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**APPENDIX I:**  
East Maui Water Lease:  
Agricultural and Related Economic  
Impacts

Plasch Econ Pacific, LLC



***EAST MAUI WATER LEASE:  
AGRICULTURAL AND RELATED ECONOMIC IMPACTS***

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**APPENDIX**

State and County Goals, Objectives, Policies and Guidelines Related  
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## ACRONYMS AND ABBREVIATIONS

A&B	Alexander & Baldwin, Inc.
ac	acre
ALISH	Agricultural Lands of Importance in the State of Hawai‘i
au	animal units
BLNR	Board of Land and Natural Resources, State of Hawai‘i
County	County of Maui
CPI	Consumer Price Index
CWRM	Commission on Water Resource Management
D&O	Decision and Order by CWRM
DBEDT	Department of Business, Economic Development and Tourism, State of Hawai‘i
DHHL	Department of Hawaiian Home Lands, State of Hawai‘i
dir	direct
direct impacts	the initial impacts (sales, employment, and payroll) generated by an an action
diversified agriculture	As used in Hawai‘i, crops other than sugarcane and pineapple
DLIR	Department of Labor and Industrial Relations, State of Hawai‘i
DLNR	Department of Land and Natural Resources, State of Hawai‘i
EMI	East Maui Irrigation Company, Ltd.
EMI System	The aqueduct system operated by EMI
final sales	sales subject to the 4% State excise tax
gad	gallons per acre per day
GIS	geographic information system
har	harvested
HC&S	Hawaiian Commercial and Sugar Co.
high-quality farmland	Land having high soil ratings
household spending	the purchase of goods and services by employees and their families
I-O Model	Input-output model of Hawai‘i’s economy, State of Hawai‘i

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IAL	Important Agricultural Lands
IIFS	Interim Instream Flow Standards
indirect impacts	the secondary impacts (sales, employment, and payroll) generated by the purchase of goods and services by the companies, their workers, and the families of workers included in the direct impacts
intermediate sales	sales subject to the 0.5% State excise tax
Kula Ag Park	Kula Agricultural Park
lb	pound
Lease	East Maui Water Lease
LSB	Land Study Bureau
LUC	Land Use Commission, State of Hawai‘i
Mahi Pono	Mahi Pono LLC and its affiliated companies
MDWS	Maui Department of Water Supply
MECO	Maui Electric Company
mgd	million gallons per day
MHI	Munekiyo Hiraga, Inc.
mW	megawatts
mWh	megawatt hours
n.e.	not estimated
Nā Moku	Nā Moku ‘Aupuni ‘O Koolau Hui, Beatrice Kepani Kekahuna, Marjorie Wallett, and Elizabeth Lehua Lapenia
NAFTA	North America Free Trade Agreement
NHLS	Native Hawaiian Legal Corporation
NRCS	Natural Resources Conservation Service, US Department of Agriculture
PEP	Plasch Econ Pacific LLC
res	residents
sf	square feet
State	State of Hawai‘i
unit	cow-and-calf unit
Water Lease	East Maui Water Lease
yr	year

# EXECUTIVE SUMMARY

## 1. EAST MAUI WATER LEASE

### a. Proposed Lease

In 2001, Alexander & Baldwin, Inc. (**A&B**) and its subsidiary East Maui Irrigation Company, LLC (**EMI**)—A&B and EMI are herein referred to collectively as A&B—requested that the Board of Land and Natural Resources (**BLNR**) offer a long-term East Maui Water Lease (the **Water Lease** or **Lease**) at public auction.

Under the proposed Lease, the State of Hawai‘i would allow the continued diversion of East Maui surface water for delivery to Central Maui and Upcountry Maui. The Central Maui agricultural lands, as well as other lands formerly owned by A&B, are now owned by various entities including MP EMI, LLC MP Central A, LLC, MP Central B, LLC, MP CPR, LLC, MP East A, LLC, MP East B, LLC, and MP West, LLC (individually or collectively, **Mahi Pono**) which acquired these lands from A&B in December 2018. In addition, since early 2019, Mahi Pono owns 50% of EMI and is the managing member of EMI; A&B is the other member of EMI.

For the purposes of this Environmental Impact Statement, the Proposed Action constitutes the issuance of one long-term (30-year) Water Lease from the BLNR that authorizes the lessee the *"right, privilege, and authority to enter and go upon"* the License Area for the *"purpose of developing, diverting, transporting, and using government owned waters"* through the existing EMI Aqueduct System (**EMI System**) which supplies water to domestic and agricultural water users. The Water Lease, which will be awarded by public auction, will enable the lessee to enter upon lands owned by the State of Hawai‘i in order to maintain and repair existing access roads and trails used as part of the EMI System, and will allow for the continued operation of the EMI System to deliver water to the MDWS for domestic and agricultural water needs in Upcountry Maui, including the agricultural users at the Kula Agricultural Park (**Kula Ag Park**) and the 262-acre Park expansion, as well as for the Nāhiku community, which, through MDWS, draws up to 20,000 to 45,000 gpd, dependent on weather, directly from the EMI System. It will also allow the continued supply of water to approximately 30,000 acres of agricultural lands in Central Maui now owned by Mahi Pono.

Compared to past water diversions that occurred for over 90 years, the potential future flow of surface water from East Maui has been reduced significantly due to a June 2018 Decision and Order (**D&O**) by the Commission on Water Resource Management (**CWRM**) to fully or partially restore stream flows in East Maui, which also incorporates previous A&B decisions to voluntarily reduce stream diversions.

## b. Duration of Lease

The request submitted to BLNR was for a long-term 30-year Water Lease. A Water Lease of that duration is needed to provide sufficient time for Mahi Pono to implement its Farm Plan and provide a return on its investment.<sup>1</sup> A&B is requesting a long-term Water Lease in order to provide sufficient time for Mahi Pono to implement its Farm Plan, and to provide a return on its investment. An estimated 10 years will be required for Mahi Pono and its lessees to remove volunteer sugarcane and weeds from 30,000 acres, amend soils, install field improvements, build warehouses and other structures, and plant crops. The predominant crops will be various types of orchard trees (avocado, coffee, citrus, macadamia nuts, etc.), which reflect a long-term commitment to farming. About 5 to 12 years will be required for orchard trees to reach full maturity, after which the trees will provide yields for 35 to over 100 years.

A short-term Water Lease would derail development of the Mahi Pono Farm Plan as well as any plan to convert the Central Maui lands to diversified agriculture because of the risk of not being able to farm for a long enough period to recover their planned investment. Conversely, the longer the term of the Water Lease, the greater the beneficial agricultural and economic impacts because of the certainty that comes from a long-term lease, which could encourage greater investment in long-term improvements. The State has the authority to issue a Water Lease with up to a 65-year term. However, the analysis used herein assumes a 30-year Water Lease. As mentioned, a longer term Lease would generate greater beneficial impacts.

## 2. BASELINE CONDITIONS AND WATER-LEASE ALTERNATIVES

This analysis of agricultural impacts addresses (1) three baseline conditions for past surface-water diversions from East Maui, and (2) three future water-lease alternatives represented by estimates for the year 2030:

- Past baseline conditions
  - Typical Sugar (2006 Crop)

This baseline covers surface-water diversions and related agricultural impacts for the 2006 sugarcane crop in Central Maui. This year represents typical sugarcane operations during the 20-year period from 1987 to 2006: rainfall in East Maui was regarded as normal, the restoration of stream flows was not large enough to significantly affect HC&S operations, and the plantation was economically healthy.

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1. Mahi Pono's Farm Plan utilizes most of the water available after consideration of the CWRM D&O, however, it is understood that Department of Hawaiian Home Lands (DHHL) is entitled to establishing a reservation of water prior to the issuance of the Lease.

The EMI System also delivered water to the MDWS to meet a portion of the requirements of Upcountry Maui. In addition, water was delivered to the MDWS for the Nahiku community in East Maui.

- Recent Sugar (Years 2008 to 2013)

This baseline covers average surface-water diversions and related agricultural impacts for the 6-year period just prior to the closure of HC&S: 2008 to 2013.

This period is not typical of sugar operations in that rainfall was below normal, water returned to East Maui streams was large enough to adversely affect sugarcane operations, and HC&S struggled to achieve profitable operations. Also, a large volume of brackish groundwater was used to irrigate the sugarcane in order to maintain high levels of biomass for energy production, even though the high salinity decreased sugar yields.

- Post Sugar (Year 2017)

The analysis for Post Sugar is for the year 2017, after sugar operations ended and diversified agricultural initiatives were just beginning. The EMI System continued to deliver water to the MDWS for Upcountry Maui and Nahiku.

— Alternatives for the future

- Water Lease Limited to CWRM D&O Alternative (proposed action/preferred alternative)

For this alternative, the State would offer at public auction a Water Lease that would enable the awarded lessee the right to divert the East Maui streams in an amount up to the maximum flow allowed by the CWRM D&O. Due to the CWRM D&O and prior voluntary decisions by A&B, significantly less water will be available to Central Maui from the EMI System than has been the case in the past. This report assumes that the Water Lease supplies water through the EMI System for use in Central Maui.

Mahi Pono scaled its Farm Plan, which includes water to lessees of Mahi Pono in Central Maui, to match the available supply of surface water. Under this alternative, it is projected that 30,000 acres of diversified agriculture in Central Maui could be supported. If more water were available, then more crops would be planted. If less water were available, then the Farm Plan would be changed, possibly increasing land for pasture and decreasing land for crops.

The EMI System would continue to supply surface water to the MDWS for Upcountry Maui, but the supply would be maintained at its recent level and not increased to accommodate future growth. Also, water would continue to be delivered to the MDWS for the Nahiku community in East Maui.

- Water Lease with Less than CWRM D&O Alternative

For this alternative, the Water Lease that is put to public auction would allow surface water to be diverted from East Maui, but at a lower level than in the previous alternative. The water would be used to irrigate fields in Central Maui, and to continue water deliveries to the MDWS but at a lower level than under the Water Lease Limited to CWRM D&O Alternative.

Depending on the available supply of surface water, Maui Pono would have to scale down its Farm Plan to the amount of water available.

This alternative is not included in Table ES1 because no particular amount of decreased flow of surface water from East Maui is currently known. However, Section 5.c of this Executive Summary provides information needed to estimate agricultural and related economic impacts for various levels of reduced flow of surface water.

- No Water Lease Alternative

For this alternative, no surface-water would be diverted from State lands in East Maui. Surface water would continue to flow to Central Maui, but it would be limited to waters originating from private lands. Nearly all available water would be used to irrigate fields in Central Maui. Because the agreements with MDWS provide that the delivery of water to MDWS for Upcountry Maui is contingent upon the Lease being issued, no water is presumed to be provided to the MDWS.

This alternative would require major changes to the Mahi Pono Farm Plan in order to reduce their demand for irrigation water and match the available supply.

### 3. GEOGRAPHIC AREAS AND AGRICULTURAL CONDITIONS

The Water Lease would affect three farm areas:

- Central Maui

This area comprises the Central Maui lands owned by Mahi Pono, which are former HC&S sugarcane lands that historically were serviced

by the EMI System, along with supplemental brackish groundwater pumped from wells now owned by Mahi Pono. These lands are east of Maui Veterans Highway. In this report, Central Maui excludes the former sugarcane lands irrigated with surface water from the West Maui Ditch System. These excluded fields are located west of Maui Veterans Highway.

Central Maui has some of the best agricultural conditions in the State for farming, including a large area in a compact configuration, high-quality soils, high solar radiation, a location near markets and shipping terminals, potentially ample water at low delivery costs (assuming a new Water Lease with a reasonable use fee), and rents that will be comparatively low for lessees.

Most of the water for irrigating crops must come from surface water. Upper fields can be irrigated only with surface water, and lower fields can be irrigated with a mix of surface water and brackish groundwater. Because of salinity and the salt tolerance of diversified crops, 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.

If insufficient water is available from the EMI System, then crop farming will have to be reduced.

— Upcountry Maui

The Kula Ag Park and other farm areas in Upcountry Maui (together with Upcountry's domestic water users) depend upon water supplied by the EMI System and delivered by the MDWS. If insufficient water is available from the EMI System, then these farms would be affected.

Upcountry Maui has lands that are suitable for farming, but the conditions are not as good as those in Central Maui. 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 Kula Ag Park are much higher than those planned for Central Maui (\$1,200 per acre vs \$150 per acre).

— East Maui

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.

The CWRM D&O has and will result in increased stream flows, thereby allowing increased farming activity in East Maui.

#### **4. OUTLOOK FOR AGRICULTURE**

##### **a. Central Maui**

Provided that sufficient water is available, Central Maui is expected to host a major expansion in crop farming and cattle grazing. 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.

To the extent economically feasible, Mahi Pono and other farmers on its land will grow food crops for the Hawai'i market. However, the Hawai'i market is too small to use all of the available farmland in Central Maui solely to serve the Hawaii market, and thus some export is necessary.

Central Maui agricultural land that cannot be farmed is likely to be used for grazing cattle.

Depending on the supply of surface water delivered to Central Maui, the amount of land used could range from (1) about 5,280 acres in crops and 24,470 acres in pasture, to (2) about 15,950 acres in crops and 13,800 acres in pasture. An additional 250 acres would be used for green energy.

##### **b. Upcountry Maui**

For the Water Lease Limited to CWRM D&O Alternative, existing farming in Upcountry Maui would continue, and the Kula Ag Park would expand by at least 262 acres as planned. Other than this expansion, no significant increase of commercial agriculture is anticipated in Upcountry Maui, primarily because Central Maui offers better conditions for farming. However, some residents of Upcountry Maui may engage in limited semi-commercial agriculture because they are attracted to the farming lifestyle.

For the No Water Lease Alternative, water deliveries by the EMI System to the MDWS would drop to zero. Several years would be required for the MDWS to develop groundwater wells or other alternatives to fill the shortfall in supply, and the feasibility of such development is uncertain. Assuming domestic customers would have priority over agricultural customers, farmers in Upcountry Maui would lack water to irrigate their crops until the new wells are operational. As a result, farms would close or relocate to Central Maui. Even after the new wells are operational, little commercial farming is expected to return to Upcountry Maui because Central Maui has better conditions for farming.



For the Water Lease with Less than CWRM D&O Alternative, this report assumes the impacts on farming would be proportional to the reduction in the supply of water delivered by the EMI System to the MDWS.

**c. East Maui**

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, ample stream water should now be available to irrigate taro lo‘i and the small farms relying on East Maui streams because the CWRM D&O “will return free flowing water, with no upstream diversions, to all streams which have historically supported significant kalo cultivation ...” The large volume of water that flows out of the taro lo‘i can be used to irrigate other crops.

Given the CWRM D&O to fully restore the flow of all taro streams in East Maui, all alternatives are expected to result in the same expansion of taro and other farming in East Maui.

## **5. SUMMARY OF FINDINGS**

### **a. Major Impacts and Benefits**

Table ES-1 summarizes the major impacts and benefits for the past baseline conditions and two of the three alternatives for the future. The table is divided into 6 parts: (1) Water Supply and Allocation, (2) Agricultural Land Use, (3) Agricultural Water Use, (4) Agricultural Development and Operations, (5) Employment and Payroll, and (6) State and County Revenues. Mahi Pono’s current Farm Plan assumes full development by about 2030. Also, all dollar amounts are expressed in 2018 purchasing power.

#### Water Supply and Allocation

The supply of East Maui surface water that is available for Central and Upcountry Maui is projected to decline significantly: from about 156.54 mgd for Typical Sugar, to 92.32 mgd for the Water Lease Limited to CWRM D&O Alternative, and to 30.76 mgd for the No Water Lease Alternative. For the No Water Lease Alternative, all of the water would come from private lands.

The total water supply (surface water plus groundwater) would decline from about 199.04 mgd for Typical Sugar to 113.63 for the Water Lease Limited to CWRM D&O Alternative and 38.44 mgd for No Water Lease Alternative. The use of groundwater is limited in order to keep salinity below about 30‰ when applied to lower fields in Central Maui.

For the Water Lease Limited to CWRM D&O Alternative, about 106.53 mgd would be allocated to Central Maui for agricultural use, and 7.1 to MDWS for Upcountry Maui.<sup>2</sup> For the No Water Lease Alternative, all of the water would be allocated to Central Maui for agricultural use.

### Agricultural Land Use

#### *Central Maui*

For the Water Lease Limited to CWRM D&O Alternative, about 15,950 acres would be used for growing crops, including 12,850 acres for orchard crops and 3,100 acres for other crops. About 13,800 acres would be used for pasture, of which about 4,700 acres would be irrigated. About 250 acres would be used for green energy, such as a solar farm.

For the No Water Lease Alternative, the reduced supply of water would require a major reallocation of land from growing crops to unirrigated pasture. About 5,250 acres would be used for growing crops, including 4,180 acres for orchard crops and 1,100 acres for other crops. About 24,470 acres would be used for pasture, of which about 3,800 acres would be irrigated. Land for green energy would remain at 250 acres.

#### *Upcountry Maui*

For the Water Lease Limited to CWRM D&O Alternative, about 1,520 acres of farmland would be irrigated with water from the EMI System.

For the No Water Lease Alternative, farmlands in Upcountry Maui that have been irrigated with water from the EMI System are expected to drop to zero acreage for the reasons given in Section 4.b of this Executive Summary.

#### *East Maui*

As indicated in the CWRM D&O, stream restoration could result in 44.83 acres planted in taro in East Maui, and 35.09 acres in other crops. These estimated acreages are the same for all alternatives.

### Agricultural Water Use

#### *Central Maui*

Agricultural water use in Central Maui is projected to decline from about 143.19 mgd for Typical Sugar to 82.34 mgd for the Water Lease Limited to CWRM D&O Alternative and 29.72 mgd for No Water Lease Alternative.

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2. 7.1 mgd was the long-term average presented in the CWRM D&O.

*Upcountry Maui*

For the Water Lease Limited to CWRM D&O Alternative, about 4.16 mgd would be used to irrigate farms supplied with water from the EMI System.

For the No Water Lease Alternative, it is assumed that no water would be delivered from the EMI System.

*East Maui*

For all water-lease alternatives, gross and net water requirements would be about 6.28 and 1.52 mgd, respectively (derived from the CWRM D&O acreage estimates for the affected farms in East Maui). 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.

Agricultural Development and Operations*Central Maui*

For the Water Lease Limited to CWRM D&O Alternative, converting Central Maui from sugarcane to diversified agriculture would entail a capital investment of about \$214.7 million for land preparation and improvements, with expenditures spread out over approximately 10 years. During this period, expenditures and indirect sales would average about \$39.9 million per year. Corresponding figures for the No Water Lease alternative are \$144.8 million invested over about 6 years, with expenditures and indirect sales averaging about \$42.9 million per year.

At full operations, and assuming the Water Lease Limited to CWRM D&O Alternative, farm sales would total about \$160.7 million per year, of which about \$104.4 million would be Hawai'i sales and \$56.2 million would be export sales. Adding energy sales of about \$8.2 million results in total direct sales of about \$168.9 million per year. Direct and indirect sales would total about \$329.5 million per year.

The direct sales of about \$160.7 million per year exceeds sales during sugar operations: about \$100.7 million per year for Typical Sugar, and about \$115.6 million for Recent Sugar. The HC&S revenues figures are for the former plantation lands east of Maui Veterans Highway, and not the entire plantation.

For the No Water Lease Alternative, operations would generate much lower farm sales: about \$57.7 million per year in farm sales, of which about \$46.1 million would be Hawai'i sales and \$11.5 million would be export sales. Adding energy sales results in total direct sales of about \$65.9 million per year. Direct and indirect sales would total about \$123.5 million per year.

*Upcountry Maui*

For the Water Lease Limited to CWRM D&O Alternative, the farms that depend on water from the EMI System would generate direct sales of about \$14.1 million per year. Direct and indirect sales would total about \$31.8 million per year.

For the No Water Lease Alternative, these figures would drop to zero.

*East Maui*

For all water-lease alternatives, the farms in East Maui that depend on stream water would generate about \$1.4 million per year in direct sales, and about \$2.9 million per year in direct and indirect sales.

Employment and Payroll*Central Maui*

For the Water Lease Limited to CWRM D&O Alternative, converting Central Maui from sugarcane to diversified agriculture would employ an average of about 210 workers over a period of about 10 years. Corresponding figures for the No Water Lease Alternative are an average of about 175 workers over about 6 years.

At full operations of farming operations in Central Maui, and assuming the Water Lease Limited to CWRM D&O Alternative, employment would reach about 790 direct jobs with a payroll of about \$28.5 million per year, and 1,140 direct and indirect jobs with a payroll of \$45.3 million. The direct employment of 790 jobs would exceed the 630 direct jobs formerly provided by HC&S for Typical Sugar. The HC&S employment figure is for the former plantation lands east of Maui Veterans Highway, and not the entire plantation.

For the No Water Lease Alternative, full operations would provide about 270 direct jobs with a payroll of about \$9.9 million per year, and 390 direct and indirect jobs with a payroll of \$15.6 million.

*Upcountry Maui*

For the Water Lease Limited to CWRM D&O Alternative, the farms that depend on water from the EMI System would provide about 100 jobs with a payroll of about \$3.5 million per year, and would generate about 150 direct and indirect jobs having a payroll of \$5.8 million.

For the No Water Lease Alternative, these figures would drop to zero.

*East Maui*

For all water-lease alternatives, the farms in East Maui that depend on stream water would provide about 14 jobs with a payroll of about \$500,000 per year, and generate about 21 direct and indirect jobs having a payroll of about \$800,000.

## State and County Revenues

### *Central Maui*

For the Water Lease Limited to CWRM D&O Alternative, the expenditures on land preparation and capital improvements needed to convert Central Maui from sugarcane to diversified agriculture would generate State tax revenues of about \$18.62 million over the assumed 10-year development period, but this would be offset by energy subsidies of \$18.75 million, for net loss of about \$130,000. State revenues would come from excise taxes, corporate income taxes, and personal income taxes. The County derives negligible tax revenues from development activity: there are no major County taxes on expenditures for land preparation and improvements, profits generated, or the payroll of those involved with the development activity. However, once the improvements are completed, the County will benefit from an increase in property-tax revenues due to the increased property values.

For the No Water Lease Alternative, the conversion would generate State tax revenues of about \$11.41 million over the assumed 6-year development period, but this would be offset by energy subsidies of \$18.75 million, for a net loss of about \$7.34 million.

At full operations of farming operations in Central Maui, and assuming the Water Lease Limited to CWRM D&O Alternative, State tax revenues would be about \$4.46 million per year, and County property taxes would be about \$800,000 per year. Property taxes for the County are low because agricultural land is assessed at agricultural values, not at market values.

For the No Water Lease Alternative, full operations would generate State tax revenues of about \$1.66 million per year, and County tax revenues of about \$650,000. Tax revenues for the State are less because crop production and sales would be less. Property taxes are lower because more of the land would be used for pasture, which has a lower assessed value than cropland.

### *Upcountry Maui*

For the Water Lease Limited to CWRM D&O Alternative, the farms that depend on water from the EMI System would generate annual State taxes of about \$540,000, and County revenues of about \$850,000. The County revenues include property taxes and rents from the Kula Ag Park.

For the No Water Lease Alternative, most of these figures would drop to zero or near zero because of the loss of farms and farm production. The County would lose rents from the Kula Ag Park, and property tax revenues would be lower, assuming the agricultural lands would be assessed at pasture values.

### *East Maui*

For all water-lease alternatives, the East Maui farms would generate about \$67,000 per year in State taxes and about \$100 in County property taxes.

**b. Water Lease Limited to CWRM D&O Alternative vs the No Water Lease Alternative**  
Central Maui

For Central Maui, the Water Lease Limited to CWRM D&O Alternative would provide far more economic activity and benefits than would the No Water Lease Alternative. The difference between the two alternatives would be as follows:

- About 11,570 acres more green open space in the form of farms and irrigated pastures (20,650 acres vs 9,080 acres).
- About three times as much food production, including greater food self-sufficiency and more exports.
- About \$206 million per year more in direct and indirect sales (\$329.5 million vs \$123.5 million).
- About 750 more direct and indirect jobs (1,140 jobs vs 390 jobs).
- About \$29.7 million per year more in total payroll (\$45.3 million vs \$15.6 million).
- Development activity (land preparation and capital improvements) lasting about 4 years longer (10 years vs 6 years), with similar magnitudes of sales and employment (about \$40 million per year direct and indirect sales, and about 300 direct and indirect jobs).
- About \$2.9 million per year more in State and County tax revenues (\$4.6 million vs \$1.7 million).

Upcountry Maui

For Upcountry Maui, the Water Lease Limited to CWRM D&O Alternative would allow farming to continue and expand at the Kula Ag Park, and continue at other farms that irrigate crops with water originating from the EMI System. In total, about 1,510 acres would be farmed in 2030, generating about \$31.8 million per year in direct and indirect sales, about 150 direct and indirect jobs, and about \$5.8 million in payroll for these jobs.

For the No Water Diversions Alternative, farming activity is expected to be near zero for the farms that depended on water from the EMI System in 2017. For these farms, water to irrigate crops is not expected to be available for several years, and once farming ends, significant farming is not expected to return to the area because of better farming conditions in Central Maui.

East Maui

All alternatives would result in the same agricultural activity and benefits for East Maui (see Table 7., Section 7c).

### c. Water Lease with Less than CWRM D&O Alternative

For the Water Lease with Less than CWRM D&O Alternative, the State would allow water to be diverted from East Maui to Central Maui in an amount falling between (1) the 92.32-mgd flow estimated for the Water Lease Limited to CWRM D&O Alternative, and (2) the 30.76-mgd flow estimated for the No Water Lease Alternative. To demonstrate the impacts of such an intermediate alternative, the following table provides (1) the impacts of the Water Lease Limited to CWRM D&O Alternative at full operations of the Mahi Pono Farm plan, and (2) the incremental changes in these impacts (in red) caused by each mgd-reduction in surface water from the 92.32-mgd flow estimated for the Water Lease Limited to CWRM D&O Alternative.

	<u>Central Maui</u>	<u>Upcountry Maui</u>	<u>Units</u>
— Land use			
• Crops	15,950	1,509	acres
Decrease per 1 mgd	173.31	24.51	acres
• Irrigated pasture	4,700		acres
Decrease per 1 mgd	14.62		acres
• Unirrigated pasture	9,100		acres
Increase per 1 mgd	187.93		acres
— Sales, Ag operations			
• Direct sales	\$168.9	\$15.1	million/yr
Decrease per 1 mgd	\$1.673	\$0.245	million/yr
• Direct and indirect sales	\$329.5	\$31.8	million/yr
Decrease per 1 mgd	\$3.346	\$0.517	million/yr
— Employment			
• Direct	793	101	jobs
Decrease per 1 mgd	8.447	1.634	jobs
• Direct and indirect	1,142	149	jobs
Decrease per 1 mgd	12.164	2.418	jobs
— Payroll			
• Direct payroll	\$28.5	\$3.5	million/yr
Decrease per 1 mgd	\$0.303	\$0.057	million/yr
• Direct and indirect payroll	\$45.3	\$5.8	million/yr
Decrease per 1 mgd	\$0.481	\$0.095	million/yr
— State Revenues	\$4.46	\$0.54	million/yr
Decrease per 1 mgd	\$0.0456	\$0.0088	million/yr

Thus, each 1-mgd reduction of surface water from the Water Lease Limited to CWRM D&O Alternative would result in the following changes for Central Maui (first column of the above table): a reduction by about 173 acres of land in crops, a reduction by about 15 acres of land in irrigated pasture, an increase of about 188 acres of land in unirrigated pasture, a reduction in direct sales on Maui of about \$1.7 million per year, a reduction in direct-and-indirect sales on Maui and O'ahu of about \$3.3 million per year, about 8.5 fewer direct jobs on Maui having a payroll of about \$300,000 per year, about 12 fewer direct-and-indirect jobs on Maui and O'ahu having a payroll of about \$500,000 per year, and a reduction in State revenues of about \$50,000 per year. Significant but smaller changes would occur for Upcountry Maui (second column of the above table).

## **6. CONSISTENCY WITH STATE AND COUNTY AGRICULTURAL POLICIES**

Of the three alternatives, the Water Lease Limited to CWRM D&O Alternative is the most compatible with State and County agricultural policies. This alternative would (1) preserve and protect the most agricultural land and water, and (2) promote the most agricultural activity.



Table ES-1. Summary

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>1. WATER SUPPLY AND ALLOCATION</b>							
<b>Water supply (before system losses)</b>							
Surface water from East Maui							
From State lands	Table 1. Section 1.a	n.e.	n.e.	n.e.	61.57	-	mgd
From private lands	Table 1. Section 1.a	n.e.	n.e.	n.e.	30.76	30.76	mgd
Total surface water	Table 1. Section 1.a	156.54	113.71	23.99	92.32	30.76	mgd
Brackish groundwater	Table 1. Section 1.a	42.50	69.90	-	21.31	7.69	mgd
Total water supply	Table 1. Section 1.a	199.04	183.61	23.99	113.63	38.44	mgd
<b>Water allocations (before system losses)</b>							
MDWS	Table 1. Section 1.b	3.23	7.10	2.86	7.10	-	mgd
Central Maui, Ag and related uses	Table 1. Section 1.b	195.81	180.78	n.e.	106.53	38.44	mgd
<b>2. AGRICULTURAL LAND USE</b>							
<b>Central Maui</b>							
Sugarcane							
Upper fields (surface water only)	Table 2. Section 2.a	29,427	30,320				acres
Lower fields (surface and brackish water)	Table 2. Section 2.a	12,800	12,729				acres
Total sugarcane	Table 2. Section 2.a	16,627	17,591				acres
Diversified Ag and energy							
Crops, irrigated							
Orchards	Table 2. Section 2.a				12,850	4,180	acres
Other crops	Table 2. Section 2.a			200	3,100	1,100	acres
Total crops				200	15,950	5,280	acres
Pasture							
Irrigated	Table 2. Section 2.a			-	4,700	3,800	acres
Unirrigated	Table 2. Section 2.a			500	9,100	20,670	acres
Total pasture				500	13,800	24,470	acres
Green energy (solar)	Table 2. Section 2.a				250	250	acres
Fallow				29,300			acres
Total Ag and energy				30,000	30,000	30,000	acres
Irrigated fields							
Upper fields (surface water only)	Table 2. Section 2.a				20,650	9,080	acres
Lower fields (surface and brackish water)	Table 2. Section 2.a				6,390	2,720	acres
Total irrigated fields					14,260	6,360	acres
<b>Upcountry Maui (farms supplied with water from EMI)</b>							
Kula Ag Park	Table 2. Section 2.b			447	709	-	acres
Other Farms	Table 2. Section 2.b			800	800	-	acres
Total farmland				1,247	1,509	-	acres
<b>East Maui (farms with appurtenant and riparian rights)</b>							
Taro	Table 2. Section 2.c				44.8	44.8	acres
Other farms	Table 2. Section 2.c				35.1	35.1	acres
Total farmland					79.9	79.9	acres
<b>3. AGRICULTURAL WATER USE (after system losses)</b>							
<b>Central Maui</b>							
Sugar operations							
Total water use, sugarcane	Table 3. Section 3.a	143.19	132.45				mgd
By source							
Surface water	Table 3. Section 3.a	112.07	81.24				mgd
Brackish groundwater	Table 3. Section 3.a	31.12	51.21				mgd
By area							
Upper fields (surface water only)	Table 3. Section 3.a	62.28	55.61				mgd
Lower fields (surface and brackish water)	Table 3. Section 3.a	80.90	76.84				mgd
Brackish water share							
All fields	Table 3. Section 3.a	21.7%	38.7%				
Lower fields	Table 3. Section 3.a	38.5%	66.6%				

Table ES-1. Summary of Impacts

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
Diversified Ag							
Total water use, crops and irrigated pasture	Table 3. Section 3.a			0.68	82.34	29.72	mgd
By source							
Surface water	Table 3. Section 3.a				65.87	23.77	mgd
Brackish groundwater	Table 3. Section 3.a				27.69	9.97	mgd
By area							
Upper fields (surface water only)	Table 3. Section 3.a				27.69	9.97	mgd
Lower fields (surface and brackish water)	Table 3. Section 3.a				54.65	19.75	mgd
Brackish water share							
All fields	Table 3. Section 3.a				20.0%	20.0%	
Lower fields	Table 3. Section 3.a				30.1%	30.1%	
Upcountry Maui (farms supplied with water from EMI)							
Kula Ag Park	Table 3. Section 3.b			0.46	1.46	-	mgd
Other Farms	Table 3. Section 3.b			1.36	2.70	-	mgd
Total farmland				1.82	4.16	-	mgd
East Maui (farms with appurtenant and riparian rights)							
Gross water use (includes water returned to streams)							
Taro farms	Table 3. Section 3.c			n.e.	6.28	6.28	mgd
Other farms					(included with water for taro)		
Net water use	Table 3. Section 3.c			n.e.	1.52	1.52	mgd
Taro farms	Table 3. Section 3.c				1.34	1.34	mgd
Other farms	Table 3. Section 3.c				0.18	0.18	mgd
<b>4. AGRICULTURAL DEVELOPMENT AND OPERATIONS</b>							
Central Maui							
Sugar operations							
Direct sales	Table 4. Section 4.a	\$ 100.7	\$ 115.6				million/yr
Direct and indirect sales	Table 4. Section 4.a	\$ 191.4	\$ 219.7				million/yr
Diversified Ag							
Development activity							
Development period	Table 4. Section 4.a				10	6	years
Expenditures and sales							
Total development expenditures	Table 4. Section 4.a				\$ 214.7	\$ 144.8	million
Average annual development expenditures	Table 4. Section 4.a				\$ 21.5	\$ 24.1	million/yr
Average annual development expenditures and indirect sales	Table 4. Section 4.a				\$ 39.9	\$ 42.9	million/yr
Operations							
Direct sales							
Farm sales							
Hawaii sales	Table 4. Section 4.a				\$ 104.4	\$ 46.1	million/yr
Export sales	Table 4. Section 4.a				\$ 56.2	\$ 11.5	million/yr
Total farm sales	Table 4. Section 4.a				\$ 160.7	\$ 57.7	million/yr
Energy Sales	Table 4. Section 4.a				\$ 8.2	\$ 8.2	million/yr
Total direct sales	Table 4. Section 4.a			\$ 0.5	\$ 168.9	\$ 65.9	million/yr
Direct and indirect sales	Table 4. Section 4.a			\$ 1.1	\$ 329.5	\$ 123.5	million/yr
Upcountry Maui (farms supplied with water from EMI)							
Development activity, Kula Ag Park							
Increase in acreage	Table 2. Section 2.b				262	-	acres
Development period	Table 4. Section 4.b				5	-	years
Expenditures and sales							
Total development expenditures	Table 4. Section 4.b				\$ 1.3	\$ -	million
Average annual development expenditures	Table 4. Section 4.b				\$ 0.3	\$ -	million/yr
Average annual development expenditures and indirect sales	Table 4. Section 4.b				\$ 0.6	\$ -	million/yr
Operations, Kula Ag Park and other farms							
Direct sales	Table 4. Section 4.b			\$ 12.5	\$ 15.1	\$ -	million/yr
Direct and indirect sales	Table 4. Section 4.b			\$ 26.3	\$ 31.8	\$ -	million/yr

