

While participants understood their relationship with the EMI Aqueduct System, they believed that not all Upcountry Maui communities are served equally by the EMI Aqueduct System. They said that the EMI Aqueduct System supports the two water treatment plants for Kula, including Olinda /Upper Kula and Piiholo WTP only in times of drought. They believe there needs to be clarification on the actual Upcountry Maui dependence on the EMI Aqueduct System.

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.

At the time (November 2018), with the conversion of A&B to a real estate investment trust, participants believed that water for agricultural uses is inconsistent with a company whose primary purpose is real estate.

However, one person was very concerned about making any change to the EMI Aqueduct System unless it was really needed. He said that the EMI Aqueduct System has worked well for over 100 years, and that any change should be carefully studied to make sure that the modifications are necessary and make sense.

During the focus group meeting with ranchers and farmers held on November 12, 2018 at the Kula Community Center, it was stressed that participants wanted to see a cap on potable water for Upcountry Maui needs, though they stressed that residents should get water they need. When that cap is reached, alternative sources such as wells should be used.

Overall, participants in each group supported local water users. East Maui supported Upcountry Maui use of water and vice-a-versa. Participants also stressed that the amount of water from the EMI Aqueduct system serving Upcountry Maui, which participants identified as 6 mgd, is a very small portion of the total water being diverted. They believe that Upcountry Maui water needs should be put in perspective of the overall water quantity that would be made available with a 30-year Water Lease.

Participants doubted that the MDWS could adapt to changes if the EMI Aqueduct System were to curtail or discontinue providing water and services as is currently occurring. They said that the MDWS is already experiencing difficulty in maintaining the Upcountry Maui Water System now, and that any challenge would likely not be met. Residents were concerned that if domestic water was limited in any way, then the MDWS would need to pump water from wells. This would be more costly than receiving water from the EMI Aqueduct System and the MDWS would likely pass this cost to the water users. Likewise, well development would also cost money and water users would end up paying through water fees.

April 2019 Interviews

"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.

Impacts and Mitigation Measures

The effect of the Proposed Action on Upcountry Maui domestic and agricultural water users will depend on how much water will be released from the EMI Aqueduct System for the MDWS use. If Upcountry Maui water needs exceed its water allocation, other sources of water will need to be developed. The cost of well development and pumping is expected to result in increased water fees.

Two areas of mitigative measures are recommended for consideration, should the proposed Water Lease be granted by the BLNR. These measures are intended to establish an ongoing working relationship between the community, Mahi Pono and EMI, and related public agencies, as well as continue resolution with East Maui communities.

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.

A starting point for identifying stakeholder groups could be the interviewees and focus group participants that participated in Earthplan's SIA and their networks.

It is recommended that interest groups are equitably 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.

Central Maui

November 2018 Focus Group Meetings

During the focus group meeting with ranchers and farmers on November 12, 2018, participants stressed that water from the Water Lease should be allocated to agriculture first, and that the priority should be for local farmers, ranchers and flower growers who are actively in production, as determined by tax status.

The participants tended to oppose monocrops that would not be produced by local farmers. They noted that coffee production for Starbucks was cited in the media as a possibility in the A&B farm plan; this was not consistent with local farming. Also, it was noted that pongamia orchards, an alternative being considered by A&B, would bring invasive species to the area and is poisonous for cattle. They believed that A&B's recent conversion of sugar lands to ranch lands was an effort to lower taxes because of lower production value. They reported that these lands continue to have sugarcane and are not used for ranching.

This group strongly advocated for quantification of water under the Water Lease. They felt that a water lease without indications of how the water would be specifically used would be irresponsible. They suspected that, while some of the water might be reserved for the 23,000 acres of IAL, there may be less restrictions on water use of the remaining 10,000 acres of the 33,000 acres in Central Maui. They speculated that these lands could eventually be used for non-agricultural uses.

During the environment and sustainability focus group meeting on November 16, 2018, participants were concerned with the type of agriculture that the water would support. They felt that a display produced by A&B that illustrated possible diversified agriculture was neither credible nor sincere. Participants noted that media coverage indicated that A&B has a potential agricultural partner. However, participants noted that there is no indication if this is real. Further, this group believes any agricultural activities supported by a State water lease should be local based and not threaten the social environment with chemicals, downwind spraying and incompatible or potentially harmful crops, such as pongamia.

Overall, participants, particularly ranchers and farmers, expressed interest in leasing land from A&B. Frustration was shared about previous efforts of local farmers in negotiating leases with the company. Reportedly there has been a policy of a minimum of a thousand acres, which most local ranchers and farmers could not afford. One person described a situation in which he was willing to lease a large tract, then sublease affordable portions to other farmers; this was not permitted.

Participants wanted to see Central Maui be a place for a wide diversity of successful agricultural activities operated by Maui farmers.

Participants suspected that eventually water from State lands will be used to urbanize at least a portion of A&B land holdings. While it may be difficult from a land use entitlement perspective to convert these lands for urban uses, conversion of the 10,000 acres that are not designated as IAL may be a more feasible opportunity. Participants strongly felt that the Water Lease should spell out specific uses allowed and what happens if A&B vacillates from the agreement. If unforeseen urbanization did occur, participants were very concerned that the area's infrastructure would be significantly impacted. They did not believe that such development would be curtailed by public agencies and public officials interested in increased tax revenues.

April 2019 Interviews

Those interviewed stressed that they wanted to see agriculture as a major land use on Central Maui. Several mentioned that the greenery experienced is an integral part of what makes Maui special. They said the green landscape is visually pleasing when driving along the coast and on mauka – makai highways. Interviewees talked about how they look forward to seeing this landscape as they fly over the agricultural fields when flying in and out of Maui. With the loss of the sugar industry, they were concerned that agriculture might be replaced by less desirable alternatives, namely more urban development. They did not want to see undeveloped Central Maui lands populated by residential communities and business complexes.

Interviewees pointed out the agriculture needs to re-establish a major role in Maui's economy. Though interviewees had different ideas about the source of and how much water would be needed for future agriculture, there was consensus that Central Maui agricultural activities will need water to remain economically viable. Those interviewed saw the potential for supporting businesses that supply the agricultural industry, such as irrigation, fertilizer, equipment, and so on. Local food vendors and restaurants would also have access to locally grown food, the supply of which is currently limited. Further, the continuation and promotion of agriculture encourages young people and future generations to consider farming as a way of life

Interviewees were heartened that Mahi Pono has publicly, and in one-on-one meetings, stated that no GMOs would be used in its agricultural operations. However, those interviewed were unclear about the extent to which chemical pesticides, fertilizers and soil additives would be used in agricultural operations. They urged Mahi Pono to share this information with the community. Moreover, those interviewed felt the use of chemicals would further "kill the soil" and is contrary to regenerating the soil and organic farming practices. It was noted that chemicals used even in the short-term time frame may detract from Mahi Pono's qualification to qualify for organic farming status.

A key positive aspect noted by interviewees is the wide variety of crops being discussed in farm plans and crop plans presented by Mahi Pono. They liked that one crop would not dominate the agricultural landscape. They noted that previous A&B discussions of possible monocrops were problematic because these crops, such as coffee, would dominate Maui's agricultural environment, only to be largely exported.

Those interviewed hoped that future Central Maui agricultural activities would help Maui and Hawai'i become increasingly food self-sufficient. As an island state, Hawai'i is dependent on imported food and vulnerable to limitations on the quality of this food and transportation disruptions. They hoped that the potential large scale agricultural operations and production with the new ownership of Central Maui lands would provide food supply for Maui and Hawai'i that can lead to food self-sufficiency.

Interviewees encouraged agricultural production that would include the local market as a major target, thereby increasing the potential for food self-sufficiency. They wanted to see a variety of crops catering to the local market, and suggested produce such as dryland taro, avocado, guava, sweet potato, macadamia nuts, and popular vegetables such as bok choy and eggplant. They also hoped that Maui restaurants, supermarkets and food vendors could acquire local foods that would be fresh, affordable and a constant supply. Those interviewed expected that some of the agricultural produce would be exported as a necessary financial strategy. Interviewees wanted to see a healthy balance between allocating a portion of agricultural products for Maui food self-sufficiency and exportation for profit.

While it was noted that large scale agriculture is necessary to create a critical mass, it was also stressed that this scale of agriculture should be balanced by supporting individual livestock ranchers, small farmers and local businesses. Interviewees liked the community agricultural component proposed by Mahi Pono. They felt that, while it would provide land for small farmers, the consolidation of support, such as processing, equipment and marketing, would help lower costs for local farmers. However, it is noted that none of the interviewees indicated that they were personally involved in crop farming activities that may be part of the community farming program, nor did they know anyone who had been approached with this opportunity.

Overall, those interviewed wanted Mahi Pono to succeed. This is based on what they had heard, learned and discussed with Mahi Pono thus far. The new ownership and related ramifications imply a future that had not been previously envisioned, a future that could possibly achieve acceptable community objectives, realize viable diversified agriculture in Central Maui, support food self-sufficiency, help local ranchers and farmers, and revive agriculture as a viable economic stimulus for Maui. Interviewees appreciated that many agricultural jobs would result when Mahi Pono's farm plan is implemented. They were

concerned, however, that, with the current low unemployment rate, Mahi Pono may find it difficult to fill new employment positions. Other challenges to finding employees could be housing and high labor costs.

The current lack of affordable housing is a problem. Interviewees said that the housing market intended for Maui's local working population is typically filled by retirees moving to Maui who can afford the average-priced homes. This results in keeping housing costs high and pricing out local buyers. Maui residents therefore have difficulty in finding affordable housing that will allow them to remain on Maui.

Another problem cited was high labor costs and unionization. These present economic challenges to many businesses operating in and starting up on Maui. One person felt that unionization and high labor costs may be economic deterrents in establishing BMP, the requirements of which exceeds minimal industry standards.

Interviewees wanted to see these challenges addressed so that there is an optimal labor supply to support Mahi Pono's farm plan.

Impacts and Mitigation Measures

The effect of the proposed Water Lease on Maui-based farmers, ranchers, and flower growers will depend on whether they can participate in future diversified agriculture in Central Maui. Thus far, there has been discussion regarding setting aside land for local farmers and eventually creating support facilities and services intended to provide means to reduce costs for individual farms. Little or no mention has been made regarding including livestock farmers in Mahi Pono's farm plan.

Interviewees have shared information with Mahi Pono regarding the significant contribution of agriculture on climate change. It was noted that agriculture is responsible for a significant portion of GHG emissions, and is therefore a main contributor to climate change.

Participants explained that regenerative agriculture integrates farm management practices to systematically improve soil health. Healthy soil would improve crop yields and resistance to pests. It was pointed out that regenerative agriculture reduces water use through the selection of crops that adapt well to local climate. If done properly, this practice can decrease reliance on agricultural chemicals, including fertilizers and biocides. Regenerative agriculture also integrates livestock that are humanely raised into crop production.

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. They also stressed that Mahi Pono actively facilitate internship programs and educational activities that will help young people learn about agriculture, food self-sufficiency, and resource stewardship.

Two areas of mitigative measures are recommended for consideration, should the proposed Water Lease be granted by the BLNR. These measures are intended to establish an ongoing working relationship between the community, Mahi Pono and

EMI, and related public agencies, as well as continue resolution with East Maui communities.

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.

A starting point for identifying stakeholder groups could be interviewees and focus group participants and their networks.

It is recommended that interest groups are equitably 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.

4.7.3 Economic and Fiscal

Munekiyo Hiraga, in support of this DEIS, prepared an Economic and Fiscal Impact Study (June 2019) assessing the economic and fiscal impacts of the Proposed Action (See Appendix H). This study assesses economic and fiscal impacts of the Proposed Action on the EMI Aqueduct System and operations, and the implied impacts on three geographic areas of Maui under both baseline conditions (outlined below) and future conditions. For an assessment of future conditions, the year 2030 was selected as the point for analysis of the impacts of the Proposed Action because it is assumed that timeframe would allow for the full implementation of the farm plan in Central Maui. The three geographic areas are: (1) East Maui, including Nāhiku, (2) Upcountry Maui; and (3) Central Maui.

Baseline Conditions

A&B cultivated sugarcane continuously in Central Maui for over a century. EMI, originally a subsidiary of A&B and now jointly owned and operated by A&B and Mahi Pono, has operated the EMI Aqueduct System since 1878 to provide irrigation to the Central Maui fields. Water service by EMI to the MDWS for Upcountry Maui began in the early 1960's. Although A&B ended sugarcane operations in December 2016, the long history of sugarcane cultivation provides relevant baseline conditions for the purposes of assessing economic and fiscal impacts associated with the Proposed Action.

a. Typical Sugarcane Cultivation: 2006

The year 2006 is representative of the 1987 to 2006 period of "typical" sugarcane operations. Rainfall in East Maui was regarded as normal, the restoration of stream flows was not large enough to significantly affect HC&S sugarcane operations, and the plantation was economically healthy. The 2006 analysis was applied to EMI operations and impacts on Central Maui, and not to assess the economic and fiscal impacts for East Maui, Nāhiku or Upcountry Maui as the impacts for these areas in 2006 were not expected to be substantially different from the 2008 to 2013 period.

b. Recent Sugarcane Cultivation: 2008 to 2013

This period was used to represent the recent sugarcane cultivation period, while sugar operations were still active and some stream restoration had been implemented. The 2008 to 2013 time period was selected because those years are representative of the last 6 full years of sugarcane operations, stream restoration had occurred, and because the CWRM D&O incorporated water diversion and distribution data for these years.

c. Interim Diversified Agriculture Operations (2017)

Since the cessation of sugarcane operations in 2016, some of the former sugarcane fields have been transitioned into other types of agricultural uses. The current "existing condition", however, is actually an interim condition which is expected to change over time as additional fields are transitioned to diversified agriculture under the Proposed Action. While the interim diversified agriculture operations are the current "existing conditions", much of the former sugar fields are currently fallow, thus the sugarcane cultivation analyses described above provide more appropriate benchmarks to which the Proposed Action may be compared for the purposes of economic and fiscal impacts.

Future Condition/Proposed Action

The economic and fiscal impacts of the Proposed Action include a discussion of operational costs, revenue, employment and earnings related to the EMI Aqueduct System; agricultural operations in Upcountry Maui, Central Maui, and East Maui (i.e., taro cultivation); and the impact on public/domestic water supplies (and related issues) in Nāhiku and Upcountry Maui. analysis Those impacts are described below, sorted by the impacts on EMI Operations and the respective impacts to East Maui, Upcountry Maui, and Central Maui.

4.7.3.1. EMI Operations - Economic and Fiscal Impacts: Baselines and Proposed Action

a. Typical Sugarcane Cultivation: 2006

In 2006, EMI diverted an estimated 156.54 mgd of surface water. Average daily use by the MDWS was 3.23 mgd (Plasch Econ Pacific, LLC, 2019).

Typical Sugarcane Cultivation: 2006 - Economic and Fiscal Impacts

In 2006, EMI's operational costs were $2.0 million, or $0.035 per 1,000 gallons (kgal). Operational costs include EMI labor, fringe benefits, materials, professional services, taxes, revocable permit rent to the State, and other expenses. It is noted that this represents the cost to transport the water to Maliko Gulch. There were additional costs

for water transportation and storage from Maliko Gulch to the MDWS and the Central Maui agricultural fields. However, these additional costs were covered by HC&S. As such, the $0.035 per kgal cost does not reflect the full cost to provide water to the MDWS and Central Maui.

