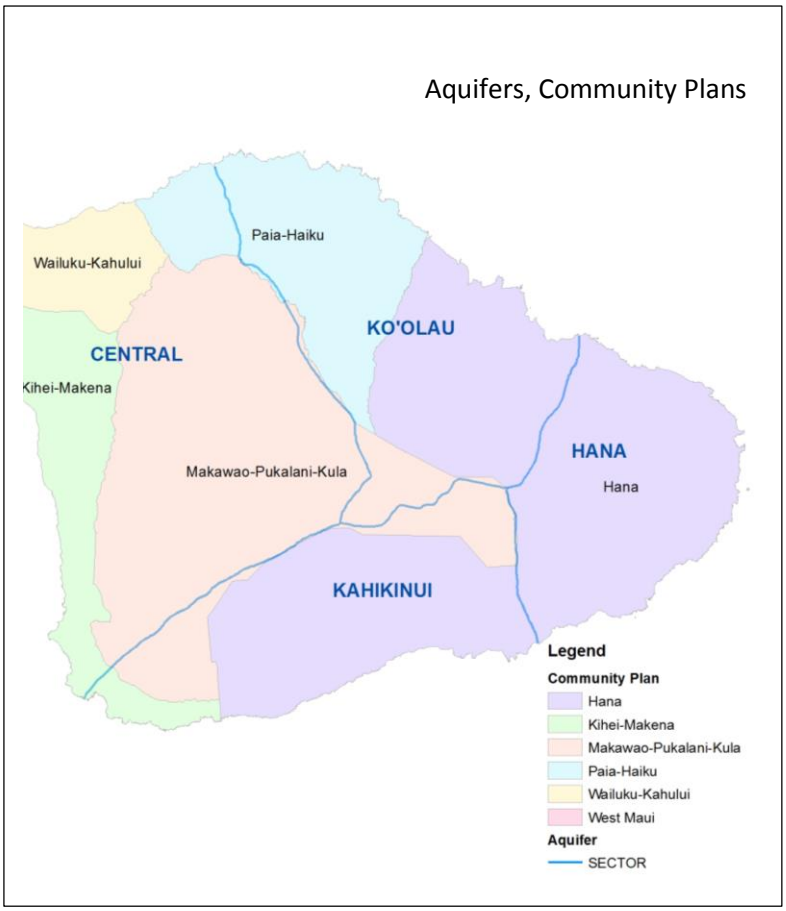
HĀNA REGION (KOʻOLAU, HĀNA & KAHIKINUI AQUIFER SECTORS)

This is a synopsis of work in progress for the Koʻolau, Hāna and Kahikinui aquifer sectors for further public input. Analysis is ongoing and the information below has not been reviewed by the Board of Water Supply, County Council or the State Commission on Water Resource Management. Preliminary findings are subject to change based on input and further analysis. The objective of the water use and development plan is "to set forth the allocation of water to land use through the development of policies and strategies to guide the County in its planning, management and development of water resources to meet projected demands."

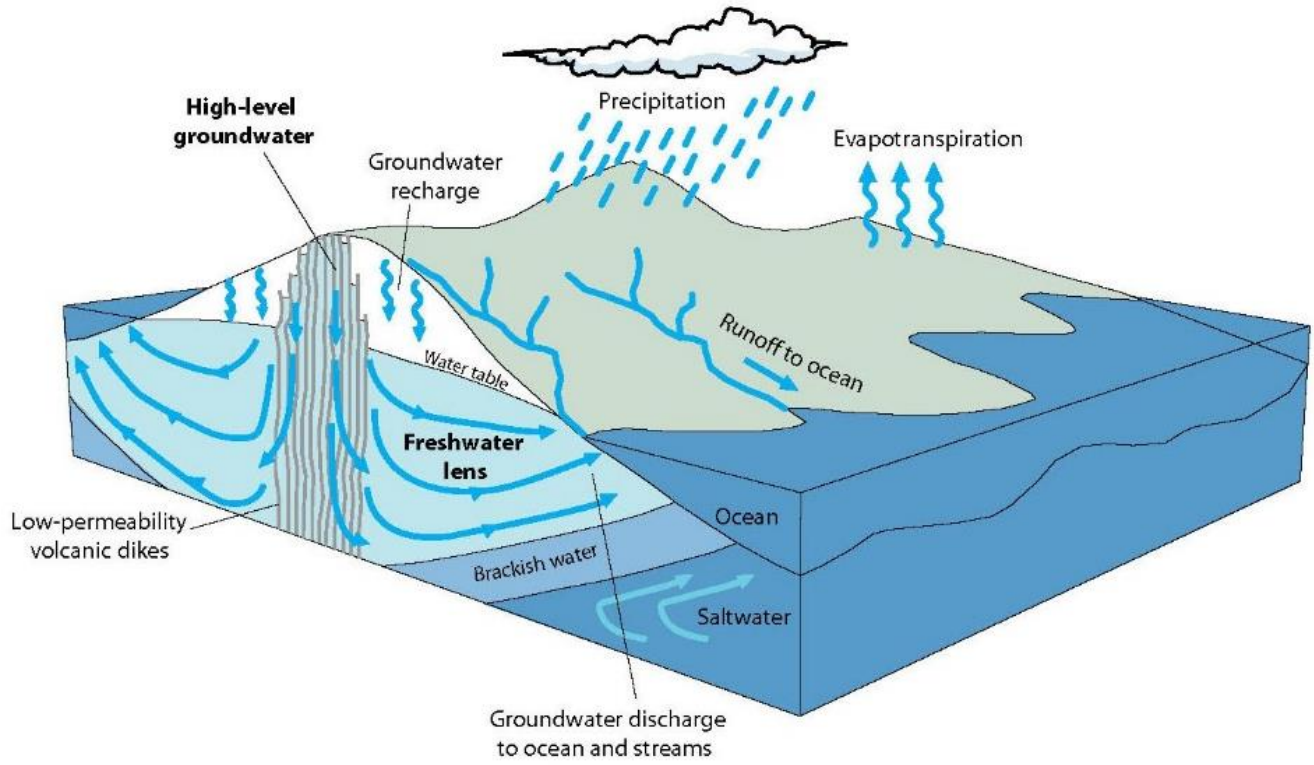
PLANNING BOUNDARIES

The Water Use and Development Plan (WUDP) allocates water to land uses and water users consistent with the Maui Island Plan. The WUDP uses hydrologic units for presentation and analysis consistent with state requirements for updating the plan. Community Plan boundaries do not coincide with the hydrologic units. The Hāna Community Plan contains most of Hāna, Koʻolau and Kahikinui aquifer sectors. The Haiku-Paʻia Community Plan spans portions of the Koʻolau aquifer sector. The Makawao-Pukalani-Kula Community Plan spans small portions of the Koʻolau and Kahikinui aquifer sectors. The region also encompasses all or portions of various moku (Koʻolau, Hāna, Kīpahulu, Kaupō, Kahikinui, Hāmākuapoko, Hāmākualoa, Kula and Honuaʻula) and their underlying ahupuaʻa as shown below.



WATER RESOURCES IN THE HĀNA REGION

Climate, hydrology, geology and human activities affect the water cycle and the surface and ground water systems which are interconnected. On northeast Haleakalā, in the area between Makawao and Keʻanae Valley, fresh saturated groundwater occurs as (1) perched, high-level water above an unsaturated zone, and (2) a freshwater-lens system underlain by seawater. In the area between Keʻanae Valley and Nāhiku, the groundwater system appears to be saturated above sea level to altitudes greater than 2,000 ft. For southeast and southwest Haleakalā, information related to groundwater systems is sparse although perched and freshwater-lens systems are expected to be present. (*Spatially Distributed Groundwater Recharge Estimated Using A Water-Budget Model For The Island of Maui, Hawaiʻi, 1978-2002)*



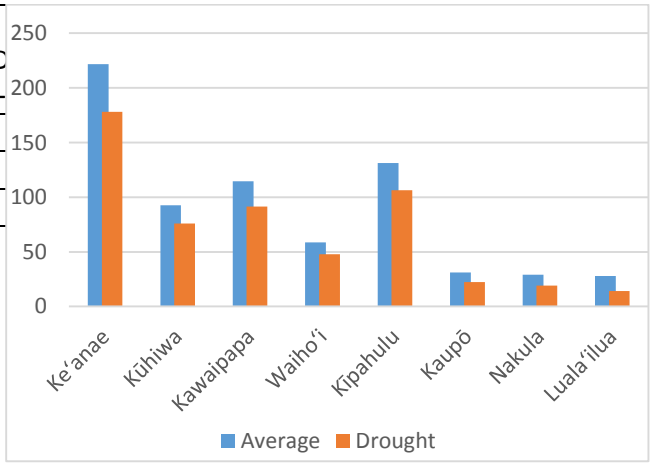
Hydrology of Ocean Islands, USGS Pacific Islands Water Science Center http://hi.water.usgs.gov/studies/GWRP/islhydro.html

A 2014 USGS study evaluated aquifer recharge, finding that recharge under average climate conditions (using 1978–2007 rainfall and 2010 land cover) was reduced significantly during drought conditions (using 1998–2002 rainfall and 2010 land cover). For windward areas (e.g., Kūhiwa), recharge estimates are most sensitive to fog-interception rates and forest-canopy evaporation, while recharge estimates in dry aquifer systems (e.g., Lualaʻilua) are more sensitive to irrigated crop areas and parameters related to evapotranspiration. Drought conditions are estimated to result in a 19% to 37% reduction in aquifer recharge, with the greatest decreases in the dryer areas.