Table ES-1. Summary of Impacts

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>East Maui (farms with appurtenant and riparian rights)</b>							
Direct sales	Table 4. Section 4.c				\$ 1.4	\$ 1.4	million/yr
Direct and indirect sales	Table 4. Section 4.c				\$ 2.9	\$ 2.9	million/yr
<b>5. EMPLOYMENT AND PAYROLL</b>							
<b>Central Maui</b>							
Sugar operations							
Employment							
Direct jobs	Table 5. Section 5.a	630	620				jobs
Direct and indirect jobs	Table 5. Section 5.a	1,342	1,321				jobs
Payroll							
Direct payroll	Table 5. Section 5.a	\$ 48.5	\$ 34.3				million/yr
Direct and indirect payroll	Table 5. Section 5.a	\$ 82.7	\$ 68.0				million/yr
Diversified Ag							
Development activity							
Development period	Table 4. Section 4.b				10	6	years
Employment							
Direct jobs	Table 5. Section 5.a				208	176	jobs
Direct and indirect jobs	Table 5. Section 5.a				326	293	jobs
Payroll							
Direct payroll	Table 5. Section 5.a				\$ 8.8	\$ 7.7	million/yr
Direct and indirect payroll	Table 5. Section 5.a				\$ 14.5	\$ 13.3	million/yr
Operations							
Employment							
Direct jobs	Table 5. Section 5.a			7	793	273	jobs
Direct and indirect jobs	Table 5. Section 5.a			10	1,142	393	jobs
Payroll							
Direct payroll	Table 5. Section 5.a			\$ 0.3	\$ 28.5	\$ 9.9	million/yr
Direct and indirect payroll	Table 5. Section 5.a			\$ 0.5	\$ 45.3	\$ 15.6	million/yr
<b>Upcountry Maui (farms supplied with water from EMI)</b>							
Development activity							
Development period	Table 4. Section 4.a				5	-	years
Employment							
Direct jobs	Table 5. Section 5.b				5.2	-	jobs
Direct and indirect jobs	Table 5. Section 5.b				7.5	-	jobs
Payroll							
Direct payroll	Table 5. Section 5.b				\$ 0.21	\$ -	million/yr
Direct and indirect payroll	Table 5. Section 5.b				\$ 0.31	\$ -	million/yr
Operations							
Employment							
Direct jobs	Table 5. Section 5.b			83	101	-	jobs
Direct and indirect jobs	Table 5. Section 5.b			123	149	-	jobs
Payroll							
Direct payroll	Table 5. Section 5.b			\$ 2.9	\$ 3.5	\$ -	million/yr
Direct and indirect payroll	Table 5. Section 5.b			\$ 4.8	\$ 5.8	\$ -	million/yr
<b>East Maui (farms with appurtenant and riparian rights)</b>							
Employment							
Direct jobs	Table 5. Section 5.c			n.e.	14	14	jobs
Direct and indirect jobs	Table 5. Section 5.c			n.e.	21	21	jobs
Payroll							
Direct payroll	Table 5. Section 5.c			n.e.	\$ 0.5	\$ 0.5	million/yr
Direct and indirect payroll	Table 5. Section 5.c			n.e.	\$ 0.8	\$ 0.8	million/yr

Table ES-1. Summary of Impacts

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>6. STATE AND COUNTY REVENUES</b>							
<b>Central Maui</b>							
Sugar operations							
State revenues	Table 6. Section 6.a	\$ 5.88	\$ 5.08				million/yr
Maui County property taxes	Table 6. Section 6.a	\$ 0.05	\$ 0.07				million/yr
City and County of Honolulu, excise tax surcharge	Table 6. Section 6.a		\$ 0.04				million/yr
Diversified Ag							
Development activity							
State revenues (cumulative)	Table 6. Section 6.a				\$ (0.13)	\$ (7.34)	million
State taxes	Table 6. Section 6.a				\$ 18.62	\$ 11.41	million
Energy subsidy	Table 6. Section 6.a				\$ (18.75)	\$ (18.75)	million
Maui County revenues (cumulative)	Table 6. Section 6.a				n.e.	n.e.	million
City and County of Honolulu, excise tax surcharge (cumulative)	Table 6. Section 6.a				\$ 0.06	\$ 0.04	million
Operations							
State revenues	Table 6. Section 6.a			\$ 0.03	\$ 4.46	\$ 1.66	million/yr
Maui County property taxes	Table 6. Section 6.a			\$ 0.02	\$ 0.80	\$ 0.65	million/yr
City and County of Honolulu, excise tax surcharge	Table 6. Section 6.a			\$ 0.00	\$ 0.14	\$ 0.05	million/yr
<b>Upcountry Maui (farms supplied with water from EMI)</b>							
Development activity							
State revenues (cumulative)	Table 6. Section 6.b				\$ 0.18	\$ -	million
Maui County revenues (cumulative)	Table 6. Section 6.b				n.e.	n.e.	million
City and County of Honolulu, excise tax surcharge (cumulative)	Table 6. Section 6.b				n.e.	n.e.	million
Operations							
State revenues	Table 6. Section 6.b			\$ 0.45	\$ 0.54	\$ -	million/yr
Maui County revenues	Table 6. Section 6.b			\$ 0.54	\$ 0.85	\$ 0.00	million/yr
City and County of Honolulu, excise tax surcharge	Table 6. Section 6.b			\$ 0.002	\$ 0.002	\$ -	million/yr
<b>East Maui (farms with appurtenant and riparian rights)</b>							
State revenues	Table 6. Section 6.c			n.e.	\$ 0.067	\$ 0.067	million/yr
Maui County property taxes	Table 6. Section 6.c			n.e.	\$ 0.0001	\$ 0.0001	million/yr
City and County of Honolulu, excise tax surcharge	Table 6. Section 6.c			n.e.	\$ 0.0003	\$ 0.0003	million/yr

# EAST MAUI WATER LEASE: AGRICULTURAL AND RELATED ECONOMIC IMPACTS

## 1. INTRODUCTION

### a. Proposed Water Lease

Since 1986, the Board of Land and Natural Resources (**BLNR**) has been issuing 1-year revocable permits for four license areas in East Maui to Alexander & Baldwin, Inc. (**A&B**) and its subsidiary East Maui Irrigation Company, LLC (**EMI**)—A&B and EMI are herein referred to collectively as A&B. The permits have allowed A&B to divert surface water via the aqueduct system owned by EMI (the **EMI System**) to (1) irrigate fields in Central Maui and (2) supply water to the Maui Department of Water Supply (**MDWS**) for use in Upcountry Maui, including agricultural users at the Kula Agricultural Park, as well as for the Nāhiku community, which draws up 20,000 to 45,000 gallons per day, dependent on weather, from the EMI System.

In 2001, A&B requested that the BLNR offer a long-term (30 years) East Maui Water Lease (the **Water Lease** or **Lease**) at public auction for the right, privilege and authority to enter and go upon State-owned lands in East Maui for the purposes of developing, diverting, transporting and using government-owned waters. BLNR action on issuing a Water Lease has been delayed for various reasons, including the requirement that an environmental review be completed before a lease could be issued.

Under the proposed Lease, the State of Hawai‘i would allow the continued diversion of East Maui surface water for delivery to Central Maui and Upcountry Maui. The Central Maui agricultural lands, as well as other lands formerly owned by A&B, are now owned by MP Central A, LLC, MP Central B, LLC, MP CPR, LLC, MP East A, LLC, MP East B, LLC, MP West, LLC, and MP EMI, LLC (individually or collectively, "**Mahi Pono**"), which acquired these lands from A&B in December 2018. In addition, since early 2019, Mahi Pono owns 50% of EMI and is the managing member of EMI; A&B is the other member of EMI.

Compared to past water diversions that occurred for over 90 years under continuous sugar cultivation (since 1923 when the EMI System reached full development), the potential future flow of surface water from East Maui has been reduced significantly due to a June 2018 Decision and Order (**D&O**) by the Commission on Water Resource Management (**CWRM**) to fully or partially restore stream flows in East Maui, which also incorporates previous A&B decisions to voluntarily reduce stream diversions.

## **b. Content and Purpose**

This report addresses the agricultural and related economic impacts of the proposed Lease. It was prepared to support the Environmental Impact Statement being prepared under Hawaii Revised Statutes Chapter 343, by Wilson Okamoto Corporation. Compliance with the requirements of Hawaii Revised Statutes Chapter 343 is necessary before the BLNR can consider issuing the Lease.

## **c. Scope of Analysis**

### Baseline and Water Lease Alternatives

The analysis addresses the following baseline and alternative surface-water diversions from East Maui:

— Past baseline conditions

- Typical Sugar (2006 Crop)

The analysis for Typical Sugar is for the year 2006, which was before significant stream restorations. The EMI System also delivered water to the MDWS to meet a portion of the requirements of Upcountry Maui. In addition, water was delivered to the MDWS for the Nahiku community in East Maui.

- Recent Sugar (Years 2008 to 2013)

The analysis for Recent Sugar covers the 2008-to-2013 period. The EMI System continued to deliver water to the MDWS for Upcountry Maui and Nahiku.

- Post Sugar (Year 2017)

The analysis for Post Sugar is for the year 2017, after sugar operations ended and diversified agriculture initiatives were just beginning. The EMI System continued to deliver water to the MDWS for Upcountry Maui and Nahiku.

— Alternatives for the future

- Water Lease Limited to CWRM D&O<sup>1</sup>

For this alternative, surface water would be diverted from East Maui up to the maximum flow allowed by the D&O. The water would be used to irrigate fields in Central Maui, and to continue water deliveries to the MDWS at the current level.

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1. Mahi Pono's Farm Plan utilizes most of the water available after consideration of the CWRM D&O, however, it is understood that the Department of Hawaiian Home Lands (DHHL) is entitled to a reservation of water prior to the issuance of the Lease.

- Water Lease with Less than CWRM D&O

For this alternative, surface water would be diverted from East Maui, but at a lower level than for the previous alternative. The water would be used to irrigate fields in Central Maui, and to continue water deliveries to the MDWS but at a lower level than currently.

- No Water Lease

For this alternative, no surface-water would be diverted from State lands in East Maui. Surface water would continue to flow to Central Maui, but it would be limited to waters originating from private lands. Nearly all available water would be used to irrigate fields in Central Maui. Because the agreements with MDWS provide that the delivery of water to MDWS for Upcountry Maui is contingent upon the Lease being issued, for the purposes of this report, no water is presumed to be provided to the MDWS.

More details on the baseline conditions and the alternatives for the future are provided in Section 4.

### Geographic Areas

The analysis addresses three farm areas:

- Central Maui

This area comprises the Central Maui lands owned by Mahi Pono, which are former HC&S sugarcane lands that historically were serviced by the EMI System, along with supplemental brackish groundwater pumped from wells now owned by Mahi Pono. These lands are east of Maui Veterans Highway. In this report, Central Maui excludes the former sugarcane lands irrigated with surface water from the West Maui Ditch System. These excluded fields are located west of Maui Veterans Highway.

Most of the Central Maui lands are now planned for various crops and cattle ranching. Most of the water for irrigating crops must come from surface water. Upper fields can be irrigated only with surface water, and lower fields can be irrigated with a mix of surface water and brackish groundwater. Because of salinity and the salt tolerance of diversified agricultural crops, 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.

If insufficient water is available from the EMI System, then crop farming will have to be reduced.

— Upcountry Maui

The EMI System supplies water to the MDWS, some of which is then delivered to the County's Kula Ag Park and other farm areas in Upcountry Maui, and more water is planned for the 262-acre expansion of the Park. In addition, water from the EMI System supplies a portion of the water distributed by the MDWS Upcountry Water System to residents, businesses, Kamehameha Schools, the Department of Hawaiian Home Lands, and government facilities. The communities served include Kula, Pukalani, Makawao, Ha'ikū, Hali'imaile, Waiakoa, Keokea, Waiohuli, 'Ulupalakua, Kanaio, Olinda, 'Oma'opio, Kula Kai, and Pūlehu.

If insufficient water is available from the EMI System, then the MDWS will have to develop new water sources, and farming may have to be reduced. Also, domestic and business customers of MDWS may have to reduce their water use.

— East Maui

Some of the water from East Maui streams is diverted for taro farms and other farm operations. An increase in stream flows, as ordered by the CWRM D&O, allows for an increase in taro and other farm activity in East Maui.

In the material which follows, the primary focus of the agricultural impact analysis is on Central Maui because this where most of the changes in agriculture are expected to occur, and the area that will be affected most by a Water Lease from the State.

### Agronomic Conditions

Agronomic conditions are summarized for each of the three geographic areas, including:

- Soil quality.
- Solar radiation.
- Elevations.
- Slopes
- Climatic conditions.
- Access to irrigation water.
- Access to markets.



### Economic Impacts

For each condition/alternative and geographic area, the analysis addresses the following agricultural impacts:

- Supply of water available for agriculture.
- Acreages by agricultural use.
- Water use.
- Production.
- Sales.
- Employment.
- Payroll.
- State and county taxes generated (excise, income, and property taxes).

The analysis of economic impacts is limited to the economic impacts associated with agricultural activities, and do not include the impacts associated with the operations of the EMI System.

### **d. Methodology**

#### Multipliers

Acreages by agricultural use are translated into economic impacts based on a number of multipliers. These multipliers reflect the professional judgment of the consultant, and were derived from the following sources: various agricultural projects in Hawai‘i; Hawai‘i farmers, ranchers, and land owners; publications by the U.S. Department of Agriculture; publications by the Hawai‘i Department of Agriculture; publications by the University of Hawai‘i, College of Tropical Agriculture and Human Resources; U.S. Census data; the *State of Hawai‘i Data Book*; *The Hawai‘i State Input-Output Study: 2017 Benchmark Report (I-O Model)*; employment and labor rates from the Department of Labor and Industrial Relations (**DLIR**); and State and County tax rates.

#### Direct and Indirect Impacts

“**Direct**” economic impacts (gross sales, employment, payroll, etc.) are the immediate effects of a change in a particular sector of the economy. Traditionally, “indirect” impacts are changes in other sectors of the economy that are caused by the direct impacts, but exclude impacts related to the purchase of goods and services by employees and their families (**household spending**). Traditionally, “induced” impacts are changes in the economy that are caused by the household spending by those who are affected by the direct and indirect changes in the economy. In this report, “**indirect**” economic impacts are redefined broadly to include both the traditional indirect economic impacts and the induced economic impacts.

### 2018 Dollars

Dollar amounts are expressed in terms of 2018 purchasing power and market conditions. Values, prices, costs and dollar amounts for prior years are adjusted for inflation to 2018 dollars based on the Honolulu Consumer Price Index (**CPI**) for Urban Consumers. Dollar amounts after 2018 are not increased to account for inflation, appreciation of property values, changes in labor rates, changes in building costs, or other changes in market conditions.

### Future Impacts

The economic impacts of future agricultural operations are based on (1) full implementation of farm plans, and (2) the farms reaching full maturity. Most of these impacts are expected to occur by 2030, but production and sales could increase after this date due to the maturing of some orchard trees. The year 2030 is used for future impacts in order to be consistent with long-term plans by the County of Maui.

### Accuracy of Estimates

Much of the analysis contained in this report is quantitative in nature, where numbers are used to help communicate anticipated plans and impacts. However, these numbers should not be interpreted as precise predictions. Rather, they represent the best estimates of what is expected to occur based on available information about planned development and operations, market conditions, and tax rates. In practice, the future may bring significant deviations from the projections.

## **e. Organization of the Report**

Section 2 provides information on the EMI System, Lease areas and the lease alternatives. The EMI System and lease areas are shown in Figures 1 and 2, respectively.

Section 3 provides information on the CWRM D&O, and on Interim Instream Flow Standards (**IIFS**).

Section 4 defines the baseline conditions and the water-lease alternatives that are analyzed in this report.

Section 5 provides information on the agronomic conditions of the three agricultural areas addressed in the analysis.

Section 6 provides an overview of the agricultural outlook for Central Maui, Upcountry Maui, and East Maui.

Sections 7 through 12 and their corresponding Tables 1 through 6 provide the analysis of agricultural impacts, including:

- Section 7 and Table 1: Water Supply and Allocation
- Section 8 and Table 2: Agricultural Land Use
- Section 9 and Table 3: Agricultural Water Use
- Section 10 and Table 4: Agricultural Development and Operations
- Section 11 and Table 5: Employment, Payroll and Population Supported
- Section 12 and Table 6: State and County Revenues

Each table covers the three past baseline conditions and two of the three lease alternatives. The Water Lease with Less than CWRM D&O Alternative is not included in the tables because the flow of surface water from East Maui has not been specified. However, Section 13 provides the information needed to estimate agricultural and related economic impacts for assumed flows.

Each table of the tables is divided into three parts, one for each geographic area. The tables provide the detailed assumptions and calculations, while the text highlights the main findings. In these tables, the quantities appearing in **bold** highlight the more significant impacts.

Section 13 summarizes the economic impacts and benefits of the alternatives.

Section 14 summarizes the consistency of the Lease with State and County agricultural policies.

The figures and tables are at the end of the report, along with an Appendix that provides a summary of State and County goals, objectives, policies and guidelines related to agricultural lands.

## 2. EMI AQUEDUCT SYSTEM

### a. Overview of the EMI System

Since 1878, A&B or its predecessors and EMI have operated the EMI System, which is an integrated system of diversions, ditches, intakes, and tunnels that collect surface water from streams located on the rainy windward slopes of East Maui. This surface water is then transported to the comparatively dry agricultural fields in Central Maui.

The EMI System, which was completed in 1923, consists of about 388 intakes, over 24 miles of ditches, about 50 miles of tunnels, and numerous small dams, pipes, and flumes. Dirt roads and trails provide access to maintain the system.

The EMI System has four parallel levels of water ditches, running from east to west across the East Maui mountains. From *mauka* to *makai*, these are the Wailoa, New Hāmākua, Lowrie, and New Ha‘ikū ditches. The Wailoa and Lowrie ditches run year-round, while the New Hāmākua and New Ha‘ikū ditches run on surplus water from the other ditches. Wailoa is the highest elevation ditch, thus has access to large and reliable sources of

water. The Lowrie Ditch captures water that cascades down from higher elevations, and has ground water sources that contribute to generally year round flow. The Wailoa water can be sent to 4 turbines that have a production capacity of 6.1 MW.

Two of the main areas for measuring the water flow from the EMI System are at Honopou Stream and Maliko Gulch. Honopou Stream is the western boundary at the end of the State license areas. Maliko Gulch is considered the end of the EMI System and the beginning of the Central Maui field irrigation system.

Historically, the surface water was used to irrigate the HC&S sugarcane fields—fields which are now planned for diversified agriculture. In addition, a portion of the water from East Maui is delivered to MDWS for the domestic water needs of Upcountry Maui and the irrigation needs of small farms throughout Upcountry, as well as in the County’s Kula Ag Park. The MDWS also delivers up a small volume of water to the Nahiku community in East Maui.

The estimated replacement cost of the EMI System would exceed \$325 million (updated from Wilcox).

## **b. Watershed and Lease Areas**

The watersheds from which the EMI System collects water total about 50,000 acres on the north slope of Haleakala, of which Mahi Pono now owns about 17,000 acres and the State owns about 33,000 acres. Historically, the right to collect water from State lands has been leased to A&B and its predecessors, with the first lease having been granted by the administration of King Kalākaua.

As shown in Figure 2, the State lands include four License Areas:

- Nahiku: TMKs (2)1-2-04:05, 07; 10,111.220 acres, more or less
- Ke‘anae: TMK (2)1-1-02:02 (por.); 10,768.000 acres, more or less
- Honomanu: TMK (2)1-1-001:443: 381.000 acres, more or less
- Huelo: TMKs (2)1-1-001:05 and (2)2-9-014:01, 05,11 ,12,17; 8,752.690 acres, more or less

The License Areas are within the Ko‘olau Forest Reserve while mauka portions of the Ke‘anae and Nahiku License Areas are bordered by the Kipahulu and Nana Forest Reserve. The Hanawi Natural Area Reserve also lies within the Nahiku License Area.

Thirty seven (37) streams are within the proposed Lease area, two of which are below the EMI System and therefore have never been diverted by the EMI System. However, ten of those streams have been ordered for full restoration, meaning that A&B has and/or will be stopping all diversions and restoring full water flow as required by the D&O. In addition, diversions will be reduced for several other streams.

### **c. East Maui Water Lease**

As discussed in Section 1.a, A&B requested that the BLNR offer a long-term Water Lease at public auction. The objectives for the Lease are as follows:

— **Continue to provide water to support agriculture in Central Maui**

The proposed Water Lease will allow the EMI System to continue to supply water to support agriculture on approximately 30,000 acres of fields in Central Maui. Although A&B/HC&S ended its sugar operations in 2016, A&B had planned and Mahi Pono currently plans to put as much of the former sugarcane lands into other diversified agricultural uses as economically feasible.

— **Continue to meet domestic and agricultural water demands in Upcountry Maui**

The EMI System supplies water to the MDWS Upcountry Water System, which is the second largest system in the County. The continuation of the proposed Water Lease is necessary to continue MDWS's service for agricultural and domestic purposes in Upcountry Maui.

MDWS's service includes delivery of non-potable water that originate from the EMI System to the Kula Ag Park and the planned 262-acre expansion of the Park.

— **Continue to serve community water demands in the Nahiku Community**

The Nahiku community, a small community in Eastern Maui, draws about 41,000 gallons per day from the EMI System. The water is delivered by the MDWS. The proposed Water Lease is critical to continued water service for this community.

— **Preserve and maintain the EMI System**

The EMI System is a major capital asset that supplies water to support both agriculture and domestic uses. The proposed Water Lease will allow this valuable asset to be preserved and maintained to serve these needs for water.

### **d. Water Flows from State vs Private Lands**

Historically, it has been recognized that 70% of the EMI System flow east of Honopou Stream comes from State lands, and 30% comes from private lands, and thus this assumption is utilized in this report. Between Honopou Stream and Maliko Gulch, all of the additional water flow comes from private lands.

### 3. INTERIM INSTREAM FLOW STANDARDS

On May 24, 2001, the Native Hawaiian Legal Corporation filed petitions with CWRM to Amend the Interim Instream Flow Standards (IIFS) for 27 East Maui streams on behalf of Nā Moku ‘Aupuni ‘O Koolau Hui, Beatrice Kepani Kekahuna, Marjorie Wallett, and Elizabeth Lehua Lapenia (collectively **Nā Moku**).

In 2007, A&B ceased diversion on Waiokamilo Stream, fully restoring flows to the stream, in response to an interim order by the BLNR.

In June 2018, the CWRM amended the IIFS for East Maui streams. In its D&O, CWRM fully or partially restored stream flows for most of the petitioned East Maui streams, and limited the volume of water which can be diverted from East Maui streams. The D&O “will return free flowing water, with no upstream diversions, to all streams which have historically supported significant kalo cultivation (Honopou, Huelo, Hanehoi, Pi‘ina‘au, Palauhulu, Ohia (Waiianui), Waiokamilo, Kualani, Wailuanui, Makapipi).”<sup>2</sup>

### 4. BASELINE CONDITIONS AND WATER-LEASE ALTERNATIVES

This analysis of agricultural impacts addresses (1) three baseline conditions for past and recent surface-water diversions from East Maui, and (2) three future water-lease alternatives represented by estimates for the year 2030.

#### a. Past Water Diversions

The three baseline conditions for past surface-water diversions from East Maui include the following:

— Typical Sugar (2006 Crop)

This baseline covers surface-water diversions and related agricultural impacts for the 2006 sugarcane crop in Central Maui. This year represents typical sugarcane operations during the 20-year period from 1987 to 2006: rainfall in East Maui was regarded as normal, the restoration of stream flows was not large enough to significantly affect HC&S operations, and the plantation was economically healthy.

Selected agricultural impacts are provided for Central Maui but, with a few exceptions, are not provided for Upcountry Maui and East Maui. For these areas, agricultural impacts of more recent periods are more relevant.

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2. Although the Executive Summary in the CWRM D&O mentioned Kualani and Ohia, those streams (also referred to as Hamau and Waiianu) have never been diverted by the EMI System. CWRM D&O FOF 57.

— Recent Sugar (Years 2008 to 2013)

This baseline covers average surface-water diversions and related agricultural impacts for the 6-year period just prior to the closure of HC&S: 2008 to 2013. The plantation shut down operations over a 2-year period ending in 2016.

This period is not typical of sugar operations in that rainfall was below normal, water returned to East Maui streams was large enough to adversely affect sugarcane operations, and HC&S struggled to achieve profitable operations. Also, a large volume of brackish groundwater was used to irrigate the sugarcane in order to maintain high levels of biomass for energy production, even though the high salinity decreased sugar yields.

— Post Sugar (Year 2017)

This baseline covers surface-water diversions and related agricultural impacts for 2017, after HC&S ceased its sugar operations and diversified agriculture initiatives were just beginning.

## **b. Future Water-Lease Alternatives**

The three future water-lease alternatives include the following:

— Water Lease Limited to CWRM D&O Alternative (proposed action/preferred alternative)

For this alternative—which is the proposed action/preferred alternative—the State would offer a Water Lease at public auction that allows surface water to be diverted from State lands in East Maui up to the maximum flow allowed by the CWRM D&O under the IIFS. Due to IIFS and prior voluntary decisions by A&B, significantly less surface water will be available to Central from the EMI System than has been the case in the past. This report assumes that Mahi Pono is the successful bidder for the Water Lease.

Mahi Pono scaled its Farm Plan, which includes water to lessees of Mahi Pono, to match the available supply of surface water. Under this alternative, it is projected that 30,000 acres of diversified agriculture in Central Maui could be supported, of which over 20,000 acres would be irrigated. If more water were available, then more crops would be planted. If less water were available, then the Farm Plan would be changed, possibly increasing land for pasture and decreasing land for crops.

The EMI System would continue to supply surface water to the MDWS for Upcountry Maui, but the supply would be maintained at its recent level and not increased to accommodate future growth. Also, water would continue to be delivered to the MDWS for the Nahiku community in East Maui.

— Water Lease with Less than CWRM D&O Alternative

For this alternative, the Water Lease that would be put to public auction would allow surface water to be diverted from East Maui, but at a lower level than in the previous alternative. The water would be used to irrigate fields in Central Maui, and to continue water deliveries to the MDWS but at a lower level than under the Water Lease Limited to CWRM D&O alternative. Depending on the available supply of surface water, Maui Pono would have to scale down its Farm Plan to the amount of water available.

As mentioned previously, this alternative is not included in the tables because no particular amount of decreased flow of surface water from East Maui is currently known. However, Section 13 provides information needed to estimate agricultural and related economic impacts for various levels of reduced flow of surface water

— No Water Lease Alternative

For the this alternative, no surface-water would be diverted from State lands in East Maui. Surface water would continue to flow to Central Maui, but it would be limited to waters originating from private lands. Nearly all available water would be used to irrigate fields in Central Maui. Because the agreements with MDWS provide that the delivery of water to MDWS for Upcountry Maui is contingent upon the Lease being issued, no water is presumed to be provided to the MDWS.

This alternative would require major changes to the Mahi Pono Farm Plan in order to reduce their demand for irrigation water and match the available supply.

The estimated agricultural impacts discussed in the following sections are for the year 2030.

### **c. Duration of Lease**

A&B is requesting that the State offer at public auction a long-term (30 years) Water Lease in order to provide sufficient time for Mahi Pono to implement its Farm Plan, returning agriculture to approximately 30,000 acres in Central Maui, and to provide a return on its investment.



An estimated 10 years will be required for Mahi Pono and lessees to remove volunteer (i.e., rogue) sugarcane and weeds from 30,000 acres, amend soils, install field improvements (e.g., irrigation systems, fencing, etc.), build warehouses and other structures), and plant crops.

In addition, about 5 years or more will be required for avocado, citrus and coffee trees to reach full maturity, and 12 years or more for macadamia nuts. After reaching maturity, macadamia nuts trees will provide yields for 35 years or more, citrus and coffee for 50 years or more, and avocado for over 100 years.

In order for Mahi Pono and other farmers to justify the very substantial investment in a 30,000-acre farm, a long-term water lease will be required. A short-term lease would derail development of the Mahi Pono Farm Plan—or any long term agricultural use of the Central Maui fields including any plan to convert the Central Maui lands to diversified agriculture—because of the risk of not being able to farm for a long enough period to recover their planned investment.

Conversely, the longer the term of the Water Lease, the greater the agricultural and economic benefits because of the certainty that comes from a long-term lease, which could encourage greater investment in long-term improvements. The State has the authority to issue a Water Lease with up to a 65-year term. However, the analysis used herein assumes a 30-year Water Lease.

## **5. AGRICULTURAL CONDITIONS**

### **a. Central Maui**

#### Acreage and Layout

The Central Maui fields are shown in Figure 3, and include the areas east of Maui Veterans Highway (areas in blue and purple). The blue areas are upper fields which can be irrigated only with surface water, and the purple fields are lower fields which can be irrigated with a mix of surface water and brackish groundwater.

The fields total about 30,000 acres encompassing most of Central Maui. As can be seen in Figure 3, the configuration is geographically compact.

#### Soil Ratings

Three classification systems are commonly used to rate Hawai'i soils: (1) Land Capability Grouping, (2) Agricultural Lands of Importance to the State of Hawai'i, and (3) Overall Productivity Rating. The soil ratings are for about 30,302 acres of the Central Maui fields that have been irrigated with water from the EMI System.

*Land Capability Grouping (NRCS Rating)*

The 1972 Land Capability Grouping by the U.S. Department of Agriculture, **NRCS** rates soils according to eight levels, ranging from the highest classification level “I” to the lowest “VIII” defined as follows:

- Class I: few limitations that restrict their use.
- Class II: moderate limitations that reduce the choice of plants or require moderate conservation practices.
- Class III: severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV: very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V: not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife habitat.
- Class VI: severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.
- Class VII: very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.
- Class VIII: limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

The sub-classification defines the limitations:

- c: climate/limited rainfall.
- e: subject to erosion.
- s: stoniness, unfavorable texture, shallowness, or low water-holding capacity.
- w: excess water/poorly drained.

Figures 4 and 5 show the NRCS ratings of the Central Maui agricultural lands, with and without irrigation. Based in geographic information system (**GIS**) analysis by Munekiyo Hiraga, Inc. (**MHI**), the estimated acreages for each class, with and without irrigation, are as follows:

	<u>Acres, with Irrigation</u>	<u>Acres, without Irrigation</u>
— Class I	4,449 (14.7%)	0
— Class II	17,216 (56.8%)	1,644 (5.4%)
— Class III	3,051 (10.1%)	5,233 (17.3%)
— Class IV	2,629 (8.7%)	15,364 (50.7%)
— Class V	0	0

— Class VI	282 (0.9%)	5,386 (17.8%)
— Class VII	2,642 (8.7%)	2,642 (8.7%)
— Not rated	<u>33</u> (0.1%)	<u>33</u> (0.1%)
— Total	30,302	30,302

With irrigation, approximately 71.5% of the fields are rated Class I or Class II. However, without irrigation, no lands are rated Class I and only about 5.4% are rated Class II.

#### *Agricultural Lands of Importance in the State of Hawai‘i (ALISH)*

ALISH ratings were developed in 1977 by the NRCS, UH College of Tropical Agriculture and Human Resources, and the State of Hawai‘i, Department of Agriculture. This system classifies land into three broad categories:

- Prime: agricultural land which is land that is best suited for the production of crops because of its ability to sustain high yields with relatively little input and with the least damage to the environment.
- Unique: agricultural land which is non-Prime agricultural land used for the production of specific high-value crops.
- Other: agricultural land which is non-Prime and non-Unique agricultural land that is important to the production of crops.

Figure 6 shows the ALISH ratings of the Central Maui agricultural lands. The estimated acreages for each rating are as follows:

	<u>Acres</u>
— Prime	25,669 (84.7%)
— Unique	0
— Other	2,254 (7.4%)
— Not rated	<u>2,378</u> (7.9%)
— Total	30,302

These ratings reflect the fact that the Central Maui lands were irrigated in 1977. With less water, less acreage would be rated as Prime.

#### *Overall Productivity Rating (LSB Rating)*

In 1967, the UH Land Study Bureau (**LSB**) developed an Overall Productivity Rating for Maui soils, which classifies soils according to five levels, with “A” representing the class of highest productivity and “E” the lowest. The ratings reflect the irrigation in 1967.

Figure 7 shows the LSB ratings of the Central Maui agricultural lands. The estimated acreages for each rating are as follows:

	<u>Acres</u>
— A	24,128 (79.6%)
— B	3,439 (11.3%)
— C	1,443 (4.8%)
— D	667 (2.1%)
— E	438 (1.4%)
— Not rated	<u>207</u> (0.7%)
— Total	30,302

About 27,567 acres (90.9%) are high-quality lands rated A or B.

These ratings reflect the fact that the Central Maui lands were irrigated in 1967. With less water, less acreage would be rated as A or B.

#### *Summary Evaluation of Soil Quality*

In this report, the term “**high-quality farmland**” is used to describe land that is rated I or II by NRCS, Prime or Unique by ALISH, or A or B by the LSB. Under this definition, 27,097 acres in Central Maui consist of high-quality farmland (see Figure 8). The high-quality farmlands are scattered throughout Central Maui.

With less water, less acreage would be rated as high-quality farmland.

#### Sugar Yields

Another measure of the agronomic quality of the Central Maui lands is average sugar yields. Assuming good agricultural practices, yields are generally higher for fields having good soils, high solar radiation, and sufficient water. Lands considered good for growing sugarcane are good for growing many other crops.

Figure 9 shows average sugar yields (tons per harvested acres) in Central Maui for the 1994-to-2016 period. Hawai‘i sugarcane was a 2-year crop, unlike most other areas throughout the world where cane is grown as a 1-year crop. Thus, annual yields are half the numbers shown in Figure 9.

Figure 9 is consistent with Figure 8; the good farmlands in Central Maui are scattered throughout the former plantation.

#### Elevations

Elevations of the Central Maui fields range from 5 feet to 1,100 feet in mauka areas.

### Slopes

Slopes of the Central Maui fields range from zero to over 7%. During severe rains storms, level fields are more prone to flooding and possible losses of vegetable crops, while fields having higher slopes are more prone to erosion.

### Climatic Conditions

Like other areas in Hawai‘i, Central Maui has a mild *semitropical* climate that is due primarily to three factors: (1) Hawai‘i’s mid-Pacific location near the Tropic of Cancer, (2) the surrounding warm ocean waters that vary little in temperature between the winter and summer seasons, and (3) the prevailing northeasterly tradewinds that bring air having temperatures which are close to those of the surrounding waters.

### *Solar Radiation*

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 Pā‘ia (see Figure 10). Other high-quality farm areas in the State—such as Kunia and ‘Ewa on O‘ahu, and the fields in the southwest corner of Kaua‘i—have similar high-levels of solar radiation.

### *Rainfall*

Average annual rainfall in the 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 (see Figure 11). 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.

### *Temperatures*

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.

### *Winds*

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.

### Irrigation Water and Salinity

The Central Maui fields can be irrigated with water from two sources: (1) East Maui surface water delivered by the EMI System and (2) brackish groundwater wells. Fields west of Maui Veterans Highway, which are not included in the analysis, can be irrigated with surface water from the West Maui Ditch System and supplemental brackish groundwater. Water from the West Maui Ditch System are not used to irrigate fields east of Maui Veterans Highway.

### *Surface Water*

A major advantage of farming Central Maui fields is that the EMI System can deliver by gravity a large volume of water at relatively low delivery cost. For the 2008-to-2013 period, the delivery cost was about 3.9 cents per 1,000 gallons vs about 52 cents for brackish groundwater. This accounting includes the payments to the State for the water, but does not include the cost of delivering surface water from Maliko Gulch to the fields in Central Maui—costs which were borne by HC&S. Also the cost of surface water per 1,000 gallons will increase with less available surface water since fixed costs will be spread over a smaller volume of water.

For comparison, the MDWS buys water from Wailuku Water Co. and Maui Land and Pine at 53.5 cents and 27.6 cents per 1,000 gallons, respectively. Farmers in Central O‘ahu—who compete with Maui farmers in the Honolulu and export markets—are charged 58 cents per 1,000 gallons for surface water from Waiahole Ditch.

The higher-elevation fields in Central Maui can be irrigated only with surface water from the EMI System for two reasons: (1) the high pumping cost of groundwater, and (2) the existing water-distribution system was not designed to deliver expensive groundwater to these higher-elevation fields.

Surface water is also used on the lower-elevation fields, but it is mixed with brackish groundwater. The surface water lowers the salinity (which can adversely affect crop yields), and reduces pumping costs.