Direct spending by EMI, excluding the revocable permit payment to the State from the operational costs, was $1.8 million. The purchase of goods and services by EMI and the families of employees generated indirect sales and in turn, these suppliers generated more indirect sales by their purchases of goods and services. The indirect sales are estimated at $2.2 million. Total direct spending and indirect sales was $4.0 million, of which $3.2 million was on Maui and $0.8 million on Oʻahu.

EMI employed 16 people in 2006 with a payroll of $0.8 million. As with indirect sales, EMI operations generated indirect jobs, including those at companies providing supplies and equipment, professional services, and those involved with supplying goods and services to families of employees. EMI operations generated about 7 indirect jobs with an associated payroll of $0.3 million. The total direct and indirect employment was 23, of which about 20 were on Maui. The direct and indirect jobs associated with EMI operations supported an estimated 51 people.

EMI revenues primarily consist of the revenue from water delivered to the MDWS. EMI also received some land lease revenue, however the amount of lease income was nominal.

With respect to fiscal impacts, the MDWS paid EMI $0.06 per thousand gallons of water delivered for the Upcountry Water System. Based on delivery of 3.23 mgd, the MDWS payment to EMI in 2006 was $70,700.

Associated taxes accrued to the State of Hawaiʻi General Fund would include General Excise Tax (GET) on direct spending and indirect sales, and payroll taxes paid by employees. GET would be approximately $42,000, while payroll tax paid by employees is estimated at $47,400. The total tax revenue accrued to the State in 2006 was approximately $89,400.

EMI paid $158,284 in 2006 to the State Special Land Development Fund for the revocable permits for the water, which is equivalent to approximately $210,800 in 2018 dollars. The OHA receives 20% of the revocable permit revenue, while the DHHL receives 30%. This translates to approximately $42,200 for OHA and $63,200 for DHHL.

b. Recent Sugarcane Cultivation: 2008 to 2013

Between 2008 and 2013, EMI diverted an average of 113.71 mgd to HC&S (CWRM D&O, FOF 685). Average daily use by the MDWS was 7.1 mgd (CWRM D&O, FOF 551). The remainder was utilized by HC&S to support A&B's agricultural operations or represents system losses.

Recent Sugarcane Cultivation: 2008 to 2013 - Economic and Fiscal Impacts

Average operational costs for EMI between 2008 and 2013 was $1.6 million, or $0.039 per thousand gallons (kgal). As previously noted, this represents the cost to transport the water to Maliko Gulch; it does not reflect the full cost to provide water to the MDWS and Central Maui.

Direct spending by EMI, excluding the revocable permit payment to the State from the operational costs, was $1.4 million. Total direct spending and indirect sales was $3.2

Fiscal impacts are determined based on an average usage of 7.1 mgd for which the MDWS payments to EMI totaled approximately $155,500 per year. GET would average approximately $37,000 per year while payroll tax paid by employees is estimated at $45,400 annually. The total tax revenue accrued to the State was approximately $82,400 per year.

EMI paid $187,900 to the State Special Land Development Fund for the revocable permits for the water, including approximately $37,600 for the OHA and $56,400 for the DHHL.

c. Interim Diversified Agriculture Operations (2017)

In 2017, an estimated 23.99 mgd of surface water was diverted from the Collection Area. The MDWS used 2.86 mgd, which is significantly lower than the historical average cited by CWRM of 7.1 mgd.

Interim Diversified Agriculture Operations (2017) - Economic and Fiscal Impacts

In 2017, EMI operational costs were $1.7 million. Direct spending by EMI, excluding the revocable permit payment to the State, was $1.5 million. Total direct spending and indirect sales was $342 million, of which $2.7 million was on Maui. EMI employed 13 people in 2017, with a payroll of $0.5 million. Total direct and indirect jobs was 19, with an associated payroll of $0.8 million.

In terms of fiscal impacts, based on the MDWS' water use of 2.86 mgd, the MDWS paid $62,600 to EMI for the delivery of surface water. Total State GET and payroll tax revenues would be $65,700. EMI paid $162,200 to the State Special Land Development Fund for the revocable permits for the water with the same proportional disbursements to the OHA and the DHHL.

d. Proposed Action - Issuance of Water Lease

Due to the nature of the EMI Aqueduct System, the operational costs are largely fixed, with minimal variable costs. Future operational costs for the EMI Aqueduct System are anticipated to be similar to the average cost experienced during the recent sugar operations period (2008-2013), with the only variation being the amount of the Water Lease payments owed to the State. Therefore, while the costs remain constant, the per unit cost for delivery of water increases as the amount of water diverted decreases. The maximum amount of water allowed in compliance with the CWRM D&O translates to an estimated 87.95 mgd from the Collection Area plus an estimated 4.37 mgd that could be diverted from the area between Honopou and

Maliko Streams, which is outside of the License Area, for an estimated total diversion of 92.32 mgd.

Proposed Action - Economic and Fiscal Impacts

Total operational costs for EMI labor, fringe benefits, materials, professional services, taxes, Water Lease, and other expenses are projected to be $2.3 million per year. This would translate to $0.068 per kgal. A currently unknown factor in EMI's operating cost is the annual Water Lease payment to DLNR. For the purposes of the economic impacts analysis, the Water Lease payment has been calculated based on the equivalent per unit cost under the existing 2019 revocable permit. The revocable permit rent payment set in November 2018 for calendar year 2019 was $230,964.24, which represents an increase from the rent that was previously paid. Assuming 16.8 MGD is diverted under the 2019 revocable permit, the Water Lease rent rate would translate to $0.038 per thousand gallons. This rate of $0.038 is assumed as the basis for the future annual lease payment to the DLNR. However, the actual Water Lease rental amount will be based on an appraisal conducted prior to issuance of the Water Lease. Should the Water Lease amount be higher or lower, the operational costs of the EMI Aqueduct System would be adjusted accordingly.

Direct spending by EMI, excluding the long-term Water Lease payments to the State from the operational costs, is forecasted to be $1.4 million. Total direct spending and indirect sales is estimated at $3.2 million, of which $2.6 million would be on Maui.

EMI is expected to employ a staff of 17 people with a payroll of $0.8 million. Total direct and indirect jobs was 24, with an associated payroll of $1.1 million. The direct and indirect jobs associated with EMI operations would support an estimated 54 residents.

Fiscal impacts under the Proposed Action assume that the rate the MDWS pays to EMI will increase because EMI's per unit operating cost will increase as the fixed costs will be spread out over a lower volume of water diverted and possible higher Water Lease payments to the State compared to historic payments. It is estimated that EMI's operating cost under the Proposed Action would be $0.068 per kgal, which is higher than the current MDWS payment to EMI of $0.06 per kgal. The actual rate the MDWS will pay to EMI in 2030 will be subject to a future agreement between the parties. However, for the purposes of the fiscal impacts analysis, the 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 amount paid to the State Special Land Development Fund for the Water Lease would be based on an appraisal conducted prior to issuance of the Water Lease. Assuming the amount of the Water Lease is based on the equivalent per unit cost under the existing revocable permits, the annual payment to the Special Land Development Fund would be $846,700. Of this, $169,300 would be disbursed to OHA and $254,000 would be set aside for the DHHL. GET revenue would be estimated at $37,000 while payroll tax would be $45,400 per year.

4.7.3.2. East Maui - Economic and Fiscal Impacts: Baselines and Proposed Action

Impacts related to East Maui include both the agricultural users in East Maui, such as taro farmers, as well as residents in Nāhiku who rely on water delivered through the EMI Aqueduct System.

Due to the heavy rainfall on the windward slopes of Haleakalā and the many streams in the area, many of the makai communities in East Maui are well suited for growing taro and truck crops. Also, a number of farmers in East Maui have appurtenant and riparian rights to use water from these streams. Collectively, there are about 45 acres in East Maui that are suitable for growing taro, and about 35 acres for truck crops (Plasch Econ Pacific, LLC, 2019).

Nāhiku is a small rural community in east Maui located makai of Hana Highway in the vicinity of mile marker 25. The Nāhiku community is characterized by rural residential uses. There is no significant commercial development in Nāhiku. MDWS receives water directly from the EMI Aqueduct System for the Nāhiku community, with the source of that water being a development tunnel located east of Makapipi Stream, that feeds into the Koʻolau Ditch and is accessed by MDWS in the Koʻolau Ditch near Makapipi Stream.

a. Baseline Condition

A number of East Maui farmers divert stream water to irrigate taro loʻi and small farms. Taro farming is difficult and labor-intensive, and the net returns are modest. Nevertheless, many farmers are attracted to the lifestyle and to growing this culturally significant crop. Farmers in East Maui have reported that past surface-water diversions to supply water to Central Maui left insufficient water in the streams for them to take full advantage of the agricultural potential in East Maui. The CWRM D&O returns free flowing water, with no upstream diversions, to all streams that have historically supported significant taro cultivation. As a result, ample stream water should now be available to irrigate taro loʻi and the small farms relying on East Maui streams.

In Nāhiku, there are 43 water meters, all located along Nāhiku Road (County of Maui, Department of Water Supply, 2019). In 2013, there were 43 connections to MDWS' Nāhiku system, serving a population of 107 people. The average daily flow to the Nāhiku community was 41,000 gpd 2013 (County of Maui, Department of Water Supply, 2019).

> **Baseline Condition: Economic and Fiscal Impacts:**
> Given the small population of Nāhiku and the lack of commercial land uses, the economic and related fiscal impacts for the Nāhiku community are considered negligible. Insufficient data is available to describe the economic and fiscal baseline conditions for East Maui.

b. Proposed Action - Issuance of Water Lease

Under the Proposed Action, the amount of water that can be diverted must be in compliance with the CWRM D&O, which required a return of flow to the taro streams in East Maui. The Proposed Action also contemplates a continuation of water delivery to MDWS and therefore the continuation of service to the Nāhiku community.

Proposed Action - Economic and Fiscal Impacts

The taro farms and other farms in East Maui that depend on stream flows would produce at full development about 1.0 million pounds per year of taro, and about 400,000 pounds per year of other crops. The resulting direct sales would be about $1.4 million per year. Indirect sales generated by the purchase of goods and services would be about $1.5 million per year. Thus, total direct and indirect sales would be about $2.9 million per year (with rounding), of which about $2.3 million would be on Maui and $500,000 on O'ahu. Profits from farm operations and indirect sales would be about $300,000.

Full development of the taro farms and other farms in East Maui that depend on stream flows would result in about 14 jobs and generate about 7 indirect jobs, for a total of about 21 jobs. The payroll is expected to reach about $500,000 for the direct jobs and $800,000 for all direct and indirect jobs. The direct and indirect jobs provided will support an estimated 47 residents, most of which would be on Maui.

Given the small population of Nāhiku and the lack of commercial land uses, the economic impacts to Nāhiku under the Proposed Action, where water continues to be provided to the community, are considered negligible.

In terms of fiscal impacts, the taro farms and other farms in East Maui that depend on stream flows would generate approximately $67,000 per year in State taxes at full development. For the County of Maui, property taxes will total about $100 per year. The City and County of Honolulu will derive about $300 per year from the excise tax surcharge. Given the small population of Nāhiku and the lack of commercial land uses, the fiscal impacts to Nāhiku under the Proposed Action, where water continues to be provided to the community, are considered negligible.

4.7.3.3 Upcountry Maui - Economic and Fiscal Impacts: Baselines and Proposed Action

The MDWS Upcountry Water System relies on three surface water sources for potable water, one of which is delivered by the EMI Aqueduct System through the Wailoa Ditch to the Kamole-Weir Water Treatment Plant (WTP), and the other two through the MDWS higher elevation aqueducts (the Upper and Lower Waikamoi flumes) maintained by EMI through a contractual agreement. All three sources are addressed through a contractual agreement between the County and A&B, and under that agreement continued delivery to MDWS is contingent upon the issuance of the Water Lease.

Approximately 80% to 90% of water delivered within the MDWS Upcountry Maui Water System is supplied by surface water and the remainder is by groundwater (wells) (CWRM D&O, FOF 799). As noted above, one of the water sources that the MDWS Upcountry District relies on for potable water is delivered by the EMI Aqueduct System through the Wailoa Ditch. The surface water delivered by Wailoa Ditch is treated at the Kamole Weir WTP, which has the largest production capacity of the three WTPs within the MDWS Upcountry District.

In 1993, the MDWS determined that the Upcountry Water System had insufficient supply for fire protection, domestic, and irrigation purposes to take on new or additional services without detriment to existing customers. A water meter priority list for landowners who had applied for

water service in the area was established in 1994. As of January 3, 2019, there were 1,650 applicants on the water meter list (MDWS, 2019).

a. Recent Sugarcane Cultivation: 2008 to 2013

Between 2008 and 2013, the Upcountry Water System used an average of 7.9 mgd. Approximately 60% of the MDWS' water use in the Upcountry System is for residential, commercial, or institutional use and 40% is for agricultural users. Of this, an average of 7.1 mgd was delivered by the EMI Aqueduct System (CWRM D&O at pp. 143, 213).

> **Recent Sugarcane Cultivation: 2008 to 2013 - Economic and Fiscal Impacts**
> In 2010, there were approximately 35,300 people within the Upcountry Maui Water System service area (CWRM D&O, FOF 797). Based on a median household income of $77,400, households in the Upcountry Maui Water System area had a collective income of $1.0 million.
>
> It is estimated that there were approximately 830 businesses in Upcountry Maui in 2010, employing 5,100 individuals. Total payroll is estimated at $232.1 million and direct sales revenue associated with these businesses is estimated to be $836.4 million.
>
> Fiscal impacts include revenues and expenditures related to the MDWS activities going into to the County's Water Supply Fund. Based on the average amount of water delivered by the EMI Aqueduct System between 2008 and 2013, it is estimated that the MDWS paid $155,500 to EMI.
>
> The County of Maui assesses water service fees based on 18 different use classifications (i.e., single-family, multi-family, industrial, etc.). The same water rates are charged across the nine (9) water systems in Maui County. The average water service fee rate Countywide is $4.00 per kgal. Based on this rate and water usage between 2008 and 2013, water service fees averaged $11.5 million annually from Upcountry Maui.

b. Interim Diversified Agriculture Operations (2017)

According to the MDWS Annual Report, the Upcountry Water System used 7.9 mgd in 2017, of which 2.86 mgd was provided by EMI. MDWS's use of surface water from the EMI Aqueduct System was low in 2017 because heavy rainfall increased supplies from other County sources that depend upon rainfall (Plasch Econ Pacific, LLC, 2019).

Approximately 40% of the water delivered through the Upcountry Maui Water System is for agricultural uses, including supplying non-potable water to KAP, which consists of 31 farm lots ranging from 7 to 29 acres owned by the County of Maui. The source of water for KAP and the planned 262-acre expansion of KAP, is Reservoir 40, which is sourced by the EMI Aqueduct System. The economic and fiscal impacts related to this supply to KAP are assessed in Section 4.7.4 regarding Agricultural Economy and therefore are not repeated here.

Interim Diversified Agriculture Operations (2017) - Economic and Fiscal Impacts

In 2017, there were estimated 37,100 residents and 14,200 households within the Upcountry Maui Water System service area. Based on a median household income of $77,400, households in Upcountry Maui had a collective income of $1.1 billion and consumption expenditures of $603.5 million. Residential property values within the Upcountry Maui Water System service area was approximately $2.3 billion in 2017.

There were approximately 880 businesses in Upcountry Maui in 2017, employing 5,400 individuals. Total payroll is estimated at $245.7 million. Direct sales associated with these businesses were approximately $885.6 million. Commercial property values within the Upcountry Maui Water System Service Area were approximately $145.8 million in 2017.