Recharge by Aquifer Sector During Average and Drought Climate Conditions (mgd)

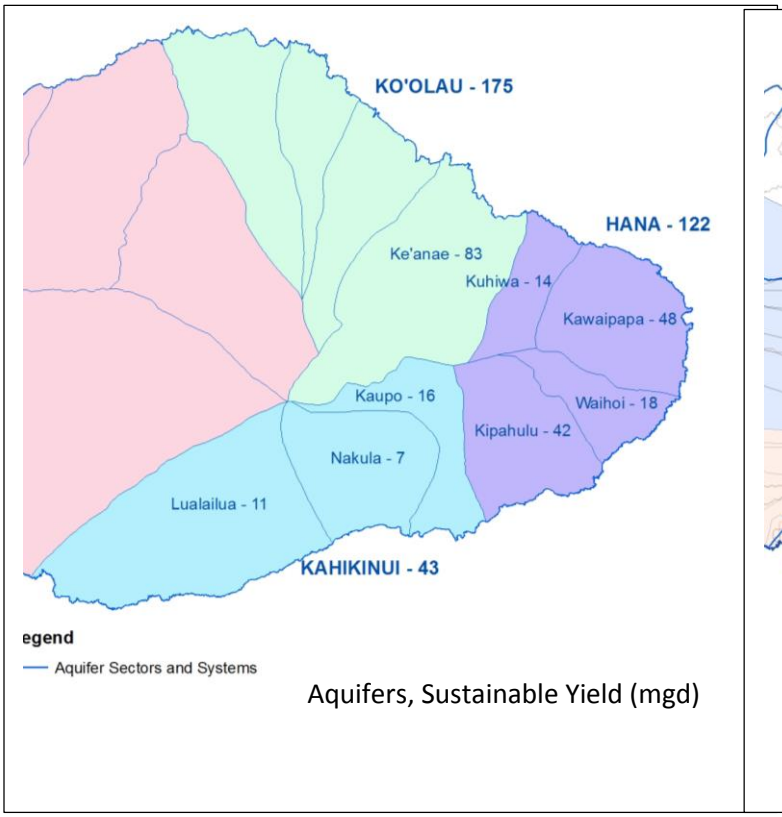
Aquifer	Inflow Average	Outflow Average	Recharge Average	Recharge Drought	D_
Koʻolau	1032	621	411	324.96	
Hāna	844	447	397	321.5	
Kahikinui	202	114	88	55.52	

Source: Spatially Distributed Groundwater Recharge Estimated Using A Water-Budget Model For The Island of Maui, Hawaiʻi, 1978–2007

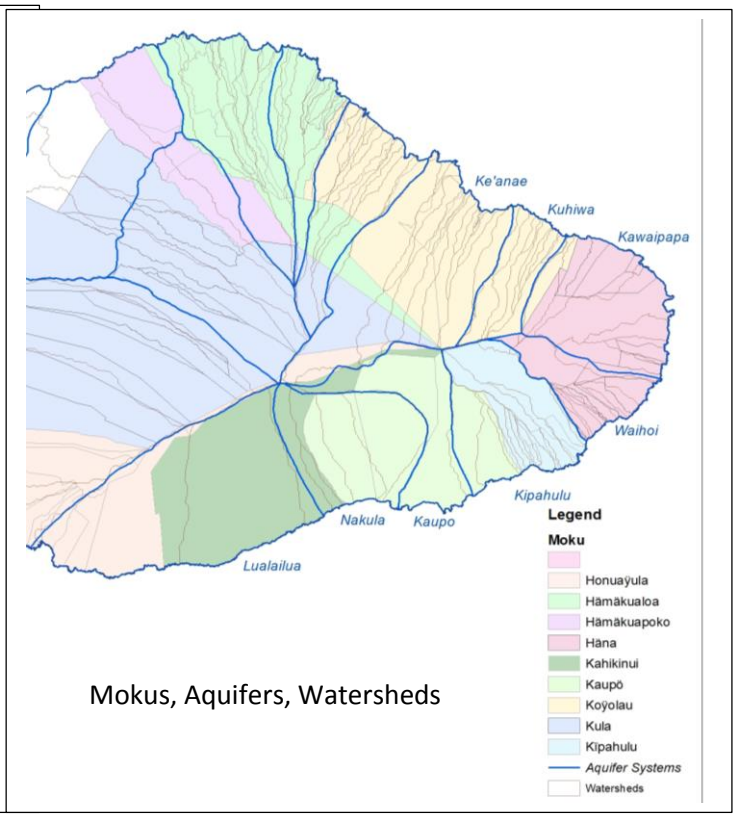


Sustainable Yield

The groundwater sustainable yield (SY) is the maximum rate that groundwater can be withdrawn without impairing the water source as determined by the Commission on Water Resource Management (CWRM). The sustainable yield for the subject aquifers and aquifer systems shown below; the total for the region is 340 mgd.



Aquifers, Sustainable Yield (mgd)



Mokus, Aquifers, Watersheds

Surface Water

Streams on windward Haleakalā are fed by abundant rainfall and groundwater discharge. In the area between Makawao and Keʻanae Valley, groundwater discharges to streams from a perched, high-level saturated groundwater system. East of Keʻanae Valley, groundwater discharges to streams from a vertically extensive freshwater-lens system. Water diverted from various streams on windward Haleakalā via the East Maui Irrigation (EMI) system has been mainly used to irrigate sugarcane in central Maui. Stream reaches on leeward Haleakalā tend to be ephemeral.

East Maui Instream Flow Standards and Contested Case

CWRM adopted interim instream flow standards (IFS) for East Maui streams in 1988, with several later amendments as shown in the table below. Diversions can affect streamflow, leaving some downstream reaches dry, which can adversely affect kuleana and appurtenant rights, traditional and customary practices, stream ecology, water quality, recreational activities, and aesthetics.

Interim Instream Flow Standards

… "that amount of water flowing in each stream on the effective date of this standard, and as that flow may naturally vary throughout the year and from year to year without further amounts of water being diverted offstream through new or expanded diversions, and under the stream conditions existing on the effective date of the standard, except as may be modified by the following..."

Instream Flow Standards

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

In 2001 the Native Hawaiian Legal Corporation (NHLC), on behalf of Na Moku 'Aupuni o Ko'olau Hui (Na Moku), petitioned CWRM to amend the Interim IFS for 27 East Maui streams. In 2008 and 2010, CWRM approved amendments to the Interim IFS for about half the streams and established measurable IIFS of status quo conditions for the remaining streams; only 6 of the 27 streams had flow restored. The County DWS and the NHLC, on behalf of Na Moku, filed petitions for a contested case hearing before the CWRM. Na Moku appealed the CWRM's decision contending that the CWRM erred in concluding that Na Moku had no right to contest the case hearing and in reaching its underlying decision regarding IIFS amendment for the nineteen streams. The Intermediate Court of Appeals remanded to the CWRM and the contested case hearing began on March 3, 2015. Na Moku asserted the right to sufficient stream flow to support the exercise of their traditional and customary native Hawaiian rights to grow kalo, gather, and exercise other rights for religious, cultural, and subsistence purposes. The petition also alleges that the Commission had not carried out its obligations under public trust by failing to require HC&S and EMI to prove: 1. Their actual need; 2. That there are no feasible alternative sources of water to accommodate that need; and 3. The amount of water diverted does not harm a public trust purpose or any potential harm does not rise to a level that would preclude a finding that the requested use is nevertheless reasonably-beneficial.