### *Brackish Groundwater*

Brackish groundwater is available from 15 brackish wells in Central Maui having a combined pumping capacity of 228 million gallons per day (**mgd**).<sup>3</sup> For the 2008-to-2013 period, these wells delivered about 70 mgd of brackish groundwater to the lower-elevation fields that were planted in sugarcane. The brackish groundwater is mixed with surface in order to lower the salinity of the water applied to crops. Because of salinity and the salt

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3. "Pumping capacity" as used here refers to the size of the currently installed pumps and not the quality or quantity of the water source.

tolerance of crops, the useable supply of brackish groundwater is limited by the supply of surface water.

As mentioned, water from these wells is comparatively expensive at about 52 cents per 1,000 gallons. This cost is based on electricity provided by Maui Electric Company (**MECO**) to power the pumps.

### *Salinity of Irrigation Water*

According to the Maui Department of Water Supply, “Many of the older high-capacity irrigation wells and shafts operated by sugarcane plantations in central Maui reported salinity exceeding 4 percent of seawater” (“Maui Island Water Use and Development Plan Draft, Part III Regional Plan, Central Aquifer Sector Area,” Nov. 2018). Akinaka & Associates (**A&A**) found that, during prolonged droughts, the brackish groundwater in Central Maui had average salinity of about 3.6% seawater (chlorides of about 703 mg/L), and this level of salinity is assumed for analysis.

Crops sensitive to salinity can be irrigated with diluted brackish water with little reduction in yields, provided that the water is less than about 0.9% seawater (derived from Government of Western Australia, Department of Agriculture and Food, “Water Salinity and Plant Irrigation,” and Wikipedia, “Salt Tolerance of Crops”).

Less than half of the crops planned for the lower-elevation fields are sensitive to salinity. With this in mind, a reasonably aggressive adjustment to this 0.9% seawater mix would result in irrigation water containing about 1.1% seawater. This adjustment would result in a target figure for irrigation water in the lower elevation fields of Central Maui of more than 70% surface water and less than 30% brackish groundwater ( $30\% \times 3.6\% = 1.1\%$ ). The upper elevation fields of Central Maui would be irrigated with 100% surface water. 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.

The irrigation system in Central Maui was not designed to vary the mix of surface water and brackish groundwater to accommodate crop needs of different fields. As a result, the surface-to-groundwater mix will be the same across all of the lower fields that can be irrigate with groundwater.

### Road Access

Access to the Central Maui fields is provided by Hāna Highway, Haleakalā Highway, Maui Veterans Highway, and Baldwin Avenue. In addition, many miles of plantation roads allow movement within the former HC&S plantation.

### Surrounding Uses

Surrounding uses are as follows:

- West: former sugarcane lands most of which are planned by Mahi Pono for continued agricultural use. These lands are irrigated with (1) surface water from the West Maui Ditch System and (2) brackish groundwater.
- North: coastal communities.
- East: agriculture and limited urban develop.
- South: coastal communities, Kealia Pond National Wildlife Refuge, and ranching.

### Locational Advantages and Disadvantages

#### *Maui Island Market*

Farmers in Central Maui are well-located for supplying the Maui Island market because of the short trucking distance to Kahului, which is the Island's commercial, industrial, processing, distribution and transportation center. Kahului and nearby communities are also the largest population center on the island for both customers and labor.

While the Maui Island market is significant, it is comparatively small: in 2015, Maui County had a *de facto* population of about 215,190 residents and visitors.

#### *Honolulu Market*

All Maui farmers are at a disadvantage when competing against O'ahu farmers in supplying the Honolulu market due to inter-island shipping costs, delays and extra handling. In comparing barge and air-cargo services, shipping by barge is less expensive and larger loads can be shipped, but the shipments are slow and infrequent. Air service is faster and frequent, but it is far more expensive and capacities are limited.

In 2015, O'ahu had a *de facto* population of about 1,054,386 residents and visitors—over five times greater than the Maui market.

#### *Mainland Market*

Compared to Hawai'i, the mainland market is enormous: in 2015, the U.S. population totaled 320.9 million. In supplying this market with products that can be carried by container ship—i.e., crops having long shelf-lives such as coffee, nuts, and canned fruit—farmers on Maui are competitive with farmers on O'ahu and the other islands. Even though freight from Maui must first be barged to Honolulu then transferred onto a container ship, Matson's overseas shipping service includes inter-island barge service at no additional fee. With the exception of some minor port charges, Matson charges a common fare for all the islands.

In the case of fresh crops that must be shipped by air to the mainland—i.e., crops having short shelf-lives such as fresh vegetables, fruits, and flowers—farmers on Maui are at a disadvantage compared to O'ahu farmers because most mainland air cargo is shipped via Honolulu's Daniel K. Inouye International Airport. Compared to farmers on O'ahu, Maui farmers encounter additional costs, delays, and handling to cover inter-island air-cargo



service and transferring the fresh crops from small inter-island aircraft to large overseas aircraft.

However, overseas air-cargo service from Maui has improved because the current generation of aircraft can depart from the short runway at Kahului with a full load of passengers and a full load of cargo in the hold. This direct service allows farmers on Maui to be more competitive in mainland markets. However, the lift capacity from Maui is limited by the number of direct flights.

In the U.S. mainland market, Hawai‘i farmers must also compete against farmers on the mainland and in Mexico, Central and South America, Southeast Asia, etc. Most of the competing farm areas have lower production and delivery costs than Hawai‘i does. Competing against Mexico is particularly difficult given the North America Free Trade Agreement (NAFTA) and Mexico’s proximity to major U.S. markets.

#### Summary of Locational Advantages

In terms of location, farmers in Central Maui are well-situated to supply the small Maui Island market. And compared to other farmers in Hawai‘i, 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.

#### Land-Use Designations

About 29,455 acres (98%) of the subject 30,000 acres of farmland in Central Maui are in the State Agricultural District. About 545 acres scattered among 18 parcels are designated Urban. Even though these lands are designated Urban, they are zoned Agriculture and Mahi Pono does not plan to develop them for urban uses.

At the County level, all of the subject 30,000 acres are designated for agricultural use in various plans, and are zoned Agriculture.

In addition, most of the Central Maui farmland is designated as Important Agricultural Lands (IAL)—see Figure 12. In 2009, the State Land Use Commission (LUC) approved a petition by A&B to designate 27,102 acres of its Maui lands as IAL, including about 23,000 acres of its Central Maui lands serviced by the EMI System.

As stated in HRS Chapter 205: “The objective for the identification of important agricultural lands is to identify and plan for the maintenance of a strategic agricultural land resource base that can support a diversity of agricultural activities and opportunities that expand agricultural income and job opportunities and increase agricultural self-sufficiency

for current and future generations.” IALs are defined as lands that: “(1) Are capable of producing sustained high agricultural yields when treated and managed according to accepted farming methods and technology; (2) Contribute to the State's economic base and produce agricultural commodities for export or local consumption; or (3) Are needed to promote the expansion of agricultural activities and income for the future, even if currently not in production.”

The IAL designation provides the farmer access to incentives that promote profitable agricultural operations. Incentives include the approval to construct on-site farm dwellings and employee housing, income tax credits for agricultural costs, financing opportunities, loan guarantees, and expedited State-level permitting for agricultural processing facilities.

### Potential Urbanization of Ag Land

Portions of the Central Maui farmland abut land in the Urban District (see Figure 3). However, Mahi Pono is not planning urban development on any of its farmland.

### Ag Lease Terms

Subject to the terms of the Water Lease, Mahi Pono plans to offer favorable lease terms for its lands in Central Maui, including anticipated rents of \$150 per acre per year. This rate is low compared to annual per-acre rents of about \$350 for large farm parcels on O‘ahu, over \$400 for State Ag Parks on O‘ahu, and about \$1,200 for the County’s Kula Ag Park.

### Summary of Agricultural Conditions

Central Maui has some of the best agricultural conditions in the State for farming, including a large area in a compact configuration, high-quality soils, high solar radiation, a location near markets and shipping terminals, and potentially ample water at low delivery costs (assuming a new Water Lease with a reasonable use fee), and for lessees rents that will be comparatively low.

## **b. Upcountry Maui**

### Agricultural Lands and Activities

The Upcountry Water System Service Area is shown in Figure 13, and the agricultural lands and activities in this area are shown in Figure 14.

### Soil Ratings

Figures 15 and 16 show the NRCS ratings of Upcountry agricultural lands, with and without irrigation. For Kula, the estimated acreages for each class, with and without irrigation, are as follows:

	<u>Acres, Irrigated</u>	<u>Acres, Non-irrigated</u>
— Class I	0	0
— Class II	0	0
— Class III	384 (85.9%)	0
— Class IV	0	384 (86.0%)
— Class V	0	0
— Class VI	48 (10.8%)	48 (10.8%)
— Class VII	0	15 (3.3%)
— Not rated	<u>15</u> (3.3%)	<u>0</u>
— Total	447	447

For the other Upcountry lands, estimated acreages for each class, with and without irrigation, are as follows:

	<u>Acres, Irrigated</u>	<u>Acres, Non-irrigated</u>
— Class I	1 (0.0%)	0
— Class II	5,614 (9.2%)	5,466 (9.0%)
— Class III	9,010 (14.8%)	8,933 (14.6%)
— Class IV	6,834 (11.2%)	20,121 (33.0%)
— Class V	0	0
— Class VI	6,172 (10.1%)	14,177 (23.2%)
— Class VII	12,088 (19.8%)	12,088 (19.8%)
— Class VIII	178 (0.3%)	178 (0.3%)
— Missing	21,067	
— Not rated	<u>76</u> (0.1%)	<u>76</u> (0.1%)
— Total	61,040	61,040

Figure 17 shows the ALISH ratings for the Upcountry agricultural lands. The estimated acreages for each rating are as follows:

	<u>Acres, Kula</u>	<u>Acres, Other Upcountry</u>
— Prime	63 (14.1%)	14,893 (24.4%)
— Unique	0	18 (0%)
— Other	354 (79.1%)	28,331 (46.4%)
— Not rated	<u>30</u> (6.8%)	<u>17,797</u> (29.6%)
— Total	447	61,040

Figure 18 shows the LSB ratings for the Upcountry agricultural lands. The estimated acreages for each rating are as follows:

	<u>Acres, Kula</u>	<u>Acres, Other Upcountry</u>
— A	432 (96.6%)	16,723 (27.4%)
— B	0	4,802 (7.9%)
— C	0	22,392 (36.7%)
— D	0	12,933 (21.2%)
— E	0	2,294 (3.8%)
— Not rated	<u>15</u> (3.4%)	<u>1,896</u> (3.1%)
— Total	447	61,040

About 432 acres of the Kula agricultural lands and about 17,134 acres of the Other Upcountry lands consist of high-quality farmland (see Figure 19).

### Climatic Conditions

#### *Solar Radiation*

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 (see Figure 20). The Kula Ag Park receives about 450 calories per square centimeter per day.

#### *Rainfall*

Average annual rainfall in Upcountry Maui ranges from 15 to nearly 120 inches (see Figure 21). The Kula Ag Park receives an average of less than 25 inches per year.

#### *Temperatures*

At Kula, average temperatures range from the low 50s in the winter to the high 70s in the summer.

#### *Winds*

As with 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.

### Irrigation Water

The MDWS supplies irrigation water to the small farmers in Upcountry Maui. For large-volume users, the cost is \$1.10 per 1,000 gallons for potable (treated) water and \$1 per

1,000 gallons for non-potable water. These rates are far more expensive than the irrigation water for Central Maui sourced from the EMI System or private brackish wells (see Subsection 5.a).

EMI charges 6 cents per 1,000 gallons to deliver East Maui surface water to the MDWS for the Kula Ag Park and other Upcountry farm areas, as well as for domestic use. This charge includes (1) EMI's cost to deliver water to Maliko Gulch (about 3.9 cents), plus (2) HC&S's cost to deliver water from Maliko Gulch to the MDWS system.

In the future, EMI's charges to the MDWS could increase because (1) the fixed costs EMI incurs will be spread over a lower volume of water diverted from East Maui, and (2) the lease payments and conditions attached to Lease from the State for water diverted from State lands could be costly.

### Road Access

Access from Upcountry Maui to the markets and shipping terminals in Kahalui are provided via Kula Highway and Haleakalā Highway. Trucking distance from the Kula Ag Park to the harbor is about 14 miles.

### Surrounding Uses

The Kula Ag Park and many of the Upcountry grazing lands are surrounded by open space, while many of the small farms are located near residential communities.

### Locational Advantages and Disadvantages

The locational advantages and disadvantages for Upcountry Maui are similar to those for Central Maui, although the trucking distances are longer.

### Summary of Agricultural Conditions

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 Kula Ag Park are much higher than those planned for Central Maui (\$1,200 per acre vs \$150 per acre).

### **c. East Maui**

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. The East Maui taro streams are shown in Figure 22.

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 (see Section 8.c). 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 Hawai‘i.

## **6. OUTLOOK FOR AGRICULTURE**

### **a. Central Maui**

Provided that sufficient water is available, Central Maui is expected to host a major expansion in crop farming and cattle grazing. As indicated above, the area has very favorable conditions for agriculture, including:

- A very large supply of agricultural land in a compact configuration.
- Favorable agronomic conditions for much of this land (i.e., high-quality soils, high solar radiation, moderate slopes, etc.).
- Access to water delivered at a relatively low cost through the EMI System, assuming the Water Lease Limited to CWRM D&O Alternative and no significantly higher costs that result from the Water Lease rent payments and conditions (the delivery includes the payments to the State for the Water Lease).

In late December 2018, A&B announced that it sold (1) about 41,000 acres of Central Maui land to Mahi Pono, including almost all the farmland serviced by the EMI System. However, A&B retained ownership of the Pu‘unēnē mill property and other remnant parcels.

Mahi Pono is a joint farming venture between (1) Pomona Farming LLC based in California, and (2) Public Sector Pension Investment Board of Canada. The Mahi Pono team has significant experience cultivating diverse crops and managing cattle operations on more than 100,000 acres on the continental U.S. Also, the company has established market channels, and substantial financial resources.

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 (anticipated to be \$150 per acre per year) for long periods. Orchard crops reflect a long-term commitment to farming.

To the extent economically feasible, Mahi Pono and other farmers on its land will grow food crops for the Hawai'i market. However, the Hawai'i market is too small to use all of the available farmland in Central Maui solely to serve the Hawai'i market, and thus some export is necessary. Currently, Hawai'i farmers use about 15,000 acres to supply about one-third of the fresh fruits, vegetables and melons consumed in Hawai'i (this does not include nuts or coffee). Self-sufficiency is low because of low-cost imports from the mainland.

Depending on the supply of surface water delivered to Central Maui, the amount of land used could range from (1) about 5,280 acres in crops and 24,470 acres in pasture, to (2) about 15,950 acres in crops and 13,800 acres in pasture. An additional 250 acres would be used for green energy.

Mahi Pono paid about \$6,400 per acre for its purchase of the Central Maui fields. This compares to over \$30,000 per acre for large parcels of good farmland on O'ahu, and about \$100,000 per acre for farmland in Oxnard, California, which is about 60 miles west-northwest of the large Los Angeles market and shipping terminals. The price Mahi Pono paid for the land may assist with their goal of achieving profitable agricultural operations without requiring supplemental income from non-agricultural activities.

Central Maui agricultural land that cannot be farmed—possibly because of insufficient water or insufficient demand for crops that can be profitably grown in the area—is likely to be used for grazing cattle. Even though cattle grazing yields far lower returns and employment per acre than does farming, cattle grazing provides four benefits: (1) a productive use of agricultural land; (2) land management by the rancher (e.g., erosion control, preventing illegal dumping, etc.); (3) reduced fire hazard because the cattle help control the vegetation; and (4) reduced property taxes because the land is assessed at its agricultural value instead of its market value.

## **b. Upcountry Maui**

The EMI System supplies water to the MDWS, which in turn treats and distributes a portion of this water to small farms in Upcountry Maui and the remainder to domestic users. The EMI System also delivers water to the County's Kula Ag Park distribution system. The supply of water delivered by the EMI System to the MDWS would remain at its current level under the Water Diversions Limited to the CWRM D&O Alternative. However, the charge by EMI to deliver water to MDWS could increase (see Section 5.b).

In 2018, A&B sold 262 acres to the County for the expansion of the Kula Ag Park, and agreed to supply the MDWS with 1 mgd of surface water from the EMI System to meet the needs of the expansion area, subject to the continuation of State permits or issuance of the Water Lease. The needed water allocation will result from infrastructure improvements to the reservoir and pumps that serve the Ag Park, and use existing deliveries from the EMI System more efficiently. Thus, the current level of water deliveries to the Kula Ag Park will suffice for both the existing and expanded Kula Ag Park areas.

The County has expressed a desire to expand the Park by an additional 610 acres, however this has not been funded or currently pursued. This expansion would require additional water be made available to the County from the EMI System.

Other than the Kula Ag Park, no significant increase of commercial agriculture is expected to occur in Upcountry Maui, primarily because Central Maui offers an abundant supply of high-quality farmland, higher solar radiation, flatter terrain, a location closer to markets and shipping terminals, and potentially far better access to water at a lower water rate. However, some residents of Upcountry Maui may engage in limited semi-commercial agriculture because they are attracted to the farming lifestyle, and farming would lower their property taxes. These semi-commercial farmers may sell some of their crops to help cover operating costs.

For the No Water Lease Alternative, water deliveries by the EMI System to the MDWS would drop to zero. As discussed in Section 9.b below, several years would be required for the MDWS to develop groundwater wells or other alternatives to fill the shortfall in supply, and the feasibility of such development is uncertain. Assuming domestic customers would have priority over agricultural customers, farmers in Upcountry Maui would lack water to irrigate their crops until the new wells are operational. As a result, farms would close or relocate to Central Maui. Even after the new wells are operational, little commercial farming is expected to return to Upcountry Maui because Central Maui has better conditions for farming.

For the Water Lease with Less than CWRM D&O Alternative, this report assumes the impacts on farming would be proportional to the reduction in the supply of water delivered by the EMI System to the MDWS.

### **c. East Maui**

A number of East Maui farmers divert stream water to irrigate taro lo‘i 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 (CWRM D&O).

However, in light of the D&O, ample stream water should now be available to irrigate taro lo‘i and the small farms relying on East Maui streams. As mentioned previously, the D&O “will return free flowing water, with no upstream diversions, to all streams which have historically supported significant kalo cultivation ...” The large volume of water that flows out of the taro lo‘i can be used to irrigate other crops.

Given the CWRM D&O to fully restore the flow of all taro streams in East Maui, all alternatives are expected to result in the same expansion of taro and other farming in East Maui.



## 7. WATER SUPPLY AND ALLOCATION

Table 1 summarizes the supply and allocation of surface water from the EMI System, plus supplemental brackish groundwater used in Central Maui. The table covers the three past water diversions and two of the water-lease alternatives defined in Section 4.

### a. Past Water Diversions

#### Typical Sugar (2006 Crop)

A&B regards 2006 as typical during healthy sugar operations: rainfall in East Maui was regarded as normal, the restoration of stream flows was not large enough to significantly affect HC&S sugar operations, and the plantation was economically healthy.

To grow the 2006 sugarcane crop, the EMI System delivered an average of about 156.5 mgd based on daily readings measured at Maliko Gulch (see Table 1, Section 1.a). In actuality, flows vary greatly from day to day. This figure is a weighted average based on 30% of the EMI System flow in 2004, 55% of the flow in 2005, and 15% of the flow in 2006. A weighted average is used because Hawaiian sugarcane is normally a 2-year crop which requires more water in the initial months, and no water during the last month or so before harvesting.

The corresponding supply of brackish groundwater was approximately 42.5 mgd (see Table 1, Section 1.a). Thus the total water supply was about 199 mgd.

The 199 mgd were used as follows: (1) about 3 mgd by the MDWS for delivery to Upcountry Maui, (2) 143 mgd to irrigate sugarcane in Central Maui, (3) 0.25 mgd to irrigate pineapple, (4) 8 mgd for HC&S industrial activities, and (5) 44 mgd for system losses (see Table 1, Section 1.b).

System losses due to evaporation and leakage are estimated at 22.7% of the gross water use by agriculture, but excluding the water used for pineapple since the fields were close to Maliko Gulch (195.81 mgd total Ag use, less 0.25 mgd for pineapple  $\times$  22.7% = 44.39 mgd). The 22.7% figure for system losses is used for all water-lease alternatives.

After system losses, about 151 mgd were used for sugar operations (143.19 mgd for irrigation + 7.98 mgd for HC&S industrial uses = 151.17 mgd). About 95% of the water was used for irrigation (143.19 mgd  $\div$  151.17 mgd = 94.72%).

Of the 143 mgd that were used to irrigate sugarcane, about 112 mgd were surface water and 31 mgd were brackish groundwater (42.50 mgd gross supply of groundwater less system losses of 22.7%  $\times$  94.72% used for irrigation = 31.12 mgd of groundwater applied after system losses). Thus, brackish groundwater supplied about 22% of the water that was used for irrigating sugarcane (31.12 mgd  $\div$  143.19 mgd = 21.7%).

As shown in Section 1.c of Table 1, water delivery costs were about 3.5 cents per 1,000 gallons for surface water (MHI). The delivery costs for the surface water includes the payments to the State for the Water Lease.

### Recent Sugar (Years 2008 to 2013)

During the last 6 years of full sugarcane operations, and as reported in the CWRM D&O, A&B diverted an average approximately 114 mgd of surface water from East Maui, and pumped an average of approximately 70 mgd of brackish groundwater, for a total water supply of approximately 184 mgd (see Table 1, Section 1.a).

During the 2008-to-2013 period, the average supply of surface water was about 43 mgd less than that for the Typical Sugar Baseline (156.54 mgd – 113.71 mgd = 42.83 mgd). The reduction in surface water was due to (1) less rainfall and (2) stream-flow restoration in East Maui.

During the subject 6-year period, the average gross supply of about 184 mgd of surface water and brackish groundwater was used as follows: (1) approximately 7.1 mgd by the MDWS for delivery to Upcountry Maui, (2) approximately 132 mgd to irrigate sugarcane, (3) approximately 7 mgd for other uses in Central Maui, and (4) approximately 42 mgd for system losses (see Table 1, Section 1.b). The table also shows an adjustment of about 4 mgd due to under reported use by the MDWS in the CWRM D&O.

System losses due to evaporation and leakage are calculated to be approximately 23.05% of the gross water use by agriculture for the subject period.

After system losses, about 139 mgd were used for sugar operations (132.45 mgd for irrigation + 6.66 mgd for HC&S industrial and other uses = 139.11 mgd). Thus, about 95% of the water was used for irrigation ( $132.45 \div 139.11 = 95.21\%$ ).

Of the approximately 132 mgd that were used to irrigate sugarcane, about 81 mgd were surface water and 51 mgd were brackish groundwater (69.9 mgd gross supply of groundwater less system losses of  $23.05\% \times 95.21\%$  used for irrigation = 51.21 mgd of groundwater applied after system losses). Thus, brackish groundwater supplied about 39% of the water to irrigate sugarcane ( $51.21 \text{ mgd} \div 132.45 \text{ mgd} = 38.7\%$ ). As noted in Section 3.a, a large volume of brackish groundwater was used to irrigate the sugarcane in order to maintain high levels of biomass for energy production, even though the high salinity decreased sugar yields.

As shown in Section 1.c of Table 1, water delivery costs were about 3.9 cents per 1,000 gallons for surface water, and about 52 cents per 1,000 gallons for brackish groundwater (MHI and A&B).

### Post Sugar (Year 2017)

After the closure of sugarcane operations, A&B reduced the flow of the EMI System to about 28 mgd in 2017 to meet the needs of MDWS, the initial diversified agricultural projects, and other existing Central Maui uses (see Table 1, Section 1.a). This 28 mgd is less than the 30.76 mgd available under the No Water Lease Alternative.

In 2017, A&B pumped a negligible amount of brackish groundwater. Thus, the total water supply was about 28 mgd.

Water uses included about (1) about 2.9 mgd by the MDWS to supply water to Upcountry Maui; (2) 1 mgd for industrial activities; (3) 4 mgd to irrigate crops; and (4) 20.5 mgd to maintain the reservoirs and for fire protection, plus system losses (not shown in Table 1). 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. As discussed in Section 9.b, about 1.5 mgd of the the County water was for the Kula Ag Park and about 1.4 mgd was for other Upcountry users.

As shown in Section 1.c of Table 1, water delivery costs were about 16.2 cents per 1,000 gallons for surface water, and about 52 cents per 1,000 gallons for brackish groundwater (MHI and A&B). The cost of the surface water increased because fixed costs were spread over a much smaller volume of surface water from the EMI System.

## **b. Future Water-Lease Alternatives**

### Water Lease Limited to CWRM D&O Alternative (proposed action/preferred alternative)

For this alternative, the Water Lease that is put to auction would authorize continued diversions of surface water from State lands in East Maui up to the maximum allowed under the D&O. Most of the water would be used to irrigate crops in Central Maui. For Upcountry Maui and Nahiku, the EMI System would continue to supply water to the MDWS, but the supply would be maintained at its recent level and would not be increased to accommodate future growth. The charge by EMI to deliver water to MDWS will increase (see Section 5.b).

A&A estimates that compliance with the CWRM D&O would result in the EMI System being able to deliver a flow of 92.32 mgd (see Table 1, Section 1.a).

The supply of surface water from the EMI System would be reduced by about 66 mgd compared to the Typical Sugar Baseline (156.54 mgd less 92.32 = 64.22 mgd), and about 21 mgd compared to the Recent Sugar Baseline (113.71 mgd less 92.32 = 21.39 mgd).

Water deliveries by the EMI System to the MDWS would remain at about 7.1 mgd,<sup>4</sup> leaving about 84 mgd to irrigate crops in Central Maui (92.32 mgd from the EMI System less 7.1 mgd to the MDWS = 85.22 mgd).

Assuming a split of 80% surface water and 20% brackish groundwater for irrigating crops in Central Maui (i.e., a 4-to-1 mix), about 21 mgd of brackish groundwater would be required (85.22 mgd of surface water  $\div$  4 = 21.31 mgd). This 80%/20% split applies to the farm as a whole. However, all of the groundwater is applied to the lower fields, and none to the upper fields which are irrigated only with surface water. The resulting water mix that is applied to the lower fields is about 70% surface water and 30% brackish groundwater (see

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4. 7.1 mgd was the long-term average presented in the CWRM D&O.

Table 3, Section 3.a). This mixture is consistent with safe use of brackish groundwater on diversified crops (see Section 5.a).

As shown in Section 1.a of Table 1, the water supply for the Central Maui fields and Upcountry Maui would total about 114 mgd (92.32 mgd of surface water plus 21.31 mgd of groundwater = 113.63 mgd).

As shown in Section 1.b of Table 1, agricultural water use in Central Maui would total about 107 mgd (a supply of 113.63 mgd less 7.1 mgd by the MDWS = 106.53). System losses are estimated at about 24 mgd (22.7% of 106.53 mgd = 24.18 mgd), leaving about 82 mgd applied to crops after system losses (106.53 mgd less 24.18 for losses = 82.34 mgd with rounding). Of this amount, about 66 mgd would be surface water (80% of 82.34 mgd = 65.88 mgd), and about 16 mgd would be brackish groundwater (20% of 82.34 mgd = 16.47 mgd). Some water would be used for industrial activities (e.g., the washing of crops), but the amount is not estimated.

As shown in Section 1.c of Table 1, water delivery costs would increase to about 6.8 cents per 1,000 gallons for surface water, and would remain at about 52 cents per 1,000 gallons for brackish groundwater. The delivery costs of the surface water includes the payments to the State for the water, and assumes that the rent payment will continue at its 2017 level.

#### Water Lease with Less than CWRM D&O Alternative

For this alternative, the Water Lease that is put to public auction would allow surface water to be diverted from East Maui, but at a lower level than in the previous alternative. As discussed in Section 4.b, this alternative is not included in the tables because no particular amount of decreased flow of surface water from East Maui is currently known.

#### No Water Lease Alternative

For this alternative, it is assumed that the State does not issue the requested Water Lease. And because the agreements between the County and A&B are contingent upon the Lease being issued, the supply of water to MDWS would terminate. As much water as possible from private lands in East Maui would be used to irrigate Central Maui fields.

Without the water from State lands, the EMI System would deliver a flow of about 31 mgd from private lands (see Table 1, Section 1.a). The surface water from the EMI System would be reduced by about 126 mgd compared to the Typical Sugar Baseline (156.54 mgd less 30.76 = 125.79 mgd with rounding), and about 83 mgd compared to the Recent Sugar Baseline (113.71 mgd less 30.76 = 82.96 mgd with rounding).

Assuming a split of 80% surface water and 20% brackish groundwater for irrigating crops in Central Maui, about 8 mgd of brackish groundwater would be required (30.76 mgd of surface water  $\div$  4 = 7.69 mgd). For the lower-elevation fields where groundwater is used,

this split translates to a mix of about 70% surface water and 30% brackish groundwater. As previously, this mixture is consistent with safe use of brackish groundwater on diversified crops. No brackish groundwater would be used on the higher-elevation fields.

As shown in Section 1.a of Table 1, the water supply for the Central Maui fields would total about 38 mgd (30.76 mgd of surface water plus 7.69 mgd of groundwater = 38.44 mgd with rounding).

All of this water would be used to irrigate crops in Central Maui. System losses are estimated at about 9 mgd (22.7% of 38.44 mgd = 8.73 mgd), leaving about 30 mgd applied to crops after system losses (38.44 mgd less 8.73 for losses = 29.72 mgd with rounding). Of this amount, about 24 mgd would be surface water (80% of 29.72 mgd = 23.77 mgd with rounding), and about 6 mgd would be brackish groundwater (20% of 29.72 mgd = 5.94 mgd).

As shown in Section 1.c of Table 1, water delivery costs would increase to about 12.9 cents per 1,000 gallons for surface water, and would remain at about 52 cents per 1,000 gallons for brackish groundwater.

## 8. AGRICULTURAL LAND USE

Table 2 shows acreages of past and projected agricultural land uses.

### a. Central Maui

#### Typical Sugar (2006 Crop)

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 Hawai'i 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 System and brackish groundwater wells, and about 5,750 acres were irrigated with water from the West Maui Ditch System and brackish groundwater wells (see Table 2, Section 2.a). For the fields irrigated by the EMI System, about 12,800 acres (43.5%) were upper fields irrigated only with surface water, and about 16,630 acres (56.5%) were lower fields irrigated with a mix of surface water and brackish groundwater.

#### Recent Sugar (Years 2008 to 2013)

For the 2008-to-2013 period, the above estimated acreages changed modestly (see Table 2, Section 2.a). The plantation was slightly larger at about 36,180 acres, of which about

30,320 acres were fields irrigated with water from the EMI System, including about 12,730 acres (42.0%) upper fields, and 17,590 acres (58%) lower fields.

Post Sugar (Year 2017).

In 2017, about 200 acres in Central Maui were used to grow the energy crop pongamia, and about 500 acres were for unirrigated pasture.

Water Lease Limited to CWRM D&O Alternative, Diversified Agriculture (Year 2030)

Mahi Pono has developed an initial Farm Plan consistent with the Water Lease Limited to CWRM D&O Alternative. This 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. For the Central Maui fields, planned estimated acreages are as follows (see Table 2, Section 2.a):

	<u>Acres</u>
— Crops	
• Community Farm (vegetables, melons, etc.)	800
• Orchards (lemons, limes, mandarins, oranges, macadamia nuts, coffee, avocados, etc.)	12,850
• Tropical fruits (dragon fruit, guava, lilikoi, papaya, white pineapple, etc.)	600
• Row crops and annual crops (potatoes, etc.)	1,200
• <u>Energy crops</u>	<u>500</u>
• Total Crops	15,950
— Pasture	
• Irrigated	4,700
• <u>Unirrigated</u>	<u>9,100</u>
• Total Pasture	13,800
— <u>Green energy (solar farms)</u>	<u>250</u>
— Total Acreage	30,000

Over 80% of the land in crops will be used for orchards (12,850 acres ÷ 15,950 acres). As mentioned, orchard farming reflects a long-term commitment to agriculture.

About 6,390 acres of upper fields would be irrigated with just surface water because they cannot be irrigated with brackish groundwater, while about 14,260 acres of lower fields would be irrigated with a mixture of surface water and brackish groundwater.

If more water were available, then crop acreage would be increased and pasture acreage decreased, and vice versa. Crop farming provides more employment and other economic benefits per acre than does pasture land.

Regarding the Community Farm, 1-, 5- and 10-acre fields are planned to be offered to local farmers at below-market rents. Also, farmers will have access to Mahi Pono's equipment, management, budgeting and marketing services.

Regarding green energy, it is assumed that this will take the form of a solar farm with storage batteries located on lower-quality agricultural land. Sheep may be grazed among the solar panels to control vegetation.

Mahi Pono would lease about 2,050 acres to other farmers, plus about 250 acres leased for green energy.

Over one-third of the land scheduled for crop farming is being prepared or will soon be prepared for farming (see Figure 23). Near-term crops and estimated acreages include the following:

	<u>Acres</u>
— Community Farm	250
— Citrus	
• Lemons	125
• Limes	800
• Mandarins	400
• Oranges	350
— Other orchard	
• Avocados	275
• Coffee	350
• Macadamia nuts	1,000
— Tropical fruits	
• Dragon fruit	25
• guava	20
• Lilikoi	35
• Papaya	15
• White pineapple	3
— Sweet potatoes	470
— Row crops (finger-link potatoes and peppers)	430
— Cover crops (sunflower and Sudan grass)	400
— <u>Nursery</u>	<u>510</u>
— Total	5,458



The nursery will be used to grow crops to implement the Mahi Pono Farm Plan, and not for growing plants for commercial sales. In addition to the above, pasture lands are being prepared for grazing cattle.

No Water Lease Alternative, Diversified Agriculture (Year 2030)

Mahi Pono has developed a scaled-down Farm Plan consistent with the No Water Lease Alternative. As before, this initial Plan will evolve over time. For the Central Maui fields, planned estimated acreages are as follows (see Table 2, Section 2.a):

— Crops	
• Community Farm (vegetables, melons, etc.)	300
• Orchards (lemons, limes, mandarins, oranges, macadamia nuts, coffee, avocados, etc.)	4,180
• Tropical fruits (dragon fruit, guava, lilikoi, papaya, white pineapple, etc.)	200
• Row crops and annual crops (potatoes, etc.)	400
• <u>Energy crops</u>	<u>200</u>
• Total Crops	5,280
— Pasture	
• Irrigated	3,800
• <u>Unirrigated</u>	<u>20,670</u>
• Total Pasture	24,470
— <u>Green energy (solar farms)</u>	<u>250</u>
— Total Acreage	30,000

About 2,720 acres of upper fields would be irrigated with surface water only, while about 6,360 acres of lower fields would be irrigated with a mixture of surface water and brackish groundwater.

Mahi Pono would lease about 1,250 acres to other farmers, plus about 250 acres leased for green energy.

**b. Upcountry Maui**

Post Sugar (Year 2017)

The EMI System supplies water to the MDWS for its 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. The estimated acreages by use are as follows:



- Diversified crops: 2,823 acres
- Pineapple: 1,447 acres
- Pasture, unirrigated: about 28,230 acres

The land in diversified crops includes the Kula Ag Park, which is managed by the County of Maui, Office of Economic Development to promote the development of diversified agriculture on the island of Maui. The Ag Park consists of 31 farm lots ranging from 10 to 30 acres, and totaling 447 acres. The lots are leased to 26 farmers who grow a variety of crops, including vegetables, turf grass, landscape nursery products, flowers, bananas, and dryland taro.

In recent years, water provided by the EMI System to the MDWS was used to irrigate crops at the Kula Ag Park, plus about 800 additional acres of farmland in Upcountry Maui. The 800 acres is based on (1) water use of about 2.7 mgd, and (2) about 3,375 gallons per acre per day (**gad**) (800 acres x 3,375 gad = 2.7 mgd). The 2.7 mgd for other Upcountry farms is derived in Section 9.b., and Table 3, Section 3.b. In 2017, however, water from sources other than the EMI System was used to irrigate farms in Upcountry Maui (see Section 9.b).

The total farmland irrigated with water from the EMI System is about 1,250 acres (447 acres for Kula Ag Park plus about 800 acres for other farms = 1,247 acres)—see Table 2, Section 2.b).