In total, direct sales from residents' consumption expenditures and Upcountry Maui businesses are estimated at $1.3 billion and residential and commercial property value is approximately $2.5 billion. In addition to residents and businesses serviced by the MDWS in Upcountry Maui, there are also numerous public uses that benefit from water from the EMI Aqueduct System and the MDWS. These public uses include but are not limited to, public and private schools, fire stations, community centers, and parks. The MDWS system also services agricultural users including the KAP.

Fiscal impacts during this period, based on an assumed delivery of 2.86 mgd from the EMI Aqueduct System in 2017, mean the MDWS would have paid $62,600. Based on the average water service fee rate Countywide of $4.00 per kgal and the assumed water usage in 2017, water service fees of $11.6 million were collected from Upcountry Maui and deposited into the Water Supply fund.

c. Proposed Action - Issuance of Water Lease

For the purposes of analyzing the impacts of the Proposed Action, it is assumed that the Upcountry Maui Water System will have access to 7.1 mgd supplied by the EMI Aqueduct System. However, that amount is not sufficient to address expected growth in Upcountry Maui, which is projected to require as much as an additional 7.95 mgd to meet future demands through 2030.

The MDWS projects that by 2030, the population of the area served by the Upcountry Maui Water System will grow to 43,675 residents, with a predicted additional water need of 1.65 mgd (CWRM D&O at 214). In addition to water demand resulting from population growth, additional water is needed to meet the demands of the applicants on the water meter waiting list. MDWS anticipates that it will need to develop between 4.2 mgd and 7.95 mgd in addition to the approximately 7.1 mgd currently provided through the EMI Aqueduct System, to meet demands through 2030 (CWRM D&O at 214). For the purposes of the economic and fiscal impacts analysis, it is assumed that the full 7.95 mgd will be needed to meet future demands through 2030.

The MDWS has evaluated a variety of strategies to meet the long-term future demands in the Upcountry Maui Water System and/or respond to reductions in the surface water supply. The strategies that have been determined to be most cost effective consist of combinations of

additional basal well capacity and/or construction of raw water storage reservoirs. New basal well development would involve construction of new wells at the 1,300 foot elevation and/or wells at the 1,800 foot elevation, along with transmission pipelines, storage tanks, and booster pump stations. A possible limitation on the development of new wells is the Consent Decree that MDWS entered into in 2003 that requires that the MDWS conduct rigorous cost/benefit analyses of other water source options before developing groundwater in the East Maui region. According to an assessment by Brown and Caldwell, development of additional basal wells may be a "viable strategy to meet future needs from a technical perspective; however, there are legal issues that must be resolved before the MDWS can proceed" (Brown and Caldwell, 2014). In addition, the hydrogeological viability of the wells would need to be assessed.

Constructing additional raw water storage reservoirs to store water from wet periods for use during dry periods presents another strategy to meet future water demand. The MDWS evaluated reservoirs ranging in size from 100 million gallons (mgal) to 300 mgal to serve the Olinda, Piiholo, and/or Kamole Weir WTPs. The analysis determined that the most cost-effective reservoirs would be reservoirs designed to feed the Piiholo WTP or the Kamole-Weir WTP (Brown and Caldwell, 2014).

New reservoirs have high capital costs but lower operational and maintenance costs compared to groundwater wells. There must be sufficient source water available to fill the reservoir. In comparison, new wells carry relatively lower capital costs but require transmission and storage improvements and have higher operational costs due to the cost of pumping groundwater. It is also noted that there is risk associated with drilling new wells because of the uncertainty of the quantity and quality of water that would be found. The assessment prepared by Brown and Caldwell opined that it would be easier to develop new basal wells than to construct new storage reservoirs due to the need for capital financing mechanisms to construct expensive reservoirs, and potential environmental issues associated with constructing a new reservoir in the Lower Kula area (Brown and Caldwell, 2014).

Proposed Action - Economic and Fiscal Impacts

Under the Proposed Action it is assumed that MDWS will continue to have access of up to 7.1 mgd through the EMI Aqueduct System. The County of Maui projects that the population in the Upcountry Maui Service Area will grow to approximately 43,700 in 2030, translating to an estimated 16,700 households. Assuming a median household income of $77,400, households in the Upcountry Maui Service Area are anticipated to have a collective income of $1.3 billion and consumption expenditures of $710.0 million. Residential property values within Upcountry Maui are estimated to grow to $2.7 billion.

Assuming proportional growth in line with population, there will be an estimated 1,100 businesses in Upcountry Maui in 2030, employing 6,700 individuals. Total payroll would be estimated at $304.9 million, while direct sales associated with these businesses would be $1.1 billion. Commercial property values within Upcountry Maui are estimated to grow to $180.9 million.

In total, direct sales from residents' consumption expenditures and Upcountry Maui businesses are estimated at $1.6 billion and residential and commercial property value is approximately $2.9 billion.

Fiscal impacts to Upcountry Maui arise from the assumption that the MDWS will need to develop 7.95 mgd of new water sources to meet future demands through 2030 (even with the continued supply of 7.1 mgd from the EMI Aqueduct System under the Proposed Action). The Brown and Caldwell analysis indicates that incremental basal wells would be a strategy to meet future demands assuming no reduction in surface water flows. Under the Brown and Caldwell analysis, the life-cycle unit cost of developing and operating wells is $34 per kgal. It is noted that the life-cycle unit cost to develop new water for Upcountry Maui customers is high. In comparison, a similar analysis conducted for the Central Maui Water System showed a unit cost of less than $10 per kgal, or less than one third the cost of Upcountry Maui water development (Brown and Caldwell, 2014). The total life-cycle cost for 7.95 mgd of new wells is $1.2 billion. The life-cycle cost is expressed as the net present value of all the costs incurred over 25 years, including capital, operating, and maintenance costs.

As previously mentioned, the rate that the MDWS pays to EMI will increase by 2030 because it is assumed that EMI's per unit operating cost will increase under the Water Lease. The actual rate the MDWS will pay to EMI will be subject to a future agreement between the two entities. However, for the purposes of this analysis, the 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, the MDWS would pay an estimated $268,900 per year to EMI.

Water service rates vary by class of users (i.e., residential, commercial, agricultural, etc.). The average the MDWS water service rate Countywide is $4 per kgal. Inasmuch as the same water rates are charged across the nine water systems in Maui County, there are many factors that determine the water service rate. Therefore, it is difficult to predict what the water service rate would be in 2030. However, it is noted that the life-cycle unit cost to develop new water for Upcountry customers of $34 per kgal far exceeds the current average water service rate of $4 per kgal. It is assumed that the MDWS would seek a variety of funding sources to cover the cost to develop new wells. This may include County capital improvement program funds as well as State and/or Federal funds.

Nevertheless, due to the significant cost of new water source development, it would be reasonable to expect that water service rates would increase in the future to offset the costs of new water sources. As noted above, the County's water rate structure is uniform for all customers; water rates are not dependent on the service area a customer is located in (Brown and Caldwell, 2014). Therefore, under the MDWS' current rate structure, the increases would apply Countywide because rates do not vary by service area.

4.7.3.4. Central Maui - Economic and Fiscal Impacts: Baseline and Proposed Action

A&B continuously cultivated sugarcane on the fields of Central Maui for over a century. These Central Maui fields were irrigated by water from the EMI Aqueduct System and brackish groundwater. The impact analysis is based on approximately 30,000 acres of Central Maui fields that were historically serviced by the EMI Aqueduct System and supplemental brackish

groundwater. Excluded from the analysis were fields west of Maui Veterans Highway that were irrigated with surface water from the Wailuku Water Co. and supplemental brackish water.

a. Typical Sugarcane Cultivation: 2006

For the 2006 crop, 145,200 tons of raw sugar were produced from the Central Maui fields, of which approximately 84% (29,430 acres) was served by water sourced through the EMI Aqueduct System.

Typical Sugarcane Cultivation: 2006 - Economic and Fiscal Impacts

Sales of sugar and energy sourced from Central Maui generated approximately $101 million in direct sales. The purchase of goods and services by HC&S and families of those employees generated indirect sales estimated at $91 million. Total direct and indirect sales were $191 million, of which $160 million was on Maui. Profits from sugar operations and indirect economic sales were estimated at $19 million.

HC&S employed some 630 workers, and total indirect jobs during this time is estimated at 710, for a total direct and indirect employment of 1,300 jobs. Payroll was approximately $48.5 million for direct jobs and $82.7 million for all jobs (direct and indirect). These jobs supported an estimated 3,300 residents.

In terms of fiscal impacts, sugar generated an estimated $5.9 million in State tax revenues and rental payments to the State. The revenues were low because the sale of exported sugar was exempt from excise taxes. Property taxes to the County of Maui were about $50,000 per year.

b. Recent Sugarcane Cultivation: 2008 to 2013

During this period, approximately 36,180 acres of land was farmed for sugar, of which approximately 84% (30,320 acres) were served by water sourced through the EMI Aqueduct System.

Recent Sugarcane Cultivation: 2008 to 2013 - Economic and Fiscal Impacts

The amount of sugar produced in this period was less than the prior period (136,300 tons/year versus 145,200 tons/year). Sales of sugar and energy generate annual revenue of approximately $116 million in direct sales. Total direct and indirect sales averted nearly $220 million per year. Profits from sugar operations and indirect sales were estimated at $22 million.

HC&S employment was slightly lower than in the prior period 620 workers compared to 630 workers). Total direct and indirect employment is estimated at 700 workers. Payroll for direct workers is estimated at $34.3 million, and total payroll (direct and indirect) was $68 million).

Fiscal impacts include State tax revenue during this period, which averaged $5.1 million. Property taxes paid to the County of Maui were about $70,000 per year. The City and County of Honolulu received some $40,000 per year from the excise tax surcharge.

c. Interim Diversified Agriculture Operations (2017)

During this period very little of the Central Maui lands were in cultivation. Approximately 200 acres were used to grow pongamia and 500 acres used for unirrigated pasture.

Interim Diversified Agriculture Operations (2017) - Economic and Fiscal Impacts

Economic impacts during this period are negligible. The limited use of the Central Maui fields generated an estimated 10 direct and indirect jobs with a total payroll of $0.5 million.

Fiscal impacts during this period were $30,000 in tax revenues, and $20,000 per year paid to the County of Maui for real property taxes. The excise surcharge to the City and County of Honolulu was negligible.

d. Proposed Action - Issuance of Water Lease

Impacts from the issuance of the Water Lease are measured in two phases. First, during the estimated 10-year development period, where the Central Maui fields get prepared and used for diversified agriculture. Second, the full operations period, which follows the development period and is when the Central Maui fields are in full operation under the Mahi Pono farm plan.

Under the Mahi Pono farm plan Central Maui is expected to host a major expansion in crop farming and cattle grazing under the Proposed Action. Mahi Pono's current plans for Central Maui envision cultivating a broad range of food and non-food crops for local consumption and export, including orchard crops (citrus, macadamia nuts, coffee, avocado, etc.), tropical fruits, vegetables and melons, row crops, annual crops, energy crops, and grass-fed cattle. In addition, the company plans to lease some of its land to other farmers at favorable terms, including relatively low rents for long periods. A solar farm is also proposed under the farm plan.

Proposed Action - Economic and Fiscal Impacts - Development Period

Implementation of the Mahi Pono farm plans requires conversion of former sugarcane lands into cropland, irrigated pasture, and unirrigated pasture. An estimated 319,000 square feet of building space (for washing and packing areas, storage etc.) would be required, as well as the development of a 37.5 mW solar farm with storage batteries. The total development expenditures would be about $214.7 million, or an average expenditure of about $21.5 million per year assuming a 10-year development period. Indirect sales associated with development activities are estimated to be $18.5 million per year for a total of $39.9 million per year, of which $33.5 million would be on Maui and $6.5 million on Oʻahu. Profits on development activity and indirect sales would be about $4.0 million per year.

Direct and indirect employment associated with the development activities to implement the farm plan would average about 326 jobs, of which 285 jobs would be on Maui and 42 jobs on Oʻahu. Actual employment would vary over the 10-year development period. Payroll for the direct and indirect jobs would average $14.5 million per year and these jobs would support an estimated 730 residents.

Fiscal impacts will raise from the conversion of Central Maui farmlands from sugarcane to diversified agriculture and green energy would generate an average of about $1.9 million per year in State taxes, for a 10-year cumulative total of about $18.6 million. However, because developers of solar farms receive a State subsidy of $500,000 per 1 mW of generating capacity, the planned solar farm would generate a State subsidy averaging $1.88 million per year for a cumulative total of about $18.8 million. Thus, State tax revenues from development activities less the energy subsidy would result in a cumulative loss of about $100,000 (with rounding).

The County of Maui would derive negligible tax revenues from the anticipated development activity and the City and County of Honolulu would derive cumulative excise tax surcharges of about $1.0 million.

Proposed Action - Economic and Fiscal Impacts - Full Operations

At full operations, the Mahi Pono farm plan will cause a substantial amount of crop production, including about 8 million pounds per year from the Community Farm, 321 million pounds per year from orchards, and 9 million pounds per year of tropical fruits, plus production from row crops, annual crops, and energy crops. Annual sales are expected to reach $155.9 million. The pastures would support a cattle herd of about 7,300 cow-and-calf animal units, produce over 4,300 calves per year, and generate revenues of about $4.8 million per year. The solar farm would generate about 82,125 mW of electricity per year, with revenues of about $8.2 million per year. Combined farm and energy revenues would reach $168.9 million per year in direct sales (far exceeding the 2006 revenues from sugar production of $101 million, and the $116 million average for the 2008 to 2013 period).

Purchases of goods and services by farmers and the families of employees would generate indirect sales and, in turn, these suppliers would generate more indirect sales by their purchase of goods and services. The indirect sales are estimated at about $160.7 million per year. Total direct and indirect sales would be about $329.5 million per year, of which about $273.3 million would be on Maui and about $56.2 million on Oʻahu. Profits from farm operations, energy operations, and indirect sales would be about $33 million.

At full operations farm employment is expected to reach about 790 jobs (about 160 more than provided by sugar operations in 2006). The jobs would be typical of those provided by diversified-crop farming and ranching-managing soils and pests, operating and maintaining irrigation systems, planting crops, pruning trees, harvesting crops, sorting and washing crops, packing crops, trucking crops to markets and shipping terminals, moving cattle among pastures, maintaining fences, marketing, accounting, etc.

The purchase of goods and services by farmers and ranchers and by the families of their employees would generate an estimated 350 jobs. In total, about 1,140 direct and indirect jobs would be supported, including about 1,000 jobs on Maui. Payroll is estimated at $45.3 million for all direct and indirect jobs. The direct and indirect jobs would support an estimated 2,550 residents.

Regarding fiscal impacts at full operations, diversified agricultural operations in Central Maui would generate an estimated $4.5 million in State tax revenues by 2030. Property taxes paid by to the County of Maui would be about $800,000 per year, and the City and County of Honolulu would derive about $140,000 per year from the excise tax surcharge.

4.7.4 Agricultural Economy

In support of this DEIS, Plasch Econ Pacific LLC prepared a report on Agricultural and Related Economic Impacts (June 2019) assessing the economic agricultural impacts of the Proposed Action (see Appendix I). This study assesses agricultural and related economic impacts for the Proposed Action as compared to baseline conditions (outlined in section 4.7.3 above) and an agricultural assessment of three geographic areas: (1) East Maui, including Nāhiku; (2) Upcountry Maui, including KAP; and (3) Central Maui.

The year 2030 was selected as the point for analysis of the impacts of the Proposed Action because it is assumed that timeframe would allow for the full implementation of the farm plan in Central Maui.