The Hearing Officer's proposed Decision and Order of January 2016 in the East Maui Contested Case was not adopted by CWRM and subsequent to HC&S announcing cessation of sugar cane cultivation by the end of the year, CWRM ordered re-opened hearings to address HC&S current and future use of surface water and the impact on the groundwater; the impact on DWS's use of surface water due to cessation of sugar operations; the County's position on future use of sugarcane fields; and issues concerning management of the EMI ditch system. In a September 2016 Minute Order, the CWRM Hearings Officer reiterated the requirement that CWRM weigh competing instream and offstream uses, including economic impact on offstream uses, in amending the IIFS. The contested case hearing is currently scheduled for January 2017. Should the contested case decision be unfavorable to certain parties, appeals may prolong the case for months or even years.

The table below shows registered or permitted diversions, whether the IIFS for the stream is subject to the East Maui Contested Case, whether A&B stated in April 2016 that it will restore 100% of streamflow to certain streams as stated in the "Status" column below, and whether the County DWS has a diversion or service located within the hydrologic unit.

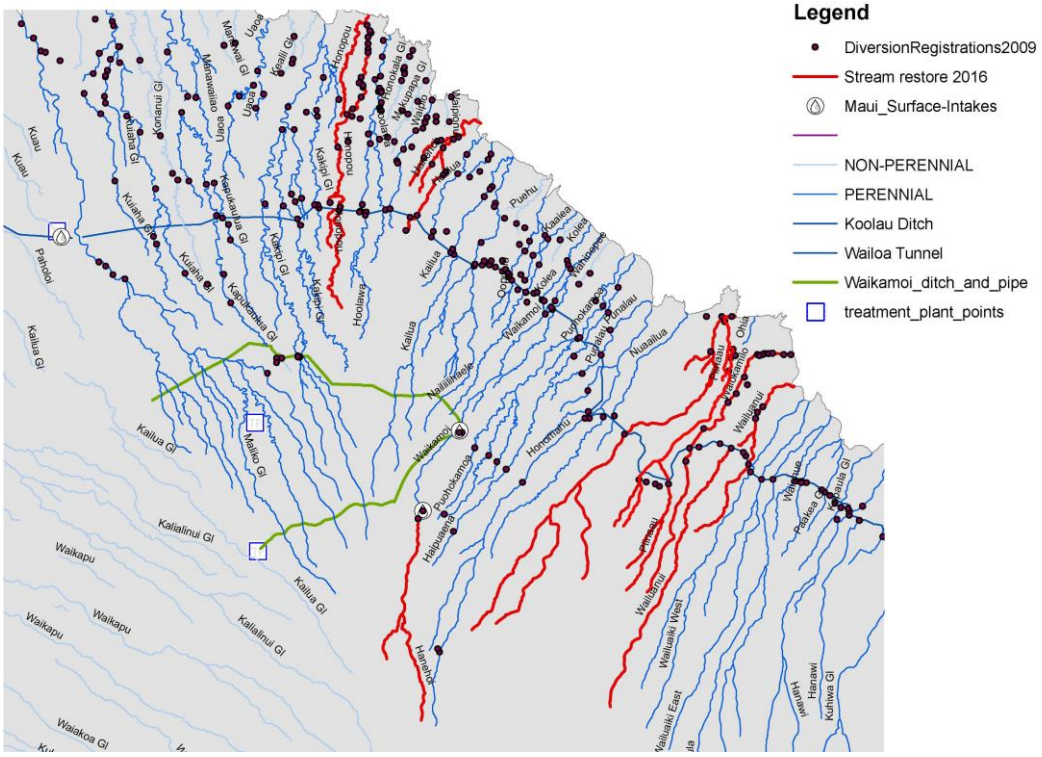
Hydrologic Unit Code	Hydrologic Unit Name	Aquifer System	No. of Diversions	Interim Instream Flow Standard (IIFS)	Status of IIFS	Co DWS Diversion	Co DWS Service
6027	Maliko	Haiku	10	HAR §13-169-44			
6028	Kuiaha	Haiku	30	HAR §13-169-44			
6029	Kaupakulua	Haiku	15	HAR §13-169-44			
6030	Manawaiiao	Haiku	3	HAR §13-169-44			
6031	Uaoa	Haiku	6	HAR §13-169-44			
6032	Kealii	Haiku	4	HAR §13-169-44			
6033	Kakipi	Haiku	21	HAR §13-169-44			
6034	Honopou	Honopou	23	9-25-2008 - 2.31mgd below Haiku Ditch and 1.49 below taro diversions	Contested Case CCH-MA13-01, A&B to restore 100% streamflow*		Kamole WTF, Kula Ag Park
6035	Hoolawa	Honopou	37	HAR §13-169-44			
6036	Waipio	Honopou	15	HAR §13-169-44			
6037	Hanehoi	Honopou	12	9-25-2008 - 0.09 below Haiku Ditch on Huelo trib, 0.69 below Haiku Ditch, 0.74mgd above community pipe, 2.21mgd at terminal waterfall	Contested Case CCH-MA13-01, A&B to restore 100% streamflow to Hanehoi (Puolua)*		Kamole WTF, Kula Ag Park
6038	Hoalua	Honopou	4	HAR §13-169-44			
6039	Hanawana	Honopou	5	HAR §13-169-44			
6040	Kailua	Honopou	6	HAR §13-169-44			
6041	Nailiilihaele	Waikamoi	12	HAR §13-169-44			

Hydrologic Unit Code	Hydrologic Unit Name	Aquifer System	No. of Diversions	Interim Instream Flow Standard (IIFS)	Status of IIFS	Co DWS Diversion	Co DWS Service
6042	Puehu	Waikamoi	1	HAR §13-169-44			
6043	Oopuola	Waikamoi	15	HAR §13-169-44			
6044	Kaaiea	Waikamoi	3	HAR §13-169-44			
6045	Punaluu	Waikamoi	1	HAR §13-169-44			
6046	Kolea	Waikamoi	8	0.13mgd at Hana Hwy	Contested Case CCH-MA13-01		
6047	Waikamoi	Waikamoi	11	5-25-2010 -1.81mgd at Hana Hwy	Contested Case CCH-MA13-01, A&B to restore 100% streamflow*	Olinda and Piiholo WTFs	Kamole WTF, Kula Ag Park
6048	Puohokamoa	Waikamoi	8	5-25-2010 -0.26mgd at Hana Hwy	Contested Case CCH-MA13-01	Olinda and Piiholo WTFs	Kamole WTF, Kula Ag Park
6049	Haipuaena	Waikamoi	5	5-25-2010 -0.06mgd at Hana Hwy	Contested Case CCH-MA13-01	Olinda and Piiholo WTFs	Kamole WTF, Kula Ag Park
6050	Punalau	Waikamoi	3	5-25-2010 -HAR §13-169-44	Contested Case CCH-MA13-01		Kamole WTF, Kula Ag Park
6051	Honomanu	Waikamoi	8	5-25-2010 -0.00mgd at Hana Hwy	Contested Case CCH-MA13-01	Piiholo WTF	Kamole WTF, Kula Ag Park
6052	Nuaailua	Waikamoi	2	5-25-2010 -2.00mgd below Kookau Ditch	Contested Case CCH-MA13-01		Kamole WTF, Kula Ag Park
6053	Piinaau	Keanae	14	HAR §13-169-44	Contested Case CCH-MA13-01, A&B to restore 100% streamflow to Piiinaau & Palahulu*		Kamole WTF, Kula Ag Park
6054	Ohia	Keanae	1	2.97mgd at Hana Hwy	Contested Case CCH-MA13-01		
6055	Waiokamilo	Keanae	18	3.17mgd below Koolau Ditch	A&B to restore 100% streamflow (has not been diverted since 2007 (CCHMA1301-20141230-HC&S-WL)*		
6056	Wailuanui	Keanae	8	4.03mgd at Hana Hwy	Contested Case CCH-MA13-01, Streamflow restored by A&B		Kamole WTF, Kula Ag Park
6057	W. Wailuaiki	Keanae	1	2.46mgd (wet) and 0.40mgd (dry) seasonal at Hana Hwy	Contested Case CCH-MA13-01		Kamole WTF, Kula Ag Park
6058	E. Wailuaiki	Keanae	1	2.39mgd (wet) and 0.13mgd (dry)	Contested Case CCH-MA13-01		Kamole WTF, Kula Ag Park
6059	Kopiliula	Keanae	2	HAR §13-169-44. Temporarily amended to include SCAP MA-352 on Kopiliula Stream for the implementation of a Land Restoration Plan (11/20/2002).	Contested Case CCH-MA13-01		Kamole WTF, Kula Ag Park
6060	Waiohue	Keanae	3	2.07mgd at Hana Hwy	Contested Case CCH-MA13-01		
6061	Paakea	Keanae	2	0.97mgd at Hana Hwy	Contested Case CCH-MA13-01		