#### Water Lease Limited to CWRM D&O Alternative (Year 2030)

For the Water Lease Limited to CWRM D&O Alternative, the EMI System would continue to supply water to the MDWS for Upcountry Maui, but the supply would remain at the current level and would not increase to accommodate future growth in the region.

A&B agreed to supply water for the planned 262-acre expansion of Kula Ag Park. As indicated earlier, the water will come from infrastructure improvements to the reservoir and pumps that serve the Ag Park—improvements that will save water. Thus no increase in deliveries by A&B to the Kula Ag Park is required.

In addition, the County plans to expand Kula Ag Park by an additional 610 acres. However, it is assumed that this second expansion will not occur because of (1) insufficient water, and (2) better agronomic conditions in Central Maui, including cheaper rents and cheaper water.

Thus, the Kula Ag Park would grow to 709 acres (447 existing acres + 262 acres recently added).

Other than the Kula Ag Park, no significant increase of commercial agriculture is expected to occur in Upcountry Maui for the reasons given in Section 6.b: Central Maui offers an abundant supply of high-quality farmland, higher solar radiation, flatter terrain, a location closer to markets and shipping terminals, and potentially far better access to water at

a lower water rate. However, some residents of Upcountry Maui may engage in limited semi-commercial agriculture because they are attracted to the farming lifestyle.

Thus, farmlands in Upcountry Maui that are irrigated with water from the EMI System is expected to increase from about 1,250 acres in 2017 to about 1,510 acres by 2030 (see Table 2, Section 2.b). The increase would be due to the 262-acre expansion of the Kula Ag Park.

#### No Water Lease Alternative (Year 2030)

As mentioned in Section 6.b, water deliveries by the EMI System to the MDWS would drop to zero for the No Water Lease Alternative, and several years would be required to develop groundwater wells to fill the shortfall in supply. In the meantime, the commercial farms in Upcountry Maui that depend on water from the EMI System are likely to close or relocate. Once gone, they are unlikely to return to Upcountry Maui given the better agronomic conditions, cheaper rents, and cheaper water in Central Maui.

Thus, for this alternative, farmlands in Upcountry Maui that have been irrigated with water from the EMI System would drop to zero (see Table 2, Section 2.b).

#### **c. East Maui**

As mentioned in Section 6.c, farmers in East Maui have reported that past surface-water diversions for Central Maui left insufficient water in the streams to take full advantage of the agricultural potential in East Maui. However, the D&O will result in ample stream water to irrigate taro lo‘i and the small farms that rely on East Maui streams.

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:

	Taro Lo‘i ( <u>acres</u> )	Other Ag ( <u>acres</u> )
— Area		
• Keanae	12.13	7.00
• Wailuā	7.22	11.86
• Wailuā	8.30	11.23
• Wailuā	11.63	5.00
• Honopou	<u>5.55</u>	<u>.</u>
— 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 (see Table 2, Section 2.c). These estimated acreages would be the same for all water-lease alternatives.

## 9. AGRICULTURAL WATER USE

Irrigation water requirements for crops and pastures are shown in Table 3.

### a. Central Maui

#### Typical Sugar (2006 Crop)

After system losses, the volume of water used to irrigate the 2006 sugarcane crop was about 143 mgd, or about 4,866 gad (see Table 3, Section 3.a). About 112 mgd (78.3%) was surface water and 31 mgd (21.7%) was brackish groundwater. The upper fields used about 62 mgd of surface water, while the lower fields used a 81-mgd mix of surface water (61.5%) and brackish groundwater (38.5%).

Gross water requirements (before system losses) were about 185 mgd—about 145 mgd of surface water and 40 mgd of brackish groundwater.

#### Recent Sugar (Years 2006 to 2013)

For the 2006-to-2013 period, water used to irrigate the sugarcane crop declined to 132 mgd (a decrease of 11 mgd from the 2006 crop), and the per-acre usage declined to 4,368 gad (a decrease of 498 gad)—see Table 3, Section 3.a. About 81 mgd (61.3%) was surface water and 51 mgd (38.7%) was brackish groundwater. The upper fields used about 56 mgd of surface water, while the lower fields used a 77-mgd mix of surface water (33.4%) and brackish groundwater (66.6%). 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 (a decline of 13 mgd from the 2006 crop), including about 106 mgd of surface water (a decline of 39 mgd) and about 67 mgd of brackish groundwater (an increase of 26 mgd).

#### Post Sugar (Year 2017)

In 2017, less than 1 mgd was used to irrigate an energy crop.

#### Water Lease Limited to CWRM D&O Alternative, Diversified Agriculture (Year 2030)

Future water requirements will evolve over time based on the available supply, which crops are planted, per-acre water requirements of the crops, etc.

For the Water Lease Limited to CWRM D&O Alternative, full development of the Mahi Pono Farm Plan (Section 8.a) would require an estimated 82 mgd of irrigation water after system losses, or about 3,987 gad (see Table 3, Section 3.a). About 66 mgd (80%) would be surface water and 16 mgd (20%) brackish groundwater. Upper fields would use about 28 mgd of surface water, while the lower fields would use a 55-mgd mix of surface

water (70%) and brackish groundwater (30%). This mix is consistent with safe use of brackish groundwater on diversified crops (see Section 5.a).

Gross water requirements (before system losses) would be about 107 mgd (a decline of 79 mgd from the 2006 sugarcane crop), including about 85 mgd of surface water (a decline of 60 mgd) and about 21 mgd of brackish groundwater (a decline of 19 mgd).

#### No Water Lease Alternative, Diversified Agriculture (Year 2030)

For the No Water Lease Alternative, about 30 mgd of irrigation water would be required for the scaled-down Mahi Pono Farm Plan, or about 3,259 gad (see Table 3, Section 3.a). About 24 mgd (80%) would be surface water and 6 mgd (20%) would be brackish groundwater. Upper fields would use about 10 mgd of surface water, while the lower fields use a 20-mgd mix of surface water (70%) and brackish groundwater (30%).

Gross water requirements (before system losses) would be about 38 mgd (a decline of 147 mgd from the 2006 sugarcane crop), including about 31 mgd of surface water (a decline of 114 mgd) and about 8 mgd of brackish groundwater (a decline of 33 mgd).

#### **b. Upcountry Maui**

##### Post Sugar (Year 2017)

In 2017, the EMI 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 (40% of the the historic average of 7.9 mgd) were used for agriculture.

About 0.46 mgd were for crops at the Kula Ag Park, however, 1.5 mgd had to be supplied by the EMI System to the County's Kula Ag Park water system to produce the 0.46 mgd used by the farmers. About 2.7 mgd were used for crops elsewhere in Upcountry Maui (agricultural use of 3.16 mgd less 0.46 mgd used at the Kula Ag Park). For this report, it is assumed that, in a normal year, about 2.7 mgd delivered by the MDWS to Upcountry farms originates from the EMI System. As mentioned in Section 8.b, 2.7 mgd are sufficient to irrigate about 800 acres of farmland.

Pineapple in Upcountry Maui relies on groundwater pumped from a Maui Land and Pine well on private land. A&B has allowed groundwater to be transported through the EMI System and withdrawn from a downstream location, but the water for Upcountry Maui pineapple is not sourced from the surface waters diverted by the EMI System. The pastures in Upcountry Maui are not irrigated.

Other farmers in Upcountry Maui rely on rainfall to water their crops.

### Water Lease Limited to CWRM D&O Alternative (Year 2030)

For the Water Lease Limited to CWRM D&O Alternative, future water deliveries by the EMI System for agriculture in Upcountry Maui are expected to remain the same, notwithstanding the expansion of the Kula Ag Park, whose water needs will be provided through water savings achieved through infrastructure improvements to the reservoir and pumps that serve the Kula Ag Park. Future water requirements will remain about the same elsewhere in the district (see Table 3, Section 3.a).

### No Water Lease Alternative (Year 2030)

For the No Water Lease Alternative, the supply of water delivered by the EMI System to the MDWS is presumed to drop to zero because the agreements with County provide that the delivery of water is contingent upon the Lease being issued (see Table 3, Section 3.b).

Any shortfall in supply is likely to be met by the MDWS developing new groundwater wells. However, several years would be required to prepare engineering designs; conduct environmental studies and write environmental reports; obtain approvals from various State and County agencies; dig, case, and test exploratory wells; dig and case permanent wells; connect the new wells to the MDWS delivery system; etc.

In the meantime, the commercial farms in Upcountry Maui that depend on water from the EMI System are likely to close or relocate as mentioned in Section 6.b. Once gone, they are unlikely to return to Upcountry Maui given the better agronomic conditions, cheaper rents, and cheaper water in Central Maui.

### **c. East Maui**

Wetland taro requires very large volumes of water flowing through the lo'i, partly to control the water temperature, thereby preventing taro rot. After flowing through the lo'i, 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 (see Table 3. Section 3.c). These requirements would be the same for all water-lease alternatives.

## **10. AGRICULTURAL DEVELOPMENT AND OPERATIONS**

Table 4 provides information on agricultural development and operations, with an emphasis on expenditures and sales. All dollar amounts are expressed in terms of 2018 purchasing power.

### **a. Central Maui**

#### Typical Sugar, Operations (2006 Crop)

For the 2006 sugar crop, HC&S produced about 145,200 tons of raw sugar, and sold sugar and energy to generate about \$101 million in direct sales (see Table 4, Section 4.a). These figure are for the former plantation lands east of Maui Veterans Highway, and not the entire plantation.

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.

#### Recent Sugar, Operations (Years 2008 to 2013)

For the 2008-to-2013 period, 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)—see Table 4, Section 4.a. 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.

#### Post Sugar, Operations (Year 2017)

By 2017, A&B had replaced sugar operations with limited cattle grazing and Pongamia. Both operations were under development, producing negligible revenues in 2017.

#### Diversified Ag, Development Activity

##### *Water Lease Limited to CWRM D&O Alternative*

For the Water Diversions Limited to the CWRM D&O Alternative, 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,

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 (see Table 4, Section 4.a).

Also, the Plan would require an estimated 319,000 square feet of building space for washing and packing areas, storage, offices, 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 \$39.9 million per year, of which about \$33.5 million would be on Maui and about \$6.5 on O'ahu. 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.

As indicated above, the above economic activity is expected to last about 10 years, and will vary from year to year.

#### *No Water Lease Alternative*

For the No Water Lease Alternative, the scaled-down Mahi Pono Farm plan would require converting former sugarcane lands to about 5,280 acres of cropland, 3,800 acres of irrigated pasture, and 20,670 acres of unirrigated pasture. The total cost for this conversion is estimated at about \$40.5 million (see Table 4, Section 4.a).



Also, the Plan would require an estimated 105,600 square feet of building space costing about \$10.6 million.

As before, 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 \$144.8 million, or an average of about \$24.1 million per year assuming a 6-year development period for this scaled-down Farm Plan. Indirect sales are expected to average about \$18.8 million per year.

Thus, development expenditures plus indirect sales are expected to average about \$42.9 million per year, of which about \$36.3 million would be on Maui and \$6.6 on O`ahu. About \$31.4 million of development and consumption expenditures would be subject to the excise tax on final sales, and about \$4.3 million subject to the excise tax on intermediate sales.

Profits on development activity and indirect sales would be about \$4.3 million per year.

#### Diversified Agriculture, Operations (Year 2030)

##### *Water Lease Limited to CWRM D&O Alternative*

For the Water Diversions Limited to the CWRM D&O Alternative, full development of 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 (see Table 4, Section 4.a). 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 Maui Electric Company (MECO) to the solar-farm operator.

Combined farm and energy revenues would reach about \$168.9 million per year in direct sales, which would exceed 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. Mahi Pono's portion of the profits would be their return on their very substantial investment in agriculture in Central Maui.

#### *No Water Lease Alternative*

For the No Water Lease Alternative, the scaled-down Mahi Pono Farm Plan would result in about one-third as much crop production as the full Plan: about 3 million pounds per year from the Community Farm, 104.5 million pounds per year from orchards, and 3 million pounds per year of tropical fruits, plus production from row crops, annual crops, and energy crops (see Table 4, Section 4.a). Annual sales are expected to reach about \$51.3 million.

The pastures would support a cattle herd of about 9,700 cow-and-calf animal units, produce nearly 5,800 calves per year, and generate revenues of about \$6.3 million per year.

Thus, total farm sales would be about \$57.7 million per year, of which an estimated \$46.1 million (80%) would be Hawai'i sales and \$11.5 million export sales (20%).

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 \$65.9 million per year in direct sales, and \$57.7 million in indirect sales.

Total direct-plus-indirect sales would be about \$123.5 million, of which about \$103.4 million would be on Maui and \$20.2 million on O`ahu.

About \$8.6 million of consumption expenditures would be subject to the excise tax on final sales, and about \$103.4 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 \$800,000 per year.

Profits from farm operations, energy operations, and indirect sales would be about \$12.4 million.

### **b. Upcountry Maui**

#### Development Activity

##### *Water Diversions Limited to the CWRM D&O Alternative*

For the Water Diversions Limited to the CWRM D&O Alternative, the 262 additional acres at the Kula Ag Park would have to be converted from fallow sugarcane fields to productive fields for diversified crops. The cost of this conversion is estimated at about \$1.3

million, or an average of about \$260,000 per year assuming a 5-year development period (see Table 4, Section 4.b).

Indirect sales are expected to average about \$320,000 per year.

Thus, expenditures plus indirect sales are expected to average about \$600,000 per year.

#### *No Water Lease Alternative*

For the Water Lease Alternative, improvements to the 262 acres are unlikely to occur due to the lack of water for farming.

#### Post Sugar, Diversified Ag Operations (Year 2017)

In 2017, farmers at the Kula Ag Park 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 (see Table 4, Section 4.b).

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.

#### Diversified Ag Operations (Year 2030)

##### *Water Diversions Limited to the CWRM D&O Alternative*

For the Water Diversions Limited to the CWRM D&O Alternative, farm activity in Upcountry Maui is expected to increase due to the 262-acre expansion of the Kula Ag Park. The farmers at the Kula Ag Park and other farmers in Upcountry Maui who will rely on water from the EMI System are projected to produce an estimated 15.1 million pounds of crops per year (see Table 4, Section 4.b).

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 \$15.5 million per year, of which about \$26 million will be on Maui and about \$5.9 million on O‘ahu.

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 totaled about \$900,000 per year

Profits from farm operations and indirect sales are expected to reach about \$3.2 million per year.

### *No Water Lease Alternative*

For the No Water Diversions Alternative, farming activity and economic impacts are expected to be near zero for the farms that depended on water from the EMI System in 2017 (see Table 4, Section 4.b). For these farms, water to irrigate crops is not expected to be available for several years, and once farming ends, significant farming is not expected to return to the area because of better farming conditions in Central Maui.

### **c. East Maui**

For all water-lease alternatives, the 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 (see Table 4, Section 4.3).

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 O‘ahu. 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.

## **11. EMPLOYMENT, PAYROLL AND POPULATION SUPPORTED**

Table 5 provides information on agricultural and related employment, payroll, and the number of people supported by the agricultural activity.

### **a. Central Maui**

#### Typical Sugar, Operations (2006 Crop)

For the 2006 sugar crop, HC&S employed about 630 workers, including planters, irrigation workers, harvesters, truck drivers, mill workers, office workers, supervisors, etc. (see Table 5, Section 5.a). This employment figure is for the former plantation lands east of Maui Veterans Highway, and not the entire plantation.

As with indirect sales, sugar operations generated indirect jobs associated with the purchase of goods and services by HC&S, and by the families of HC&S employees. In turn, the companies supplying goods and services, and the families of their employees, supported additional indirect jobs by their purchases of goods and services, and so on. Indirect jobs included those at companies providing agricultural supplies and equipment, office supplies and equipment, repair services, etc. Other indirect jobs included those involved with supplying goods and services to families, including grocery workers, store clerks, restaurant

workers, service-station workers, beauticians, barbers, bankers, pharmacists, veterinarians, computer technicians, medical workers, accountants, attorneys, etc. The jobs ranged over a variety of skill levels, including entry-level, semi-skilled, skilled, and management.

Based on State employment multipliers, sugar operations generated about 710 indirect jobs in 2006.

Thus, direct-plus-indirect employment totaled about 1,300 jobs, of which about 1,100 jobs were on Maui.

The payroll was about \$48.5 million for the direct jobs and \$82.7 million for all direct and indirect jobs.

The direct and indirect jobs provided by sugar operations supported an estimated 3,000 residents living in about 1,260 homes, of which about 2,460 residents and 1,080 homes were on Maui.

#### Recent Sugar, Operations (Years 2008 to 2013)

For the 2008-to-2013 period, average employment and payroll was slightly less than that given above for the 2006 sugarcane crop (see Table 5, Section 5.a).

#### Post Sugar, Operations (Year 2017)

In 2017, most of the former sugarcane fields were fallow, but some land was used for an energy crop and for pasture. These activities generated an estimated 10 direct-plus-indirect jobs (see Table 4, Section 4.a).

#### Diversified Ag, Development Activity

##### *Water Lease Limited to CWRM D&O Alternative*

For the Water Diversions Limited to the CWRM D&O Alternative, an average of 210 workers would be needed over the assumed 10-year development period to: (1) convert former sugarcane fields to fields for diversified crops and pasture, (2) construct buildings, and (2) install a solar farm (see Table 5, Section 5.a). 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.

#### *No Water Lease Alternative*

For the No Water Lease Alternative, development activity would be less than that given above, but it would still be substantial and would last for a shorter period (6 years vs 10 years). During the development period, an average of about 176 direct jobs would be provided, plus about 116 indirect jobs, for a total of about 290 direct and indirect jobs. About 250 jobs would be on Maui and 50 jobs on O‘ahu. Actual employment would vary over time.

The payroll during development would average about \$7.7 million per year for the direct jobs and \$13.3 million for all direct and indirect jobs.

During the development period, the direct and indirect jobs would support an estimated 650 residents living in about 280 homes, with about 570 residents and 250 homes on Maui.

#### Diversified Agriculture, Operations (Year 2030)

##### *Water Lease Limited to CWRM D&O Alternative*

The Water Lease Limited to CWRM D&O Alternative would allow full development of the Mahi Pono Farm Plan, with farm employment expected to reach about 790 jobs, or about 160 more jobs than provided by sugar operations in 2006 (see Table 5, Section 5.a). 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 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.

#### *No Water Lease Alternative*

For the No Water Lease Alternative, the scaled-down Mahi Pono Farm Plan would result in about one-third as much employment as with the full Plan: about 270 direct jobs, 120 indirect jobs, and 390 total jobs (see Table 5, Section 5.a).

The payroll would be about \$9.9 million for the direct jobs and \$15.6 million for all direct and indirect jobs.

The direct and indirect jobs would support an estimated 880 residents living in about 380 homes, with about 790 residents and 350 homes on Maui.

### **b. Upcountry Maui**

#### Post Sugar, Diversified Ag Operations (Year 2017)

In 2017, farmers at the Kula Ag Park and other farms in Upcountry Maui who relied on water from the EMI System provided about 80 jobs and generated about 40 indirect jobs, for a total of about 120 jobs (see Table 5, Section 5.b).

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.

#### Development Activity

##### *Water Diversions Limited to the CWRM D&O Alternative*

For the Water Diversions Limited to the CWRM D&O Alternative, the 262-acre expansion of the Kula Ag Park would provide an average of about 7.5 direct-plus-indirect jobs during the assumed 5-year development period (see Table 5, Section 5.b). The payroll for these jobs would average about \$300,000 per year.

*No Water Lease Alternative*

For the No Water Lease Alternative, improvements to the 262 acres are unlikely to occur due to a lack of water for farming. Thus, there would be no development activity (see Table 5, Section 5.b).

Diversified Ag Operations (Year 2030)*Water Diversions Limited to the CWRM D&O Alternative*

For the Water Diversions Limited to the CWRM D&O Alternative, employment will increase due to the 262-acre expansion of the Kula Ag Park. By 2030, farmers at the Kula Ag Park and other farms in Upcountry Maui who relied on water from the EMI System are expected to provide about 100 jobs and generate about 50 indirect jobs, for a total of about 150 jobs (see Table 5, Section 5.b).

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.

*No Water Lease Alternative*

For the No Water Diversions Alternative, farming activity and employment are expected to be near zero for the farms that depended on water from the EMI System in 2017 (see Table 5, Section 5.b). For these farms, water to irrigate crops is not expected to be available for several years as mentioned previously. Once farming ends, significant farming is not expected to return to the area because better farming conditions exist in Central Maui.

**c. East Maui**

For all water-lease alternatives, 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 (see Table 5, Section 5.c).

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.



## 12. STATE AND COUNTY REVENUES

### a. Overview

Table 6 provides information on State and County revenues generated by agricultural development and operations. For the State, the major sources of revenue are the 4% excise tax on final sales, the 0.5% excise tax on intermediate sales, corporate income taxes, individual income taxes, and land rents paid to the State. For Maui County, the major sources of revenue are property taxes, and land rents paid to the County. The City and County of Honolulu derives tax revenues from economic activity on Maui because some of the indirect sales occur on O‘ahu. A portion of the sales on O‘ahu are subject to a 0.5% excise-tax surcharge which went into effect in 2007.

Farmers pay their fair shares of State and County taxes. However, most agricultural operations pay lower taxes than do most other sectors of the economy. Exported crops are exempt from the State excise tax. Crops sold for local consumption are usually taxed at the intermediate excise-tax rate of 0.5%. Crops that displace imports cause little change in final sales and little change in State excise tax revenues. At the County level, agricultural land values are lower than urban land values. Furthermore, agricultural lands are assessed at a fraction of their market values, so the property taxes are low compared to lands assessed at market values.

Sugar employees were paid higher-than-average wages, so on average their families paid more taxes than did most other families on Maui. However, the opposite is true for most workers on farms that grow diversified crops.

No major State or County expenditures are anticipated to support the planned agricultural development and operations. However, the developer of the solar farm would benefit from substantial State subsidizes.

State and County expenditures on services for families of agricultural workers are similar in magnitude to expenditures to support other families on Maui. Expenditures on services include, but are not limited to, education, libraries, social services, health services, security, fire protection, watershed management, park maintenance, road maintenance, water, waste disposal, etc.

However, State and County expenditures on services for the families of farm workers generally exceed the taxes paid by these families and their employers—a situation which also pertains to most families on Maui. Services to residents are, in effect, subsidized by tax revenues derived from visitors, resorts, commercial activities, and construction activities. Most visitors spend at a high daily rate for their rooms, meals, travel, activities, and purchases. In turn, these expenditures generate a high amount of excise taxes for the State. In addition, visitors are subject to the Transient Accommodation Tax (hotel room tax), which is shared between the State and the counties. Visitors do not require State expenditures on education, social services, and many other items. Construction activity also generates a high amount of excise taxes for the State because new homes and buildings are expensive.



For the County, much of the revenue required to subsidize services to residents are derived from a combination of high property tax assessments and high property-tax rates on resorts, time-share properties, second homes, commercial properties, and industrial properties. Operators of many of these properties provide their own security, waste removal, etc.

The focus of the material which follows is on the major State and County tax revenues generated by agricultural development and operations.

## **b. Central Maui**

### Typical Sugar (2006 Crop)

In 2006, sugar operations generated about \$5.9 million in State tax revenues and rental payments to the State (see Table 6, Section 6.a). Most of the revenues were derived from (1) excise taxes on consumption expenditures by families supported by the direct and indirect jobs that were provided, and (2) personal income taxes paid by these same families (see Table 6, Section 6.a). 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.

### Recent Sugar (Years 2008 to 2013)

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 (see Table 6, Section 6.a). 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.

### Post Sugar (Year 2017)

In 2017, diversified agriculture operations in Central Maui generated about \$30,000 in tax revenues (see Table 6, Section 6.a). 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.

Diversified Ag, Development Activity*Water Lease Limited to CWRM D&O Alternative*

For the Water Lease Limited to CWRM D&O Alternative, converting 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 (see Table 6, Section 6.a). However, developers of solar farms receive a State subsidy of \$500,000 per 1 MW of generating capacity. For the planned green energy (solar farm), the State subsidy would average about \$1.9 million per year, for a 10-year cumulative total of about \$18.8 million.

Thus, 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.

*No Water Lease Alternative*

For the No Water Lease Alternative, converting 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 6-year cumulative total of about \$11.4 million (see Table 6, Section 6.a).

For the planned green energy (solar farm), the State subsidy would average about \$3.1 million per year, for a 6-year cumulative total of about \$18.8 million.

Thus, State tax revenues minus the energy subsidy would average a negative \$1.2 million per year, for a 6-year cumulative total of a negative \$7.3 million.

Again, the County would derive negligible tax revenues from the anticipated development activity, while the City and County of Honolulu would derive cumulative excise-tax surcharges of about \$40,000.

Diversified Agriculture, Operations (Year 2030)*Water Lease Limited to CWRM D&O Alternative*

For the Water Lease Limited to CWRM D&O Alternative, diversified-agriculture operations would generate an estimated \$7.5 million in State tax revenues by 2030 (see Table 6, Section 6.a).

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.

*No Water Lease Alternative*

For the No Water Lease Alternative, State tax revenues would be about half those of the previous alternative: about \$3.8 million per year (see Table 6, Section 6.a).

Property taxes paid to the County would be about \$650,000 per year. This decrease from the previous alternative is due to more land being used for pasture, which is assessed at a lower value than cropland.

The City and County of Honolulu will derive about \$50,000 per year from the excise-tax surcharge.

**c. Upcountry Maui**Post Sugar (Year 2017).

In 2017, the farms at Kula Ag Park and other farms in Upcountry Maui that rely on water from the EMI System would generate about \$45,000 per year in State taxes (see Table 6, Section 6.b).

For the County, property taxes plus rents paid to the County by farmers at the Kula Ag Park totaled less than \$54,000 per year.

The City and County of Honolulu will derive about \$2,000 per year from the excise-tax surcharge.

Diversified Ag, Development Activity*Water Lease Limited to CWRM D&O Alternative*

For the Water Lease Limited to CWRM D&O Alternative, expansion of the Kula Ag Park will result in cumulative State tax revenues of about \$200,000 (see Table 6, Section 6.b).

The County would derive negligible tax revenues from the development activity.

*No Water Lease Alternative*

For the No Water Lease Alternative, expansion of the Kula Ag Park is not anticipated. As a result, there would be no development activity and no tax revenues.

Diversified Ag, Operations (Year 2030)*Water Lease Limited to CWRM D&O Alternative*

For the Water Lease Limited to CWRM D&O Alternative, the farms at the Kula Ag Park and other farms in Upcountry Maui that rely on water from the EMI System would generate about \$54,000 per year in State taxes (see Table 6, Section 6.b).

For the County, property taxes plus rents paid to the County by farmers at the Kula Ag Park would total about \$85,000 per year. Most of the increase from 2017 would be due to the additional rental income from the 262-acre expansion of Kula Ag Park.

The City and County of Honolulu would derive about \$2,000 per year from the excise-tax surcharge.

#### *No Water Lease Alternative*

For the No Water Diversions Alternative, farming activity and State taxes generated are expected to be near zero for the farms that depended on water from the EMI System in 2017 (see Table 6, Section 6.b). For these farms, water to irrigate crops is not expected to be available for several years as mentioned previously. Once farming ends, significant farming is not expected to return to the area because of better farming conditions in Central Maui.

The County would lose rents from the Kula Ag Park, and property taxes would be lower, assuming that the lands would be assessed at pasture values.

#### **d. East Maui**

For all water-lease alternatives, the taro farms and other farms in East Maui that depend on stream flows will generate less than \$70,000 per year in State taxes at full development (see Table 6, Section 6.b).

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.

### **13. SUMMARY OF ECONOMIC IMPACTS AND BENEFITS**

#### **a. Major Impacts and Benefits**

Table ES-1 summarizes the major impacts and benefits for the past baseline conditions and two of the three alternatives for the future. The table is divided into 6 parts: (1) Water Supply and Allocation, (2) Agricultural Land Use, (3) Agricultural Water Use, (4) Agricultural Development and Operations, (5) Employment and Payroll, and (6) State and County Revenues. Mahi Pono's current Farm Plan assumes full development by about 2030. Also, all dollar amounts are expressed in 2018 purchasing power.

#### Water Supply and Allocation

The supply of East Maui surface water that is available for Central and Upcountry Maui is projected to decline significantly: from about 156.54 mgd for Typical Sugar, to 92.32 mgd for the Water Lease Limited to CWRM D&O Alternative, and to 30.76 mgd for the No

Water Lease Alternative. For the No Water Lease Alternative, all of the water would come from private lands.

The total water supply (surface water plus groundwater) would decline from about 199.04 mgd for Typical Sugar to 113.63 for the Water Lease Limited to CWRM D&O Alternative and 38.44 mgd for No Water Lease Alternative. The use of groundwater is limited in order to keep salinity below about 30‰ when applied to lower fields in Central Maui.

For the Water Lease Limited to CWRM D&O Alternative, about 106.53 mgd would be allocated to Central Maui for agricultural use, and 7.1 to MDWS for Upcountry Maui.<sup>5</sup> For the No Water Lease Alternative, all of the water would be allocated to Central Maui for agricultural use.

### Agricultural Land Use

#### *Central Maui*

For the Water Lease Limited to CWRM D&O Alternative, about 15,950 acres would be used for growing crops, including 12,850 acres for orchard crops and 3,100 acres for other crops. About 13,800 acres would be used for pasture, of which about 4,700 acres would be irrigated. About 250 acres would be used for green energy, such as a solar farm.

For the No Water Lease Alternative, the reduced supply of water would require a major reallocation of land from growing crops to unirrigated pasture. About 5,250 acres would be used for growing crops, including 4,180 acres for orchard crops and 1,100 acres for other crops. About 24,470 acres would be used for pasture, of which about 3,800 acres would be irrigated. Land for green energy would remain at 250 acres.

#### *Upcountry Maui*

For the Water Lease Limited to CWRM D&O Alternative, about 1,520 acres of farmland would be irrigated with water from the EMI System.

For the No Water Lease Alternative, farmlands in Upcountry Maui that have been irrigated with water from the EMI System are expected to drop to zero acreage for the reasons given in Section 6.b.

#### *East Maui*

As indicated in the CWRM D&O, stream restoration could result in 44.83 acres planted in taro in East Maui, and 35.09 acres in other crops. These estimated acreages are the same for all alternatives.

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5. 7.1 mgd was the long-term average presented in the CWRM D&O.

## Agricultural Water Use

### *Central Maui*

Agricultural water use in Central Maui is projected to decline from about 143.19 mgd for Typical Sugar to 82.34 mgd for the Water Lease Limited to CWRM D&O Alternative and 29.72 mgd for No Water Lease Alternative.

### *Upcountry Maui*

For the Water Lease Limited to CWRM D&O Alternative, about 4.16 mgd would be used to irrigate farms supplied with water from the EMI System.

For the No Water Lease Alternative, it is assumed that no water would be delivered from the EMI System.

### *East Maui*

For all water-lease alternatives, gross and net water requirements would be about 6.28 and 1.52 mgd, respectively (derived from the CWRM D&O acreage estimates for the affected farms in East Maui). 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.

## Agricultural Development and Operations

### *Central Maui*

For the Water Lease Limited to CWRM D&O Alternative, converting Central Maui from sugarcane to diversified agriculture would entail a capital investment of about \$214.7 million for land preparation and improvements, with expenditures spread out over approximately 10 years. During this period, expenditures and indirect sales would average about \$39.9 million per year. Corresponding figures for the No Water Lease alternative are \$144.8 million invested over about 6 years, with expenditures and indirect sales averaging about \$42.9 million per year.

At full operations, and assuming the Water Lease Limited to CWRM D&O Alternative, farm sales would total about \$160.7 million per year, of which about \$104.4 million would be Hawai'i sales and \$56.2 million would be export sales. Adding energy sales of about \$8.2 million results in total direct sales of about \$168.9 million per year. Direct and indirect sales would total about \$329.5 million per year.

The direct sales of about \$160.7 million per year exceeds sales during sugar operations: about \$100.7 million per year for Typical Sugar, and about \$115.6 million for Recent Sugar. The HC&S revenues figures are for the former plantation lands east of Maui Veterans Highway, and not the entire plantation.

For the No Water Lease Alternative, operations would generate much lower farm sales: about \$57.7 million per year in farm sales, of which about \$46.1 million would be Hawai'i sales and \$11.5 million would be export sales. Adding energy sales results in total direct sales of about \$65.9 million per year. Direct and indirect sales would total about \$123.5 million per year.

#### *Upcountry Maui*

For the Water Lease Limited to CWRM D&O Alternative, the farms that depend on water from the EMI System would generate direct sales of about \$14.1 million per year. Direct and indirect sales would total about \$31.8 million per year.

For the No Water Lease Alternative, these figures would drop to zero.

#### *East Maui*

For all water-lease alternatives, the farms in East Maui that depend on stream water would generate about \$1.4 million per year in direct sales, and about \$2.9 million per year in direct and indirect sales.

### Employment and Payroll

#### *Central Maui*

For the Water Lease Limited to CWRM D&O Alternative, converting Central Maui from sugarcane to diversified agriculture would employ an average of about 210 workers over a period of about 10 years. Corresponding figures for the No Water Lease Alternative are an average of about 175 workers over about 6 years.

At full operations of farming operations in Central Maui, and assuming the Water Lease Limited to CWRM D&O Alternative, employment would reach about 790 direct jobs with a payroll of about \$28.5 million per year, and 1,140 direct and indirect jobs with a payroll of \$45.3 million. The direct employment of 790 jobs would exceed the 630 direct jobs formerly provided by HC&S for Typical Sugar. The HC&S employment figure is for the former plantation lands east of Maui Veterans Highway, and not the entire plantation.

For the No Water Lease Alternative, full operations would provide about 270 direct jobs with a payroll of about \$9.9 million per year, and 390 direct and indirect jobs with a payroll of \$15.6 million.

#### *Upcountry Maui*

For the Water Lease Limited to CWRM D&O Alternative, the farms that depend on water from the EMI System would provide about 100 jobs with a payroll of about \$3.5

million per year, and would generate about 150 direct and indirect jobs having a payroll of \$5.8 million.

For the No Water Lease Alternative, these figures would drop to zero.

### *East Maui*

For all water-lease alternatives, the farms in East Maui that depend on stream water would provide about 14 jobs with a payroll of about \$500,000 per year, and generate about 21 direct and indirect jobs having a payroll of about \$800,000.

## State and County Revenues

### *Central Maui*

For the Water Lease Limited to CWRM D&O Alternative, the expenditures on land preparation and capital improvements needed to convert Central Maui from sugarcane to diversified agriculture would generate State tax revenues of about \$18.62 million over the assumed 10-year development period, but this would be offset by energy subsidies of \$18.75 million, for net loss of about \$130,000. State revenues would come from excise taxes, corporate income taxes, and personal income taxes. The County derives negligible tax revenues from development activity: there are no major County taxes on expenditures for land preparation and improvements, profits generated, or the payroll of those involved with the development activity. However, once the improvements are completed, the County will benefit from an increase in property-tax revenues due to the increased property values.

For the No Water Lease Alternative, the conversion would generate State tax revenues of about \$11.41 million over the assumed 6-year development period, but this would be offset by energy subsidies of \$18.75 million, for a net loss of about \$7.34 million.

At full operations of farming operations in Central Maui, and assuming the Water Lease Limited to CWRM D&O Alternative, State tax revenues would be about \$4.46 million per year, and County property taxes would be about \$800,000 per year. Property taxes for the County are low because agricultural land is assessed at agricultural values, not at market values.

For the No Water Lease Alternative, full operations would generate State tax revenues of about \$1.66 million per year, and County tax revenues of about \$650,000. Tax revenues for the State are less because crop production and sales would be less. Property taxes are lower because more of the land would be used for pasture, which has a lower assessed value than cropland.

### *Upcountry Maui*

For the Water Lease Limited to CWRM D&O Alternative, the farms that depend on water from the EMI System would generate annual State taxes of about \$540,000, and



County revenues of about \$850,000. The County revenues include property taxes and rents from the Kula Ag Park.