East Maui - Agricultural Conditions

Because of the heavy rainfall on the windward slopes of Haleakalā and the many streams in East Maui, many makai areas along the streams are well suited for growing taro and truck crops. Also, a number of the landowners have appurtenant and riparian rights to use water from these streams for farming.

Collectively, the known landowners have about 45 acres in East Maui that are suitable for growing taro, and about 35 acres suitable for truck crops. This accounting includes only the known existing and potential farms in East Maui addressed by the CWRM D&O. Solar radiation for these areas is less than 350 calories per square centimeter per day, which is similar to or slightly below other taro-growing areas in Hawaiʻi.

A number of East Maui farmers divert stream water to irrigate taro loʻi and small farms. Taro farming is a chosen way of life and an important cultural activity for many. In the past, farmers in East Maui have reported that surface-water diversions to supply water to Central Maui left insufficient water in the streams for them to take full advantage of the agricultural potential in East Maui. However, in light of the CWRM D&O, ample stream water should now be available to irrigate taro loʻi and the small farms relying on East Maui streams. The large volume of water that flows out of the taro loʻi can be used to irrigate other crops.

According to the CWRM D&O, the usable acreage of the farms in East Maui that have water rights to the streams subject to the IIFS are as follows:

Table 4-8: Usable Acerage in East Maui for Taro Loʻi

AREA	TARO LO'I (ACRES)	OTHER AGRICULTURE (ACRES)
Keʻanae	12.13	7.00
Wailuā	7.22	11.86

Wailuā	8.30	11.23
Wailuā	11.63	5.00
Honopou	5.55	
Total Acres	44.83	35.09

This accounting only includes known farms and future farms per the CWRM D&O. Thus, stream restoration could result in about 44.83 acres planted in taro in East Maui, and 35.09 acres in other crops.

Wetland taro requires very large volumes of water flowing through the loʻi, partly to control the water temperature, thereby preventing taro rot. After flowing through the loʻi, the large volume of excess water can be used to irrigate other crops. For this analysis, it is assumed that the gross and net water requirements of taro are 140,000 and 30,000 gad, respectively. Other crops are assumed to require about 5,000 gad. With these assumptions, the gross and net water requirements for the East Maui farms are about 6.3 mgd and 1.5 mgd, respectively. The high gross water requirement reflects the fact that nearly 80% of the water used for growing taro is diverted from streams, passes through lo'i, and is then returned to the streams.

East Maui: Agricultural Impacts of the Proposed Action

The agricultural impacts to East Maui are assumed to take place irrespective of the issuance of the Water Lease. Taro farms and other farms in East Maui that depend on stream flows would produce at full development about 1 million pounds per year of taro, and about 400,000 pounds per year of other crops. The resulting direct sales would be about $1.4 million per year. Indirect sales generated by the purchase of goods and services would be about $1.5 million per year. Thus, total direct-and-indirect sales would be about $2.9 million per year (with rounding), of which about $3 million would be on Maui and $700,000 on Oʻahu. About $500,000 of consumption expenditures would be subject to the excise tax on final sales, and $2.4 million subject to the excise tax on intermediate sales. Profits from farm operations and indirect sales would be about $300,000, or possibly less.

Full development of the taro farms and other farms in East Maui that depend on stream flows protected under the CWRM D&O would result in about 14 jobs and generate about 7 indirect jobs, for a total of about 21 jobs. The payroll is expected to reach about $500,000 for the direct jobs and $800,000 for all direct and indirect jobs. The direct and indirect jobs provided will support an estimated 47 residents living in about 20 homes, most of whom would be on Maui.

These East Maui farmers will generate less than $70,000 per year in State taxes at full development. For the County, property taxes will total about $100 per year. The City and County of Honolulu will derive about $300 per year from the excise-tax surcharge.

Upcountry Maui - Agricultural Conditions

The soil ratings for Upcountry Maui (Land Capability Grouping NRCS, ALISH, LSB) are provided in Section 4.1.2.

Upcountry Maui receives moderate sunshine, with average daily insolation ranging from less than 350 to 450 calories per square centimeter per day, although a small portion of Upcountry Maui receives 500 calories. KAP receives about 450 calories per square centimeter per day. Average annual rainfall in Upcountry Maui ranges from 15 to nearly 120 inches. KAP receives an average of less than 25 inches per year. At Kula, average temperatures range from the low 50s in the winter to the high 70s in the summer. Similar to Central Maui, the prevailing tradewinds in Upcountry Maui blow from a northeasterly direction. Occasional strong winds can cause crop damage if they are not protected by windbreaks.

Upcountry Maui has lands that are suitable for farming, but the general conditions are not as good as those in Central Maui. The farms are small and scattered, solar radiation is less, farms are farther from markets and shipping terminals, water is limited and expensive, and annual rents at the KAP are much higher than those planned for Central Maui ($1,200 per acre vs. $150 per acre under the Mahi Pono farm plan).

a. Upcountry Maui: Agricultural Impacts of Interim Diversified Agricultural Operations (2017)

The EMI Aqueduct System supplies water to the MDWS Upcountry Water System Service Area, which covers approximately 61,500 acres. Approximately 32,500 acres are identified as being in agricultural use according to the County of Maui Real Property Tax records or State of Hawai'i Office of Planning. Land in diversified crops includes KAP, which is managed by the County of Maui, Office of Economic Development to promote the development of diversified agriculture on the island of Maui. KAP lots are leased to 26 farmers who grow a variety of crops, including vegetables, turf grass, landscape nursery products, flowers, bananas, and dryland taro. The total farmland irrigated with water from the EMI Aqueduct System is about 1,250 acres (447 acres for KAP plus about 800 acres for other farms = 1,247 acres).

In 2017, the EMI Aqueduct System supplied about 2.86 mgd to the MDWS for Upcountry Maui, which is well below the long-term average of 7.1 mgd. MDWS use of surface water from the EMI System was low in 2017 because heavy rainfall increased supplies from other County sources that depend on rainfall. Combined with other water sources and after system losses, the MDWS delivered about 7.93 mgd to residents, farms, businesses and others. An estimated 3.16 mgd were used for agriculture. About 0.46 mgd were for crops at the KAP, however, 1.5 mgd had to be supplied by the EMI Aqueduct System to produce the 0.46 mgd used by the farmers. About 2.7 mgd were used for crops elsewhere in Upcountry Maui. The pastures in Upcountry Maui are not irrigated. Other farmers in Upcountry Maui rely on rainfall to water their crops.

In 2017, farmers at KAP and other farmers in Upcountry Maui who relied on water from the EMI System produced an estimated 12.5 million pounds of crops per year. Annual farm sales were about $12.5 million, and indirect sales were about $13.8 million. Total direct-plus-indirect sales were about $26.3 million per year, of which about $21.5 million were on Maui and about $4.8 million on O'ahu. About $2.7 million of consumption expenditures were subject to the excise tax on final sales, and about $23.7 million subject to the excise tax on intermediate sales. Rents paid to the County totaled about

$500,000 per year. Profits from farm operations and indirect sales were an estimated $2.6 million per year.

During this timeframe, KAP farmers and other farms in Upcountry Maui who relied on water from the EMI Aqueduct System provided about 80 jobs and generated about 40 indirect jobs, for a total of about 120 jobs. The payroll was about $2.9 million for the direct jobs and $4.8 million for all direct and indirect jobs. The direct and indirect jobs would support an estimated 275 residents living in about 120 homes, with about 245 residents and 110 homes on Maui.

In 2017, the farms at KAP and other farms in Upcountry Maui that rely on water from the EMI Aqueduct System would generate about $45,000 per year in State taxes. For the County, property taxes plus rents paid to the County by farmers at the KAP totaled less than $54,000 per year. The City and County of Honolulu received about $2,000 per year from the excise-tax surcharge.

b. Upcountry Maui: Agricultural Impacts of the Proposed Action

A continuation of water supplied through the EMI Aqueduct System to serve Upcountry Maui, as planned under the Proposed Action, is projected to result in some 1,520 acres of farmland being irrigated by that source in 2030.

A continuation of water delivered through the EMI Aqueduct System to MDWS is assumed as part of the Proposed Action. Therefore, it is anticipated that the 262-acre expansion of KAP would go forward. That land would have to be converted from fallow sugarcane fields to productive fields for diversified agriculture, with an estimated cost of $1.3 million. Related indirect sales are projected at $320,000 per year over a 5-year period. Thus, expenditures plus indirect sales are expected to average approximately $600,000 per year, and cumulative State tax revenues associated with this conversion would be approximately $200,000.

Overall, farming in Upcountry Maui is expected to increase due to the KAP expansion. KAP farms and others in Upcountry Maui who will rely on water from the EMI Aqueduct System are projected to produce an estimated 15.1 million pounds of crops per year. Annual farm sales are expected to reach about $15.1 million, and indirect sales about $13.4 million. Total direct-plus-indirect sales will be about $31.8 million per year, of which about $26 million will be on Maui and about $5.9 million on Oʻahu. About $3.2 million of consumption expenditures would be subject to the excise tax on final sales, and about $28.6 million subject to the excise tax on intermediate sales. Rents paid to the County would total about $900,000 per year. Profits from farm operations and indirect sales are expected to reach about $3.2 million per year.

Employment will increase due to the KAP expansion. By 2030, farmers who rely on water from the EMI Aqueduct System are expected to provide about 100 jobs and generate about 50 indirect jobs, for a total of about 150 jobs. The payroll is expected to reach about $3.5 million for the direct jobs and $5.8 million for all direct and indirect jobs. The direct and indirect jobs provided will support an estimated 330 residents living in about 140 homes, with about 300 residents and 130 homes on Maui.

State taxes generated from Upcountry Maui farms that rely on water from the EMI Aqueduct System would generate about $54,000 per year in State taxes. For the County, property taxes plus rents paid to the County by farmers at the KAP would total about $85,000 per year. Most of the increase from 2017 would be due to the additional rental income from the anticipated KAP expansion.

Central Maui - Agricultural Conditions

The soil ratings for Central Maui (Land Capability Grouping NRCS, ALISH, LSB) are provided in Section 4.1.2. 27,097 acres in Central Maui are considered "high-quality farmland" meaning rated I or II by NRCS, Prime or Unique by ALISH, or A or B by the LSB. With less water available, less acreage would be rated as high-quality farmland.

Central Maui receives considerable sunshine, with average daily insolation ranging from slightly less than 450 calories per square centimeter per day in mauka areas, to over 500 calories near Pāʻia. Average annual rainfall in Central Maui ranges from less than 15 inches per year in the southern part of the isthmus to over 50 inches in the north-eastern area of Central Maui. Most of this rainfall occurs during the winter rainy season (October through April), while the summer months (May through September) are hot and dry. Because of the low annual rainfall and/or seasonal rainfall, irrigation water is needed to grow crops in Central Maui. Average temperatures range from the low 60s in the winter to the mid-80s in the summer. The mild temperatures are favorable for growing many crops. The prevailing tradewinds blow from a northeasterly direction across the isthmus and out to sea. Occasional strong winds can cause crop damage if they are not protected by windbreaks.

Farmers in Central Maui are well-situated to supply the small Maui Island market. Compared to other farmers in Hawaiʻi, they can also compete reasonably well in supplying mainland markets, as long as their crops have long shelf-lives and so can be shipped by surface vessel. However, compared to farmers on O'ahu, they are at a disadvantage in supplying the Honolulu market. Furthermore, they are at a disadvantage in supplying mainland markets if their crops have short shelf-lives and so must be shipped by air. Also, farmers on Maui are at a disadvantage in competing against the low-cost producers who supply mainland markets.

Most of the water for irrigating crops must come from surface water. Upper fields can be irrigated only with surface water. Lower fields can be irrigated with a mix of surface water and brackish groundwater. Because of salinity, the use of brackish water on the lower fields is limited to about 30% of the water applied. Combining the upper and lower fields, the overall water split across all 30,000 acres would be approximately 80% surface water and 20% brackish groundwater water.

a. Central Maui – Agricultural Impacts of Typical Sugar Cane Cultivation: 2006

HC&S grew sugarcane on fields in Central Maui from 1882 to 2016 (134 years). Over time, it grew to become the largest plantation in the islands, and it was the last Hawaiʻi sugar plantation to close. Its success was due to its large size and economies of scale, a compact configuration which reduced costs, favorable agronomic conditions (e.g., good soils and high solar radiation), and abundant low-cost water from the EMI System. Most of the HC&S fields were owned by A&B, but some were leased from the State

and other entities. For the 2006 crop year, HC&S grew sugarcane on about 35,180 acres, of which about 29,430 acres were irrigated by the EMI Aqueduct System and brackish groundwater wells, and about 5,750 acres were irrigated with water from the West Maui Ditch System and brackish groundwater wells. Fields irrigated by the EMI Aqueduct System had about 12,800 acres (43.5%) in the upper fields irrigated only with surface water, and about 16,630 acres (56.5%) in the lower fields irrigated with a mix of surface water and brackish groundwater.

After system losses, the volume of water used to irrigate the 2006 sugarcane crop was about 143 mgd. About 112 mgd (78.3%) was surface water and 31 mgd (21.7%) was brackish groundwater. Gross water requirements (before system losses) were about 185 mgd (about 145 mgd of surface water and 40 mgd of brackish groundwater).

During this period (2006), HC&S produced about 145,200 tons of raw sugar, and sold sugar and energy to generate about $101 million in direct sales. The purchase of goods and services by HC&S and the families of HC&S employees generated indirect sales and, in turn, these suppliers generated more indirect sales by their purchases of goods and services. The indirect sales are estimated at about $91 million. Total direct-plus-indirect sales were about $191 million, of which about $160 million was on Maui and about $32 million on O`ahu. About $46 million of consumption expenditures were subject to the excise tax on final sales, and about $67 million subject to the excise tax on intermediate sales. About $140,000 per year was paid to the State to lease fields in Central Maui. Profits from sugar operations and indirect economic sales were an estimated $19 million.

In 2006, sugar operations generated about $5.9 million in State tax revenues and rental payments to the State. Most of the revenues were derived from excise taxes on consumption expenditures by families supported by the direct and indirect jobs that were provided, and personal income taxes paid by these same families. Tax revenues were low because the sale of the exported sugar was exempt from the excise taxes. Property taxes paid by HC&S to the County of Maui were about $50,000 per year. In 2006, the City and County of Honolulu derived no revenue from the excise-tax surcharge because it was not in effect that year.

b. Central Maui: Agricultural Impacts of Recent Sugar Cane Cultivation: 2008 to 2013

During this period there was only a modest change from the typical sugar scenario. The plantation was about 36,180 acres with about 30,320 acres irrigated with water from the EMI Aqueduct System. During this period water used to irrigate the sugarcane crop declined to 132 mgd. About 81 mgd (61.3%) was surface water and 51 mgd (38.7%) was brackish groundwater. The high amount of brackish groundwater decreased sugar yields, but maintained high levels of biomass for energy production. Gross water requirements (before system losses) were about 172 mgd including about 106 mgd of surface and about 67 mgd of brackish groundwater.

HC&S produced an average of about 136,300 tons of raw sugar per year (a decrease of 8.9 tons from 2006), and sold sugar and energy to generate average annual

revenues of about $116 million in direct sales (an increase of about $15 million). Total direct-plus-indirect sales averaged nearly $220 million per year, of which about $183 million was on Maui and $36 million on O`ahu. About $37 million of consumption expenditures were subject to the excise tax on final sales, and about $103 million subject to the excise tax on intermediate sales. About $140,000 per year was paid to the State to lease fields in Central Maui. Profits from sugar operations and indirect sales were an estimated $22 million.