Hydrologic Unit Code	Hydrologic Unit Name	Aquifer System	No. of Diversions	Interim Instream Flow Standard (IIFS)	Status of IIFS	Co DWS Diversion	Co DWS Service
6062	Waiaaka	Keanae	1	0.00mgd at Hana Hwy	Contested Case CCH-MA13-01		
6063	Kapaula	Keanae	2	0.13mgd at Hana Hwy	Contested Case CCH-MA13-01		
6064	Hanawi	Keanae	6	0.06mgd at Hana Hwy	Contested Case CCH-MA13-01		Kamole WTF, Kula Ag Park
6065	Makapipi	Keanae	3	0.60mgd at Hana Hwy	Contested Case CCH-MA13-01		
6066	Kuhiwa	Kuhiwa	0	HAR §13-169-44			
6093	Kukuiula	Kipahulu	1	HAR §13-169-44			
6094	Kaapahu	Kipahulu	0	HAR §13-169-44			
6095	Lelekea	Kipahulu	0	HAR §13-169-44			
6096	Alelele	Kipahulu	0	HAR §13-169-44			
6097	Kalepa	Kipahulu	2	HAR §13-169-44			
6098	Nuanuaaloa	Kipahulu	3	HAR §13-169-44			
6099	Manawainui	Kipahulu	3	HAR §13-169-44			
6100	Kaupo	Kaupo	1	HAR §13-169-44			
6101	Nuu	Nakula	0	HAR §13-169-44			
6102	Pahihi	Nakula	0	HAR §13-169-44			
6103	Waiopai	Nakula	0	HAR §13-169-44			
6104	Poopoo	Nakula	0	HAR §13-169-44			
6105	Manawainui Gulch	Nakula	0	HAR §13-169-44			
6106	Kipapa	Lualailua	0	HAR §13-169-44			
6107	Kanaio	Lualailua	0	HAR §13-169-44			

Interim Instream Flow Standard for East Maui, HAR §13-169-44 (HAR- Hawai'i Revised Statutes). Registered and/or permitted stream diversions.
*A&B announced April 20, 2016 it will permanently restore 100% of streamflow.

Streams To Be Permanently Restored by EMI



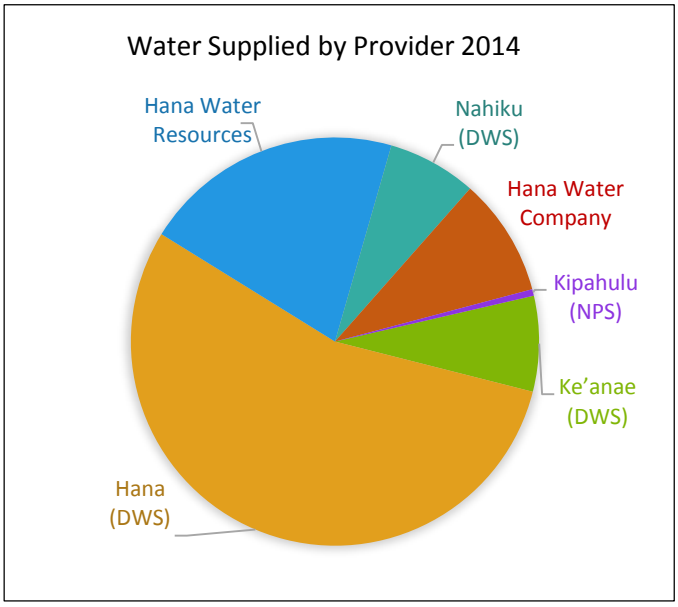
CURRENT WATER USE

The County Department of Water Supply (DWS) and privately owned "public water systems" (systems serving more than 25 people or 15 service connections) in the Hāna sector are summarized as follows. The charts below show the proportion of water consumption by water provider. All potable systems use groundwater. DWS systems water production and locations are also shown below.

Water Produced by Provider

System Name	Aquifer System	Average Daily Flow (gpd)
Ke'anae (DWS)	Koʻolau	44,000
Hāna (DWS)	Hāna	319,000
Hāna Water Resources	Hāna	120,000
Nahiku (DWS)	Hāna	41,000
Hāna Water Company	Hāna	54,000
Kipahulu (Nat'l Park Service)	Hāna	3,000
DWS Subtotal		*404,000*
Total		581,000

Dept. of Health, 2015



Well pumpage is required to be reported to CWRM reflecting actual periods of pumpage. Reported well pumpage in East Maui is minimal, with less than 0.3 % of sustainable yield pumped. While not all active wells comply with reporting requirements and pumpage data is especially incomplete for smaller domestic and irrigation wells, there is little pressure on groundwater resources in this area.

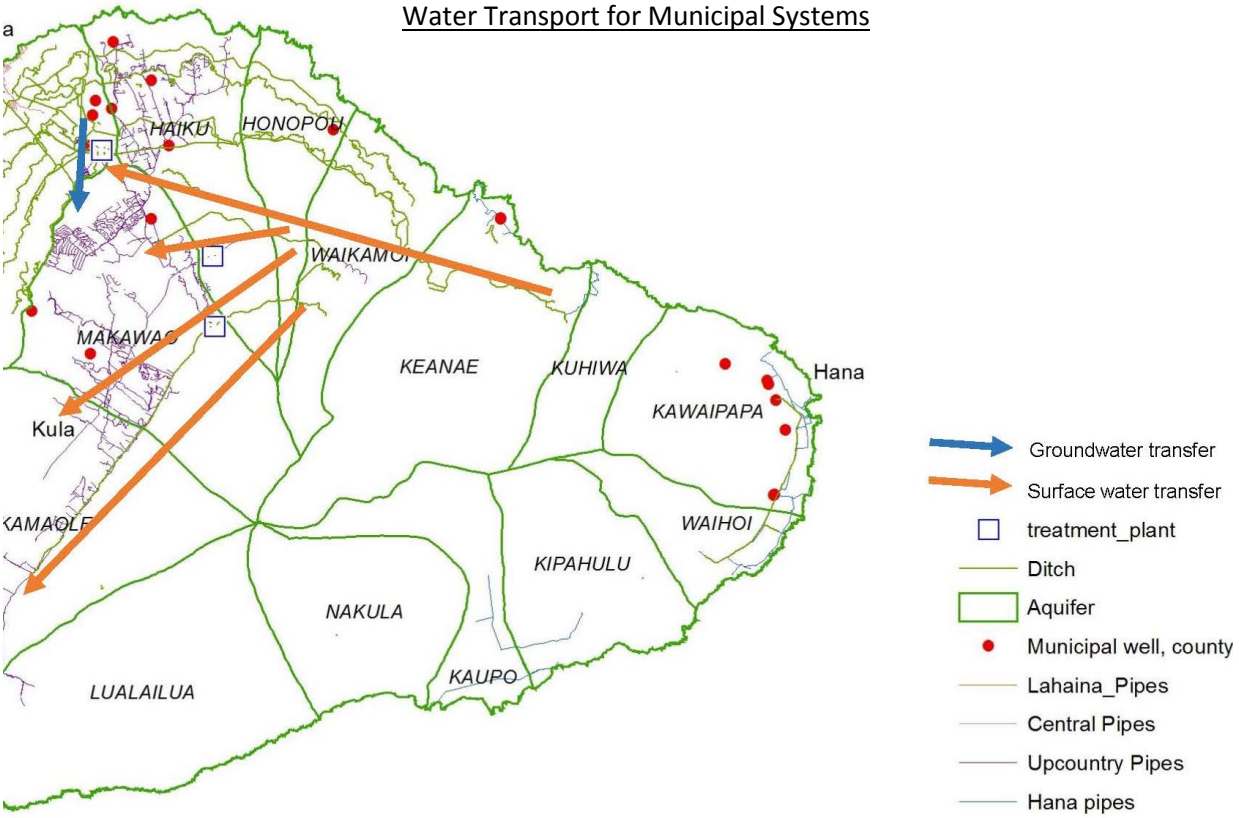
Reported Well Pumpage (2016, mgd), Sustainable Yield

Aquifer	Domestic	Industrial	Agriculture	Irrigation	Municipal County	Municipal Private	Total	Sustainable Yield
Ke'anae	0.000	0.000	0.000	0.000	0.066	0.000	**0.066**	**83**
Hāna sector	0.004	0.000	0.000	0.001	0.444	0.156	**0.606**	**122**
Kahikinui sector	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	**34**
Total	0.004	0.000	0.000	0.001	0.510	0.156	**0.672**	**239**

CURRENT WATER TRANSPORT

Surface water from Makapipi Stream in Keʻanae aquifer to Maliko Gulch in Haʻiku aquifer is conveyed to dryer Central aquifer systems for agricultural and municipal use. In 2016, HC&S reported an average of 45.8 mgd diverted at the Koʻolau ditch and Keʻanae and Nahiku diversions. As of October, water flows in the Wailoa ditch at Maliko Gulch have been reduced to 20 – 25 mgd. Over the last decade, the total amount of stream flows diverted by EMI's ditch system has been 114 mgd to 167 mgd. About 7.7 mgd of diverted water is used Upcountry for municipal use and diversified agriculture at Kula Ag Park. Future water transports are discussed under Resource Adequacy below.