For the No Water Lease Alternative, most of these figures would drop to zero or near zero because of the loss of farms and farm production. The County would lose rents from the Kula Ag Park, and property tax revenues would be lower, assuming the agricultural lands would be assessed at pasture values.

### *East Maui*

For all water-lease alternatives, the East Maui farms would generate about \$67,000 per year in State taxes and about \$100 in County property taxes.

## **b. Water Lease Limited to CWRM D&O Alternative vs the No Water Lease Alternative**

### Central Maui

For Central Maui, the Water Lease Limited to CWRM D&O Alternative would provide far more economic activity and benefits than would the No Water Lease Alternative. The difference between the two alternatives would be as follows:

- About 11,570 acres more green open space in the form of farms and irrigated pastures (20,650 acres vs 9,080 acres).
- About three times as much food production, including greater food self-sufficiency and more exports.
- About \$206 million per year more in direct and indirect sales (\$329.5 million vs \$123.5 million).
- About 750 more direct and indirect jobs (1,140 jobs vs 390 jobs).
- About \$29.7 million per year more in total payroll (\$45.3 million vs \$15.6 million).
- Development activity (land preparation and capital improvements) lasting about 4 years longer (10 years vs 6 years), with similar magnitudes of sales and employment (about \$40 million per year direct and indirect sales, and about 300 direct and indirect jobs).
- About \$2.9 million per year more in State and County tax revenues (\$4.6 million vs \$1.7 million).

### Upcountry Maui

For Upcountry Maui, the Water Lease Limited to CWRM D&O Alternative would allow farming to continue and expand at the Kula Ag Park, and continue at other farms that irrigate crops with water originating from the EMI System. In total, about 1,510 acres would

be farmed in 2030, generating about \$31.8 million per year in direct and indirect sales, about 150 direct and indirect jobs, and about \$5.8 million in payroll for these jobs.

For the No Water Diversions Alternative, farming activity is expected to be near zero for the farms that depended on water from the EMI System in 2017. For these farms, water to irrigate crops is not expected to be available for several years, and once farming ends, significant farming is not expected to return to the area because of better farming conditions in Central Maui.

### East Maui

All alternatives would result in the same agricultural activity and benefits for East Maui (see Table 7., Section 7c).

#### **c. Water Lease with Less than CWRM D&O Alternative**

For the Water Lease with Less than CWRM D&O Alternative, the State would allow water to be diverted from East Maui to Central Maui in an amount falling between (1) the 92.32-mgd flow estimated for the Water Lease Limited to CWRM D&O Alternative, and (2) the 30.76-mgd flow estimated for the No Water Lease Alternative. To demonstrate the impacts of such an intermediate alternative, the following table provides (1) the impacts of the Water Lease Limited to CWRM D&O Alternative at full operations of the Mahi Pono Farm plan, and (2) the incremental changes in these impacts (in red) caused by each mgd-reduction in surface water from the 92.32-mgd flow estimated for the Water Lease Limited to CWRM D&O Alternative.

	<u>Central Maui</u>	<u>Upcountry Maui</u>	<u>Units</u>
— Land use			
• Crops	15,950	1,509	acres
Decrease per 1 mgd	173.31	24.51	acres
• Irrigated pasture	4,700		acres
Decrease per 1 mgd	14.62		acres
• Unirrigated pasture	9,100		acres
Increase per 1 mgd	187.93		acres
— Sales, Ag operations			
• Direct sales	\$168.9	\$15.1	million/yr
Decrease per 1 mgd	\$1.673	\$0.245	million/yr
• Direct and indirect sales	\$329.5	\$31.8	million/yr
Decrease per 1 mgd	\$3.346	\$0.517	million/yr

— Employment			
• Direct	793	101	jobs
Decrease per 1 mgd	8.447	1.634	jobs
• Direct and indirect	1,142	149	jobs
Decrease per 1 mgd	12.164	2.418	jobs
— Payroll			
• Direct payroll	\$28.5	\$3.5	million/yr
Decrease per 1 mgd	\$0.303	\$0.057	million/yr
• Direct and indirect payroll	\$45.3	\$5.8	million/yr
Decrease per 1 mgd	\$0.481	\$0.095	million/yr
— State Revenues	\$4.46	\$0.54	million/yr
Decrease per 1 mgd	\$0.0456	\$0.0088	million/yr

Thus, each 1-mgd reduction of surface water from the Water Lease Limited to CWRM D&O Alternative would result in the following changes for Central Maui (first column of the above table): a reduction by about 173 acres of land in crops, a reduction by about 15 acres of land in irrigated pasture, an increase of about 188 acres of land in unirrigated pasture, a reduction in direct sales on Maui of about \$1.7 million per year, a reduction in direct-and-indirect sales on Maui and O‘ahu of about \$3.3 million per year, about 8.5 fewer direct jobs on Maui having a payroll of about \$300,000 per year, about 12 fewer direct-and-indirect jobs on Maui and O‘ahu having a payroll of about \$500,000 per year, and a reduction in State revenues of about \$50,000 per year. Significant but smaller changes would occur for Upcountry Maui (second column of the above table).

For illustration of a line-item calculation, if the EMI System were to supply 70 mgd of surface water under an intermediate alternative, then direct employment in Central Maui would be about 604 jobs calculated as follows:

- Reduction in surface-water supply: 22.32 mgd (92.32 mgd – 70 mgd).
- Reduction in direct employment: 189 jobs (22.32 mgd decrease in surface-water supply × 8.447 direct jobs/mgd from the above table).
- Resulting direct employment: 604 jobs (793 jobs under the Water Lease Limited to CWRM D&O Alternative – 189 fewer jobs because of less water)

## 14. CONSISTENCY WITH STATE AND COUNTY AGRICULTURAL POLICIES

The *Hawai‘i State Constitution*, the *Hawai‘i State Plan*, the *State Agriculture Functional Plan*, *Hawai‘i Revised Statute for Important Agricultural lands* (Chapter 205), the *County of Maui 2030 General Plan*, and the *County’s Maui Island Plan* call directly or implicitly for preserving the economic viability of plantation agriculture and promoting the growth of diversified agriculture, some specifically targeting agriculture in Central Maui (see Ap-

pendix). To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured and protected.

With regard to plantation agriculture, HC&S was the last sugarcane plantation in Hawai‘i. The Hali‘imaile Pineapple Company in Upcountry Maui irrigates its fields with groundwater, not surface water from East Maui.

The Mahi Pono Farm Plan will conserve the about 30,000 acres of high-quality agricultural land in Central Maui, and these lands will be used for diversified crops and ranching. Furthermore, the IAL designation of about 23,000 acres will help conserve this valuable farmland. However, the amount of usable farmland in Central Maui will depend on how much water the State allows to be diverted from East Maui to Central Maui under the Water Lease.

The Water Lease Limited to CWRM D&O Alternative would maintain the viability of diversified farms in Upcountry Maui that depend on water from the EMI System. But these farms could be lost under the No Water Lease Alternative due to a lack of waters. Even after new wells are developed to fill the shortfall in the supply, significant farming is not expected to return to the area because of better farming conditions in Central Maui. For the Water Lease with Less than CWRM D&O Alternative, the loss of farming activity in Upcountry Maui would be proportional to the reduced water availability from the EMI System.

For all water-lease alternatives, farming in East Maui is expected to increase because CWRM D&O has restored full flow of the taro streams.

Of the three alternatives, the Water Lease Limited to CWRM D&O Alternative is the most compatible with State and County agricultural policies. This alternative would (1) preserve and protect the most agricultural land and water, and (2) promote the most agricultural activity.

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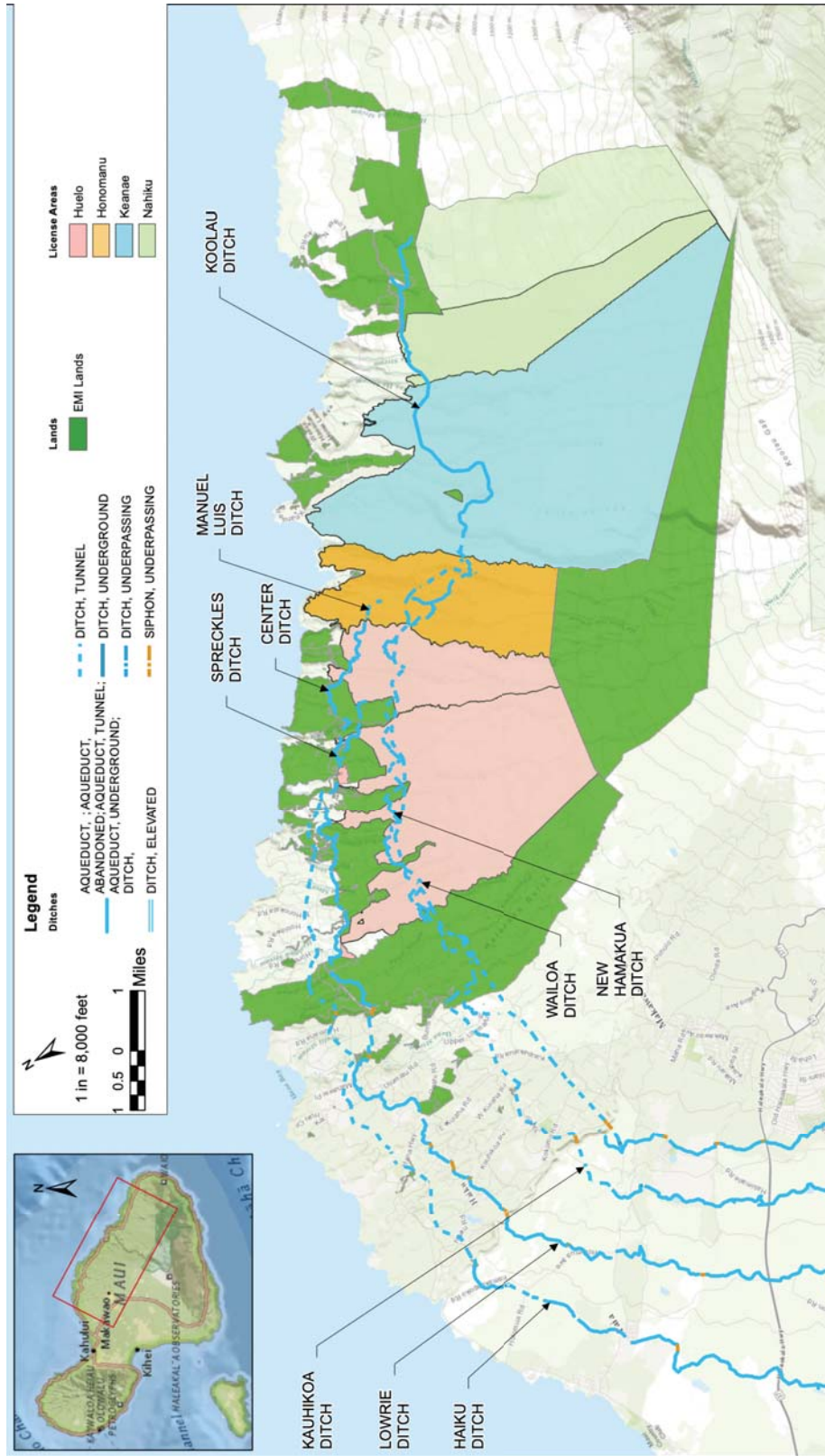