For the 2008-to-2013 period, sugar operations generated an average of about $5.1 million in State tax revenues and rental payments to the State. Property taxes paid by HC&S to the County of Maui were about $70,000 per year. The increase from 2006 was due to a higher tax rate. The City and County of Honolulu derived about $40,000 per year from the excise-tax surcharge.

c. Central Maui: Agricultural Impacts of Interim Diversified Agriculture Operations (2017)

Limited agricultural activities took place in Central Maui during this period, including 200 acres to grow the energy crop pongamia, and approximately 500 acres in unirrigated pasture. Less than 1 mgd was used to irrigate the pongamia. Negligible revenues were produced during this period.

This period generated about $30,000 in tax revenues. Property taxes paid by HC&S to the County of Maui were about $20,000 per year. Property taxes decreased because of the land was assessed at a lower value following the closure of sugar operations. The City and County of Honolulu derived negligible revenues from the excise-tax surcharge.

d. Central Maui: Agricultural Impacts of Proposed Action

Impacts from the issuance of the Water Lease are measured in two phases. First, during the estimated 10-year development period, where the Central Maui fields get prepared and used for diversified agriculture. Second, the full operations period, which follows the development period and is when the Central Maui fields are in full operation under the Mahi Pono farm plan.

The farm plan will evolve over time based on a number of factors, including the available supply of surface water, experience which will be gained on crops that grow well in Central Maui, crops that are profitable, the size of the market for profitable crops, etc. Nevertheless, current estimations are that 80% of the Central Maui fields will be used for orchards, which reflect a long-term commitment to agriculture. About 800 acres would be used for community farms of 1, 5 and 10 acres. The solar farm is assumed to use approximately 250 acres. Mahi Pono plans on leasing approximately 2,050 acres to other farmers. Full development of the Mahi Pono farm plan would require an estimated 82 mgd of irrigation water after system losses. Gross water requirements, before system losses, would be about 107 mgd, which is a decline of 79 mgd from the 2006 sugar cane crop year.

Proposed Action – Agricultural Impacts During Development Period

Implementation of the Mahi Pono farm plan would require converting former sugarcane lands to about 15,950 acres of cropland, 4,700 acres of irrigated pasture, and 9,100 acres of unirrigated pasture. The conversion is expected to take place over 10 years, to be followed by the full operations period of the farm plan. The conversion would require removing remaining sugarcane plants, adding amendments, planting windbreaks around fields, modifying field irrigation systems, installing fencing, planting crops, etc. The total cost for this conversion is estimated at about $89 million.

The farm plan also requires an estimated 319,000 square feet of building space for washing and packing areas, storage, etc. Construction is estimated at about $31.9 million.

Based on recently built or approved solar farms, the 250 acres for green energy are sufficient space for a 37.5 MW solar farm with storage batteries costing about $93.8 million. The total development expenditure would be about $214.7 million, or an average expenditure of about $21.5 million per year assuming a 10-year development period.

Excluding imported construction materials (e.g., solar panels), the annual expenditures would be about $8.9 million for field preparations and about $12.6 million per year for building structures. These figures are used to estimate indirect sales. Development activities will generate indirect sales associated with supplying goods and services to the companies involved with the development, and to the families of those who work for these companies. In turn, the companies supplying goods and services, and the families of their employees, will purchase goods and services from other companies, and so on. These indirect sales will include sales by companies supplying agricultural goods (soil amendments, fencing, irrigation systems, etc.); rental of farm equipment; equipment repair; warehousing services; shipping and trucking services; etc. Indirect sales also include sales by grocery stores, drug stores, restaurants, service stations, beauty salons, medical providers, accountants, attorneys, insurance agents, etc. Based on State economic multipliers, these indirect sales are expected to average about $18.5 million per year. Thus, development expenditures plus indirect sales are expected to average about $39.9million per year, of which about $33.5 million would be on Maui and about $6.5 on Oʻahu. About $29.4 million of development and consumption expenditures would be subject to the excise tax on final sales, and about $10.5 million subject to the excise tax on intermediate sales. Profits on development activity and indirect sales would be about $4 million per year.

An average of 210 workers would be needed over the assumed 10-year development period to convert former sugarcane fields to fields for diversified crops and pasture, construct agricultural buildings, and install a solar farm. Jobs would include equipment operators, soil specialists, irrigation specialists, planters, truck drivers, construction workers, supervisors, etc. Also, the various jobs would range over a variety of skill levels, including entry-level, semi-skilled, skilled, management, and professional positions. Most of these temporary jobs are expected to be filled by residents of Maui and other the islands. In addition to the direct jobs, about 120 indirect jobs would be generated by purchases of goods and services. Indirect jobs will include those at

companies supplying farming equipment, irrigation systems, fencing, chemicals, building materials, repair services, etc. Other indirect jobs would include those involved with supplying goods and services to families, and would range over a variety of skill levels.

Thus, direct-plus-indirect employment during the development period would average about 330 jobs, of which about 290 jobs would be on Maui and 40 jobs on O'ahu. Actual employment would vary over time. The payroll during development would average about $8.8 million for the direct jobs and $14.5 million for all direct and indirect jobs. During the development period, the direct and indirect jobs would support an estimated 730 residents living in about 310 homes, of which about 640 residents and 280 homes would be on Maui.

The conversion of the Central Maui farmlands from sugarcane to diversified agriculture and green energy would generate an average of about $1.9 million per year in State taxes, for a 10-year cumulative total of about $18.6 million. However, due to the State subsidy provided to developers of solar farms ($500,000 per 1 MW of generating capacity), the State tax revenues from development minus the energy subsidy would result in a cumulative loss of about $100,000 (with rounding). Given the nature of Hawai'i's tax system, the County of Maui would derive negligible tax revenues from the anticipated development activity. Over the 10-year development period, the City and County of Honolulu would derive cumulative excise-tax surcharges of about $60,000.

Proposed Action – Agricultural Impacts During Full Operations.

At full development, the Mahi Pono farm plan would result in a substantial amount of crop production, including about 8 million pounds per year from the Community Farm, 321 million pounds per year from orchards, and 9 million pounds per year of tropical fruits, plus production from row crops, annual crops, and energy crops. Annual sales are expected to reach about $155.9 million. The pastures would support a cattle herd of about 7,300 cow-and-calf animal units (au), produce over 4,300 calves per year, and generate revenues of about $4.8 million per year. Thus, total farm sales would be about $160.7 million per year, of which an estimated $104.4 million (65%) would be Hawai'i sales and $56.2 million export sales (35%).

Based on recently built or approved solar farms, the solar farm would generate about 82,100 MW of electricity per year, with revenues of about $8.2 million per year paid by MECO to the solar-farm operator. Combined farm and energy revenues would reach about $168.9 million per year in direct sales (exceeding the 2006 revenues from sugar production of $101 million, and the $116 million average for the 2008-to-2013 period). Purchases of goods and services by farmers and the families of employees would generate indirect sales and, in turn, these suppliers would generate more indirect sales by their purchase of goods and services. The indirect sales are estimated at about $160.7 million per year. Total direct-plus-indirect sales would be about $329.5 million, of which about $273.8 million would be on Maui and about $56.2 million on O`ahu.

About $24.9 million of consumption expenditures would be subject to the excise tax on final sales, and about $248.2 million subject to the excise tax on intermediate sales. Rental income from leasing land to other farmers and to an energy company would be

about $1 million per year. Profits from farm operations, energy operations, and indirect sales would be about $33 million.

At full development, farm employment is expected to reach about 790 jobs (about 160 more jobs than provided by sugar operations in 2006). The jobs would be typical of those provided by diversified-crop farming and ranching; e.g., managing soils and pests, operating and maintaining irrigation systems, planting crops, pruning trees, harvesting crops, sorting and washing crops, packing crops, trucking crops to markets and shipping terminals, moving cattle among pastures, maintaining fences, marketing, accounting, etc. The increase in employment would be gradual, with most jobs filled by former sugarcane workers, skilled workers from Maui and other islands, recent graduates of agricultural programs at Hawai'i high-schools and colleges, and unskilled workers who would receive on-the-job training.

The purchase of goods and services by farmers and ranchers, and by the families of their employees, would generate an estimated 350 indirect jobs. Indirect jobs would include those at companies providing agricultural supplies and equipment, office supplies and equipment, repair services, trucking services, veterinarian services, etc. Other indirect jobs would include those involved with supplying goods and services to employees and their families. Thus, direct-plus-indirect employment would totaled about 1,140 jobs, with about 1,000 jobs on Maui. Both the direct and indirect jobs would range over a variety of skill levels, including entry-level, semi-skilled, skilled, and management positions. The payroll would be about $28.5 million for the direct jobs and $45.3 million for all direct and indirect jobs. The direct and indirect jobs would support an estimated 2,550 residents living in about 1,100 homes, with about 2,290 residents and 1,010 homes on Maui.

The State will enjoy significant tax revenues when the farm plan is in full operation. The farm plan operations are estimated to generate $4.5 million in State tax revenues by 2030. Property taxes paid to the County would be about $800,000 per year. The City and County of Honolulu would derive about $140,000 per year from the excise-tax surcharge.

4.8 Recreational Uses and Park Facilities

A range of recreational uses and park facilities are located within the areas affected by the Proposed Action. The following describes such existing uses and facilities in relation to the three geographic areas where the amount of water from the License Area may affect such uses and facilities.

East Maui

The County's Department of Parks and Recreation operates and maintains several parks and recreational facilities within East Maui in the vicinity of the License Area, include the following: 4th Marine Division Memorial Park, Alfred Boteilho Sr. Gymnasium and Pā'ia Park, H.A. Baldwin Park, Ha'ikū Park and Community Center, Ho'okipa Beach Park, Lower Pā'ia Park, Pā'ia Community Center, Rainbow Park, and the Ulumalu Arena.

The State of Hawai'i DLNR, Division of Forestry and Wildlife through its Nā Ala Hele Hawai'i Trail and Access System maintains the Waikamoi Ridge Trail and the Ke'anae Arboretum Walk

within the License Area. In addition, through its Division of State Parks, DLNR also operates and maintains the Kaumahina State Wayside, Puaʻa Kaʻa State Wayside, and Wailuā Valley State Wayside located along Hana Highway, also known in this section as the Hāna Belt Road. All of the State waysides and lookouts are outside of the License Area except for the Kaumahina State Wayside, which is within the License Area (See Figure 4-37). The Hāna Highway itself, which meanders along the coastline makai of and, in some places, through portions of the License Area, is also an immensely popular sightseeing route with spectacular coastal and mauka view. Maintained by the State of Hawaiʻi Department of Transportation, the roadway has many shoulder areas that are used as pull outs for sightseeing. One of the more impressive views of the Keʻanae peninsula is from the Keʻanae-Wailuā Lookout.

Waikamoi Ridge Trail is a ½ mile loop trail just off the side of Hāna Highway. The trail is positioned at the far eastern edge of the Waikamoi Preserve, which is home to a mix of indigenous and introduced species and offering hikers many lookouts along the trail. However, the trail does not have views of any waterfalls or streams. The Keʻanae Arboretum Walk is a 1/8 mile paved walkway from Hāna Highway that is alongside Piʻinaʻau Stream on historicleveled terraces built for taro cultivation. Piʻinaʻau Stream is subject to the CWRM D&O and is ordered to be fully restored with no diversions.

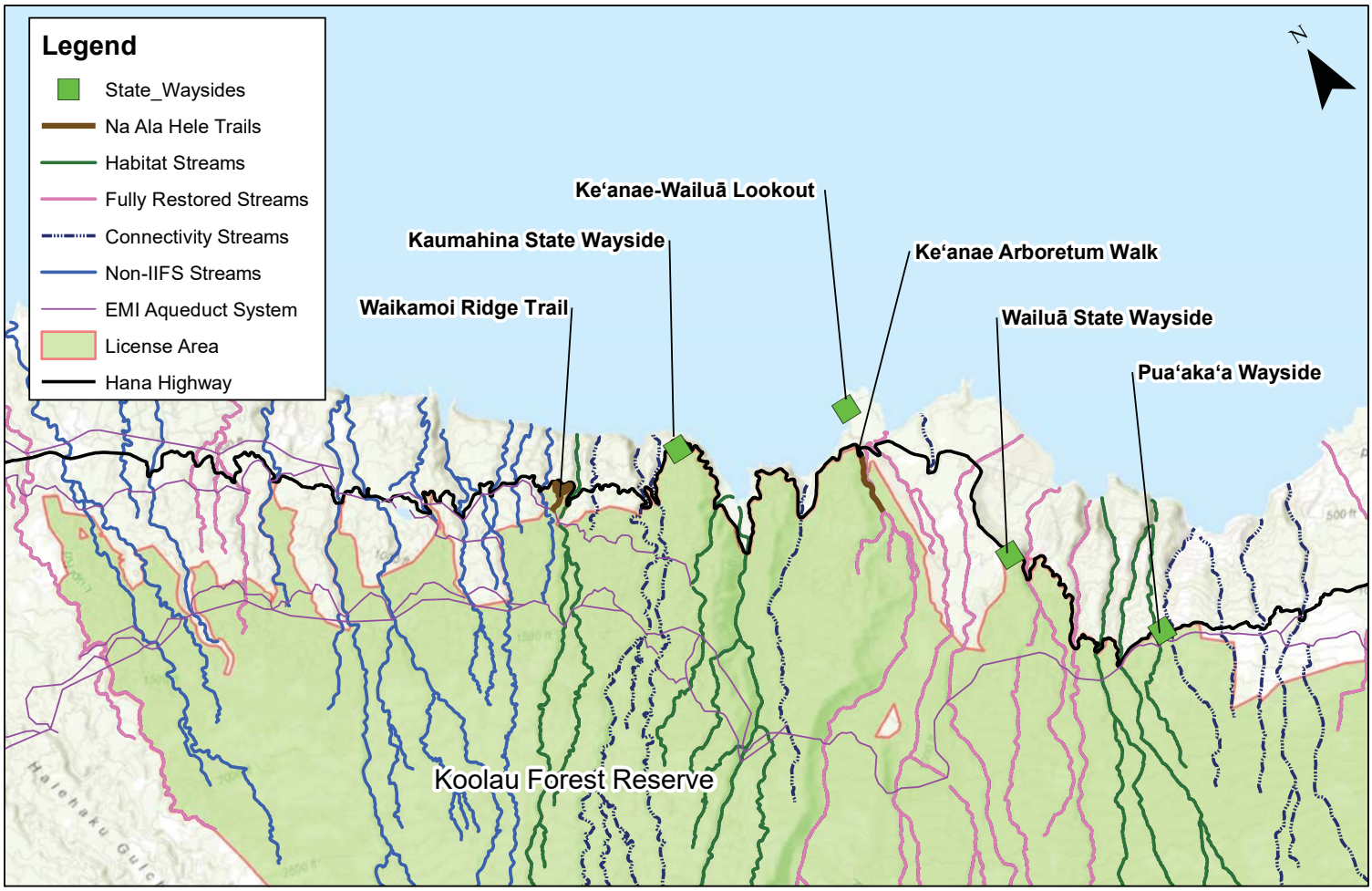
Kaumahina State Wayside is within the License Area located along Hāna Highway offering views of the northeast Maui coastline. The nearest stream to Kaumahina State Wayside is Haʻipuaʻena Stream, which is located approximately .25 miles to the east. This stream was designated as “Public Use Stream” in the CWRM D&O.