Water Transport for Municipal Systems



PROJECTED DEMAND

Wetland Taro

The CWRM's May 25, 2010 Commission Order identified the acreage of taro for each stream through the undocumented declarations of registered diverters, as a total of 1,006 acres plus water for domestic needs, but did not attempt to evaluate these claims nor relate these acres to the amount of water added to the streams in the revised IIFS. In amending the IIFS, the estimates of wetland taro and other agricultural requirements, including those that would also qualify for traditional and customary Hawaiian rights, were based on a subset of acreage that Na Moku claimed for appurtenant and riparian rights and demonstrated as suffering actual harm to their owners' reasonable use. In total, the acreage claimed by Na Moku as being either in taro or cultivable agriculture was 136.18 acres for Honopou, Palauhulu, Waiokamilo, and Wailuanui Streams, although Na Moku's expert witness conceded that these acreages are overstated by an unknown amount for taro cultivation and cultivable agriculture.

The CWRM used a water budget for taro of 130,000 to 150,000 gad which translates to an average of 260,000 to 300,000 gad during the time that water is needed to flow into the lo'i to maintain temperatures to prevent rot. Most of this water will flow through the lo'i, and into other lo'i or back into the stream where it will be available for other uses.[1]

[1] http://files.hawaii.gov/dlnr/cwrm/cch/cchma1301/CCHMA1301-20160115-HO-D&O.pdf

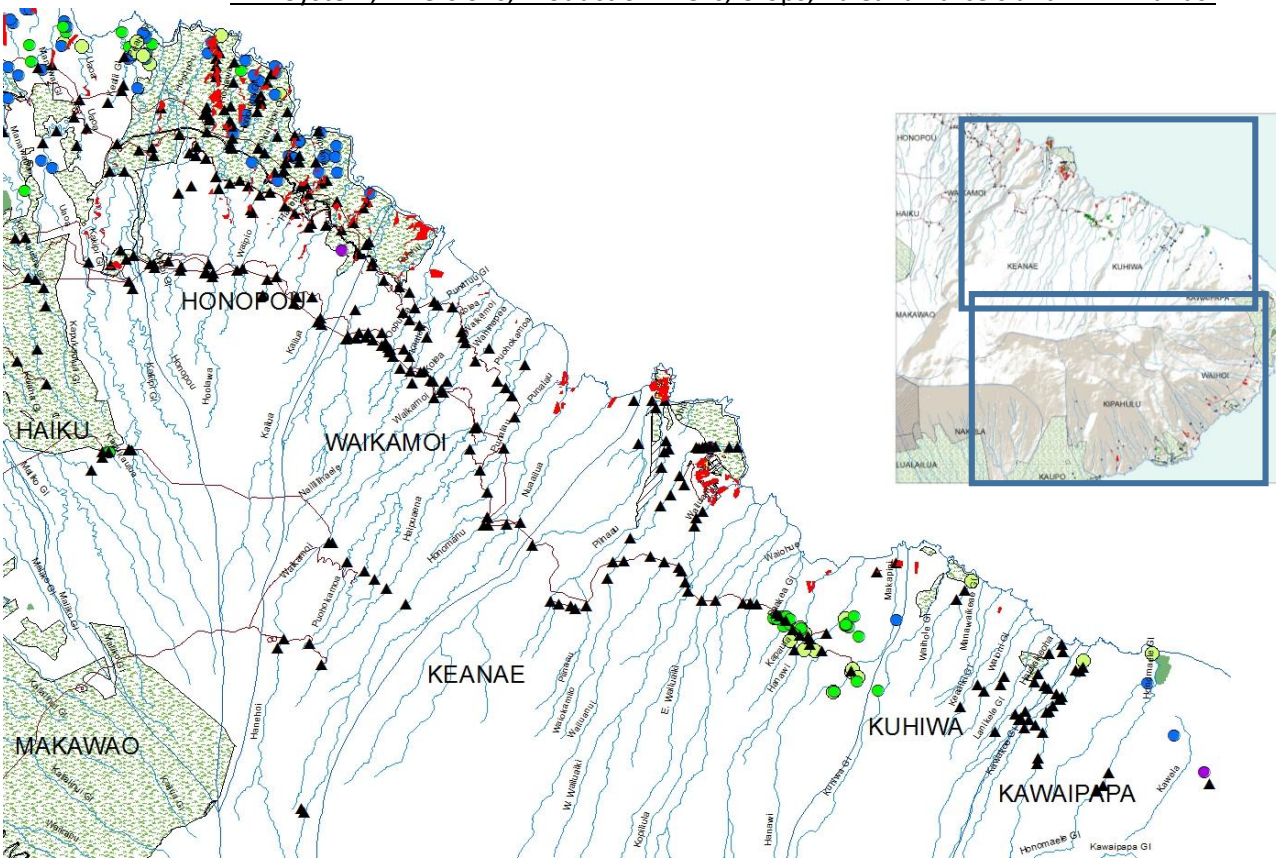
Water Requirements for Taro and Other Agriculture

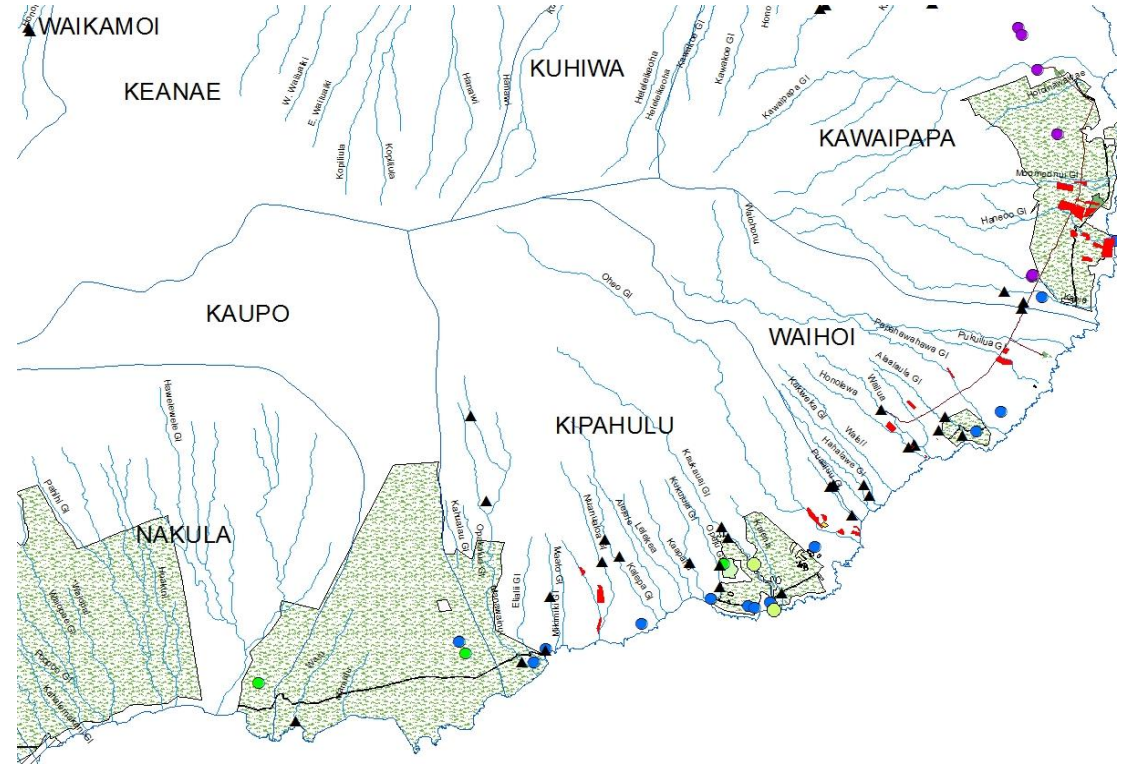
Area	Stream	Taro Lo'i (acres)	Other Ag (acres)	Taro Lo'i Water Requirements (mgd)	Other Ag Water Requirements (gpd)
Keanae	Palauhulu	13.475	7.00	1.75 - 2.02	25,714 - 28,571
Wailua	Waiokamilo & Wailuanui	30.160	28.096	3.92- 4.52	13,880 - 16,728
Honopou	Honopou	6.170	9.820	0.80 - 0.93	13,880 - 16,728
Hanehoi	Hanehoi & Puolua	2.300	?	0.30 - 0.35	
Makapipi	Makapipi	4.170	3.250	0.54 - 0.63	16,680 - 19,246
Total		**56.275**	**48.166**		

http://files.hawaii.gov/dlnr/cwrm/cch/cchma1301/CCHMA1301-20160115-HO-D&O.pdf

Taro represents appurtenant rights and other ag represents riparian rights. The water requirement for 'other agriculture' was based on 10% of taro demand.