Figure 1. EMI Aqueduct System

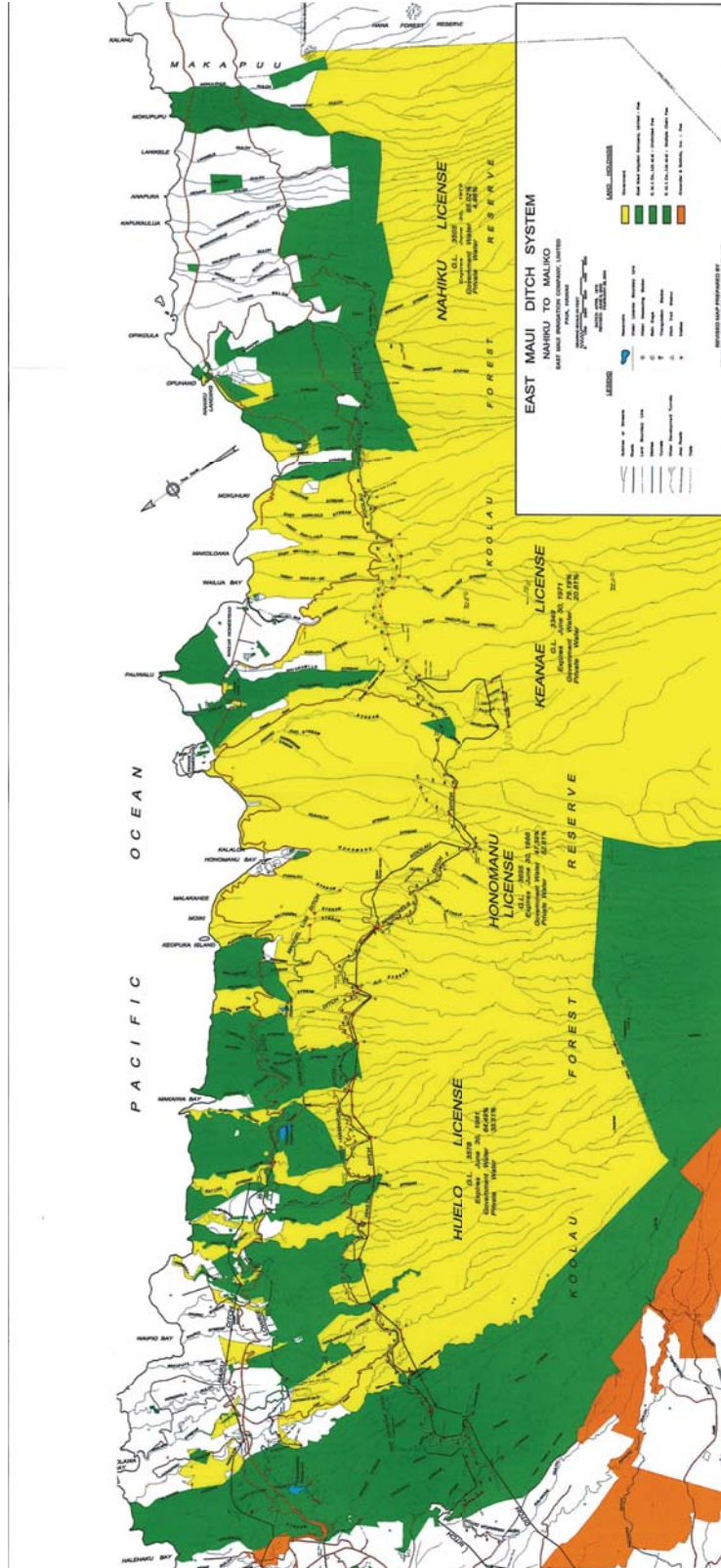


Figure 2. EMI Lease Areas



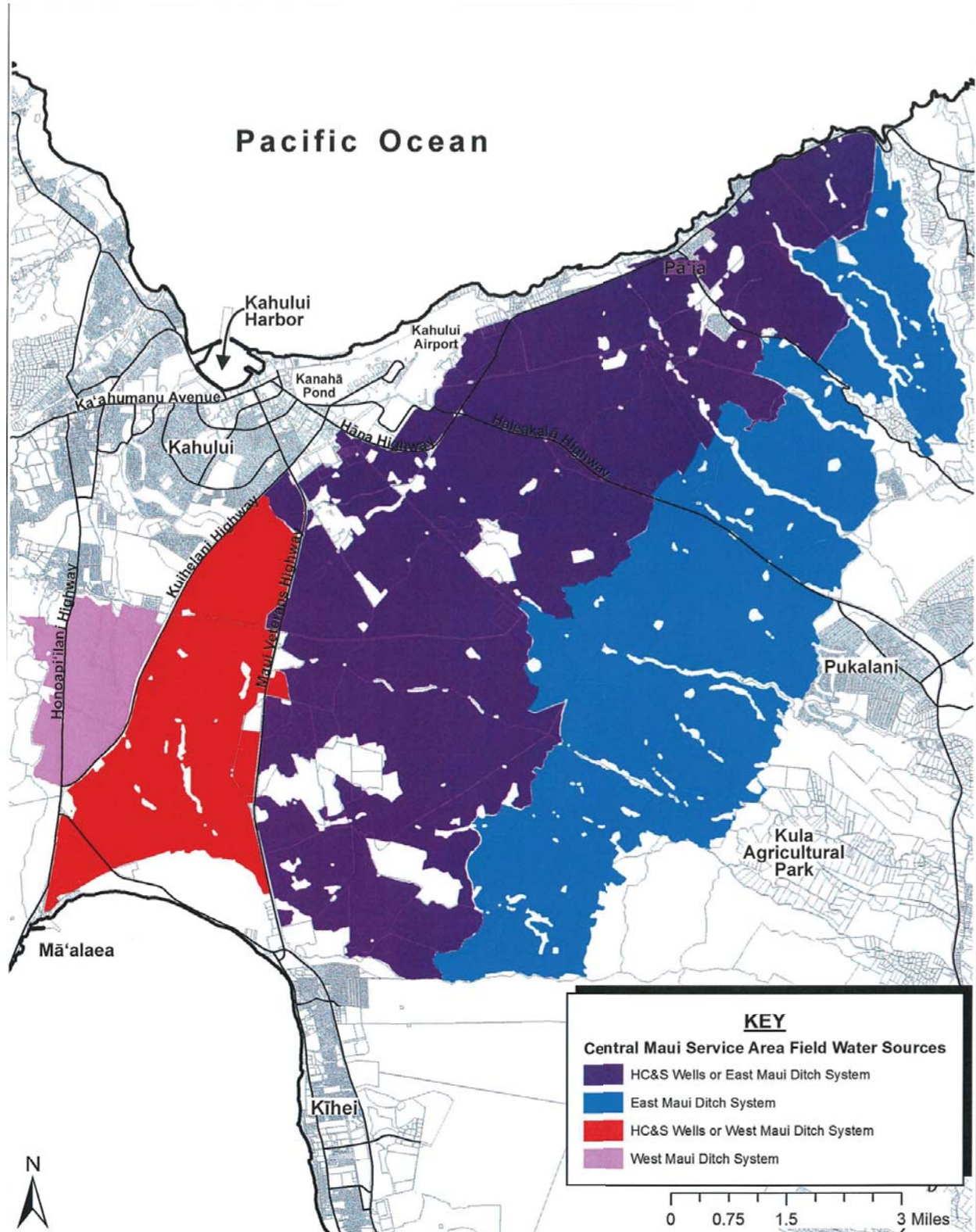


Figure 3. Central Maui Ag Lands and Water-Service Areas

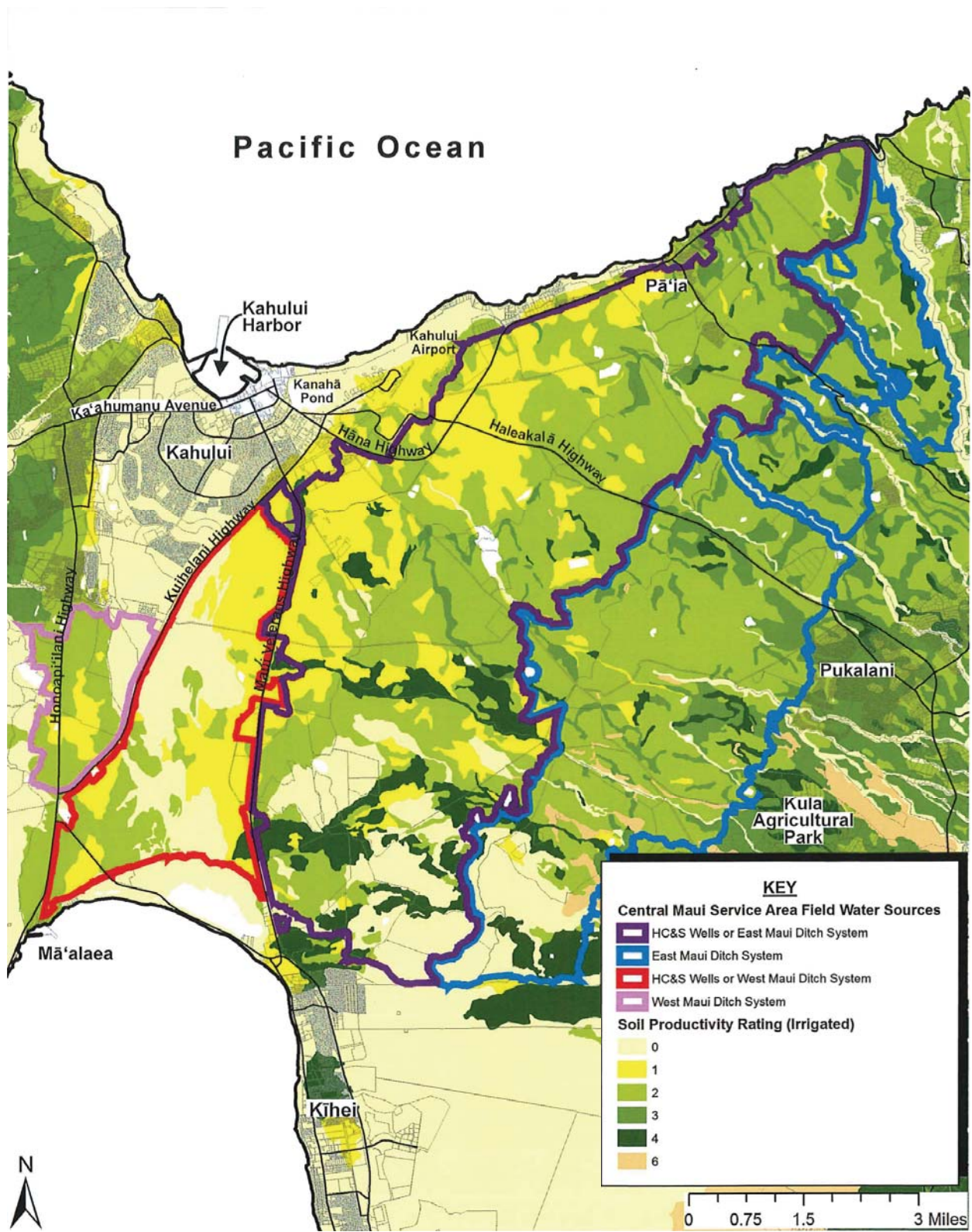


Figure 4. Central Maui, NRCS Soil Ratings, Irrigated



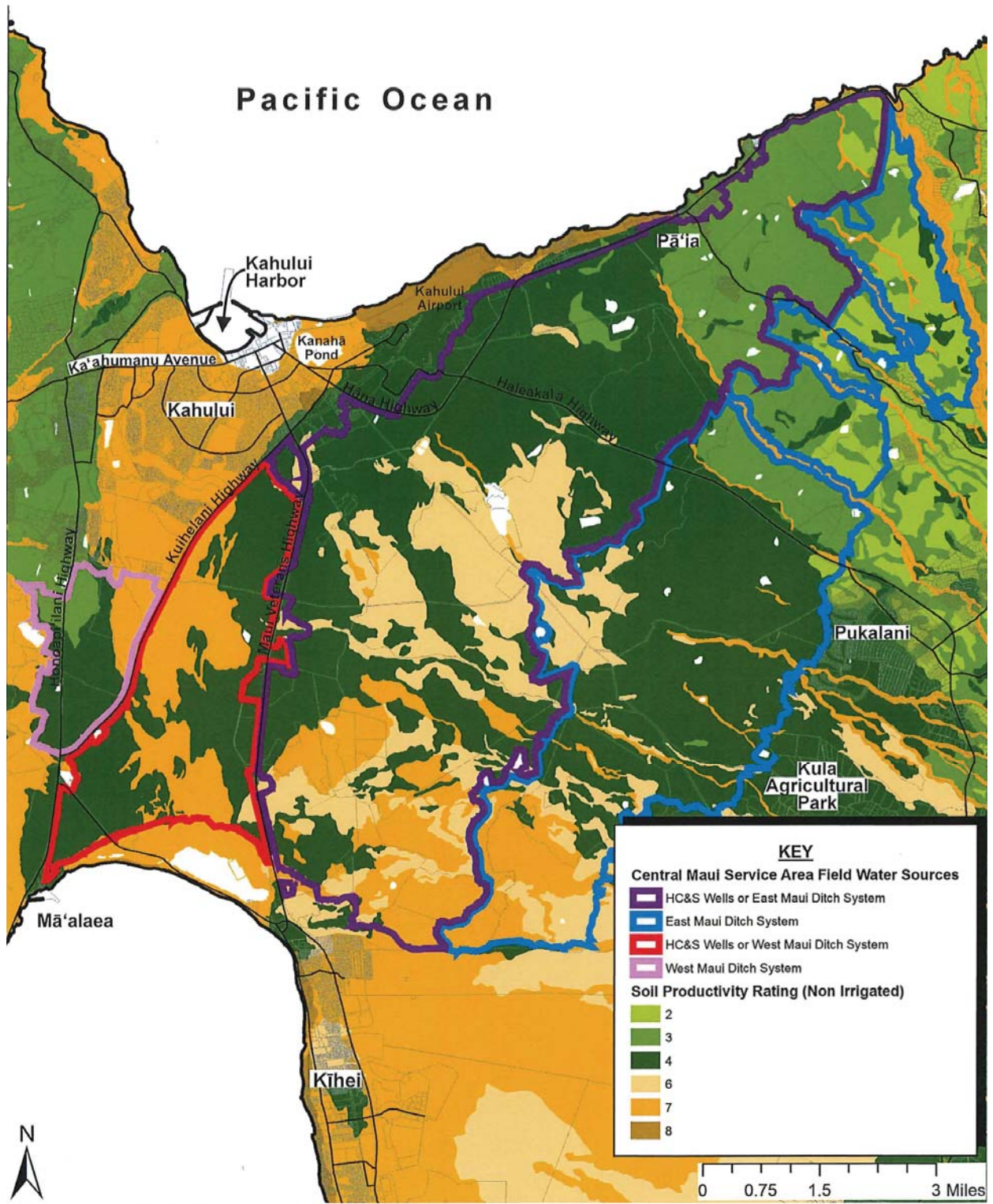


Figure 5. Central Maui, NRCS Soil Ratings, Non Irrigated

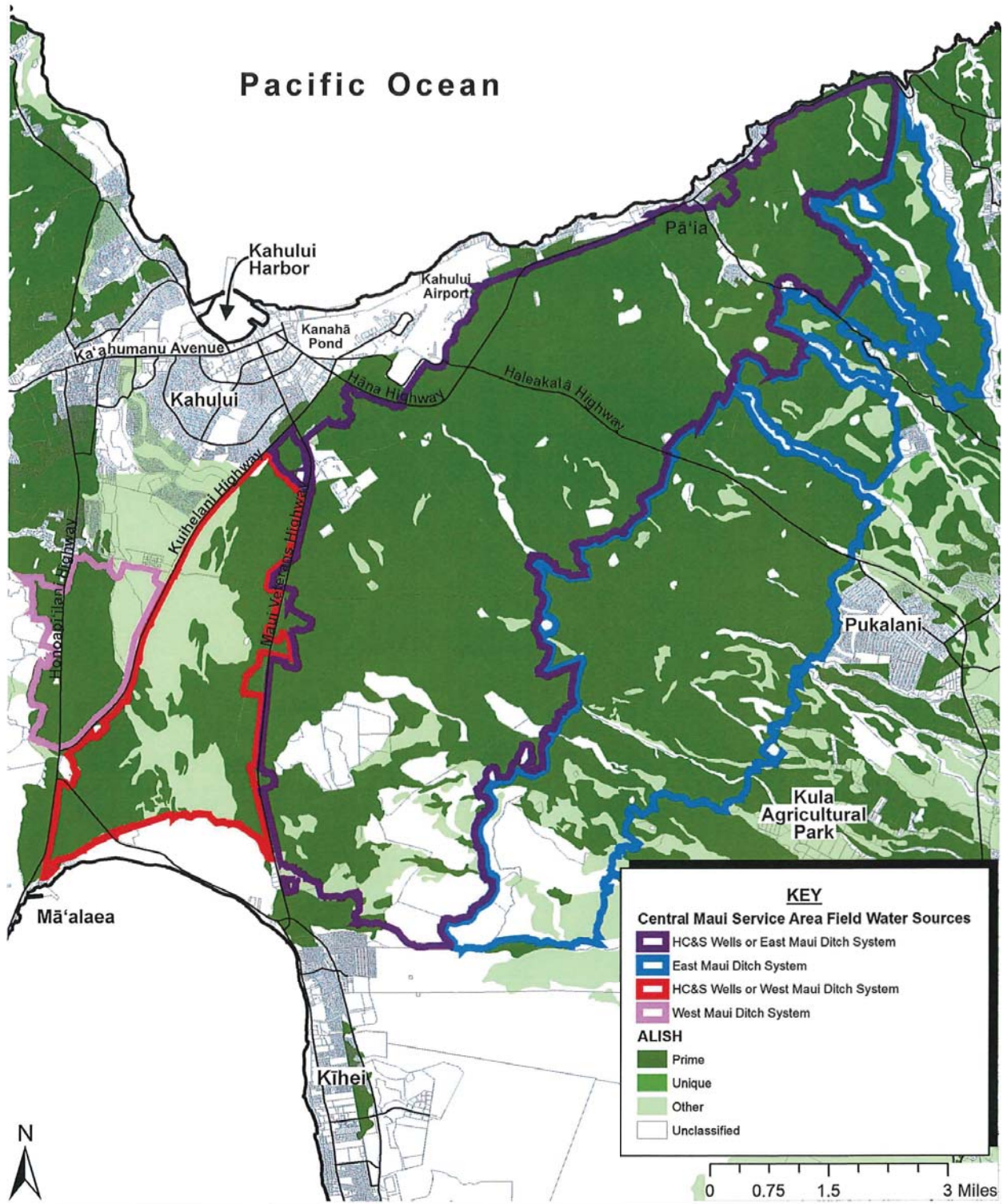


Figure 6. Central Maui, ALISH Soil Ratings



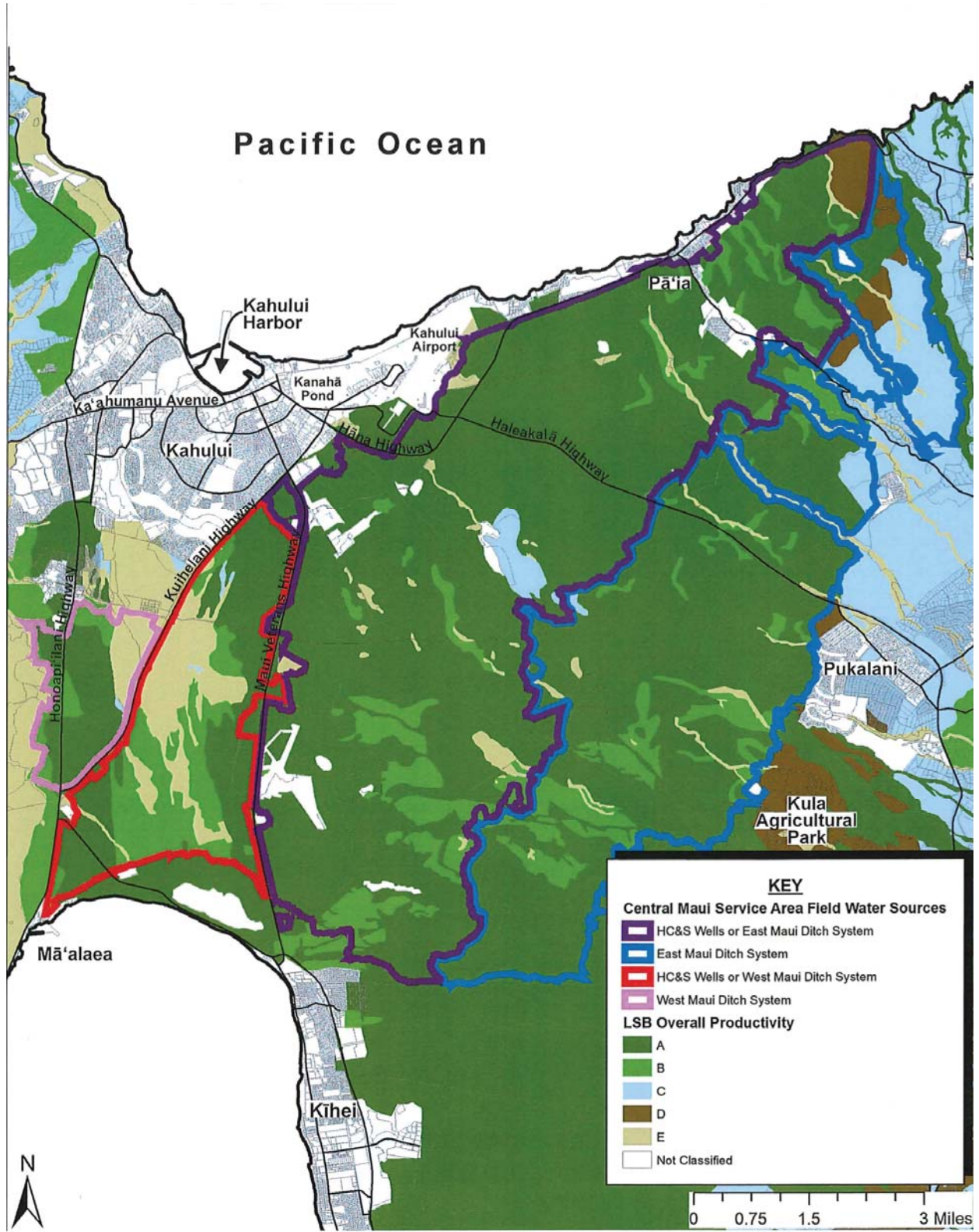


Figure 7. Central Maui, LSB Soil Ratings

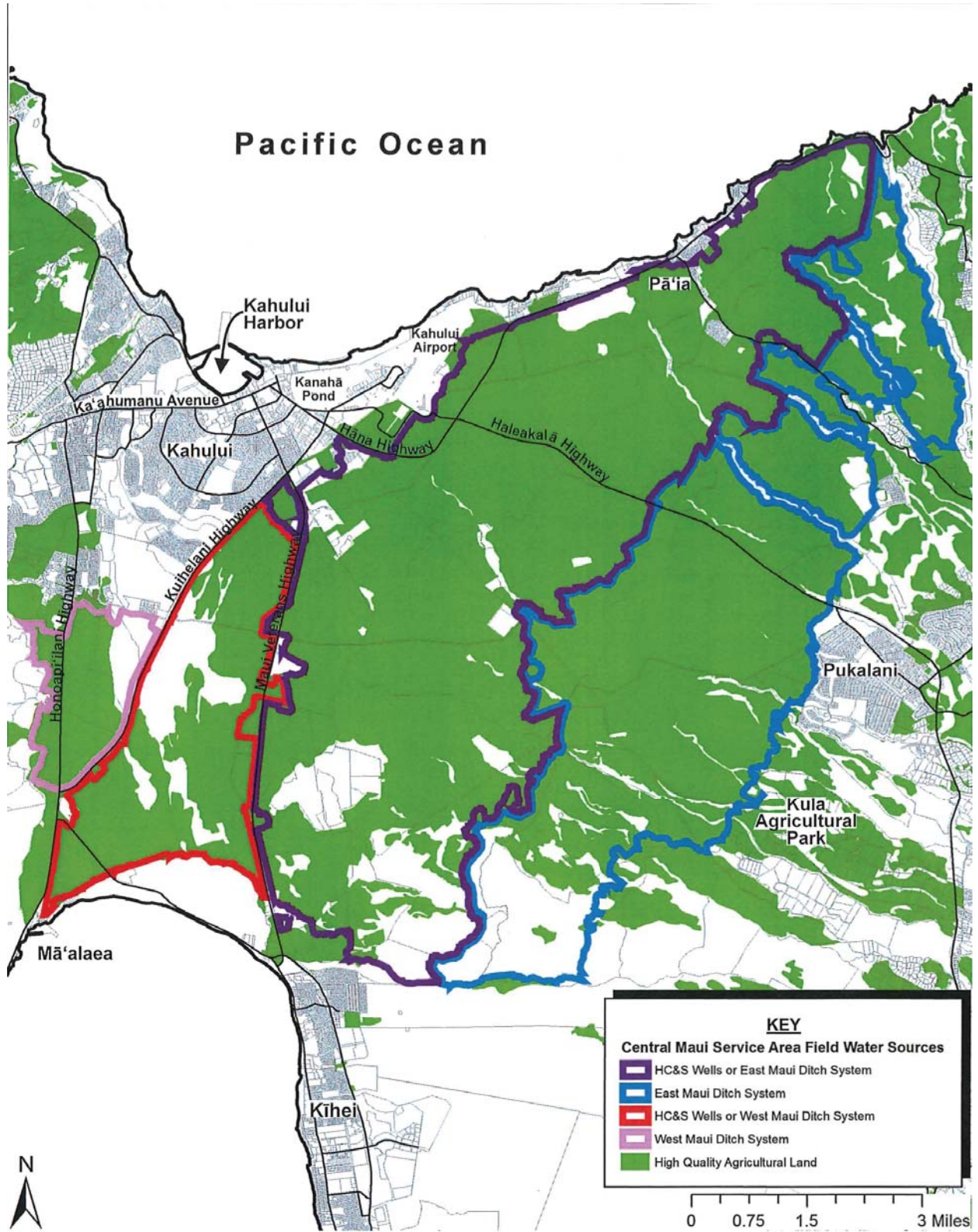


Figure 8. Central Maui, High-Quality Farmland



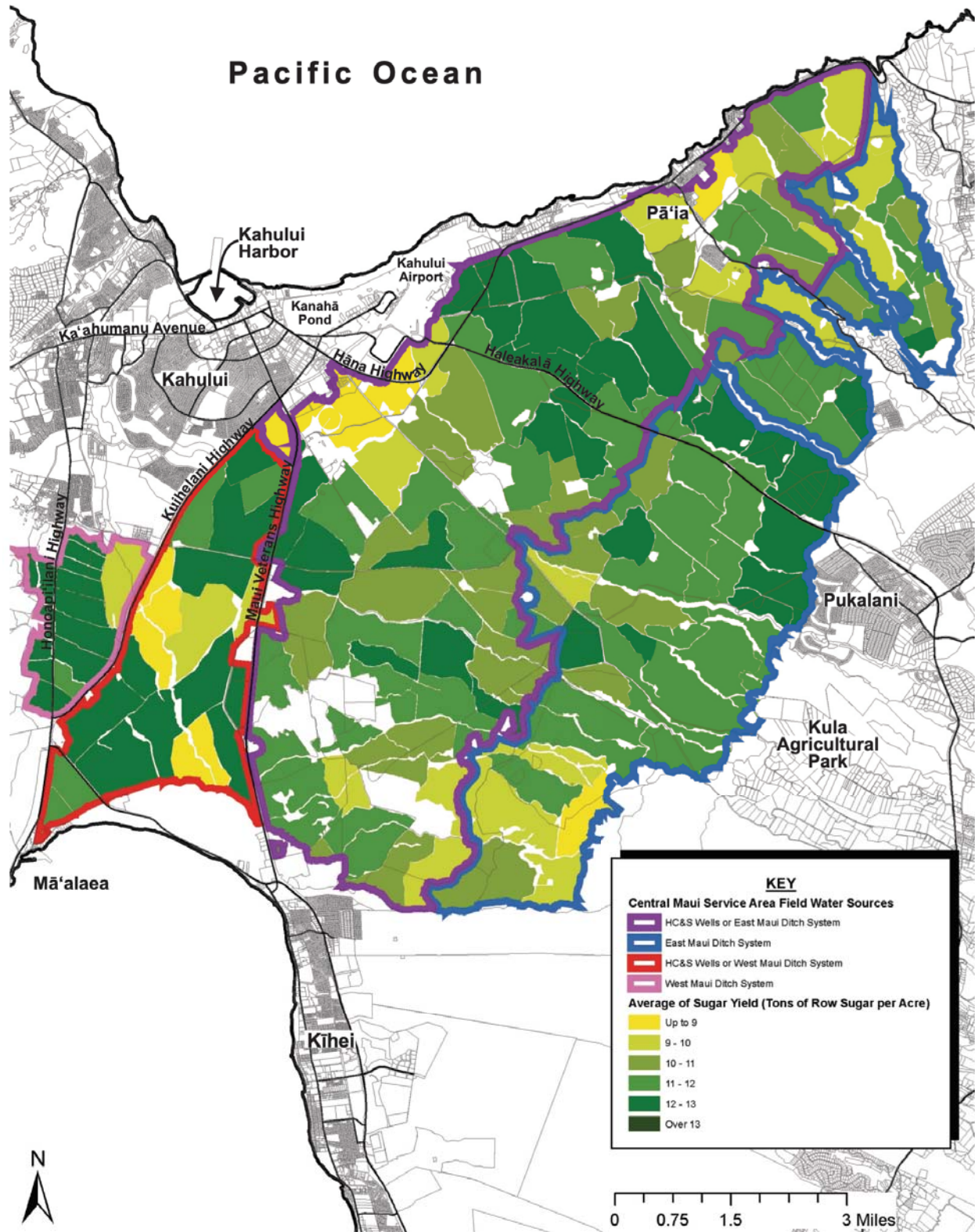


Figure 9. Central Maui, Sugar Yields

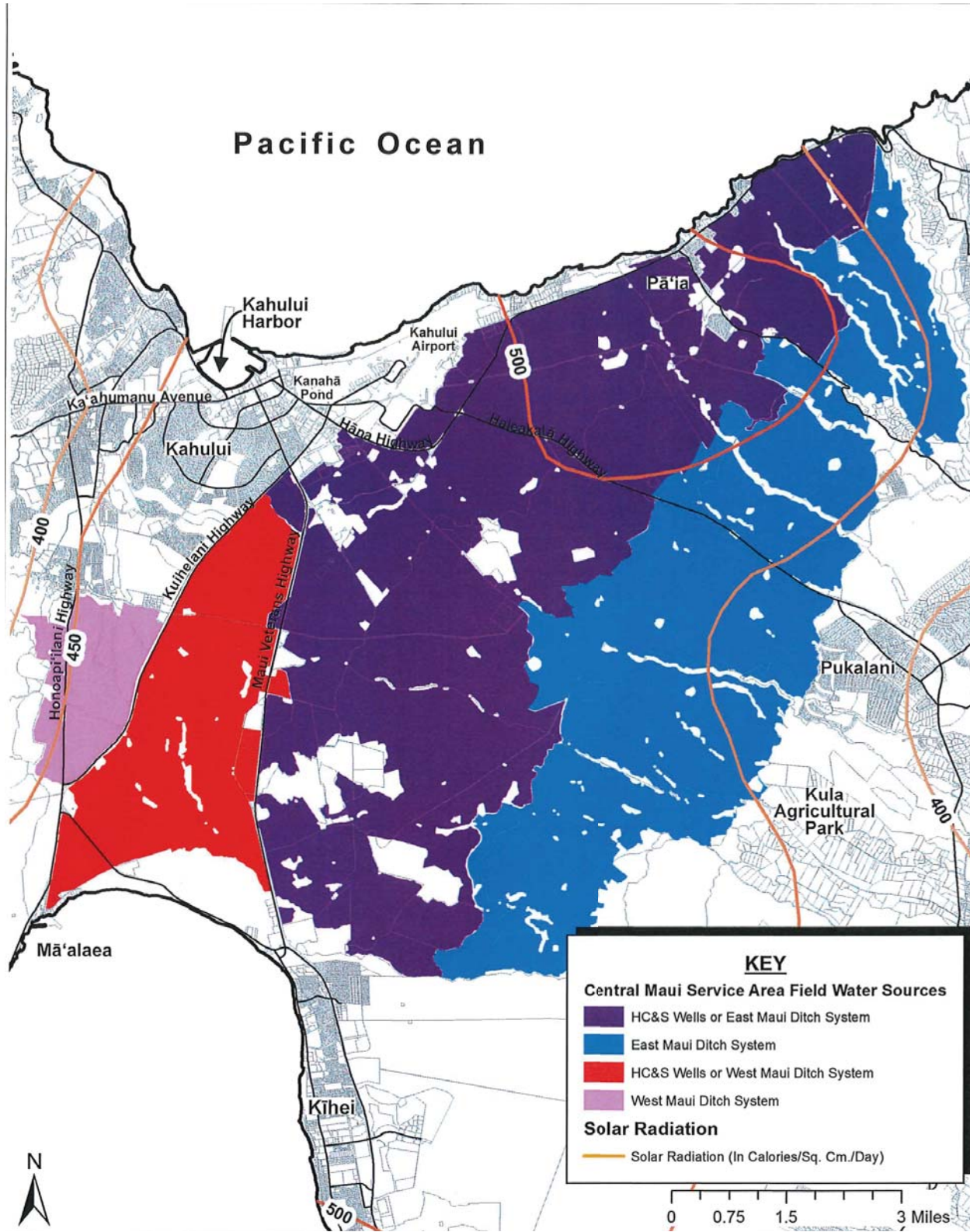


Figure 10. Central Maui, Solar Radiation



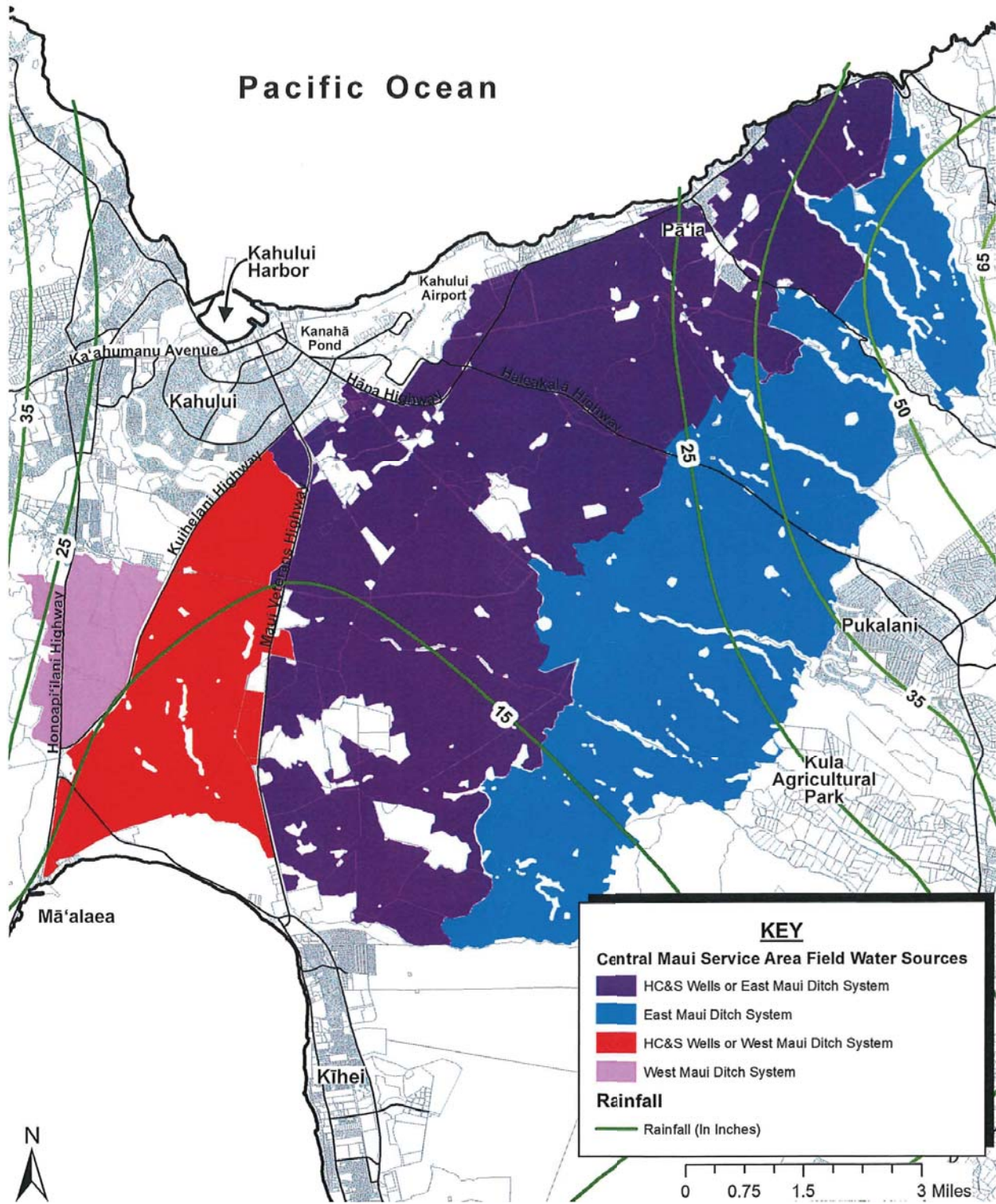


Figure 11. Central Maui, Rainfall

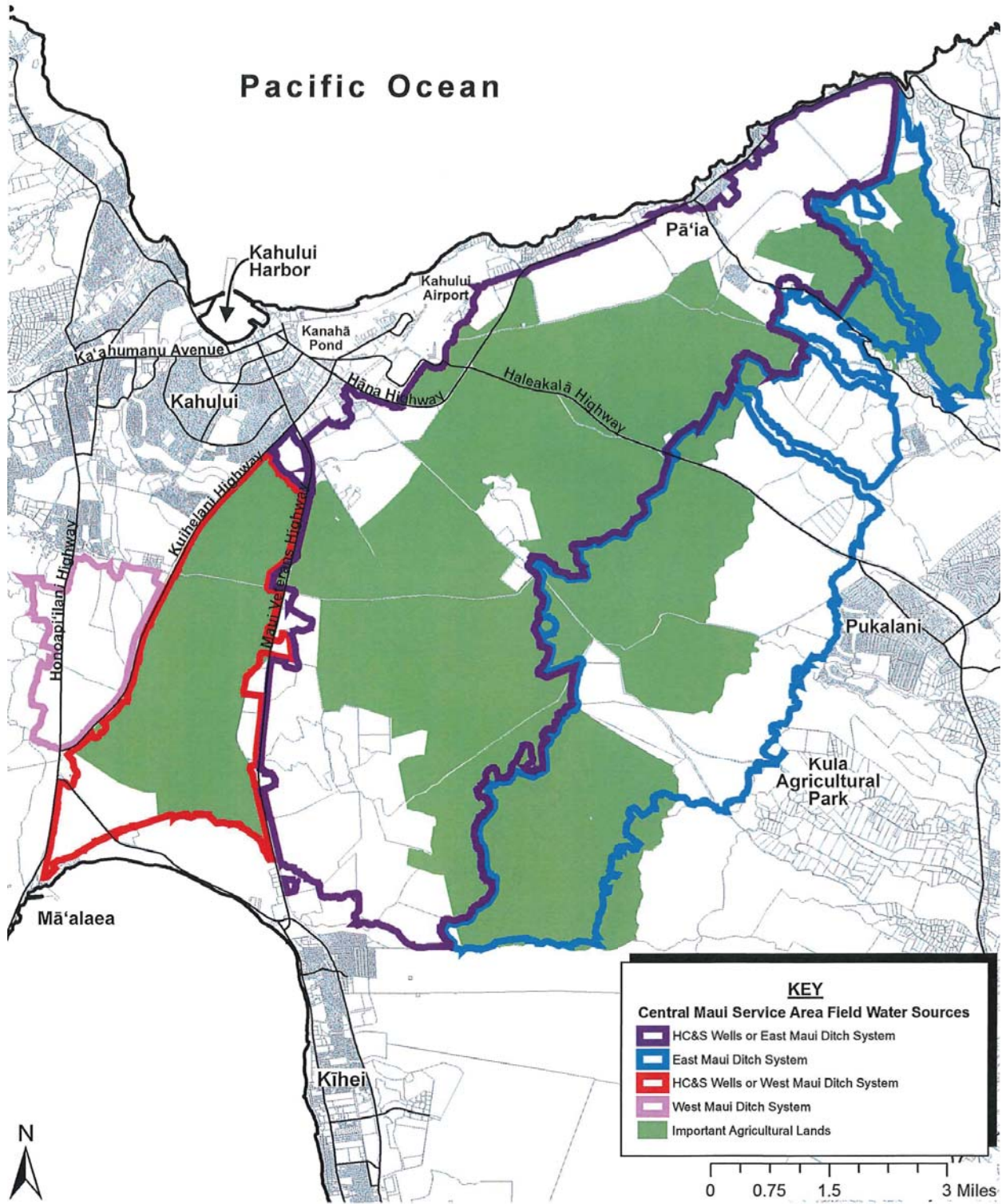


Figure 12. Central Maui, Important Agricultural Lands (IAL)