Puaʻa Kaʻa State Wayside is just off of Hāna Highway as well. This wayside offers views of some waterfalls that are from Puaʻakaʻa Stream, a tributary to Kopiliʻula Stream, which is subject to the CWRM D&O. Kopiliʻula Stream along with its tributary, Puaʻakaʻa Stream, is ordered to have limited diversions and is designated as a “Habitat Stream” under the CWRM D&O.

Wailua Valley State Wayside is lookout just off of Hāna Highway, offering views of Keʻanae Valley and Koʻolau Gap in Haleakalā’s rim. In the distance, in the valley, the wayside offers a vantage point of waterfalls that feed into the valley. This wayside is located in the vicinity of Wailuānui Stream, which also feeds Waikani Falls, which is subject to the CWRM D&O. Wailuānui Stream is ordered to be fully restored under the CWRM D&O.

Keʻanae-Wailuā Lookout is located off of Hāna Highway on Keʻanae Road offering views of the Keʻanae peninsula and is makai of the Keʻanae Arboretum Walk. This lookout is near a historic taro cultivation site that is still utilized today and is in the vicinity of Piʻinaʻau Stream which enters the ocean just east of the lookout and is ordered for full restoration.

Twin Falls is partially within the License Area. The upper falls are within the License Area but the area that is frequently visited is outside the License Area. It is noted that participants in the SIA noted that the Twin Falls trails and other area trails are subject to overgrown landscaping and flash flood conditions.



0 0.5 1 2 Miles

1 in = 1 miles

Source: ESRI, State OP, & Akinaka

FIGURE 4-37

RECREATIONAL MAP

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KE'ANAE, HONOMANŪ, AND HUELO LICENSE AREAS

The Koʻolau Forest Reserve Hunting Unit encompasses portions ofHuelo, Honomanū and Keʻanae Nāhiku within the License Area (See Figure 4-38). The Hunting Unit is administered the DLNR, Division of Forestry and Wildlife. To hunt within the License Area, hunters must obtain a license from the DLNR and an EMI Permit/Waiver. Hunting grounds are limited to one hunting party per hunting area, as regulated by the DLNR. Hunters enter the hunting unit every Saturday and Sunday, as well as holidays observed by EMI. Prior to entering, hunting parties must sign in with the license number obtained from the DLNR, and upon exiting must log in any game that are taken. Access to the hunting grounds is managed by EMI through eight existing EMI access roads. Hunting is permitted year round. Hunting parties may enter the License Area by vehicular access, however, must traverse by foot in most areas.

Hiking is also a permitted recreational use within the License Area, and is limited to hiking clubs. Access to the License Area for hiking is acquired through a Hiking Waiver from EMI. Only two hiking clubs currently enter the License Area lands approximately four to six times a year; the Sierra Club Maui Group and Mauna Ala Hiking Club. They enter on foot, and are guided by a club hiking expert with a manageable number of people

Other recreational uses are not permitted on the License Area for safety reasons, but trespassing and unpermitted access for hiking, gathering, and illegal hunting does occur on State lands

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on recreational uses and park facilities in the East Mauiare anticipated.

In general, the permitted recreational activities (hunting and hiking) in the License Area are not dependent upon the volume of water flowing in the streams. Nevertheless, with an increase in base streamflow, the subjective experience of individuals participating in hunting or hiking could be enhanced by the aesthetic of increased stream flows. In the lower reaches of streams below the License Area, streams with higher base flow would enhance recreational sightseeing, swimming and fishing/gathering activities. Increased streamflow could also impact the physical safety of those entering streams as streamflow could potentially be more turbulent.

The waysides and parks along Hana Highway in East Maui will benefit aesthetically by the increased streamflows ordered by the CWRM D&O for the streams they are associated with, as discussed previously, and may also result in an increase of recreational use of the streams such as swimming or fishing. The Proposed Action must be in compliance with the CWRM D&O so the beneficial effects on recreation should not be altered by implementation of the Proposed Action.

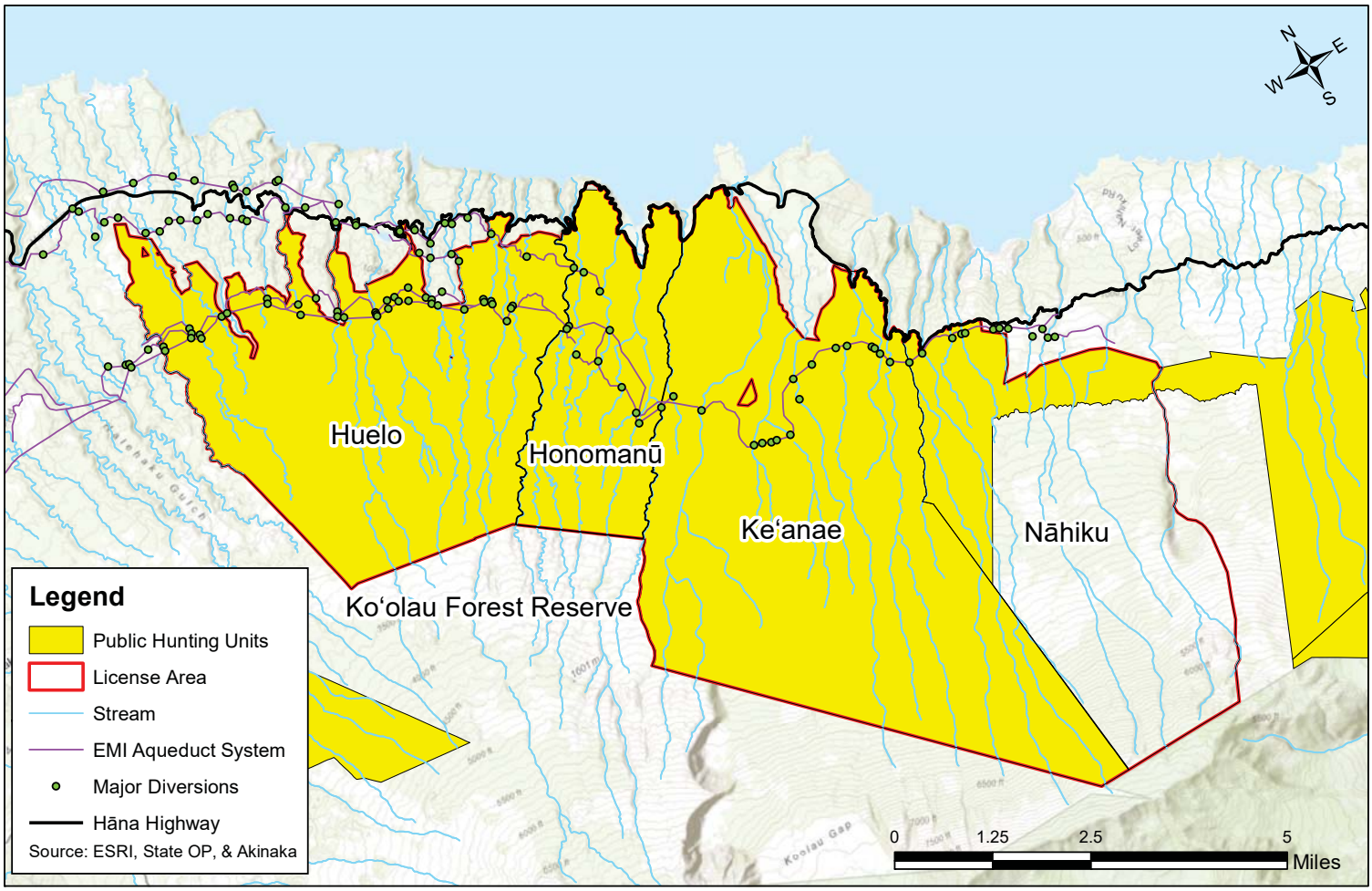


FIGURE 4-38

KOʻOLAU FOREST RESERVE HUNTING UNIT MAP

PROPOSED LEASE (WATER LEASE) FOR THE NĀHIKU, KEʻANAE, HONOMANŪ, AND HUELO LICENSE AREAS

Upcountry Maui

The County's Department of Parks and Recreation operates and maintains several parks and recreational facilities within Upcountry Maui, which include the following: The Eddie Tam Memorial Center, Hāli'imaile Park, Harold Rice Park, Kēōkea Park, Kula Community Center and Tennis Courts, Mayor Hannibal Tavares Community Center & Upcountry Pool, New Kula Ball Field, Old Kula Center, Sun Yet Sen Park, and the Waiakoa Gymnasium. Many of these facilities include irrigated landscaping restrooms, showers, water fountains, and pools that are supplied with water delivered through the EMI Aqueduct System.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on recreational uses and park facilities in the region are anticipated as the amount of water that has been used to service these facilities is anticipated to remain close to current levels. In the Proposed Action, however, because the CWRM D&O requires maintenance of base flow in certain streams, the amount of water that can be diverted when streams are naturally running low would be reduced. This would likely occur during seasonally drier summer months. If the shortage is prolonged, water conservation measures may be required. Imposition of such measures could become more frequent and last longer.

Central Maui

There are no parks or permitted recreational activities, including hunting, within the agricultural fields in Central Maui. The County's Department of Parks and Recreation operates and maintains several parks and recreational facilities within Central Maui, in the vicinity of the Central Maui agricultural fields, including the following: Kahului Community Center, Kahului Park, Kamali'i Park, and Baldwin Park. Several golf courses are also located in the vicinity of Central Maui, including the King Kamehameha Golf Club, Dunes at Maui Lani Golf Course, and Maui Country Club. There are also several public and private pools that serve the communities in the area. Water derived from the EMI Aqueduct System is not used for any recreational facilities in Central Maui.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on recreational uses and park facilities in the Central Maui region are anticipated.

4.9 Visual Resources

Maui's visual resources are important to the state's tourism industry and the quality of life enjoyed by the State's residents. The island's visual resources include a broad range of natural and developed areas and a tremendous variety of land uses, water bodies, and vegetation types. These visual resources also include urbanized areas that range from small rural towns to the largest city of Kahului.

East Maui

Several scenic view planes can be found within the vicinity of the License Area. Specifically, the License Area is located along the slopes of Haleakalā in East Maui, and affords views of the ocean to the north and the peak of Haleakalā to the south. The scenic drive along the Hāna Highway was recognized in 2000 when President Clinton designated the Hāna Millennium Legacy Trail. The following year it was listed in the National Register of Historic Places. The drive along Hāna Highway is notable for views of waterfalls, including those in streams flowing out of the License Area. The highway also features waysides, lookouts and trails discussed Section 4.7.1.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on visual resources in the region are anticipated because no new construction or land alteration is planned for the License Area. However, in the short-term, measuring from the current time, where diversions are lower due to the lack of agricultural activity in Central Maui, against the time when Mahi Pono's diversified agriculture needs begin to use the maximum amount of water permitted, there will be a decrease in stream flows and waterfalls that can be viewed along Hāna Highway. However, this expected decrease from the current baseline must be considered in a historical context as well: the impacts to such visual resources under the Proposed Action will be far less than the impacts over the years of sugarcane operations when vastly more water was diverted from East Maui than is planned under the Proposed Action.

Upcountry Maui

Many scenic viewplanes are found within Upcountry Maui. Specifically, Upcountry Maui extends from the northern shores of Haʻikū to near Makena. It affords views of the ocean to the north and south, the central isthmus and Mauna Kahalawai to the west, and the peak of Haleakalā to the east.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action

continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on visual resources in the Upcountry Maui region are anticipated because no new activities of a significant nature are associated with the Proposed Action.

Central Maui

Central Maui's visual resources consist mainly of agricultural plains and old sugar plantations. Specifically, Central Maui is located just west of the northern portion of Upcountry Maui. It boasts the view planes of the ocean to the north and south, Mauna Kahalawai to the west, and Haleakalā to the east. When sugar was being cultivated, the agricultural fields would provide a pastoral seasonally green backdrop. Since sugar is harvested on a two-year cycle, most of the fields would be green during the growing season and at least half would be green during harvest. As sugar shut down statewide, the Central Maui fields closed the final chapter of the industry, providing a last look back at a history that spanned 138 years in Hawaiʻi. Subsequently, fallow fields offer a more arid scene of pioneer species, mostly weeds, invading the agricultural fields which are generally brown in color and are not aesthetically attractive.

Impacts and Mitigation Measures

The Proposed Action will result in the transitions of the agricultural fields formerly in sugarcane operation to diversified agriculture operations. Currently, a majority of the fields are fallow and minimal agricultural activities are occurring. The visual resources are anticipated to shift to diversified agriculture, increasing the scenic beauty of Central Maui as the agricultural fields will return to a cultivated state. As discussed by participants in the SIA, the greenery of Central Maui is an integral part of what makes Maui special, and is appreciated when driving along the coast and on mauka – makai highways, and when flying overhead.

4.10 Air Quality

The State of Hawaiʻi DOH, Clean Air Branch, monitors the ambient air quality in the State for various gaseous and particulate air pollutants. The U.S. Environmental Protection Agency (EPA) has set National Ambient Air Quality standards (NAAQS) for six criteria pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, ozone, and particulate matter. Hawaiʻi has also established a state ambient air standard for hydrogen sulfide related to volcanic activity on Hawaiʻi Island. The primary purpose of the statewide monitoring network is to measure ambient air concentrations of these pollutants and ensure that these air quality standards are met.

In general, air quality throughout Maui is good, with prevalent tradewinds during most of the year facilitating dispersion and dilution of potential pollutants. Traffic congestion does not occur at a scale that would raise concerns for carbon monoxide accumulation along heavily travelled roadways, even during the calmest wind conditions.Much of the particulate matter emissions that affect air quality on the island of Maui originate from area sources, including agricultural activities on Central and Upcountry Maui. Such activities, however, do not currently reach the scale of former sugar growing operations which, in addition to soil disturbance while working

the fields, included cane burning prior to harvesting. More recently, however, wildfires in Central Maui on fallow fields formerly in sugar cultivation, have generated intense smoke and dust over relatively short periods of time until they have been extinguished.

Impacts and Mitigation Measures

East Maui

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on air quality in the East Maui region are anticipated because the use of surface water through the EMI Aqueduct System does not generate air pollution directly or indirectly, as the EMI Aqueduct System is gravity fed system.

Upcountry Maui

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on air quality in the Upcountry Maui region are anticipated as the Proposed Action would not require the construction of any new water service facilities by the MDWS. Therefore, there would be no associated dust generation, emissions by construction-related vehicles or stationary equipment such as emergency generators.

When water service is provided to the planned 262-acre expansion of the KAP, grading and grubbing work prior to cultivation will disturb soils generating dust and emissions from construction vehicles. Such activities are subject to HAR, Section 11-60.1-33, Fugitive Dust, which states, in part: "11-60.1-33(a): No person shall cause or permit visible fugitive dust to become airborne without taking reasonable precautions." And, Section 11-60.1-33(b): "...no person shall cause or permit the discharge of visible fugitive dust beyond the property lot line on which the fugitive dust originates." It will be incumbent on the County to comply with these regulations during the preparation of the expansion area and during its operation.

Central Maui

Under the Proposed Action, the regional air quality is expected to improve due to the termination of sugarcane burning practices. However, the transition to diversified agriculture may affect air quality from an increase in equipment emissions and in the very short-term, from dust from uncultivated land.

Diversified agricultural activities would be subject to HAR, Section 11-60.1-33, Fugitive Dust, which states, in part: "11-60.1-33(a): No person shall cause or permit visible fugitive dust to become airborne without taking reasonable precautions." And, Section 11-60.1-33(b): "...no person shall cause or permit the discharge of visible fugitive dust beyond the property lot line on which the fugitive dust originates. Given the expanse of the agricultural fields in Central Maui, extra precaution must be exercised near its boundaries. Particularly in these areas, mitigation measures will include keeping fallow land to a minimum, using cover crops to minimize exposed soil and limiting vehicular speed during plowing activities and while traveling onsite. Also, water will be used to minimize dust during activities such as grading and grubbing, any gathered soil will be stabilized, any loading for soil will minimize the drop distance, and soil transport will use water or soil covering to control dust.