EMI System, Diversions, Production Wells, Crops, Kuleana Parcels and DHHL Lands.





Kuleana Parcels
DHHL_lands

Agricultural Baseline 2015

All Other Crops

Category

Flowers / Foliage / Landscape
Coffee
Tropical Fruits
Diversified Crop
Commercial Forestry
Pasture
Taro
Sugar

Legend

Aquifer Systems
Streams
Ditches
Stream Diversions

Well Index

Production Wells

Irrigation
Agriculture
Municipal (DWS, Private Public)
Domestic, Individual

Population Growth Rate Demand Projection

The Water Use and Development Plan projects water demand based on projected population growth, which reflects the policy and land use of the Maui Island Plan. Population growth rate projections were applied in 5-year increments over the 20-year planning period from 2015 to 2035 for high, medium (base case) and low growth scenarios. Water consumption, including both public and private water systems, are compared to the incremental water needs for the next 20 years based on the *Socio-Economic Forecast Report, 2014* prepared by the Planning Department consistent with the Maui Island Plan. An incremental volume of demand to reflect population not served by public systems is also added as shown below; estimates were generated based on well and pump size data, population served by public water systems reported to Department of Health, and census block population located in areas not served by public systems with the latter method selected.

Water consumption and demand based on population growth rates do not account for large-scale agricultural irrigation needs. However, reclaimed water that is the end product of metered consumption would be included.

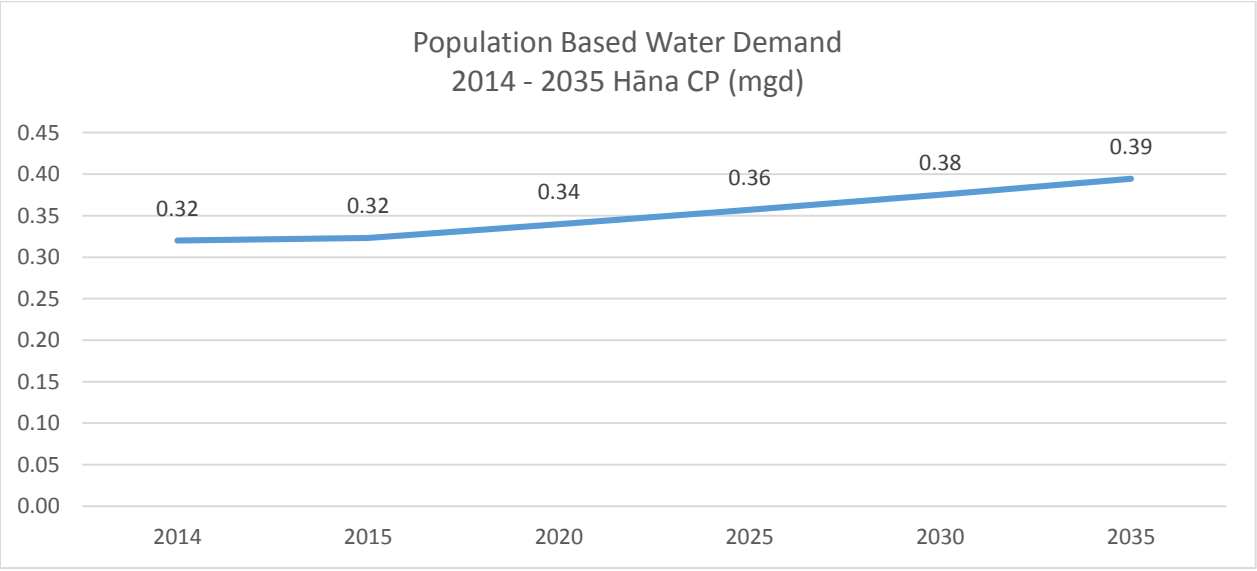
It was assumed that population growth, and thus water use, from projects described in the State Water Projects Plan and for the Department of Hawaiian Homelands are already accounted for by the population projections. Therefore, information from these documents was not used to further refine the 5-year incremental population based water demand projections.

In the 2014 Draft Socioeconomic Forecast, high and low estimates are generated for key indicators by analyzing the gap between past projections and historic trends from 1990 to 2010. The high and low estimates project future scenarios, assuming that current projections include inaccuracies on the same scale as in the past. High and low alternative projections apply variance estimates for population, jobs, visitor units and average visitor census.

The Maui Island Plan projects minimal 20-year population increase from 2015 to 2035 for the Hāna Community Plan area, which encompasses most of the region.

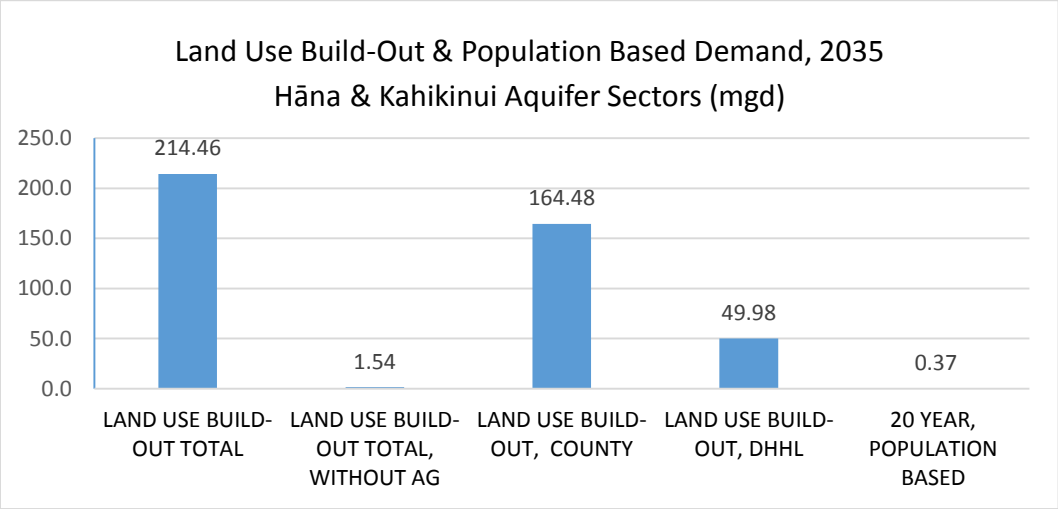
Year	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**20-Year**
Projected Population	2,291	2,408	2,531	2,660	2,795	2,938	530
Projected Population Based Water Demand		0.32	0.34	0.36	0.38	0.39	0.071

Source: 2014 Final Draft Socio-Economic Forecast, Maui County Planning Dept., Long Range Planning Division



Land Use Based Demand Projection

Land use based demand projections reflect the potential full build-out applying current County Zoning and the Department of Hawaiian Homelands land use plan designations. The Zoning Code implements the General Plan policies and regulates existing and future land development at the parcel level. State Land Use classifications are too limited in guidance of various types of development permitted in each district. While Community Plans provide more detail they do not supply density guidelines, are outdated, and may be more useful as guidance for future Water Use and Development Plan updates. The County does not have zoning jurisdiction over the Department of Hawaiian Homelands lands and accordingly build-out under those plans was also applied. Since full build-out is unlikely, especially over a 20-year period, this method is not selected for projection of future water demands. The graphic below shows build-out and population based demand for 2035 for the Hāna and Kahikinui aquifer sectors; zoning data for the Ke'anae aquifer system has not been broken out.



A population based demand requires 0.4 mgd by 2035. A land use based water demand (excluding land in the Ke'anae aquifer system) would require over 200 mgd by 2035; excluding agriculture the 2035 demand is projected to be 1.5 mgd.

RESOURCE ADEQUACY

Water demand based on population growth rates in the Hāna region would require 0.08 mgd of additional supply for a total of 0.4 mgd by 2035. An additional 10-20% would be needed to account for system losses, high growth years and other factors. Conversely, groundwater sustainable yield within the Ko'olau, Hāna and Kahikinui aquifer sectors is 440 mgd. Available groundwater resources within the region is sufficient to meet projected population growth. Irrigation needs for taro lo'i are addressed in the IFS process. Even with significant groundwater resources, alternative sources can serve population and uses without access to public systems, improve efficiency and reduce household costs. Alternative resources to be considered on Maui Island include reclaimed wastewater, rainwater catchment, grey water systems, stormwater reuse, desalination, conservation, resource augmentation, and various regulatory and planning strategies. While these are briefly outlined below, not all these strategies are available, feasible or necessary to meet demand within the East Maui region.