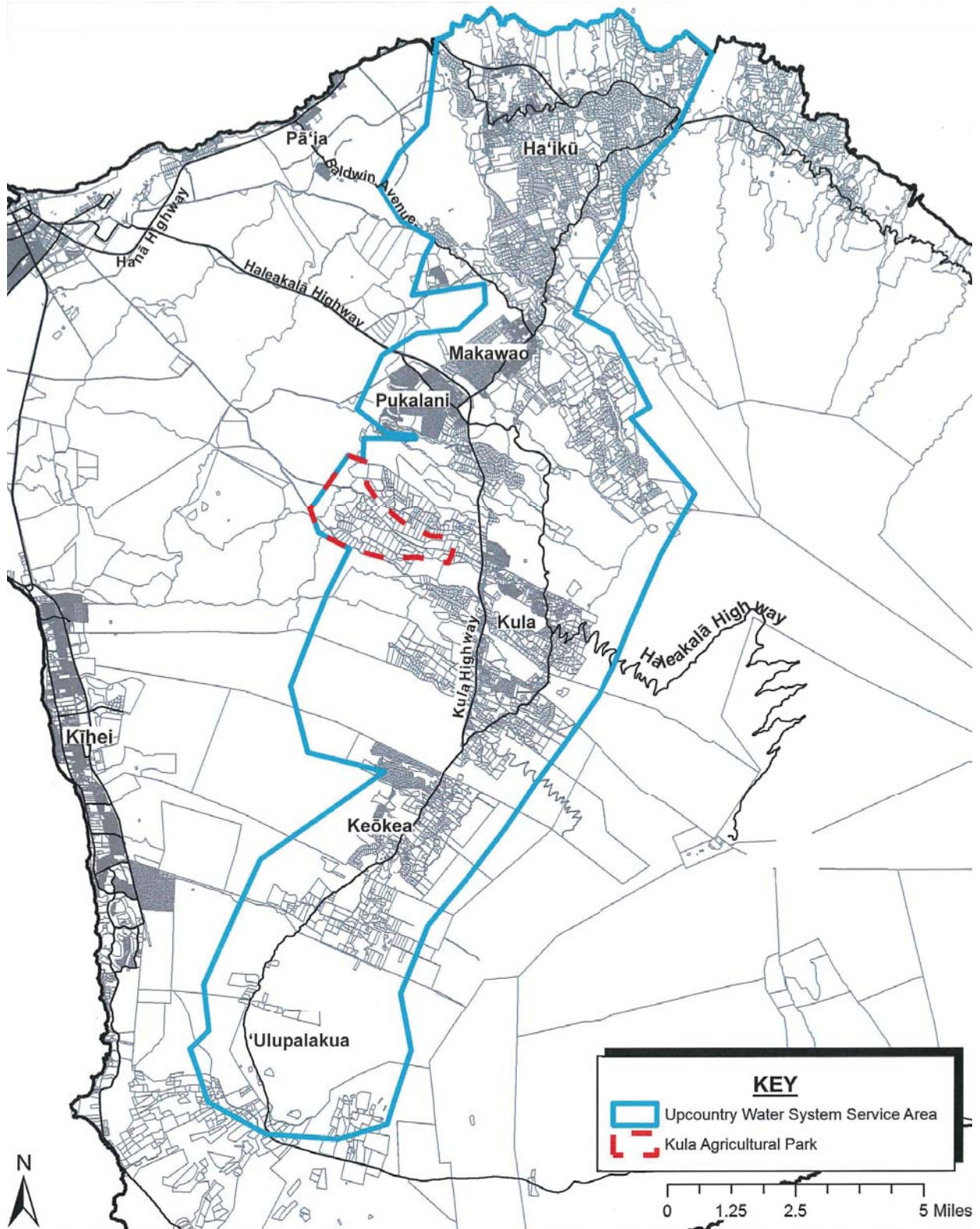


Figure 13. Upcountry Maui, Water System Service Area

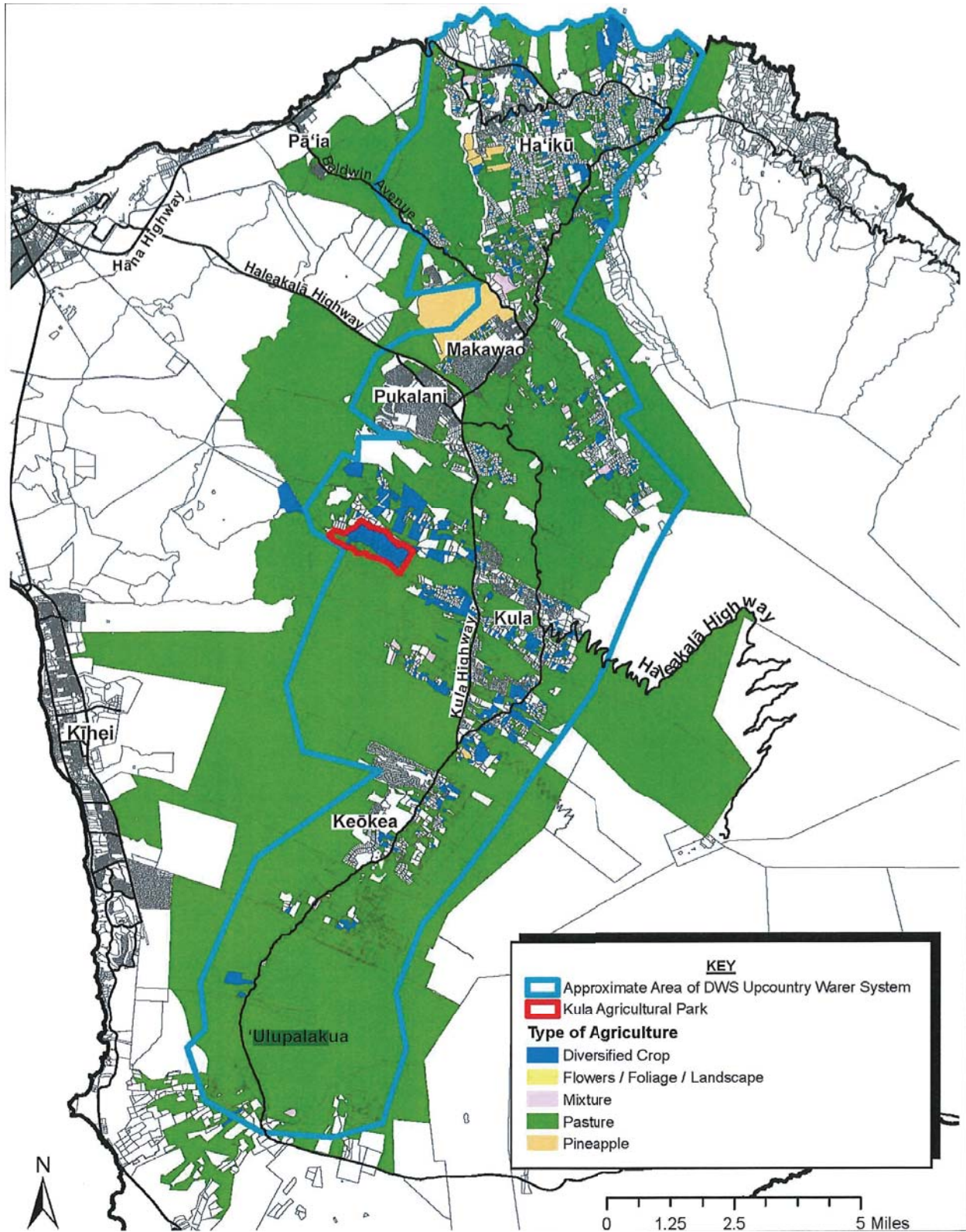


Figure 14. Upcountry Maui, Ag Lands and Activities



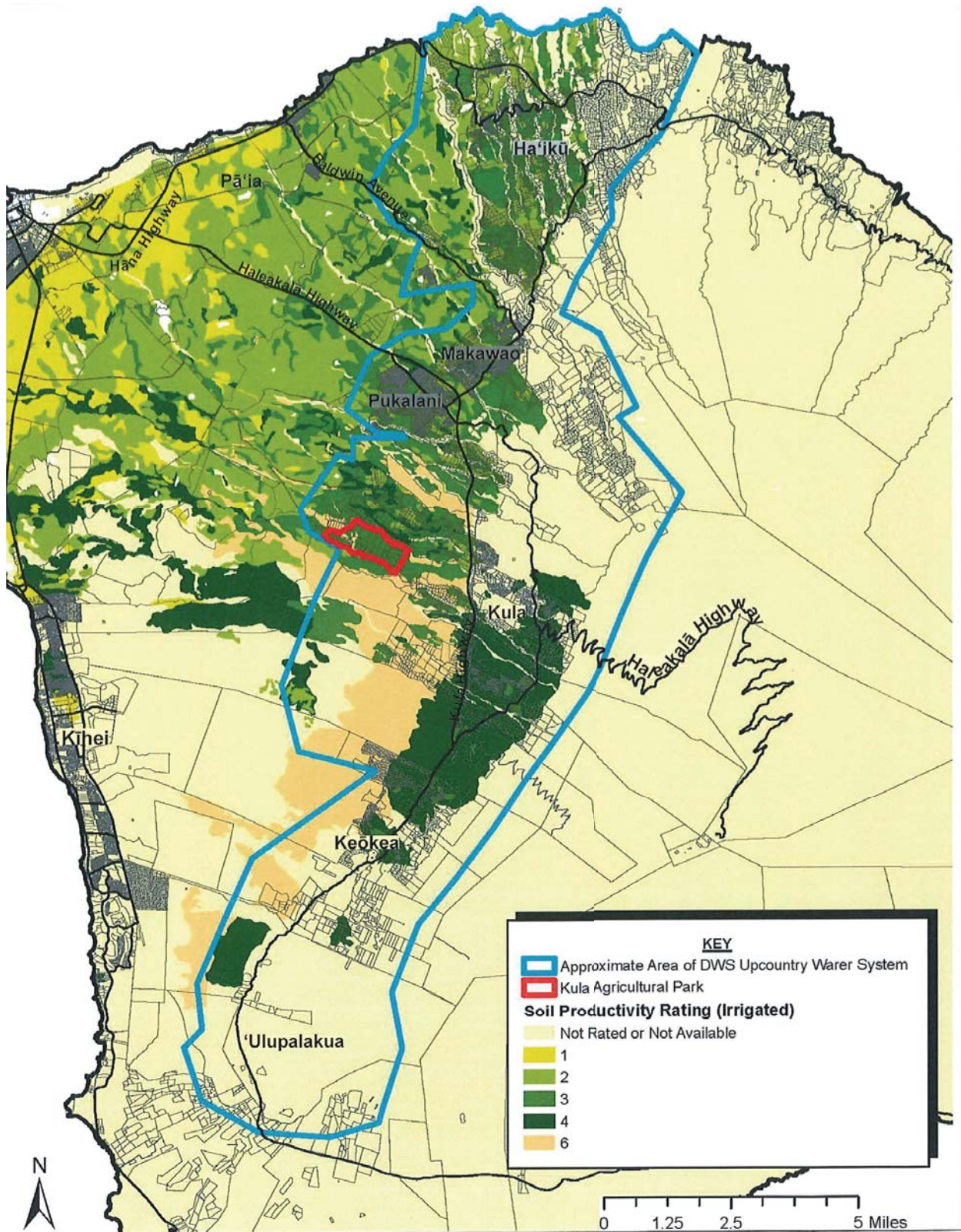


Figure 15. Upcountry Maui, NRCS Soil Ratings, Irrigated



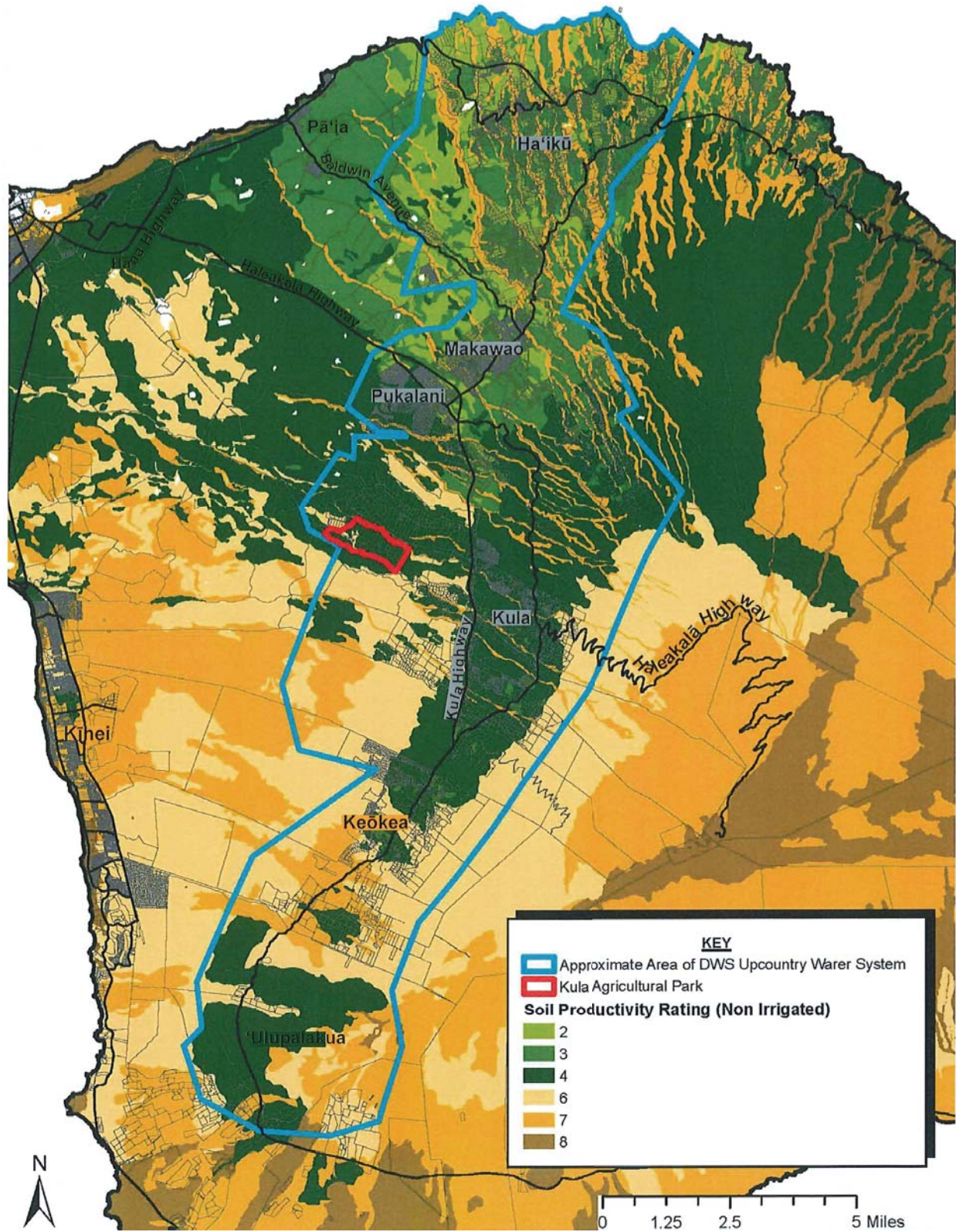


Figure 16. Upcountry Maui, NRCS Soil Ratings, Non Irrigated



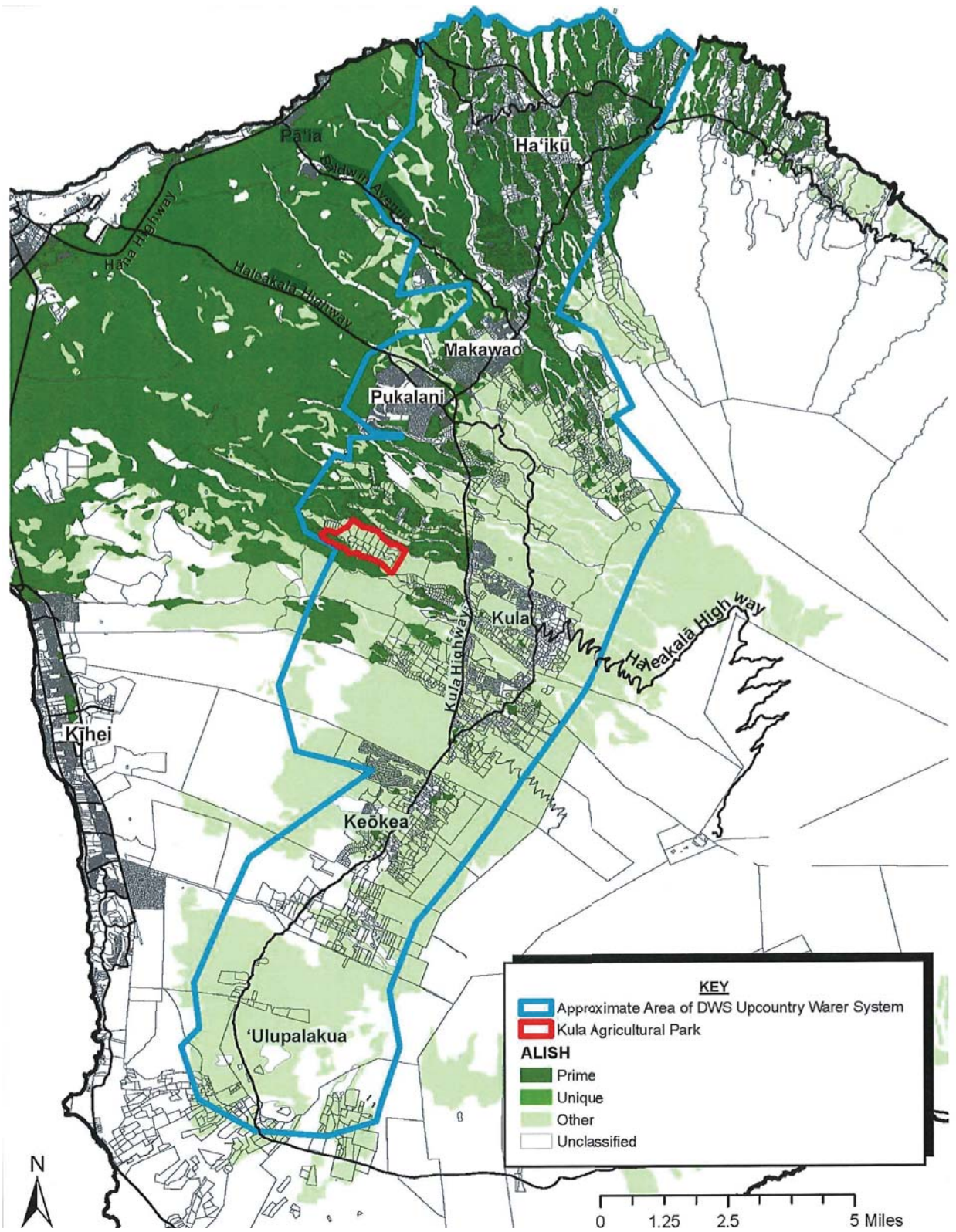


Figure 17. Upcountry Maui, ALISH Soil Ratings



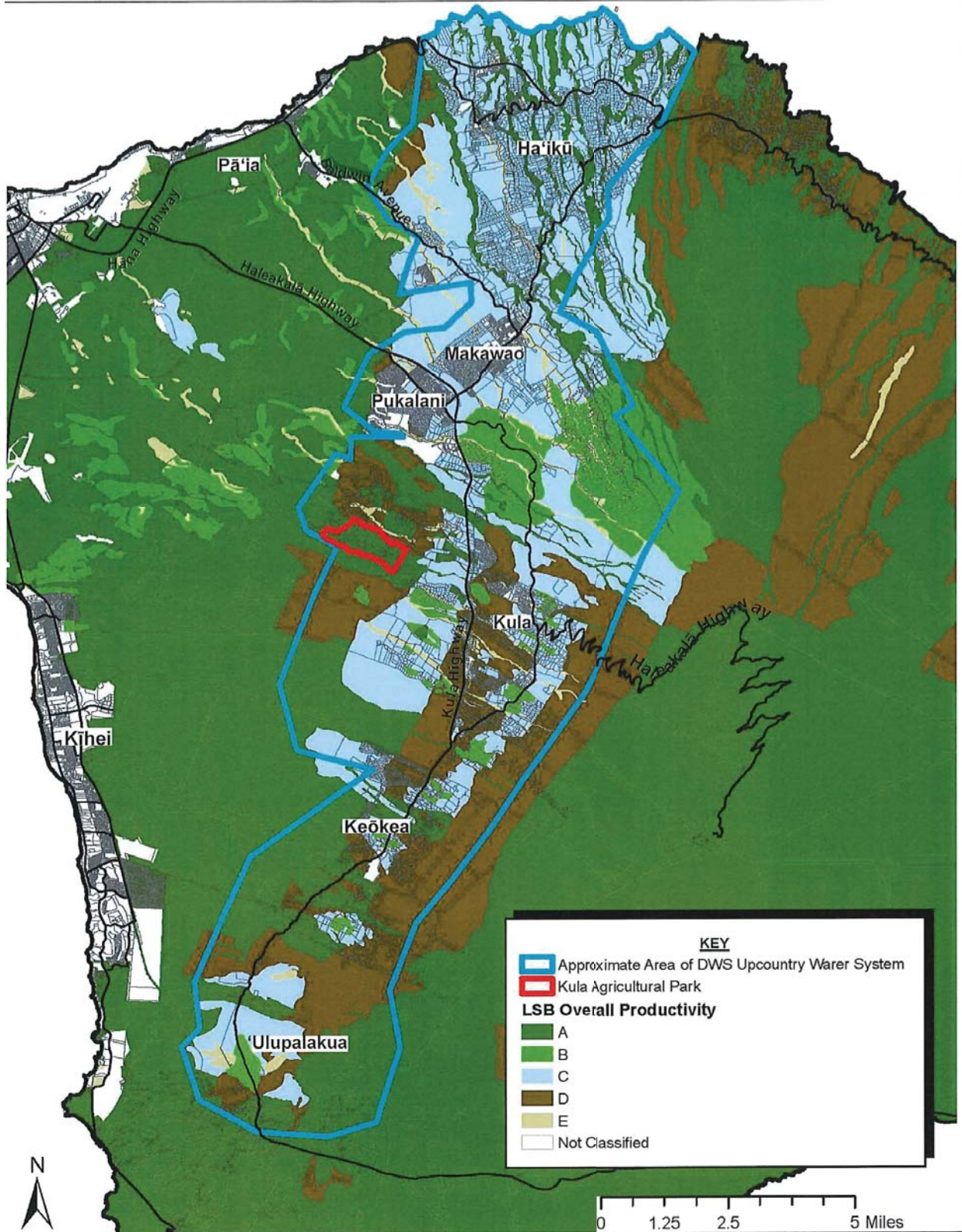


Figure 18. Upcountry Maui, LSB Soil Ratings



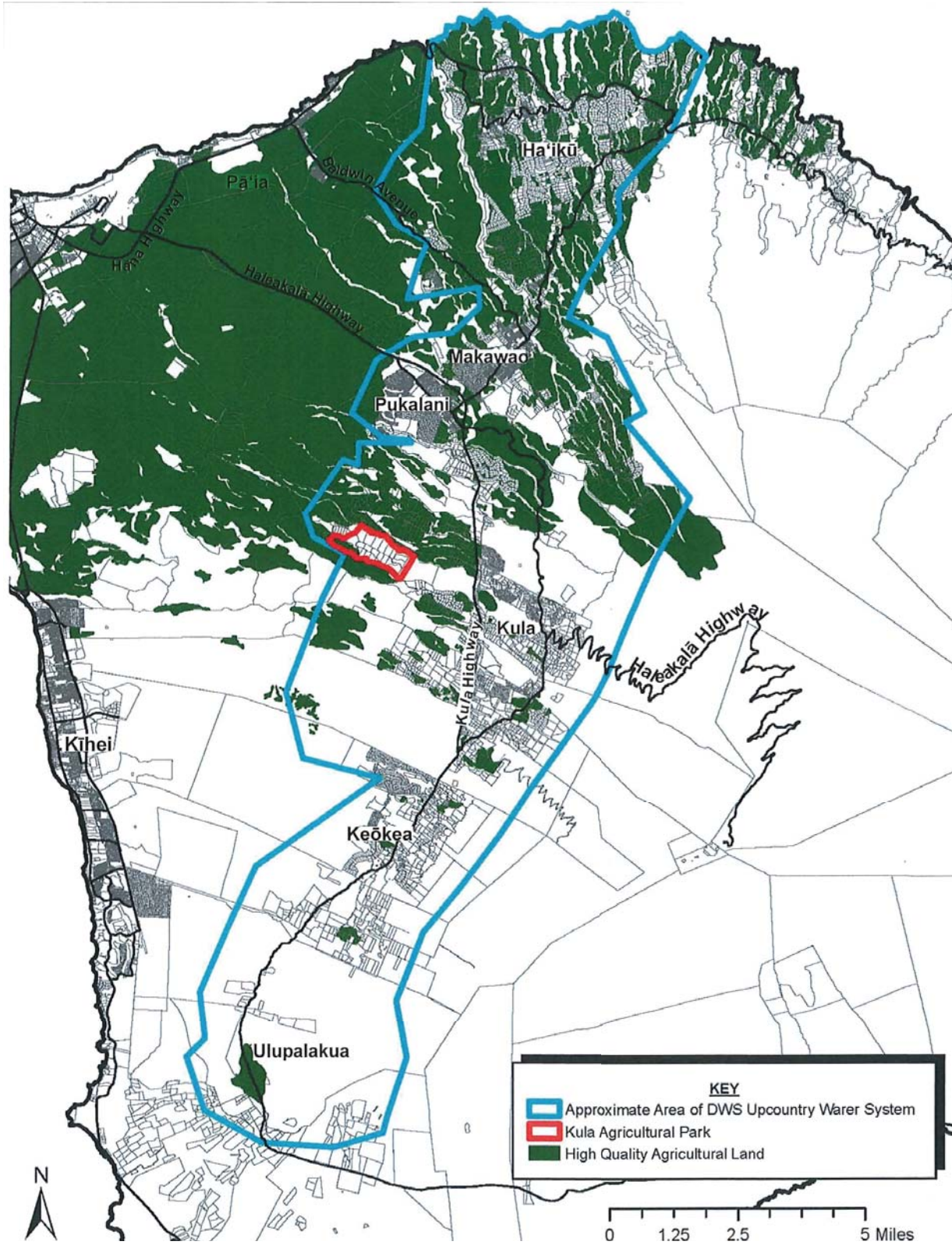


Figure 19. Upcountry Maui, High-Quality Farmland



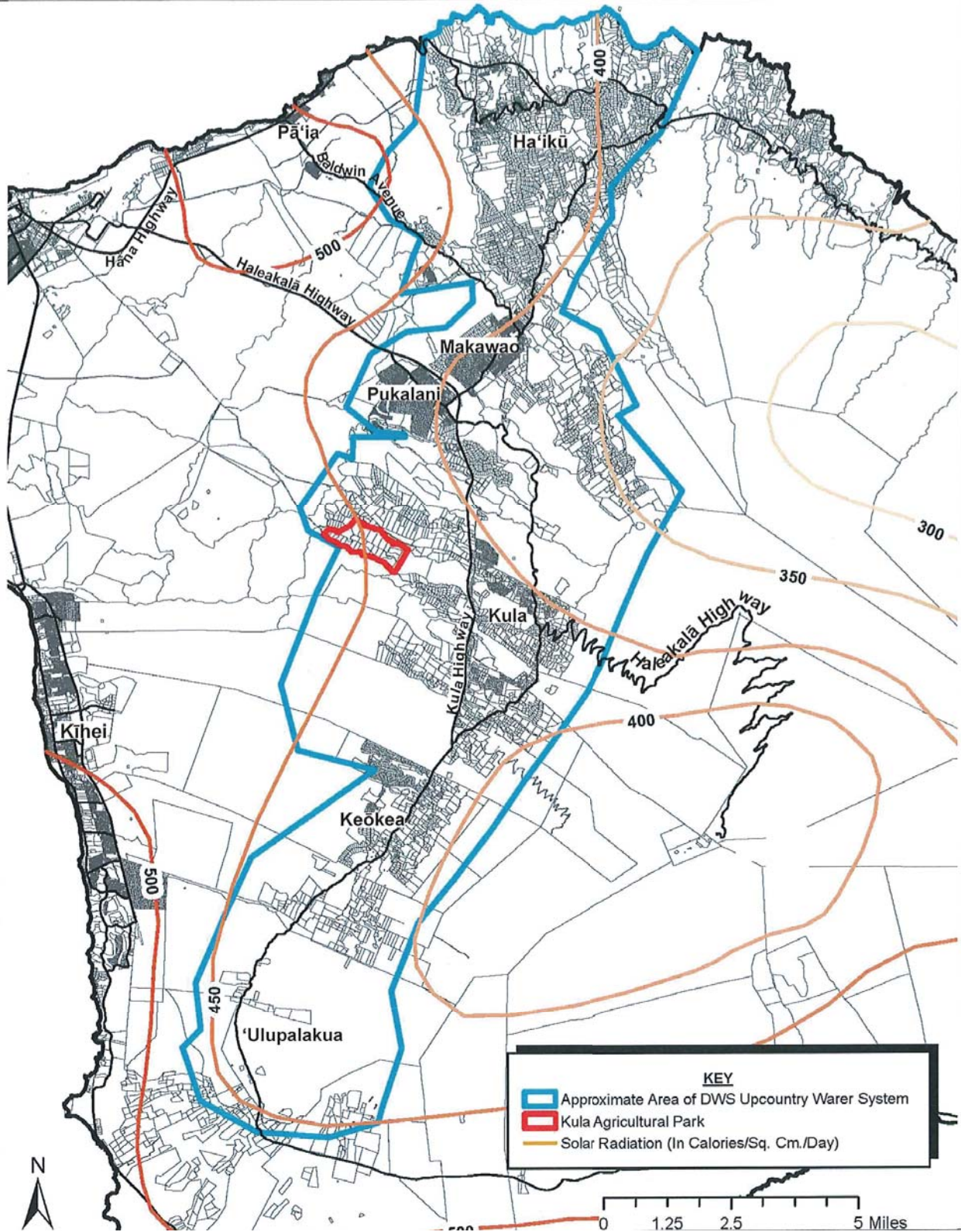


Figure 20. Upcountry Maui, Solar Radiation



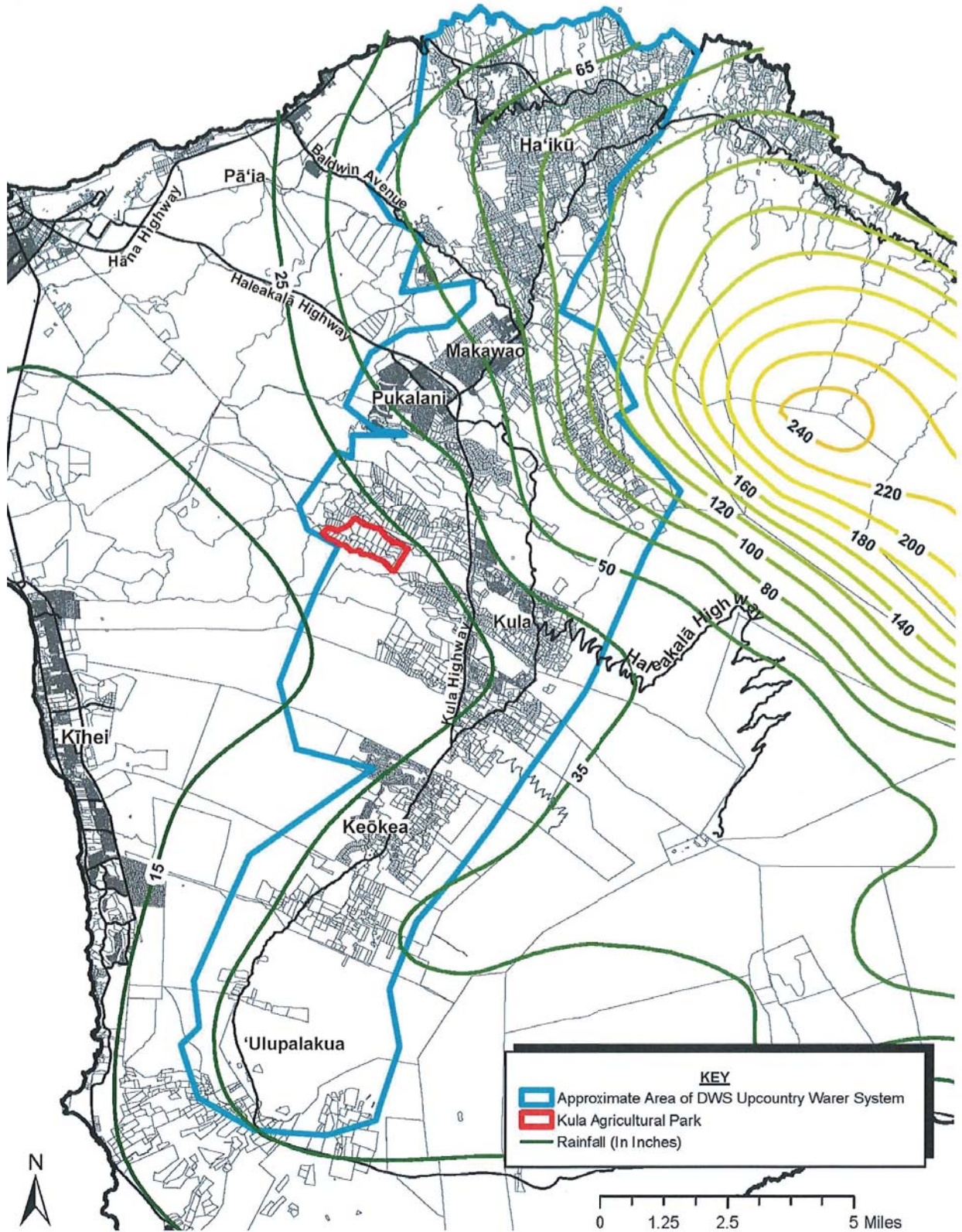


Figure 21. Upcountry Maui, Rainfall

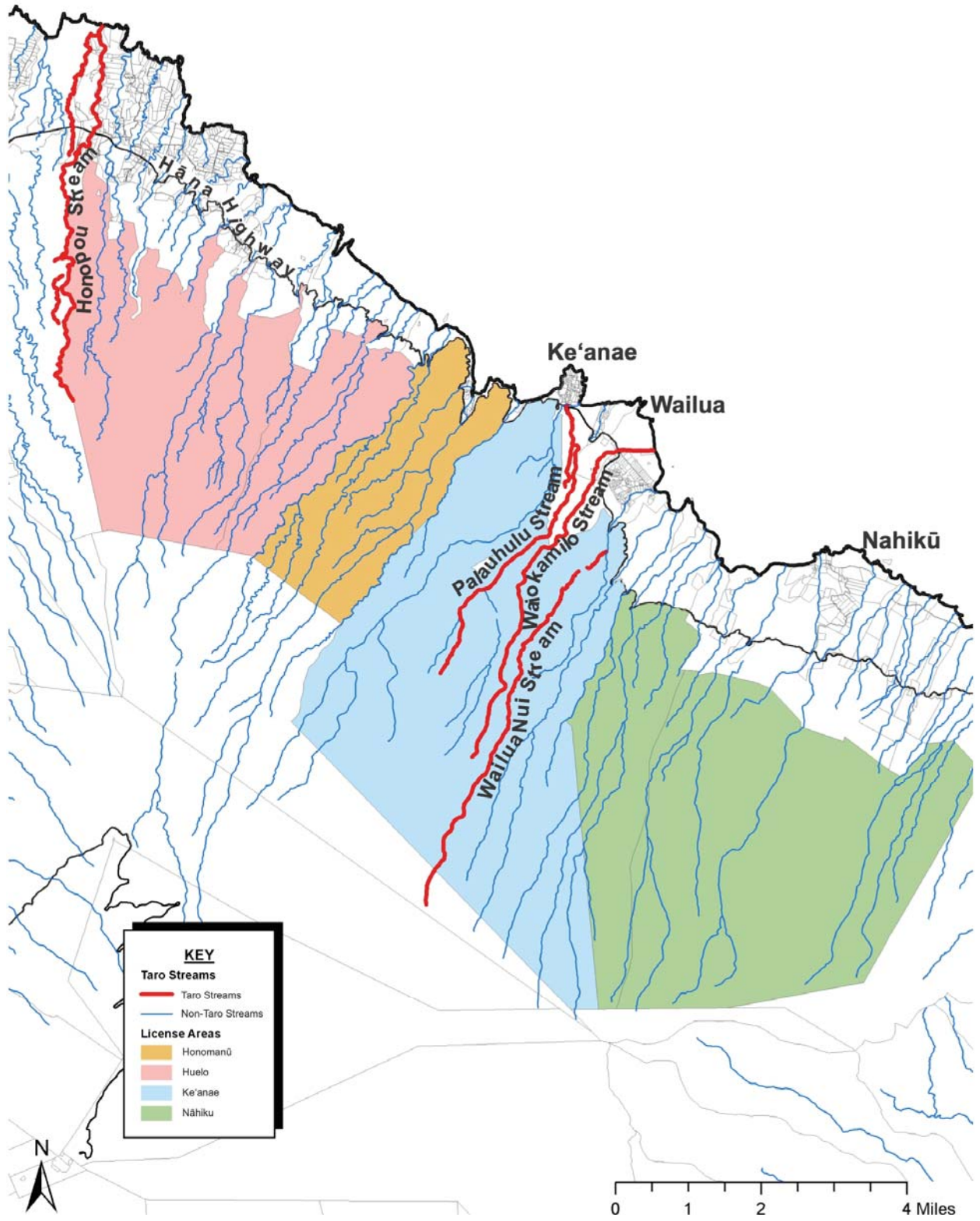


Figure 22. East Maui Taro Streams



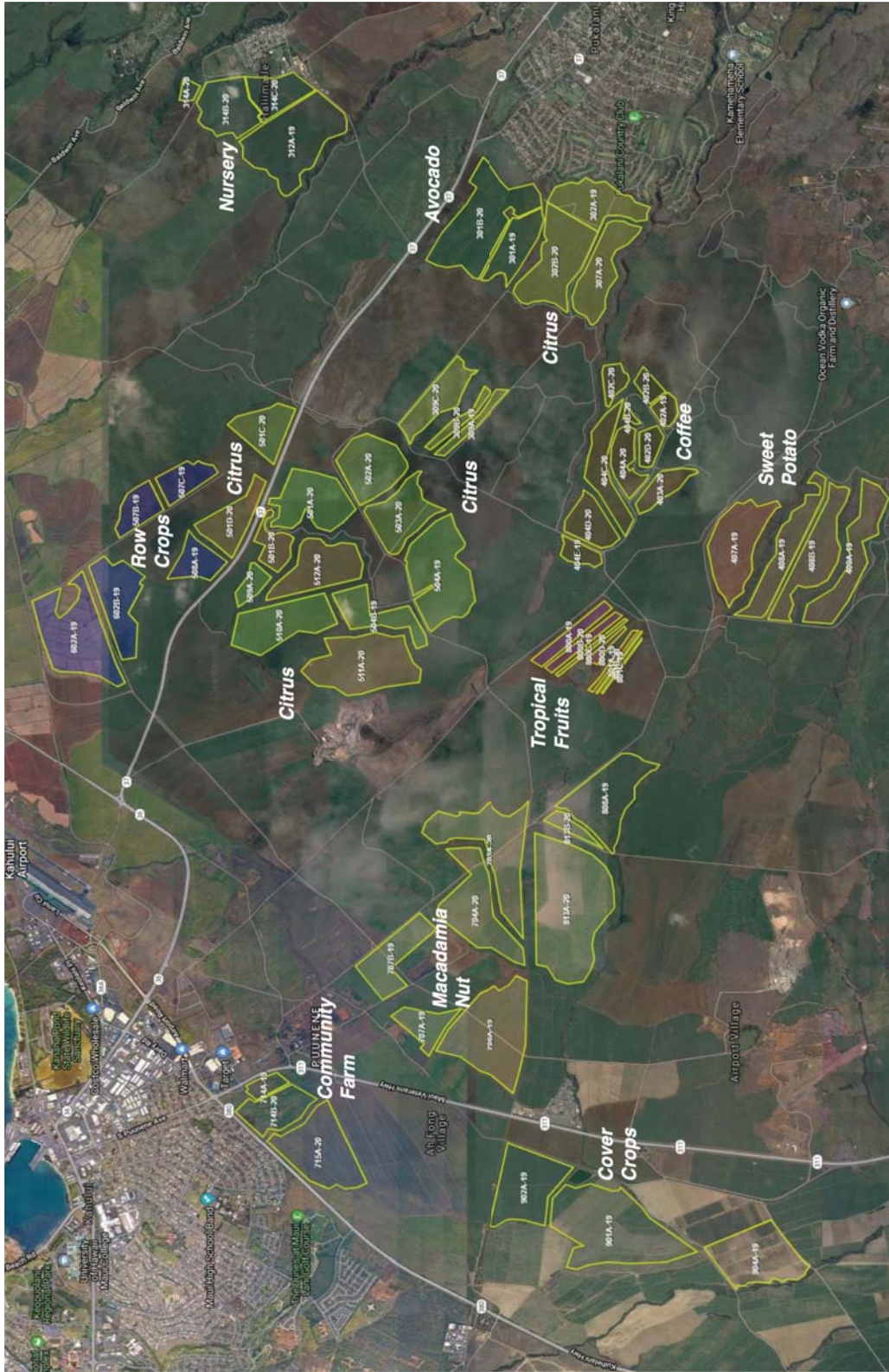


Figure 23. Mahi Pono Near-Term Farm Plan

Table 1. Water Supply, Allocation, and Costs

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

Table 2. Agricultural Land Use

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>2.a. CENTRAL MAUI</b>							
<b>Sugar operations</b>							
Fields serviced by EMI System and groundwater							
Upper fields (surface water only)	HC&S	12,800	12,729				acres
Lower fields (surface and brackish water)	HC&S	16,627	17,591				acres
Total sugarcane		<b>29,427</b>	<b>30,320</b>				acres
Fields serviced by W Maui Ditch System and groundwater							
Total plantation	HC&S	35,177	36,176				
Acreage split							
Upper fields (surface water only)		43.5%	42.0%				
Lower fields (surface and brackish water)		56.5%	58.0%				
Land leased from State	HC&S	1,447	1,447				acres
<b>Diversified Ag</b>							
By Activity							
Crops							
Community Farm	Mahi Pono/PEP				800	300	acres
Orchards (citrus, mac nuts, beverage crops)	Mahi Pono/PEP				12,850	4,180	acres
Tropical fruits	Mahi Pono/PEP				600	200	acres
Row and annual crops	Mahi Pono/PEP				1,200	400	acres
Energy crops	A&B/Mahi Pono/PEP			200	500	200	acres
Total crop farms				200	<b>15,950</b>	<b>5,280</b>	acres
Pasture							
Irrigated	A&B/Mahi Pono/PEP				4,700	3,800	acres
Unirrigated	A&B/Mahi Pono/PEP			500	9,100	20,670	acres
Total Pasture				500	<b>13,800</b>	<b>24,470</b>	acres
Green energy (solar), unirrigated	Mahi Pono/PEP			-	250	250	acres
Fallow				29,300			
Total				30,000	<b>30,000</b>	<b>30,000</b>	acres
Upper fields, Irrigated (surface water only)							
Community Farm	Mahi Pono/PEP				-	-	acres
Orchards (citrus, mac nuts, beverage crops)	Mahi Pono/PEP				4,990	1,620	acres
Tropical fruits	Mahi Pono/PEP				-	-	acres
Row and annual crops	Mahi Pono/PEP				300	200	acres
Energy crops	Mahi Pono/PEP			200	-	-	acres
Pasture, irrigated	Mahi Pono/PEP				1,100	900	
Total upper fields, Irrigated					<b>6,390</b>	<b>2,720</b>	acres
Lower fields, Irrigated (surface and brackish water)							
Community Farm	Mahi Pono/PEP				800	300	acres
Orchards (citrus, mac nuts, beverage crops)	Mahi Pono/PEP				7,860	2,560	acres
Tropical fruits	Mahi Pono/PEP				600	200	acres
Row and annual crops	Mahi Pono/PEP				900	200	acres
Energy crops	Mahi Pono/PEP			200	500	200	acres
Pasture, irrigated	Mahi Pono/PEP				3,600	2,900	acres
Total lower fields, Irrigated					<b>14,260</b>	<b>6,360</b>	acres
Unirrigated							
Pasture, unirrigated				500	9,100	20,670	acres
Green energy, unirrigated					250	250	acres
Total unirrigated					<b>9,350</b>	<b>20,920</b>	acres
By irrigation							
Irrigated				200	20,650	9,080	acres
Unirrigated				500	9,350	20,920	acres

**Table 2. Agricultural Land Use**

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
Land leased to others							
Community Farm	Mahi Pono/PEP				800	300	acres
Energy crops	Mahi Pono/PEP				500	200	acres
Other crops	Mahi Pono/PEP				750	750	acres
Green energy	Mahi Pono/PEP				250	250	acres
Total land leased					2,300	1,500	acres
<b>2.b. Upcountry MAUI (farms supplied with water from EM)</b>							
Kula Ag Park	County of Maui	n.e.	n.e.	447	709	-	acres
Other farms	PEP	n.e.	n.e.	800	800	-	acres
Total			n.e.	1,247	1,509	-	acres
<b>2.c. EAST MAUI (farms with appurtenant and riparian rights)</b>							
Taro farms	D&O	n.e.	n.e.	n.e.	44.83	44.83	acres
Other farms	D&O	n.e.	n.e.	n.e.	35.09	35.09	acres
Total farmland					79.92	79.92	acres



Table 3. Agricultural Water Use

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>3.a. CENTRAL MAUI</b>							
<b>Sugar operations</b>							
Applied water use (after system losses)							
Upper fields (surface water only)	Share based on	62.28	55.61				mgd
Lower fields (surface and brackish water)	Acreage Split	80.90	76.84				mgd
Total water use, sugarcane	Table 1. Section 1.b	<b>143.19</b>	<b>132.45</b>				mgd
Per acre		4,866	4,368				gad
Surface water	Table 1. Section 1.b	112.07	81.24				mgd
Upper fields	From above	62.28	55.61				mgd
Lower fields	Residual	49.79	25.63				mgd
Brackish water, lower fields	Table 1. Section 1.b	31.12	51.21				mgd
Share of Total water use		21.7%	38.7%				
Share of water use, lower fields		38.5%	66.6%				
Gross Water Use (before system losses)							
Surface	Percentage losses	144.98	105.57				mgd
Brackish	from Table 1, Section 1.b	40.26	66.55				mgd
Total water requirements		185.24	172.13				mgd
<b>Diversified Ag</b>							
Applied water use (after system losses)							
Upper fields, irrigated (surface water only)							
Community Farm	3,392 gad				-	-	mgd
Orchards (citrus, mac nuts, beverage crops)	5,089 gad				25.39	8.24	mgd
Tropical fruits	4,999 gad				-	-	mgd
Row and annual crops	3,392 gad				1.02	0.68	mgd
Energy crops	3,392 gad				-	-	mgd
Pasture, irrigated	1,161 gad				1.28	1.04	mgd
Total, upper fields, irrigated					27.69	9.97	mgd
Average per acre					4,333	3,665	gad
Lower fields, Irrigated (surface and brackish water)							
Community Farm	3,392 gad				2.71	1.02	mgd
Orchards (citrus, mac nuts, beverage crops)	5,089 gad				40.00	13.03	mgd
Tropical fruits	4,999 gad				3.00	1.00	mgd
Row and annual crops	3,392 gad				3.05	0.68	mgd
Energy crops	3,392 gad			0.68	1.70	0.68	mgd
Pasture, irrigated	1,161 gad				4.18	3.37	mgd
Adjustment					0.01	(0.02)	mgd
Total, lower fields, irrigated				0.68	54.65	19.75	mgd
Average Per acre					3,832	3,105	gad
Total diversified Ag				0.68	<b>82.34</b>	<b>29.72</b>	mgd
Average per acre					3,987	3,273	gad
Water use, by source							
Surface water	Residual				65.87	23.77	mgd
Upper fields					27.69	9.97	mgd
Lower fields					38.18	13.81	mgd
Brackish water, lower fields	20.0% of Total				16.47	5.94	mgd
Share of Total					20.0%	20.0%	
Share of lower fields					30.1%	30.1%	
Gross water use (before system losses)							
Surface	22.7% losses				85.22	30.75	mgd
Brackish	22.7% losses				21.30	7.69	mgd
Total gross water requirements				ne.	<b>106.52</b>	<b>38.44</b>	mgd

**Table 3. Agricultural Water Use**

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>3.b. Upcountry MAUI (farms supplied with water from EMI)</b>							
<b>Ag use of water supplied by EMI to MDWS</b>							
Kula Ag Park, diversified crops	A&B			0.46	1.46	-	mgd
Other farms	A&B			1.36	2.70	-	mgd
Total Ag use of water from EMI				1.82	4.16	-	mgd
Non Ag use of water from EMI + system losses	Residual			1.04	2.94	-	mgd
Total use of water supplied by EMI to MDWS	CORM D&O/MDWS			2.86	7.10	-	mgd
<b>3.c. EAST MAUI (farms with appurtenant and riparian rights)</b>							
<b>Gross water use (includes water returned to streams)</b>							
Taro farms	140,000 gad				6.28	6.28	mgd
Other farms					(included with water for taro)		
<b>Net water use</b>							
Taro farms	30,000 gad				1.34	1.34	mgd
Other farms	5,000 gad				0.18	0.18	mgd
Total water use					1.52	1.52	mgd

Table 4. Agricultural Development and Operations

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>4.a. CENTRAL MAUI</b>							
<b>Sugar operations</b>							
<b>Production</b>							
Raw sugar	HC&S	145,182	136,324				tons/yr
Per acre farmed (not harvested acres)		4.93	4.50				tons/yr
Turbinado sugar		n.e.	n.e.				
Energy		n.e.	n.e.				
<b>Sales</b>							
<b>Direct sales</b>							
Sugar and molasses	HC&S	\$ 78.9	\$ 96.4				million/yr
Energy	HC&S	\$ 21.8	\$ 19.2				million/yr
Total direct sales	A&B/HC&S	\$ 100.7	\$ 115.6				million/yr
Per ton of raw sugar		\$ 694	\$ 848				million/yr
Per acre		\$ 3,423	\$ 3,813				million/yr
<b>Indirect sales</b>							
Maui	90% of dir. sales	\$ 90.7	\$ 104.1				million/yr
Oahu	65%	\$ 58.9	\$ 67.6				million/yr
	35%	\$ 31.7	\$ 36.4				million/yr
Total direct and indirect sales		\$ 191.4	\$ 219.7				million/yr
Maui		\$ 159.7	\$ 183.3				million/yr
Oahu		\$ 31.7	\$ 36.4				million/yr
<b>Sales by excise-tax category</b>							
Exempted export sales (sugar and molasses)	from above	\$ 78.9	\$ 96.4				million/yr
Final sales/consumption (taxed at 4%)	55% of payroll	\$ 45.5	\$ 37.4				million/yr
Maui	Residual	n.e.	\$ 30.3				million/yr
Oahu	55% of payroll	n.e.	\$ 7.1				million/yr
Intermediate sales (taxed at 0.5%)	Residual	\$ 67.0	\$ 85.9				million/yr
Rent paid to the State	\$ 100 per acre	\$ 0.1	\$ 0.1				million/yr
Profits on direct and indirect sales	10% of sales	\$ 19.1	\$ 22.0				million/yr
<b>Diversified Ag. development activity</b>							
Development period					10	6	years
<b>Field preparations</b>							
Cropland	Table 2, Section 2.a				15,950	5,280	acres
Pastures, irrigated	Table 2, Section 2.a				4,700	3,800	acres
Pastures, unirrigated	Table 2, Section 2.a				9,100	20,670	acres
Building space	20 sf/crop-acre				319,000	105,600	sf
Green energy capacity (solar)	0.15 MW/acre				37.5	37.5	MW
<b>Expenditures and sales</b>							
<b>Development expenditures</b>							
<b>Field preparations</b>							
Cropland	\$ 5,000 per acre				\$ 79.8	\$ 26.4	million
Pastures, irrigated	\$ 1,000 per acre				\$ 4.7	\$ 3.8	million
Pastures, unirrigated	\$ 500 per acre				\$ 4.6	\$ 10.3	million
Total field preparations					\$ 89.0	\$ 40.5	million
<b>Construction</b>							
Buildings (processing, storage, offices, etc.)	\$ 100 per sf				\$ 31.9	\$ 10.6	million
Green energy (solar)	\$ 2.5 million/MW				\$ 93.8	\$ 93.8	million
Total cost of structures					\$ 125.7	\$ 104.3	million
Total development expenditures					\$ 214.7	\$ 144.8	million

Table 4. Agricultural Development and Operations

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
Average annual development expenditures							
Field preparations					\$ 8.9	\$ 6.8	million/yr
Structures					\$ 12.6	\$ 17.4	million/yr
Total average annual development expenditures					\$ 21.5	\$ 24.1	million/yr
Hawaii activity, average annual development expenditures (excludes imported material)							
Field preparations	100%				\$ 8.9	\$ 6.8	million/yr
Structures	55%				\$ 6.9	\$ 9.6	million/yr
Indirect sales							
Field preparations	122% of H activity				\$ 10.9	\$ 8.2	million/yr
Construction	110% of H activity				\$ 7.6	\$ 10.5	million/yr
Total indirect sales					\$ 18.5	\$ 18.8	million/yr
Maui	65%				\$ 12.0	\$ 12.2	million/yr
Oahu	35%				\$ 6.5	\$ 6.6	million/yr
Total expenditures and indirect sales					\$ 39.9	\$ 42.9	million/yr
Maui					\$ 33.5	\$ 36.3	million/yr
Oahu					\$ 6.5	\$ 6.6	million/yr
Sales by excise-tax category							
Final sales/consumption (taxed at 4%)	development cost + 55% of payroll				\$ 29.4	\$ 31.4	million/yr
Maui	Residual				\$ 28.2	\$ 30.3	million/yr
Oahu	55% of payroll				\$ 1.2	\$ 1.2	million/yr
Intermediate sales (taxed at 0.5%)	Residual				\$ 10.5	\$ 11.5	million/yr
Profits on direct and indirect sales	10% of sales				\$ 4.0	\$ 4.3	million/yr
<b>Diversified Ag. operations</b>							
Beef cattle (cow and calf units)							
Pasture, irrigated	1.00 acre/unit			-	4,700	3,800	units
Pasture, unirrigated	3.50 acres/unit			143	2,600	5,906	units
Total animal units				143	7,300	9,706	units
Ag production							
Community Farm	10,000 lbs/acre			-	8.0	3.0	m lbs/yr
Orchards	25,000 per acre			-	321.3	104.5	m lbs/yr
Tropical Fruits	15,000 lbs/acre			-	9.0	3.0	m lbs/yr
Row and annual crops					n.e.	n.e.	
Energy crops					n.e.	n.e.	
Calves	0.80 calves/unit 16.2 months/calf			85	4,326	5,752	calves/yr
Energy production	25% of capacity			n.e.	82,125	82,125	MWh/yr
Sales							
Direct sales							
Farm sales							
Crop sales							
Community Farm	\$ 1.00 per lb				\$ 8.0	\$ 3.0	million/yr
Orchards	\$ 0.40 per lb				\$ 128.5	\$ 41.8	million/yr
Tropical Fruits	\$ 1.50 per lb				\$ 13.5	\$ 4.5	million/yr
Row and annual crops	\$ 4,000 per acre				\$ 4.8	\$ 1.6	million/yr
Energy crops	\$ 2,200 per acre			\$ 0.4	\$ 1.1	\$ 0.4	million/yr
Total crop sales				\$ 0.4	\$ 155.9	\$ 51.3	million/yr
Calves (hot carcass)	\$ 1,100 per calf			\$ 0.1	\$ 4.8	\$ 6.3	million/yr
Total farm sales				\$ 0.5	\$ 160.7	\$ 57.7	million/yr
Hawaii sales	Residual				\$ 104.4	\$ 46.1	million/yr
Export sales	From below				\$ 56.2	\$ 11.5	million/yr
Energy sales	\$ 0.10 per kWhr				\$ 8.2	\$ 8.2	million/yr
Total direct sales				\$ 0.5	\$ 168.9	\$ 65.9	million/yr