4.11 Noise

Noise levels are measured in units called decibels, a numeric system expressed on a logarithmic scale. Since the human ear does not perceive all pitches or frequencies equally, noise levels are adjusted, or weighted to correspond to human hearing. This adjusted unit is known as the A-weighted decibel, or dBA. In a rural area with no major roads nearby, noise levels would average around 50 dBA, whereas an urban area near a major arterial roadway would average around 70 dBA.

East Maui

The License Area encompasses predominantly undeveloped State Land Use Conservation District lands, with no industrial sources of noise.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts from noise in the East Maui region are anticipated.

Upcountry Maui

Upcountry Maui is a rural community that emits small scale noise from agriculture, cars, and equipment

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in

compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts from noise in the Upcountry Maui region are anticipated.

Central Maui

Currently, minimal agricultural operations are occurring within the agricultural fields within Central Maui emitting less noise than was the case under past sugarcane operations.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts from noise in the Central Maui region are anticipated, however, when the Mahi Pono farm plan is fully implemented, the Central Maui fields will have more activity than current levels, possibly resulting in some increase in noise levels from current conditions.

Compared to past sugar operations, however, diversified agricultural equipment and transportation vehicles will generally be smaller and quieter than those that were used to efficiently harvest a monocrop. The system of internal cane haul roads, which will be used for diversified agricultural, help to keep transportation noise away from public areas. Due to the expansive fields in Central Maui, only a few areas are close to noise sensitive uses such as residences. The nearest school, Pukalani Elementary, is a half mile away, and health care facilities are two or more miles away. Diversified agricultural activities conducted near residential areas will be mitigated by confining them to daylight hours and avoiding weekends and holidays.

4.12 Hazardous Materials

A hazardous material is generally characterized as any item or agent (physical, chemical, or biological) which has the potential to cause harm to humans, animals, or the environment, either independently or through interaction with other factors. Toxic Materials are specific hazardous materials identified in regulations. Hazardous wastes are specifically defined or determined as such based on their ignitability, corrosiveness, reactivity, and toxicity. The potential impacts hazardous materials and waste have on human health and the environment are largely dependent upon their types, quantities, toxicities, and management practices.

Hazardous wastes may take the form of a solid, liquid, contained gas, or semi-solid. In general, any combination of wastes that poses a substantial present or potential hazard to human health or the environment that has been discarded or abandoned is a hazardous waste.

EPA and Hawaiʻi universal waste regulations streamline hazardous waste management standards for federally-designated "universal wastes," which include: batteries, pesticides and mercury-containing materials. Universal wastes are considered hazardous, however, they are subject to less restrictive waste disposal regulations than for hazardous wastes.

Operations of the EMI Aqueduct System for the Proposed Action do not involve construction or ground disturbing activities, and does not involve the use of materials and processes that involve chemical agents or materials typical to construction that could be considered hazardous.

East Maui

EMI personnel use federally regulated herbicides to maintain the trails and access roads used for the maintenance of the EMI Aqueduct System.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on or from hazardous materials in the region are anticipated as the Proposed Action does not involve any the use of any hazardous materials, except for the continued use herbicides in compliance with state and federal regulations in connection with the continued maintenance of the EMI Aqueduct System.

Upcountry Maui

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on or from hazardous materials in the Upcountry Maui region are anticipated as the Proposed Action does not involve any the use of any hazardous materials in Upcountry Maui.

Central Maui

For over a century, sugarcane operations were conducted in the agricultural fields in Central Maui. To maintain sugarcane throughout the years various chemicals were used to maintain and manage crops, maintain equipment and for fuel. A survey of soils across the agricultural fields in Central Mai conducted by Mahi Pono as part of their due diligence investigations did not identify any residues of concern. All required remediation measures have or will be implemented.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI

Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on or from hazardous materials in the region are anticipated. Any use of agricultural chemicals for diversified agriculture will be in strict compliance with federal regulations and Mahi Pono will exercise due care to prevent the release of fuels, lubricants and other hazardous materials used in their operations, and utilize BMPs in their agricultural operations.

4.13 Traffic

East Maui

The primary thoroughfare in East Maui is Hāna Highway, which is a 64.4 mile-long stretch of Hawaiʻi Routes 36 and 360 that connects Kahului to Hāna. As a part of the EMI Aqueduct System, there is a system of access roads and trails that are used to access the License Area and maintain the EMI Aqueduct System by EMI personnel.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on traffic in the East Maui region are anticipated.

Upcountry Maui

Upcountry Maui has several thoroughfares. Haleakalā Highway (Hwy 37) is the major entry route into the region. Other primary roads are Baldwin Avenue (Hwy 390), which links Pāʻia to Makawao, Makawao Avenue (West Hwy 365), which connects Makawao to the Haleakalā Highway, and Kaupakalua Road (East Hwy 365) which stretches from Makawao to Haʻikū, just before Hāna Highway.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on traffic in the Upcountry Maui region are anticipated.

Central Maui

The Central Maui agricultural fields have an internal roadway network comprised of unpaved "cane haul" roads with limited crossings of public roadways. Until the end of sugar cultivation in 2016, there were three primary traffic signalized crossings being used, two along Haleakalā Highway at North Firebreak Road and Keahua Road; and, one along Mokulele Highway. During the sugarcane harvest season, these traffic signals operated to allow free traffic flow along the highway until crossing signals were activated by HC&S vehicles, primarily large trucks, involved with sugar operations. Other secondary crossings of public roadways occurred at unsignalized crossings on Baldwin Avenue and Pulehu Road. All off-road farm equipment and the majority of light passenger vehicle traffic, however, utilized the internal roadway network.

During the sugarcane planting and harvesting season, which occurred between March and December, daily harvested cane deliveries by large cane haulers to Puʻunēnē averaged approximately 125 trips. These trips were evenly spread out over a 24-hour period, seven days a week using the internal field roadway network.

The planting operations required 30 semi-truck trailer trips between the seed fields, the seed treatment facility in Puʻunēnē, and the field that was being planted. These trips were spaced out between 6:00 am and 10:00 pm, Monday through Saturday. Harvesting and farm equipment was transported via semi-truck and lowboy trailer as fields were completed, all mostly within the internal field roadway network.

Field and farm workers were transported to their assigned areas by light vehicles in order to coordinate manpower requirements. Generally, this traffic occurred between 7:00 am and 3:30 pm daily with peak movement at the beginning and end of the period. As such, there were approximately 80 vehicles that would have been involved during this transport, again, mostly using the internal field roadway network.

Workers at the HC&S Sugar Mill in Puʻunēnē commuted to one of five designated employee parking lots, the largest located at the corner of Hansen Road and Puʻunēnē Avenue. Table 4-9, estimates the number of vehicles in the employee parking areas by time and day of the week as an indication of vehicle traffic demand attributable to mill workers.

Table 4-9 Central Maui Traffic

	6:00 AM	2:00 PM	10:00 PM
Sunday	100	80	60
Monday	400	100	60
Tuesday	400	100	60
Wednesday	400	100	60
Thursday	400	100	60
Friday	400	100	60
Saturday	200	80	60

(Source: A&B)

Since the closure of sugar operations in 2016, there has been little traffic on the field roadway network, mainly consisting of Mahi Pono vehicles accessing the fields.

Impacts and Mitigation Measures

Traffic generation for diversified agricultural operations contrasts sharply against the large-scale monocrop sugar operations. Whereas the scale of sugar operations was massive and highly coordinated, diversified agriculture involves a multitude of smaller scale operations that are dispersed over time according to specific crop requirements. Unlike a monocrop, diversified crops would not necessarily share the same time frame for planting, tending, harvesting, processing and distribution. Therefore, traffic associated with those activities would be much more dispersed seasonally, over the work week and on a daily basis. Moreover, such traffic would largely be using an internal roadway network that was designed to minimize conflicts by vehicles used in sugar operations with the public roadway system.

At full operation, Mahi Pono expects to have some 790 farm employees. This compares to approximately 640 for HC&S. It is not certain if Mahi Pono's distribution of employees between the fields and a processing center near the former sugar mill in Puunene will be similar to former sugar employees between the fields and the mill. But, the expanse of the fields and the internal roadway system to the mill suggests that the impacts to public roads will not be significant.

Therefore, it is anticipated that traffic associated with the proposed diversified agricultural operations in Central Maui will not adversely affect peak-hour traffic conditions on public roadways. Nevertheless, should any traffic conflicts or traffic volume concerns on public roadways by diversified agricultural operations be identified in the future, measures can be taken to assess and address such concerns. Such measures may include signal timing adjustments to establish a minimum time between activation of signals stopping traffic along public streets or the addition of turning lanes.

4.14 Public Services and Facilities

4.14.1 Police, Fire, and Medical Services

East Maui

Police: Law enforcement services for the License Area are provided by the State of Hawai'i Division of Conservation and Resources Enforcement. The general region outside of the License Area is served by the County Police Department's headquarters in Wailuku and the Department's East Maui Patrol.

Fire: Fire protection service for the License Area is provided by the State of Hawai'i Division of Forestry and Wildlife. The general region is also served by the County Department of Fire Control's Makawao and Pā'ia Stations, which are located 6-7 miles east and south east of the proposed License Area, respectively.

Medical Services: Maui Memorial Medical Center is the only major medical facility on the island and services the East Maui region. Acute, general, and emergency care services are provided

by this 196-bed facility, while other medical and dental offices and practices are located nearby in Upcountry Maui, in Pukalani, and Makawao, as well as in Hāna. Emergency ambulance and air evacuation stations are located in both Makawao and in Hāna.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of DHHL. No significant impacts on public services in the region are anticipated as the Proposed Action will not generate the need for additional services.

Upcountry Maui

Police: Law enforcement services for Upcountry Maui are provided by Maui Police Department. Upcountry Maui is located approximately 13 miles from the Maui Police Department's headquarters in Wailuku.

Fire: Fire protection service for Upcountry Maui is provided by the Maui Country Fire Department. The general region of Upcountry Maui is serviced by the Makawao and Kula Fire Stations.

Medical Services: Maui Memorial Medical Center is the only major medical facility on the island and services the Upcountry Maui region. Acute, general, and emergency care services are provided by this 196-bed facility, while other medical and dental offices and practices are located in Upcountry Maui. Emergency ambulance and air evacuation stations are located in both Makawao and in Hāna.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on public services in the region are anticipated as the Proposed Action will not generate the need for additional services.

When water service is provided to the planned 262-acre expansion of the KAP, grading and grubbing work prior to cultivation will be accomplished by earth moving equipment that will be delivered to the site using public roads. At that time police services may be required. When the expansion becomes operational, service requirements currently provided for the existing KAP may increase demand for these services.

Central Maui

Police: Law enforcement services for Central Maui are provided by Maui Police Department. Central Maui is located in the patrol area of Maui Police Department's headquarters in Wailuku.

Fire: Fire protection service for Central Maui is provided by the Maui Country Fire Department. The general region of Central Maui is serviced by the Wailuku, Kahului, and Pāʻia Fire Stations.

Medical Services: Maui Memorial Medical Center is the only major medical facility on the island and services the Central Maui region. Acute, general, and emergency care services are provided by this 196-bed facility, while other medical and dental offices and practices are located in Central Maui.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on public services in the region are anticipated as the Proposed Action will not generate the need for additional services. The Proposed Action will allow for the resumption of the relationship with the Maui County Fire Department which allows their use of water from the various reservoirs within the agricultural fields to fight fires.

4.14.2 Education

East Maui

The State of Hawaiʻi Department of Education operates ten schools in the proximity of East Maui, including five elementary schools, two middle schools, two high schools, and one charter school. Public schools servicing the region include Pāʻia Elementary School, Hāna Elementary School, Makawao Elementary School, Pukalani Elementary School, Haʻikū Elementary School, Keʻanae School, Samuel Enoka Kalama Intermediate School, Hāna Intermediate & High School, and King Kekaulike High School.

There are a total of nine private schools that serve the region, including Kamehameha Schools Maui, Doris Todd Memorial Christian School, Clearview Christian Girls School, Seabury Hall, St. Joseph School, Haleakalā Waldorf School, Horizons Academy, Maui Ocean Academy, and Montessori of Maui.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee

or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with CWRM D&O and any reservations in favor of DHHL. No significant impacts on education in the region are anticipated.

Upcountry Maui

The State of Hawaiʻi Department of Education operates 11 schools in the proximity of Upcountry Maui, including six elementary schools, two middle school, two high schools, and one charter school. Public schools servicing the region include Pāʻia Elementary School, Hāna Elementary School, Makawao Elementary School, Haʻikū Elementary School, Pukalani Elementary School, Keʻanae School, Kula Elementary School, Samuel Enoka Kalama Intermediate School, Hāna Intermediate & High School, and King Kekaulike High School.

There are a total of nine private schools that serve the region, including Kamehameha Schools Maui, Doris Todd Memorial Christian School, Clearview Christian Girls School, Seabury Hall, St. Joseph School, Haleakalā Waldorf School, Horizons Academy, Maui Ocean Academy, and Montessori of Maui.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on education in the region are anticipated.

Central Maui

The State of Hawaiʻi Department of Education operates 11 schools in the proximity of Central Maui, including six elementary schools, two middle school, two high schools, and one charter school. Public schools servicing the region include Pāʻia Elementary School, Hāna Elementary School, Makawao Elementary School, Haʻikū Elementary School, Pukalani Elementary School, Keʻanae School, Kula Elementary School, Samuel Enoka Kalama Intermediate School, Hāna Intermediate & High School, and King Kekaulike High School.

There are a total of nine private schools that serve the region, including Kamehameha Schools Maui, Doris Todd Memorial Christian School, Clearview Christian Girls School, Seabury Hall, St. Joseph School, Haleakalā Waldorf School, Horizons Academy, Maui Ocean Academy, and Montessori of Maui.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in

compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on education in the region are anticipated.

4.14.3 Solid Waste Collection and Disposal

With the closure of the Makawao Landfill, all solid wastes generated on the island of Maui are transported to either the Central Maui Landfill in Puʻunēnē, or the Hāna Landfill in Hāna.

East Maui
Solid waste generated in East Maui would be transported to Hāna Landfill in Hāna.

Impacts and Mitigation Measures
The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the lessee to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on solid waste collection and disposal in the region are anticipated as the Proposed Action will not generate any solid waste.

Upcountry Maui
Solid Waste generated in Upcountry Maui is transported to the Central Maui Landfill in Puʻunēnē due to the closure of the Makawao Landfill.

Impacts and Mitigation Measures
The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the applicant to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on solid waste collection and disposal in the region are anticipated as the Proposed Action will not generate any solid waste.

Central Maui
Solid Waste generated in Central Maui is transported to the Central Maui Landfill in Puʻunēnē.

Impacts and Mitigation Measures
The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the applicant to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No

significant impacts on solid waste collection and disposal in the region are anticipated as the Proposed Action will not generate any solid waste.

4.15 Infrastructure and Utilities

4.15.1 Water System

East Maui

The most extensive infrastructure system in East Maui is the EMI Aqueduct System which spans the State-owned License Area and extends beyond it at Honopou Stream to Māliko Stream where the last stream diversion is located. It consists of approximately 388 separate intakes, 24 miles of ditches, and 50 miles of tunnels, as well as numerous small dams, six major reservoirs, intakes, pipes, 13 inverted siphons and flumes. Beyond Māliko Stream, the system delivers collected flows to Upcountry Maui then to Central Maui. Section 1.1.1 illustrates and describes the history of the EMI Aqueduct System.