Future Water Transport

Water transports through the EMI's system from Ko'olau to meet agricultural and municipal demands in drier regions are of outmost concern for the Hana community. Available surface water for non-instream uses cannot be determined until measurable IFS are set. However, non-instream uses are an essential IFS component. The WUDP seeks to assess community input on polices for water use planning in regarding non-instream uses and alternatives to water transports for consideration during CWRM's IFS processes. Non-instream use demands and alternatives to water transports are further explored below.

HC&S Lands

The HC&S plantation consists of over 43,000 acres of land, of which 35,000 acres were under cultivation in 2016. HC&S lands are all located within the Central Sector, the majority of land overlying the Pa'ia aquifer. All surface water delivered through the EMI system are imported from the Ko'olau sector. Yield from irrigation wells in Pa'ia and Kahului aquifers are heavily dependent on return flow from the imported surface water land application and reservoir leakage, although the additional recharge has not been quantified. HC&S conceptual "Diversified Agricultural Plan", dated March 2016, illustrates a mix of uses throughout the entire plantation envisioned by HC&S as sustainable and economically viable and takes into consideration soil types, rainfall, solar radiation and crop tolerance to brackish water irrigation. [2] The information provided in HC&S plan is presented as planning scenario 1 below and compared to alternative plausible scenarios that were developed with input from the Maui farming community, consulting the State Department of Agriculture, the Hawaii Agriculture Research Center and island specific publications. On Maui, 27,294 acres were designated by the State and approved by the voters in 2009 as Important Agricultural Lands (IAL), comprised of lands owned by Alexander & Baldwin predominately in sugarcane.[3] Agricultural experts opine that replacement crops will most likely be confined to IAL lands. An infinite range and combination of alternative crops is possible. For purposes of assessing potential water demand on HC&S lands, crops are grouped into five main categories: 1) Diversified crops; 2) Irrigated Pasture; 3) Biofuel; 4) Monocrops and 5) Koa forestry. Except for HC&S Diversified Agriculture Plan (Alternative 1), no assumptions were made about locations for specific crops within the plantation. However, available acreage was considered for crops restricted by elevation, such as koa forestry, or rainfall. Irrigation needs are estimated based on available standards and studies. Water demand varies significantly depending on cultivation methods. Water loss through various irrigation systems and other efficiencies are not considered in the analysis but addressed under resource adequacy.

As a baseline comparison, applying a sugarcane water use rate of 5,555 gpd per acre to 35,000 acres equals 194 mgd. Alternative crops and uses would generally represent a reduction in total water use for the plantation.

Diversified Crops: For planning purposes diversified crops is used here to mean farming a variety of crops, such as various orchards and vegetable crops, rather than a single commodity. Community and grassroots initiatives have advocated more opportunities for organic and regenerative farming and an increase in crops for local consumption. A range of 2,500 for wetter areas to 5,387 gpa for drier areas is used, which incorporates HC&S irrigation estimates for orchard crops. Average use for diversified crops according to the 2004 State Agricultural Water Use & Development Plan is 3,400 gpa.

Pasture: Conversion to irrigated and non-irrigated pastures for grass fed beef is currently being assessed on less than 400 acres. In the planning scenarios below 1,000 – 3,440 acres of irrigated pasture were considered and non-irrigated

[2] Case No. CCH-MA13-01 Hawaiian Commercial and Sugar Company's Opening Brief Regarding Re-Opened Evidentiary Hearing; Certificate of Service, October 17, 2016

[3] HDOA, 2/29/16. http://hdoa.hawaii.gov/wp-content/uploads/2013/02/IAL-voluntary-summary-e14_rev2-29-16.pdf

pastures in the Hamakuapoko region of the plantation with more rainfall. Irrigated demand is estimated by HC&S at 1,992 gpa and as high as 2,651 gpa in a study of 5,580 acres in Upcountry Maui.[4]

Biofuel: HC&S's Diversified Agriculture Plan calls for a mix of bioenergy crops that will be rotated over a few seasons. Anticipated focus for 3,650 acres that comprise the Waihee-Hopoi Fields are on tropical grasses. Exploratory sorghum plantings are currently underway. HC&S field studies assess water needs for bioenergy tropical grasses at between 4,776 to 5,064 gpa. For planning purposes, a range representing low irrigation demand sorghum to high water demanding banagrass is applied.

Monocrops: Monocrops are cultivated crops that do not rotate with other crops, such as the former sugarcane and pineapple plantations. Pineapple, coffee and seed production are the largest monocrops currently grown on Maui. Seed crops are currently grown on 754 acres island wide, a portion within IAL. Seed corn accounts for 95% of seed crop grown in the state. Seed crops are generally not land intensive but grown on plots of 1 to 5 acres at a time surrounded by a buffer zone. Expansion of seed crops would therefore not likely account for significant irrigation demand. Irrigation demands for pineapple and coffee range from 1,350 to 2,900 gpa.

Koa Forestry: Former sugarcane lands has been productive for forestry if the koa seed stock has been selected for disease resistance and adapted to low-elevation sites from 500 feet. Successful forestation would require ripping to break hard pans and allow roots to penetrate. Water requirements estimated at 4,380 gpa vary widely dependent on natural rainfall and growth. Other high value timber species, including milo, kamani and sandalwood could be considered for commercial plantings as well as windbreaks and habitat.

Scenarios: Future of A&B Properties Lands

Crop	**SCENARIO 1: 100% of HC&S Lands Farmed, 10 Years Phase-In**		**SCENARIO 2: 100% of IAL Farmed, 10 Years Phase-In**		**SCENARIO 3: 50% of IAL Farmed, 10 year Phase-In**		**SCENARIO 4: 25% of IAL Farmed, 20 Year Phase-In**	
	Acres	Irrigation Demand MGD	Acres	Irrigation Demand MGD	Acres	Irrigation Demand MGD	Acres	Irrigation Demand MGD
Diversified Crops	6940	28.6	8,000	20 – 43.09	4,000	10 – 21.55	9,000	22.5 – 48.48
Biofuel	14,770	62.08	12,000	35.7 – 60.77	6,000	17.86 – 30.38		
Grazing	8540	17.07	4,000	7.9 – 10.60	2,000	3.98 – 5.3		
Monocrops			3,000	4.05 – 8.7	1,500	2.02 – 4.35		
Koa Forestry			294	1.28	294	1.28		
Fallow/ non-irrigated cover crops	4650	0	7,606	0	21,106	0	25,900	
Total Plantation:	34,900	107.79	34,900	69.03 – 124.45	34,900	35.16 – 62.87	34,900	22.5 – 48.48

*IAL lands total 27,294 acres of A&B's 36,000 acre plantation

[4] 2013 "Systems Approach for Investigating Water, Energy, and Food Scenarios in East-Central Maui" by C.W. King, University of Texas at Austin.

Transports for Municipal Demand

The DWS Upcountry system is currently dependent on 80% surface water to meet municipal demands averaging 7.7 mgd. Based on population growth, the Upcountry system is anticipated to grow by about 8,400 people, which equals an additional 1.65 mgd demand. Due to limited surface water source, the cost of groundwater extraction at high elevations, and legal constraints to explore groundwater from the Haiku aquifer, the County established the Upcountry Meter list of priority for service by the County water system when water supply became available. There are about 1,800 requests for 1,900 dwelling units and a nominal number of commercial units. About one-third of the remaining requests are located outside the Urban Growth Boundary. Approximately 8 mgd would be required to satisfy the priority list, for a total additional demand of approximately 10 mgd. Demand represents both public trust uses (domestic needs and DHHL service) and non-public trust uses (agricultural irrigation and commercial use)

DWS Haʻiku System	1.87 mgd
DWS Makawao System	0.87 mgd
DWS Upper Kula System	3.78 mgd
DWS Lower Kula System	1.53 mgd
DWS Kula Agricultural Park	Negligible

In addition to projected agricultural irrigation and municipal use, resource adequacy must consider impact from drought, climate change, water losses and other uncertainties.

Drought Scenario

The Hawaii Drought Plan, 2005 Update, identifies water supply vulnerability areas, which include Upcountry and Keokea (DHHL) and Kahikinui (DHHL), agricultural vulnerability areas, including Kula, Ulupalakua and Kahikinui (DHHL).