Table 4. Agricultural Development and Operations

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
Indirect sales	100% of farm sales			\$ 0.5	\$ 160.7	\$ 57.7	million/yr
Maui	65%			\$ 0.3	\$ 104.4	\$ 37.5	million/yr
Oahu	35%			\$ 0.2	\$ 56.2	\$ 20.2	million/yr
Total direct and indirect sales				\$ 1.1	\$ 329.5	\$ 123.5	million/yr
Maui				\$ 0.9	\$ 273.3	\$ 103.4	million/yr
Oahu				\$ 0.2	\$ 56.2	\$ 20.2	million/yr
Sales by excise-tax category							
Exempted export sales	35% of farm sales			-	\$ 56.2		million/yr
20% of farm sales	20% of farm sales					\$ 11.5	million/yr
Final sales/consumption (taxed at 4%)	55% of payroll			\$ 0.3	\$ 24.9	\$ 8.6	million/yr
Maui	Residual			\$ 0.2	\$ 21.4	\$ 7.4	million/yr
Oahu	55% of payroll			\$ 0.0	\$ 3.6	\$ 1.2	million/yr
Intermediate sales (taxed at 0.5%)	Residual			\$ 0.8	\$ 248.4	\$ 103.4	million/yr
Rental income							
Community Farm	\$ 150 per acre				\$ 0.12	\$ 0.05	million/yr
Energy crops	\$ 500 per acre				\$ 0.25	\$ 0.10	million/yr
Other crops	\$ 150 per acre				\$ 0.11	\$ 0.11	million/yr
Green energy	\$ 2,000 per acre				\$ 0.50	\$ 0.50	million/yr
Total rental income					\$ 1.0	\$ 0.8	million/yr
Profits on direct and indirect sales	10% of sales			\$ 0.1	\$ 33.0	\$ 12.4	million/yr
<b>4.b. Upcountry MAUI (farms supplied with water from EM)</b>							
<b>Development activity, Kula Ag Park</b>							
Increase in acreage					262	-	acres
Development period					5	-	years
Expenditures on field preparations	\$ 5,000 per acre				\$ 1.3	\$ -	million
Annual average expenditures and sales							
Expenditures on field preparations					\$ 0.26	\$ -	million/yr
Indirect sales	122% of exp				\$ 0.32	\$ -	million/yr
Total expenditures and indirect sales					\$ 0.6	\$ -	million/yr
<b>Operations, Kula Ag Park and other farms</b>							
<b>Production</b>							
Kula Ag Park	10,000 lbs/acre	n.e.	n.e.	4.5	7.1	-	m lbs/yr
Other farms	10,000 lbs/acre	n.e.	n.e.	8.0	8.0	-	m lbs/yr
Total production				12.5	15.1	-	m lbs/yr
<b>Sales</b>							
<b>Direct sales</b>							
Kula Ag Park	\$ 1.00 per lb	n.e.	n.e.	\$ 4.5	\$ 7.1	\$ -	million/yr
Other farms	\$ 1.00 per lb	n.e.	n.e.	\$ 8.0	\$ 8.0	\$ -	million/yr
Total direct sales		n.e.	n.e.	\$ 12.5	\$ 15.1	\$ -	million/yr
<b>Indirect sales</b>							
Maui	1.11 x direct sales	n.e.	n.e.	\$ 13.8	\$ 16.7	\$ -	million/yr
Maui	65%	n.e.	n.e.	\$ 9.0	\$ 10.9	\$ -	million/yr
Oahu	35%	n.e.	n.e.	\$ 4.8	\$ 5.9	\$ -	million/yr
Total direct and indirect sales		n.e.	n.e.	\$ 26.3	\$ 31.8	\$ -	million/yr
Maui		n.e.	n.e.	\$ 21.5	\$ 26.0	\$ -	million/yr
Oahu		n.e.	n.e.	\$ 4.8	\$ 5.9	\$ -	million/yr
<b>Sales by excise-tax category</b>							
Final sales/consumption (taxed at 4%)	55% of payroll	n.e.	n.e.	\$ 2.7	\$ 3.2	\$ -	million/yr
Maui	Residual	n.e.	n.e.	\$ 2.2	\$ 2.7	\$ -	million/yr
Oahu	55% of payroll	n.e.	n.e.	\$ 0.4	\$ 0.5	\$ -	million/yr
Intermediate sales (taxed at 0.5%)	Residual	n.e.	n.e.	\$ 23.7	\$ 28.6	\$ -	million/yr
Rent, Kula Ag Park	\$ 1,200 per acre			\$ 0.5	\$ 0.9	\$ -	million/yr
Profits on direct and indirect sales	10% of sales	n.e.	n.e.	\$ 2.6	\$ 3.2	\$ -	million/yr



Table 4. Agricultural Development and Operations

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>4.c. EAST MAUI (farms with appurtenant and riparian rights)</b>							
<b>Production</b>							
Taro farms	30,000 lbs/har acre 16 months/crop		n.e.	n.e.	1.0	1.0	m lbs/yr
Other farms	10,000 lbs/acre		n.e.	n.e.	0.4	0.4	m lbs/yr
<b>Sales</b>							
<b>Direct sales</b>							
Taro farms	\$ 1.00 per lb		n.e.	n.e.	\$ 1.0	\$ 1.0	million/yr
Other farms	\$ 1.00 per lb		n.e.	n.e.	\$ 0.4	\$ 0.4	million/yr
Total direct sales			n.e.	n.e.	\$ 1.4	\$ 1.4	million/yr
<b>Indirect sales</b>							
Maui	1.11 of dir. sales 65%		n.e.	n.e.	\$ 1.5	\$ 1.5	million/yr
Oahu	35%		n.e.	n.e.	\$ 0.5	\$ 0.5	million/yr
Total direct and indirect sales			n.e.	n.e.	\$ 2.9	\$ 2.9	million/yr
Maui			n.e.	n.e.	\$ 2.3	\$ 2.3	million/yr
Oahu			n.e.	n.e.	\$ 0.5	\$ 0.5	million/yr
<b>Sales by excise-tax category</b>							
<b>Final sales/consumption (taxed at 4%)</b>							
Maui	55% of payroll Residual		n.e.	n.e.	\$ 0.5	\$ 0.5	million/yr
Oahu	55% of payroll Residual		n.e.	n.e.	\$ 0.4	\$ 0.4	million/yr
Oahu	55% of payroll Residual		n.e.	n.e.	\$ 0.1	\$ 0.1	million/yr
<b>Intermediate sales (taxed at 0.5%)</b>							
Oahu	55% of payroll Residual		n.e.	n.e.	\$ 2.4	\$ 2.4	million/yr
Profits on direct and indirect sales	10% of sales		n.e.	n.e.	\$ 0.3	\$ 0.3	million/yr

Table 5. Employment, Payroll and Population Supported

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>5.a. CENTRAL MAUI</b>							
<b>Sugar operations</b>							
<b>Employment</b>							
Direct jobs, on-site	HC&S	630	620				jobs
Acres per worker		47	49				ac/worker
Indirect jobs, offsite	1.130 per dir. Job	712	701				jobs
Maui	65%	463	455				jobs
Oahu	35%	249	245				jobs
<b>Total jobs, direct and indirect</b>		<b>1,342</b>	<b>1,321</b>				<b>jobs</b>
Maui		1,093	1,075				jobs
Oahu		249	245				jobs
<b>Payroll</b>							
Direct payroll		\$ 48.5	\$ 34.3				million/yr
Per job		\$ 76,917	\$ 55,295				
Indirect payroll		\$ 34.2	\$ 33.7				million/yr
Maui	\$ 45,500 per job	\$ 21.1	\$ 20.7				million/yr
Oahu	\$ 52,900 per job	\$ 13.2	\$ 13.0				million/yr
<b>Total payroll, direct and indirect</b>		<b>\$ 82.7</b>	<b>\$ 68.0</b>				<b>million/yr</b>
Maui		\$ 69.5	\$ 55.0				million/yr
Oahu		\$ 13.2	\$ 13.0				million/yr
<b>Residents supported</b>							
Maui	2.25 per job	2,459	2,420				people
Oahu	2.13 per job	531	522				people
<b>Total</b>		<b>2,989</b>	<b>2,942</b>				<b>people</b>
<b>Homes supported</b>							
Maui	0.44 per res.	1,082	1,065				homes
Oahu	0.34 per res.	180	178				homes
<b>Total</b>		<b>1,262</b>	<b>1,242</b>				<b>homes</b>
<b>Diversified Ag, Development Activity</b>							
<b>Employment</b>							
<b>Direct jobs, on-site</b>							
<b>Field preparations</b>							
Cropland	10 ac./worker				160	88	jobs
Pastures, irrigated	50 ac./worker				9	13	jobs
Pastures, unirrigated	100 ac./worker				9	34	jobs
<b>Total field preparations</b>					<b>178</b>	<b>135</b>	<b>jobs</b>
Construction	4.32 jobs/\$1 mil				30	41	jobs
<b>Total direct/on-site jobs</b>					<b>208</b>	<b>176</b>	<b>jobs</b>
<b>Indirect jobs, offsite</b>							
Field preparations	0.43 of d jobs				77	58	jobs
Construction	1.41 of d jobs				42	58	jobs
<b>Total indirect jobs</b>					<b>119</b>	<b>116</b>	<b>jobs</b>
Maui	65%				77	76	jobs
Oahu	35%				42	41	jobs
<b>Total jobs, direct and indirect</b>					<b>326</b>	<b>293</b>	<b>jobs</b>
Maui					285	252	jobs
Oahu					42	41	jobs
<b>Payroll</b>							
<b>Direct payroll</b>							
Field preparations	\$ 40,000 per job				\$ 7.1	\$ 5.4	million/yr
Construction	\$ 55,000 per job				\$ 1.6	\$ 2.3	million/yr
<b>Total direct payroll</b>					<b>\$ 8.8</b>	<b>\$ 7.7</b>	<b>million/yr</b>

Table 5. Employment, Payroll and Population Supported

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
Indirect payroll					\$ 5.7	\$ 5.6	million/yr
Maui	\$ 45,500 per job				\$ 3.5	\$ 3.4	million/yr
Oahu	\$ 52,900 per job				\$ 2.2	\$ 2.2	million/yr
Total payroll, direct and indirect					\$ 14.5	\$ 13.3	million/yr
Maui					\$ 12.3	\$ 11.1	million/yr
Oahu					\$ 2.2	\$ 2.2	million/yr
Residents supported							
Maui	2.25 per job				641	567	people
Oahu	2.13 per job				88	87	people
Total					730	654	people
Homes supported							
Maui	0.44 per res.				282	250	homes
Oahu	0.34 per res.				30	29	homes
Total					312	279	homes
<b>Diversified Ag, Operations</b>							
Employment							
Direct jobs, on-site							
Community Farm	15 ac./worker				53	20	jobs
Orchards	20 ac./worker				643	209	jobs
Tropical fruits	15 ac./worker				40	13	jobs
Row and annual crops	40 ac./worker				30	10	jobs
Energy crops	30 ac./worker			7	17	7	jobs
Pasture	700 au/worker			n.e.	10	14	jobs
Green energy					n.e.	n.e.	
Total direct jobs				7	793	273	jobs
Indirect jobs, offsite	0.440 per dir. Job			3	349	120	jobs
Maui	65%			2	227	78	jobs
Oahu	35%			1	122	42	jobs
Total jobs, direct and indirect				10	1,142	393	jobs
Maui				9	1,020	351	jobs
Oahu					122	42	jobs
Payroll							
Direct payroll							
Community Farm	\$ 35,000 per job				\$ 1.9	\$ 0.7	million/yr
Orchards	\$ 35,000 per job				\$ 22.5	\$ 7.3	million/yr
Tropical fruits	\$ 35,000 per job				\$ 1.4	\$ 0.5	million/yr
Row and annual crops	\$ 50,000 per job				\$ 1.5	\$ 0.5	million/yr
Energy crops	\$ 50,000 per job			\$ 0.3	\$ 0.8	\$ 0.3	million/yr
Pasture	\$ 40,000 per job				\$ 0.4	\$ 0.6	million/yr
Total direct payroll				\$ 0.3	\$ 28.5	\$ 9.9	million/yr
Indirect payroll				\$ 0.1	\$ 16.8	\$ 5.8	million/yr
Maui	\$ 45,500 per job			\$ 0.1	\$ 10.3	\$ 3.6	million/yr
Oahu	\$ 52,900 per job			\$ 0.1	\$ 6.5	\$ 2.2	million/yr
Total payroll, direct and indirect				\$ 0.5	\$ 45.3	\$ 15.6	million/yr
Maui				\$ 0.4	\$ 38.8	\$ 13.4	million/yr
Oahu				n.e.	\$ 6.5	\$ 2.2	million/yr
Residents supported							
Maui	2.25 per job			19	2,294	790	people
Oahu	2.13 per job			2	260	90	people
Total				21	2,554	879	people
Homes supported							
Maui	0.44 per res.			8	1,010	347	homes
Oahu	0.34 per res.			1	88	30	homes
Total				9	1,098	378	homes

Table 5. Employment, Payroll and Population Supported

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>5.b. Upcountry MAUI (farms supplied with water from EM)</b>							
<b>Development activity</b>							
Increase in crop acreage					262	-	acres
Development period					5	-	years
<b>Employment</b>							
Direct jobs, on-site field preparations	10 ac./worker				5.2	-	jobs
Indirect jobs, offsite	0.43 of d jobs				2.3	-	jobs
Total direct and indirect jobs					7.5	-	jobs
<b>Payroll</b>							
Direct payroll	\$ 40,000 per job				\$ 0.21	\$ -	million/yr
Indirect payroll	\$ 45,500 per job				\$ 0.10	\$ -	million/yr
Total payroll, direct and indirect					\$ 0.31	\$ -	million/yr
<b>Operations</b>							
<b>Employment</b>							
<b>Direct jobs, on-site</b>							
Kula Ag Park	15 ac./worker	n.e.	n.e.	30	47	-	jobs
Other farms	15 ac./worker	n.e.	n.e.	53	53	-	jobs
Total direct jobs		n.e.	n.e.	83	101	-	jobs
<b>Indirect jobs, offsite</b>							
Maui	0.48 per dir. Job 65%	n.e.	n.e.	40	48	-	jobs
Oahu	35%	n.e.	n.e.	14	17	-	jobs
Total jobs, direct and indirect		n.e.	n.e.	123	149	-	jobs
Maui	Residual			109	132	-	jobs
<b>Payroll</b>							
<b>Direct payroll</b>							
Kula Ag Park	\$ 35,000 per job	n.e.	n.e.	\$ 1.0	\$ 1.7	\$ -	million/yr
Other farms	\$ 35,000 per job	n.e.	n.e.	\$ 1.9	\$ 1.9	\$ -	million/yr
Total direct payroll		n.e.	n.e.	\$ 2.9	\$ 3.5	\$ -	million/yr
<b>Indirect payroll</b>							
Maui	\$ 45,500 per job	n.e.	n.e.	\$ 1.2	\$ 1.4	\$ -	million/yr
Oahu	\$ 52,900 per job	n.e.	n.e.	\$ 0.7	\$ 0.9	\$ -	million/yr
Total payroll, direct and indirect		n.e.	n.e.	\$ 4.8	\$ 5.8	\$ -	million/yr
Maui		n.e.	n.e.	\$ 4.1	\$ 4.9	\$ -	million/yr
<b>Residents supported</b>							
Maui	2.25 per job	n.e.	n.e.	245	297	-	people
Oahu	2.13 per job	n.e.	n.e.	30	36	-	people
Total		n.e.	n.e.	275	333	-	people
<b>Homes supported</b>							
Maui	0.44 per res.	n.e.	n.e.	108	131	-	homes
Oahu	0.34 per res.	n.e.	n.e.	10	12	-	homes
Total		n.e.	n.e.	118	143	-	homes

Table 5. Employment, Payroll and Population Supported

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>5.c. EAST MAUI (farms with appurtenant and riparian rights)</b>							
<b>Employment</b>							
<b>Direct jobs, on-site</b>							
Taro	4 ac./worker	n.e.	n.e.	n.e.	11	11	jobs
Other crops	12 ac./worker	n.e.	n.e.	n.e.	3	3	jobs
<b>Total direct jobs</b>		n.e.	n.e.	n.e.	<b>14</b>	<b>14</b>	jobs
<b>Indirect jobs, offsite</b>							
Maui	0.48 per dir. Job 65%	n.e.	n.e.	n.e.	7	7	jobs
Oahu	35%	n.e.	n.e.	n.e.	4	4	jobs
		n.e.	n.e.	n.e.	2	2	jobs
<b>Total jobs, direct and indirect</b>		n.e.	n.e.	n.e.	<b>21</b>	<b>21</b>	jobs
Maui	Residual	n.e.	n.e.	n.e.	19	19	jobs
<b>Payroll</b>							
<b>Direct payroll</b>							
Taro	\$ 35,000 per job	n.e.	n.e.	n.e.	\$ 0.4	\$ 0.4	million/yr
Other crops	\$ 35,000 per job	n.e.	n.e.	n.e.	\$ 0.1	\$ 0.1	million/yr
<b>Total direct payroll</b>		n.e.	n.e.	n.e.	<b>\$ 0.5</b>	<b>\$ 0.5</b>	million/yr
<b>Indirect payroll</b>							
Maui	\$ 45,500 per job	n.e.	n.e.	n.e.	\$ 0.3	\$ 0.3	million/yr
Oahu	\$ 52,900 per job	n.e.	n.e.	n.e.	\$ 0.2	\$ 0.2	million/yr
		n.e.	n.e.	n.e.	\$ 0.1	\$ 0.1	million/yr
<b>Total payroll, direct and indirect</b>		n.e.	n.e.	n.e.	<b>\$ 0.8</b>	<b>\$ 0.8</b>	million/yr
Maui		n.e.	n.e.	n.e.	\$ 0.7	\$ 0.7	million/yr
<b>Residents supported</b>							
Maui	2.25 per job	n.e.	n.e.	n.e.	42	42	people
Oahu	2.13 per job	n.e.	n.e.	n.e.	5	5	people
<b>Total</b>		n.e.	n.e.	n.e.	<b>47</b>	<b>47</b>	people
<b>Homes supported</b>							
Maui	0.44 per res.	n.e.	n.e.	n.e.	18	18	homes
Oahu	0.34 per res.	n.e.	n.e.	n.e.	2	2	homes
<b>Total</b>		n.e.	n.e.	n.e.	<b>20</b>	<b>20</b>	homes



Table 6. State and County Revenues

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>6.a. CENTRAL MAUI</b>							
<b>Sugar operations</b>							
Tax base							
Final sales							
State	Table 4, Section 4.a	\$ 45.5	\$ 37.4				million/yr
Oahu	Table 4, Section 4.a	n.e.	\$ 7.1				million/yr
Intermediate sales	Table 4, Section 4.a	\$ 67.0	\$ 85.9				million/yr
Rent paid to the State	Table 4, Section 4.a	\$ 0.1	\$ 0.1				million/yr
Profit	Table 4, Section 4.a	\$ 19.1	\$ 22.0				million/yr
Payroll	Table 5, Section 5.a	\$ 82.7	\$ 68.0				million/yr
Assessed property value	\$ 400 per acre	\$ 11.8	\$ 12.1				million
State revenues							
Excise taxes							
On final sales	4.0% of fin. sales	\$ 1.82	\$ 1.50				million/yr
On intermediate sales	0.5% of int. sales	\$ 0.33	\$ 0.43				million/yr
Corporate income taxes	1.0% of profits	\$ 0.19	\$ 0.22				million/yr
Individual income taxes	4.1% of payroll	\$ 3.39	\$ 2.79				million/yr
Rent paid to the State		\$ 0.14	\$ 0.14				million/yr
Total State taxes		\$ 5.88	\$ 5.08				million/yr
Maui County property taxes	0.45% of value	\$ 0.05					million/yr
	0.58% of value		\$ 0.07				million/yr
City & County of Honolulu, excise tax surcharge	0.5% of fin. sales		\$ 0.04				million/yr
<b>Diversified Ag, development activity</b>							
Tax base							
Development period	Table 4, Section 4.a				10	6	years
Green energy capacity (solar)					38	38	MW
Final sales							
State	Table 4, Section 4.a				\$ 29.4	\$ 31.4	million/yr
Oahu	Table 4, Section 4.a				\$ 1.2	\$ 1.2	million/yr
Intermediate sales	Table 4, Section 4.a				\$ 10.5	\$ 11.5	million/yr
Profit	Table 4, Section 4.a				\$ 4.0	\$ 4.3	million/yr
Payroll	Table 5, Section 5.a				\$ 14.5	\$ 13.3	million/yr
State revenues							
Excise taxes							
On final sales	4.0% of				\$ 1.18	\$ 1.26	million/yr
On intermediate sales	0.5% of int. sales				\$ 0.05	\$ 0.06	million/yr
Corporate income taxes	1.0% of profits				\$ 0.04	\$ 0.04	million/yr
Individual income taxes	4.1% of payroll				\$ 0.59	\$ 0.54	million/yr
Total State taxes					\$ 1.86	\$ 1.90	million/yr
Less energy subsidy	\$500,000 per MW ÷ dev yrs				\$ (1.88)	\$ (3.13)	million/yr
Net revenues					\$ (0.01)	\$ (1.22)	million/yr
Cumulative net revenues					\$ (0.13)	\$ (7.34)	million
State taxes					\$ 18.62	\$ 11.41	million
Energy subsidy					\$ (18.75)	\$ (18.75)	million
Maui County revenues					n.e.	n.e.	
City & County of Honolulu, excise tax surcharge	0.5% of				\$ 0.01	\$ 0.01	million/yr
Cumulative revenues					\$ 0.06	\$ 0.04	million

Table 6. State and County Revenues

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
<b>Diversified Ag, Operations</b>							
Tax base							
Final sales							
State	Table 4, Section 4.a			\$ 0.3	\$ 24.9	\$ 8.6	million/yr
Oahu	Table 4, Section 4.a			\$ 0.0	\$ 3.6	\$ 1.2	million/yr
Intermediate sales	Table 4, Section 4.a			\$ 0.8	\$ 248.4	\$ 103.4	million/yr
Rent	Table 4, Section 4.a			n.e.	\$ 1.0	\$ 0.8	million/yr
Profit	Table 4, Section 4.a			\$ 0.1	\$ 33.0	\$ 12.4	million/yr
Payroll	Table 5, Section 5.a			\$ 0.5	\$ 45.3	\$ 15.6	million/yr
Assessed property value							
Crop land	\$ 400 per acre			\$ 0.08	\$ 6.38	\$ 2.11	million
Pasture, irrigated	\$ 100 per acre				\$ 0.47	\$ 0.38	million
Pasture, unirrigated	\$ 60 per acre			\$ 0.03	\$ 0.55	\$ 1.24	million
Land for green energy	\$ 400 per acre				\$ 0.10	\$ 0.10	million
Fallow	\$ 100 per acre			\$ 2.9			million
Improvements	Table 5, Section 5.a				\$ 125.65	\$ 104.31	million
Total assessed value				\$ 3.0	\$ 133.1	\$ 108.1	million
State revenues							
Excise taxes							
On final sales	4.0% of			\$ 0.01	\$ 1.00	\$ 0.34	million/yr
On intermediate sales	0.5% of int. sales			\$ 0.00	\$ 1.24	\$ 0.52	million/yr
On rents paid to private landowners	4.0% rents				\$ 0.04	\$ 0.03	million/yr
Corporate income taxes	1.0% of profits			\$ 0.00	\$ 0.33	\$ 0.12	million/yr
Individual income taxes	4.1% of payroll			\$ 0.02	\$ 1.86	\$ 0.64	million/yr
Total State taxes				\$ 0.03	\$ 4.46	\$ 1.66	million/yr
Maui County property taxes	0.60% of value			\$ 0.02	\$ 0.80	\$ 0.65	million/yr
City & County of Honolulu, excise tax surcharge	4.0% of			\$ 0.00	\$ 0.14	\$ 0.05	million/yr
<b>6.b. Upcountry MAUI (farms supplied with water from EMI)</b>							
Development activity							
Tax base							
Development period	Table 4, Section 4.b				5	-	years
Expenditures and sales	Table 5, Section 5.b				\$ 0.6	\$ -	million/yr
Payroll					\$ 0.3	\$ -	million/yr
State revenues							
Excise tax on final sales	4.0% of				\$ 0.02	\$ -	million/yr
Individual income taxes	4.1% of payroll				\$ 0.01	\$ -	million/yr
Total State taxes					\$ 0.04	\$ -	million/yr
Cumulative revenues					\$ 0.18	\$ -	million
Maui County revenues (cumulative)					n.e.	ne.	
City & County of Honolulu, excise tax surcharge (cumulative)					n.e.	ne.	
Operations							
Tax base							
Final sales							
State	Table 4, Section 4.b			\$ 2.7	\$ 3.2	\$ -	million/yr
Oahu	Table 4, Section 4.b			\$ 0.4	\$ 0.5	\$ -	million/yr
Intermediate sales	Table 4, Section 4.b			\$ 23.7	\$ 28.6	\$ -	million/yr
Profit	Table 4, Section 4.b			\$ 2.6	\$ 3.2	\$ -	million/yr
Payroll	Table 5, Section 5.b			\$ 4.8	\$ 5.8	\$ -	
Assessed property value							
Kula Ag Park	\$ 400 per acre			\$ 0.18	\$ 0.28		million
	\$ 60 per acre					\$ 0.04	million
Land to be added to Kula Ag Park	\$ 100 per acre			\$ 0.03			million
Other farms	\$ 360 per acre			\$ 0.29	\$ 0.29		million
	\$ 60 per acre					\$ 0.05	million
Total assessed value				\$ 0.5	\$ 0.6	\$ 0.09	million

Table 6. State and County Revenues

(Continued)

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
State revenues							
Excise taxes							
On final sales	4.0% of			\$ 0.11	\$ 0.13	\$ -	million/yr
On intermediate sales	0.5% of int. sales			\$ 0.12	\$ 0.14	\$ -	million/yr
Corporate income taxes	1.0% of profits			\$ 0.03	\$ 0.03	\$ -	million/yr
Individual income taxes	4.1% of payroll			\$ 0.20	\$ 0.24	\$ -	million/yr
Total State taxes				\$ 0.45	\$ 0.54	\$ -	million/yr
Maui County revenues							
Property taxes	0.60% of value			\$ 0.003	\$ 0.003	\$ 0.00	million/yr
Rents, Kula Ag Park	Table 4, Section 4.b			\$ 0.54	\$ 0.85	\$ -	million/yr
Total County revenues				\$ 0.54	\$ 0.85	\$ 0.00	million/yr
City & County of Honolulu, excise tax surcharge	0.5% of			\$ 0.002	\$ 0.002	\$ -	million/yr
<b>6.c. EAST MAUI (farms with appurtenant and riparian rights)</b>							
Tax base							
Final sales							
State			n.e.	n.e.	\$ 0.5	\$ 0.5	million/yr
Oahu			n.e.	n.e.	\$ 0.07	\$ 0.07	million/yr
Intermediate sales			n.e.	n.e.	\$ 2.4	\$ 2.4	million/yr
Profits on direct and indirect sales			n.e.	n.e.	\$ 0.3	\$ 0.3	million/yr
Payroll			n.e.	n.e.	\$ 0.8	\$ 0.8	million/yr
Assessed value							
Taro	\$ 300 per acre			n.e.	\$ 0.01	\$ 0.01	million
Other Ag	\$ 300 per acre			n.e.	\$ 0.01	\$ 0.01	million
Total assessed value					\$ 0.02	\$ 0.02	million
State revenues							
Excise taxes							
On final sales	4.0% of		n.e.	n.e.	\$ 0.018	\$ 0.018	million/yr
On intermediate sales	0.5% of int. sales		n.e.	n.e.	\$ 0.012	\$ 0.012	million/yr
Corporate income taxes	1.0% of profits		n.e.	n.e.	\$ 0.003	\$ 0.003	million/yr
Individual income taxes	4.1% of payroll		n.e.	n.e.	\$ 0.034	\$ 0.034	million/yr
Total State taxes			n.e.	n.e.	\$ 0.067	\$ 0.067	million/yr
Maui County property tax	0.60% of value				\$ 0.0001	\$ 0.0001	million/yr
City & County of Honolulu, excise tax surcharge	0.5% of		n.e.	n.e.	\$ 0.0003	\$ 0.0003	million/yr

## **APPENDIX**

### **STATE AND COUNTY GOALS, OBJECTIVES, POLICIES AND GUIDELINES RELATED TO AGRICULTURAL LANDS**

#### **1. HAWAI‘I STATE CONSTITUTION (Article XI, Section 3):**

...to conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency and assure the availability of agriculturally suitable lands...

#### **2. HAWAI‘I STATE PLAN (Chapter 226, Hawaii Revised Statutes, as amended):**

##### **Section 226-7 Objectives and policies for the economy--agriculture.**

- (a) Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:
  - (1) Viability in Hawaii's sugar and pineapple industries.
  - (2) Growth and development of diversified agriculture throughout the State.
  - (3) An agriculture industry that continues to constitute a dynamic and essential component of Hawaii's strategic, economic, and social well-being.
- (b) To achieve the agricultural objectives, it shall be the policy of the State to:
  - (2) Encourage agriculture by making best use of natural resources.
  - (10) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.
  - (16) Facilitate the transition of agricultural lands in economically nonfeasible agricultural production to economically viable agricultural uses.

##### **Section 226-103 Economic priority guidelines.**

- (c) Priority guidelines to promote the continued viability of the sugar and pineapple industries:
  - (1) Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.
- (d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:

- (1) Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.
- (10) Support the continuation of land currently in use for diversified agriculture.

**Section 226-104 Population growth and land resources priority guidelines.**

(b) Priority guidelines for regional growth distribution and land resource utilization:

- (2) Make available marginal or non-essential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.

**3. AGRICULTURAL STATE FUNCTIONAL PLAN (1991)**

(Functional plans are guidelines for implementing the State Plan. They are approved by the Governor, but not adopted by the State Legislature.)

Objective H: Achievement of Productive Agricultural Use of Lands Most Suitable and Needed for Agriculture.

Policy H(2): Conserve and protect important agricultural lands in accordance with the Hawaii State Constitution.

Action H(2)(a): Propose enactment of standards and criteria to identify, conserve, and protect important agricultural lands and lands in agricultural use.

Action H(2)(c): Administer land use district boundary amendments, permitted land uses, infrastructure standards, and other planning and regulatory functions on important agricultural lands and lands in agricultural use, so as to ensure the availability of agriculturally suitable lands and promote diversified agriculture.

**4. IMPORTANT AGRICULTURAL LANDS [§205-41]**

There is a compelling state interest in conserving the State's agricultural land resource base and assuring the long-term availability of agricultural lands for agricultural use to achieve the purposes of:

- (1) Conserving and protecting agricultural lands;
- (2) Promoting diversified agriculture;
- (3) Increasing agricultural self-sufficiency; and
- (4) Assuring the availability of agriculturally suitable lands.



**5. COUNTY OF MAUI 2030 GENERAL PLAN, COUNTYWIDE POLICY PLAN (2010)**

**Countywide goals, objectives, policies and actions**

**F. Strengthen the Local Economy**

**Objective**

2. Diversify and expand sustainable forms of agriculture and aquaculture.

**Policies**

- b. Prioritize the use of agricultural land to feed the local population, and promote the use of agriculture lands for sustainable and diversified agricultural activities.
- e. Support ordinances, programs, and policies that keep agricultural land and water available and affordable to farmers.

**Implementing Actions**

- c. Create agricultural parks in areas distant from genetically modified crops.

**J. Promote Sustainable Land Use and Growth Management**

**Objective**

2. Improve planning for and management of agricultural lands and rural areas.

**Policies**

- a. Protect prime, productive, and potentially productive agricultural lands to maintain the islands' agricultural and rural identities and economies.
- c. Discourage developing or subdividing agriculturally designated lands when non-agricultural activities would be primary uses.

**Implementing Actions**

- a. Inventory and protect prime, productive, and potentially productive agricultural lands from competing non-agricultural land uses.

**6. MAUI ISLAND PLAN, GENERAL PLAN 2030 (2012)**

**Core Values**

- E. Preserve rural and agricultural lands and encourage sustainable agriculture.

**Economic Development**

**Goal**

- 4.3 Maui will have a diversified agricultural industry contributing to greater economic, food, and energy security and prosperity.

**Objective**

- 4.3.1 Strive for at least 85 percent of locally-consumed fruits and vegetables and 30 percent of all other locally-consumed foods to be grown in-State.

**Policies**

- 4.3.1.a Strive to substitute food/agricultural product imports with a reliable supply of locally-produced food and agricultural products.
- 4.3.1.c Encourage growing a diverse variety of crops and livestock to ensure the stewardship of our land while safeguarding consumer safety.

**Objective**

- 4.3.2 Maintain or increase agriculture's share of the total island economy.

**Policies**

- 4.3.2.a Encourage the export of the island's agricultural products to offshore markets.
- 4.3.2.c Encourage the continued viability of sugar cane production, or other agricultural crops, in central Maui and all of Maui Island.

**Objective**

- 4.3.3 Expand diversified agriculture production at an average annual rate of 4 percent.

**Policies**

- 4.3.3.a Promote the development of locally-grown and ecologically-sound biofuels, aquaculture, and forest products.

**Agricultural Lands**

**Goal**

- 7.1 Maui will have a prosperous agricultural industry and will protect agricultural lands.

**Objective**

- 7.1.1 Significantly reduce the loss of productive agricultural lands.

**Policies**

- 7.1.1.a Allow, where appropriate, the clustering of development on agricultural lands when approved as a CSD [Conservation Site Design] plan or similar approval mechanism.
- 7.1.1.b Require, where appropriate, the review and approval of CSD plans prior to the subdivision of agricultural land.

- 7.1.1.c Discourage developing or subdividing productive agricultural lands for residential uses in which the residence would be the primary use and any agricultural activities would be secondary uses.
- 7.1.1.e Focus urban growth, to the extent practicable, away from productive and important agricultural lands.
- 7.1.1.f Strongly discourage the conversion of productive and important agricultural lands (such as sugar, pineapple, and other produce lands) to rural or urban use, unless justified during the General Plan update, or when other overriding factors are present.
- 7.1.1.h Provide incentives for landowners to preserve and protect agricultural lands from development through the use of TDR/PDR, tax credits, easement programs, or similar means.
- 7.1.1.j Require all major developments adjacent to agricultural lands to provide an appropriate and site-specific agricultural protection buffer as part of a required site plan.

### **Directed Growth Plan**

#### **Rural Growth Area, Policies**

- 8.2.d All development within rural growth areas should avoid encroachment upon prime agricultural land.

#### **Wailuku-Kahului**

As shown in Figure 6, Pu‘unani is within the Growth Area for Wailuku, with a portion within the Urban Boundary and a portion within the Rural Boundary.

## **7. REFERENCES**

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