During full sugar cultivation in 2008, the cost to operate the EMI Aqueduct system was estimated to be $1.8M per year (Munekiyo Table 4). Since the closure of sugar, the cost has been approximately $1.5M per year due to adjustments required to reduce flow and more recently to implement the CWRM D&O. It is projected that maintenance costs will return to a more stable condition with the Proposed Action at approximately $1.4M per year, which is comparable to the five year period preceding the closure of sugar.

A portion of the Nāhiku community, a settlement located below the Nāhiku and Ke'anae License Area, is served by the MDWS directly through the EMI Aqueduct System via a development tunnel in the Koolau Ditch near Makapipi Stream. The tunnel draws up 20,000 to 45,000 gallons per day, dependent on weather, directly from the EMI Aqueduct System. The area is at a lower elevation where the water system has sufficient pressure for residential service. A more detailed description of this service is provided in Section 2.1.2.3.

Impacts and Mitigation Measures

No significant adverse impacts to the EMI Aqueduct System and the Nāhiku water system are anticipated from the Proposed Action as diversions are removed or modified in the EMI Aqueduct System to comply with the CWRM D&O and to convey the amount of water required to supply the MDWS in Upcountry Maui and to Central Maui agricultural fields as they are converted from fallow conditions to diversified agriculture. In the long-term, the MDWS service to Nāhiku would be similar to current conditions.

Upcountry Maui

The MDWS operates and maintains the "Upcountry Maui Water System" which services the communities of Kula, Pukalani, Makawao Ha'ikū, Hāli'imaile, Waiakoa, Kēōkea, Waiohuli, 'Ulupalakua, Kanaio, Olinda, 'Ōma'opio, Kula Kai, and Pūlehu. In Upcountry Maui, the MDWS serves customers' water needs for both domestic (approximately 60% of use) and agricultural (approximately 40% of use), including the agricultural users at the KAP.

The Upcountry Maui Water System relies on three surface water sources, which accounts for approximately 80-90 percent (13 mgd) of water delivered through the system (CWRM FOF 800, p. 211, 2018). One of the three surface water sources is delivered directly by the EMI Aqueduct System, through the Wailoa Ditch. Average daily use by the MDWS from the Wailoa

Ditch is 7.1 mgd, which includes water processed by the Kamole-Weir WTP and non-potable water for the KAP, which receives water from Reservoir 40. A more detailed description of this service is provided in Section 2.1.3.1.

Impacts and Mitigation Measures

No significant adverse impacts on the Upcountry Maui Water System are anticipated from the Proposed Action as diversions are removed or modified in the EMI Aqueduct System to comply with the CWRM D&O and to convey diverted flows out of the License Area. In the long-term, as diversified agriculture grows in Central Maui, the amount of water that the CWRM D&O allows to be diverted may be insufficient to meet all demands during periods of drier weather during the summer months. Because the CWRM D&O requires that base flow to be kept in certain streams, during drier weather when streamflow is low, flows may not reach a volume at which diversion would be permitted. If prolonged, this shortage could require mandatory conservation measures to be implemented, as they have in the past. Such measures, however, could be required more frequently and last longer than in the past. The effects of climate change could exacerbate this impact. However, this impact is not a result of the implementation of the Proposed Action.

Central Maui

Irrigation water for diversified agriculture in the Central Maui agricultural fields is discussed in Section 2.1.4. There is no other domestic or agricultural water service provided in Central Maui by the MDWS using water from the EMI Aqueduct System.

Impacts and Mitigation Measures

Impacts of the Proposed Action and alternatives on the availability of irrigation water for diversified agriculture in the Central Maui agricultural fields are discussed in Section 2.1.4. Since there is no other usage of water from the EMI Aqueduct System in Central Maui, no impacts associated with the Proposed Action or alternatives are anticipated.

4.15.2 Wastewater System

East Maui

There are no County operated wastewater disposal facilities in the East Maui region. Individual wastewater disposal needs in the area are currently addressed either by cesspools, septic tanks or individual wastewater treatment systems.

Impacts and Mitigations

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the applicant to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on wastewater systems in the region are anticipated.

Upcountry Maui

There are no County operated wastewater disposal facilities in the Upcountry Maui region. Individual wastewater disposal needs in the area are currently addressed either by cesspools, septic tanks or individual wastewater treatment systems.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the applicant to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on wastewater systems in the region are anticipated.

Central Maui

There are no County operated wastewater disposal facilities in the Central Maui region. Individual wastewater disposal needs in the area are currently addressed either by cesspools, septic tanks or individual wastewater treatment systems. None of these systems use water from the EMI Aqueduct System.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the applicant to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on wastewater systems in the region are anticipated.

4.15.3 Electrical System

East Maui

Electrical service to communities in East Maui, where available, is provided by the Maui Electric Company (MECO). The MDWS relies on this service to treat and supply water derived from the EMI Aqueduct System to supply domestic water to a portion of the Nāhiku community.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the applicant to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, and allows the lessee or its permittees, to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on electrical systems in the region are anticipated.

Upcountry Maui

Electrical service to Upcountry Maui, where available, is provided by the Maui Electric Company (MECO). The MDWS relies on this service at the Kamole Weir WTP to process water derived through the Kamole-Weir from the EMI Aqueduct System.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the applicant to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will continue the conveyance of water to the MDWS to meet the domestic and agricultural demands of Upcountry Maui. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on electrical systems in the region are anticipated.

Central Maui

There are two hydroelectric facilities that utilize water derived from the EMI Aqueduct System. One is located in the area historically known as Kaheka Village, and the other at Pāʻia. Currently, only Kaheka Hydroelectric plant is generating at a low load to fulfill house power demand for the office buildings, well security systems and well motor heaters. Excess generation is supplied to the utility grid with no compensation.

Generating hydroelectric power is a non-consumptive use of water and the water can subsequently be used for agricultural purposes after flowing through the hydroelectric facilities. Kaheka and Pāʻia Hydroelectric Plants generate power to supply the many drip irrigation systems, groundwater well pumps, and facility/tenant buildings through a private 62-mile transmission grid.

The Water Lease will allow the continued use of surface water for hydroelectric generation at the Kaheka and Pāʻia plants.

Impacts and Mitigation Measures

The Proposed Action is limited to the issuance of the Water Lease for the subject License Area, which would enable the applicant to continue operation of the EMI Aqueduct System that has been in operation for over a century. The Proposed Action continues the use of the system for the transport of surface water, which will allow for the transition of the agricultural fields in Central Maui to a diversified agriculture operation. The farm plan contemplated in relation to the Proposed Action includes a solar farm to generate 37.5 mW of clean energy to be provided to the MECO grid. In general, the Proposed Action will maintain existing conditions, in compliance with the CWRM D&O and any reservations in favor of the DHHL. No significant impacts on electrical systems in the region are anticipated.

4.16 Secondary and Cumulative Impacts

HAR Section 11-200-2 **Definitions and Terminology** provides the following definitions for impacts to be assessed under an EIS.

"Secondary impact" or "secondary effect" or "indirect impact" or "indirect effect" means effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

"Cumulative impact" means the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

4.16.1 Secondary Impacts

The secondary impacts of the Proposed Action primarily relate to developing diversified agriculture in Central Maui, including the economic and social impacts of diversified agriculture and job creation on Maui's broader economy and the County's tax revenues. These impacts are summarized in Section 4.7 Socio-Economic Characteristics based on a detailed evaluation in the Economic and Fiscal Impact Study (See Appendix H) and the Social Impact Assessment (See Appendix G).

4.16.2 Cumulative Impacts

4.16.2.1 Cumulative History

The cumulative impact of the Proposed Action can be regarded as an additive impact overlaid on more than 100 years of history during which the EMI Aqueduct System was developed to provide water for the development of a sugar industry in Central Maui as well as for the later development of Upcountry Maui. This DEIS summarizes the pertinent history in Chapters I and 2 as a basis for understanding the events that have shaped the existing conditions described in Chapter 4. In addition, the following studies document the pertinent history related to the sugar industry in Maui and the EMI Aqueduct System and how they have shaped existing condition:

- Archaeological LRFI (See Appendix E) discusses the historic context of the Proposed Action;
- CIA (See Appendix F) also provides a historic context and documents cultural resources and practices recalled by cultural informants;
- HSA (See Appendix D)documents the various characteristic components of the EMI Aqueduct System that provide the historic context for the functioning system; and
- SIA, which discusses history in a context for understanding the current perceptions of people from the community, including their perceptions of the recent involvement of Mahi Pono.

The cumulative history of the environment is reflected in the following studies:

- Terrestrial Flora and Fauna Technical Report (See Appendix C), which describes the present composition of flora and fauna in the License Area and the agricultural fields

of Central Maui that reflect the history of how they have been changed by human activity; and,

- Assessment of the Environmental Impact of Stream Diversions on 33 East Maui Streams[4] using the Hawaiian Stream Habitat Evaluation Procedure (HSHEP) Model (See Appendix A) which, likewise, documents the stream habitats of East Maui as they have been shaped by human activity.

4.16.2.2 The CWRM D&O

The cumulative impact of the Proposed Action on the existing environment will include its compliance with the CWRM D&O. Through the D&O, the CWRM ordered:

- Full restoration of flow in the following streams to taro growing areas or for community and non-municipal domestic uses: Honopou, Huelo (Puolua), Hanehoi, Piʻinaʻau, Palauhulu, Waiokamilo, Wailuānui, ʻŌhiʻa, Waianu, Kualani, and Makapipi. (COL 138). These streams are identified as "kalo and community streams", and have historically supported significant kalo cultivation.
- Restoration of the following streams restored to a minimum H_{90} level: Piʻinaʻau, Wailuānui, Honomanū, Waikamoi, Nuaʻailua, East Wailuāiki, Kopiliʻula, and Waiohue. Restoration of these streams should allow the stream species to flourish and reproduce, benefiting not only the natural environment but also allowing for better opportunity for the exercise of traditional and customary native Hawaiian rights. (COL 131).
- Full restoration of West Wailuāiki Stream and Honomanū Stream. West Wailuāiki presents a unique research opportunity to collect valuable information regarding the impact of full restoration of a stream versus habitat restoration $H_{90.}$ Honomanū Stream, despite having several diversions on it, has a high biological rating with a potential for high natural habitat gains with the restoration of flow to the dry reaches. Full restoration would be for the segment of stream below the Lower Kula Ditch diversion. (COL 136).
- Provision of a wetted pathway providing connectivity for the movement of instream biota.

The following studies, as summarized the DEIS in Chapter 4, address the cumulative impacts of the CWRM D&O:

- The impacts of streamflow restoration as a cumulative impact upon the existing biological habitat conditions of the streams are addressed by the Assessment of the Environmental Impact of Stream Diversions on 33 East Maui Streams[5] using the Hawaiian Stream Habitat Evaluation Procedure (HSHEP) Model (See Appendix A).

[4] The DEIS identifies 37 streams associated with the License Area (See Section 1.1.4.2). 36 streams were identified in the CWRM D&O associated with the License Area. Two of these streams, Kualani and ʻŌhiʻa streams were not included in Trutta's HSHEP model as they were not diverted by the EMI Aqueduct System and Palauhulu Stream is a tributary of Piʻinaʻau Stream and thus was combined with Piʻinaʻau Stream. Puakea Stream was not mentioned in the CWRM D&O and therefore was not assessed in the HSHEP model. This resulted in 33 distinct streams impacted by the EMI Aqueduct System.

[5] The DEIS identifies 37 streams associated with the License Area (See Section 1.1.4.2). 36 streams were identified in the CWRM D&O associated with the License Area. Two of these streams, Kualani and ʻŌhiʻa streams were not included in Trutta's HSHEP model as they were not diverted by the EMI

- The cultural effect of the CWRM D&O are discussed in the CIA.
- The agricultural economic effect of the CWRM D&O to restore the kalo streams are assessed in the East Maui Water Lease: Agricultural and Related Economic Impacts report (See Appendix I).

4.16.2.3 Objectives of the Proposed Action

Beyond the impacts of the CWRM D&O, awarding the Water Lease, as described in the Proposed Action, would cumulatively add impacts related to the achievement of its stated objectives:

- Preserve and maintain the EMI Aqueduct System, including its access roads
- Continue to meet domestic and agricultural water demands in Upcountry Maui
- Continue to provide water for agricultural purposes in Central Maui (specifically, to transition fields previously used for sugarcane cultivation into new, diversified agricultural uses)
- Continue to serve community water demands in Nāhiku

The cumulative impacts of achieving these objectives include the direct and secondary impacts summarized in Chapter 4 of the DEIS and discussed in detail in the following studies:

- Archaeological LRFI and the HSA discuss the preservation of the EMI Aqueduct System and protection of cultural resources in the License Area.
- The East Maui Water Lease: Agricultural and Related Economic Impacts report and the Economic and Fiscal Impact Study discuss the economic impacts of continuing to meet domestic and agricultural water demands in Upcountry Maui and Nāhiku as well as the provision of water to the agricultural fields in Central Maui to transition their use from sugar cultivation to diversified agriculture.
- The SIA discusses the perceived social impacts of continuing to meet domestic and agricultural water demands in Upcountry Maui and Nāhiku as well as the provision of water to the agricultural fields in Central Maui to transition their use from sugar cultivation to diversified agriculture.

4.16.2.4 Other Cumulative Impacts

As for reasonably foreseeable actions that, with the Proposed Action, could cumulatively affect the environment, there are none that would affect the amount of water that can be diverted by the EMI Aqueduct System nor are there any foreseeable new or foreseeable alternative uses of water from the EMI Aqueduct System. The EIS does discuss the DHHL's reservation for of water rights sufficient to support current and future homestead needs pursuant to HRS § 171-58(g) in Section 2.1 as well as the use of water by the expanded KAP.

4.17 Summary of Direct, Secondary and Cumulative Impacts

The Proposed Action is the award of a 30-year Water Lease. The lessee will conduct or authorize:

Aqueduct System and Palauhulu Stream is a tributary of Piʻinaau Stream and thus was combined with Piʻinaau Stream. Puakea Stream was not mentioned in the CWRM D&O and therefore was not assessed in the HSHEP model. This resulted in 33 distinct streams impacted by the EMI Aqueduct System.

- Management of the diversion of water by the EMI Aqueduct System consistent with the CWRM D&O, thereby establishing how much water will remain in the IIFS and non-IIFS streams that have historically been diverted and how much water may be diverted for other uses; and,
- EMI access to maintain the EMI Aqueduct System;

The direct, secondary, and cumulative effects of the Proposed Action and the sections of the DEIS in which the impacts are discussed include:

- Impacts to the environment as a result of changes in streamflow - Section 4.2.1 Surface Waters, 4.2.3 Coastal Waters, 4.2.2 Groundwater, and Sections 4.4.1 and 4.4.2 Flora and Fauna.
- Impacts to those who would use water from the IIFS streams, including for traditional agriculture as well as traditional cultural resources and practices related to streamflow in the IIFS streams – Section 4.6 Cultural Resources and Practices
- Impacts to consumers of water from the EMI Aqueduct System as served by the MDWS, including residential and agricultural uses in Upcountry Maui and Nāhiku – Section 3.15.1 Water System.
- Impact of using water from the EMI Aqueduct System to develop diversified agriculture in Central Maui – Section 4.7 Socio-Economic Characteristics and Section 4.4 Flora and Fauna.