A hydrological drought refers to deficiencies in surface and subsurface water supplies, which are reflected in declining surface and ground water levels when precipitation is deficient over an extended period of time.[5]

For the drought scenario, stream flow-duration discharges that are equaled 95 percent of the time (Q_{95} flow; or Q_{90} if Q_{95} flow not determined) is used in evaluating surface water availability. In the absence of numerical IFS, the planning approach is to plan within the diverted amounts when the status quo interim IFS were adopted, or as subsequently amended by CWRM.

Estimates of groundwater recharge are used to evaluate the availability of freshwater and are used by CWRM in setting sustainable yield. Islandwide, mean annual recharge is reduced by about 23 percent under drought conditions compared to average climate conditions. [6] For all aquifer systems, the 2008 sustainable yield adopted by CWRM exceeds recharge under drought conditions; therefore, sustainable yield can be used as the baseline for groundwater resources during drought conditions. Based on 2035 demand, there is hypothetically adequate groundwater by aquifer sector to supply population based demand, with the exception of the Central sector which is supplemented by irrigation return water that is not reflected in the sustainable yield. The figures below have not been reduced to reflect that currently about 11 mgd of potable demand in the Central and Lahaina sectors is sourced from surface water. Increases in agricultural groundwater demand are also not accounted for; it is possible that adjustments to crops or irrigation would be undertaken in a long-term hydrologic drought.

[5] WRPP, 2014, Drought Planning (Draft)

[6] Spatially Distributed Groundwater Recharge Estimated Using a Water-Budget Model for the Island of Maui, Hawaiʻi, 1978–2007

Aquifer Sector	2008 SY	% Drought Recharge Reduction	Reduced SY (worst case - apply drought recharge reduction)	2035 Demand	Reduced SY Balance
Wailuku	36	29%	25	5.31	25
Lahaina	34	24%	26	15.73	14
Central	26	25%	19	40.04	-17
Ko'olau	175	21%	133	1.08	156
Hāna	122	19%	99	0.36	110
Kahikinui	34	37%	21	0.01	28

% Drought Recharge Reduction: USGS, Spatially Distributed Groundwater Recharge Estimated Using A Water-Budget Model For The Island of Maui, Hawai'i, 2014, Table 8. Reduced SY: Assume 100% recharge reduction is applied to SY.

Climate Change Scenario

Climate change patterns already being seen in Hawai'i are projected to become increasingly serious before the middle of the 21st century, including (a) declining rainfall, (b) reduced stream flow, (c) increasing temperature, and (d) rising sea level. Each poses serious consequences for the replenishment and sustainability of groundwater and surface water resources. Water supply faces threats from both rising groundwater and saltwater intrusion in wells, as well as declining quality and quantity due to drought and downward trends in groundwater base flows. Preliminary predictions on future climate projections for Maui island include: 1) temperature increases at all elevations; 2) wet areas get wetter; 3) dry regions are mixed (some wetter, some drier); 4) mean annual rainfall increases (seasonal patterns show May-September drying in Central Maui); 5) mean annual reference evapotranspiration increases; and 6) little change in cloud-base elevation and trade-wind inversion height.[7] On a 20-year time frame, changes due to climate change cannot be reliably predicted but vulnerabilities can be addressed through diversification and resource augmentation.

Water Loss and Uncertainties

Water losses due to leaks, seepage, evaporation and other inefficiencies are estimated at 22.7% for the EMI system. Water audits, improved irrigation methods and storage can mitigate but not eliminate water losses. To determine resource adequacy, demand projections are increased by 20% to account for water losses and other uncertainties.

OPTIONAL STRATEGIES

Rainwater Catchment

Rainwater catchment is the collection of rainwater from a roof or other surface before it reaches the ground. Rainwater catchment is not as reliable as conventional water resources because it is extremely sensitive to the climate. However, rainwater catchment is a viable option in this region. Rainwater catchment systems are not regulated by the Department of Health, making estimates of their use difficult. No inventory of installed catchment systems throughout the island is available.

Reclaimed Wastewater

Reclaimed wastewater is a valuable resource, especially for irrigation purposes. Approximately 2.4 mgd of reclaimed wastewater is used on the island, primarily for irrigation of agriculture, golf courses and landscape. The State of Hawai'i defines R-1 water as the highest-quality recycled water; it has undergone filtration and disinfection to make it safe for use on lawns, golf courses, parks, and other areas used by people. R-2 recycled water can only be used

[7] Participatory Scenario Planning for Climate Change Adaption: Final Land Use Input, Pacific RISA, November, 2014

under restricted circumstances where human contact is minimized. R-1 is primarily used in West and South Maui. R-2 is used in Kahului. The Maui County Code was amended in 1996 requiring commercial properties (agricultural, commercial, public uses) within 100 feet of a Maui County R-1 water distribution system to connect within one year of recycled water availability and to utilize recycled water for irrigation purposes.

There is currently no reclaimed wastewater available to serve demand in the Koʻolau, Hāna and Kahikinui aquifer sectors, or for the Upcountry system that relies on Koʻolau surface water.

Stormwater Reuse

Stormwater reuse provides for capture and reuse of surface water runoff. Stormwater reclamation can potentially provide water for non-potable water demand such as irrigation and toilets. Due to contaminants picked up by stormwater runoff different levels of treatment may be necessary. Use of rain barrels or infiltration methods may be used by individuals or for small projects. Stormwater reclamation methods that employ capture and storage technologies must be planned, constructed, and operated to ensure minimal impact to streams, riparian environments, conservation lands, water rights, and cultural practices. When incorporated into the design of development projects, stormwater reuse can reduced reliance on groundwater and surface water for landscape irrigation, while minimizing infrastructure costs.

Table 7-1:
Stormwater Reclamation Technologies

Technology	Description
Source Reuse	Use rain barrels or cisterns to collect precipitation or stormwater runoff at the source to provide water for a variety of non-potable purposes or, with treatment, potable water.
Small Lot Reuse	Manage precipitation or runoff as close to source as feasible. Examples: infiltration planter boxes, vegetated infiltration basins, eco roofs (vegetated roofs), porous pavements, depressed parking lot planter strips for biofiltration, narrowed street sections with parallel or pocket bioswales.
Stormwater Capture	Employ ditches, storm drainage system interception, dry wells, infiltration galleries, and injection wells to capture stormwater.
Stormwater Storage	Use aquifer storage and recovery, stream-bank storage, detention basins, and surface reservoirs to store stormwater.
Stormwater Distribution	Distribute stormwater via gravity ditch or pipe networks, operated/regulated ditch systems, pressure pipe networks, onsite wells.

Source: CH2MHill. *Hawaii Stormwater Reclamation Appraisal Report.* Prepared for the U.S. Bureau of Reclamation and the State of Hawaii Commission on Water Resource Management. July 2005

Desalination

Desalination can remove salt and other dissolved minerals from the source water. Seawater, brackish water, or treated wastewater can be processed through several desalination methods: distillation, vacuum freezing, reverse osmosis and electrodialysis. Desalination requires significant electrical power and therefore has a high financial and potentially environmental cost. Disposal of the brine poses an environmental challenge. Injection wells or direct ocean outfall are likely options for brine disposal.

Conservation

The Hawaiʻi Water Conservation Plan, 2013, defines water conservation as the reduction in fresh water use by improving the efficiency of water delivery and end uses. Conserving water and avoiding water waste are important for long-term sustainability even in times of abundant rainfall. Managing water demands and implementing viable conservation measure can delay or avoid additional capital infrastructure, decrease operating costs, and avoid

environmental degradation relating to both public and private water utilities. Water conservation is a critical component of climate adaptation and can increase resilience to declining water supply or more frequent drought.

Conservation programs can be implemented by water purveyors of all sizes. DWS is further developing and expanding its water conservation program, which includes both supply side and demand side measures. Anticipated program elements include:

- targeted audit and direct install programs
- rebates and incentives
- expanded conservation requirements for landscaping and other uses
- expanded marketing efforts including targeted user groups such as a hotel awards program building manager information program, and agricultural user working groups/services
- energy production and efficiency measures
- continued watershed protection and restoration
- possible major capital expenditure to support reclaimed water use

Supply Side Measures

1. Leak Detection

An effective leak detection program is critical to identifying unaccounted for water and proactively preventing as much water loss as feasible. Major benefits to a leak detection program include the ability to: respond more quickly to identified leaks; find "hidden" leaks creating ongoing water loss; reduce pressure, especially during low demand; and replace aging and weakened pipe.

2. Universal Metering, Meter Testing, Repair and Replacement

Metering all classes of customers and governmental entities and replacing old water meters ensures efficiency and can identify leaks or other anomalies in water usage. Preventive and predictive maintenance can help to reduce unaccounted-for water in the system by targeting old and substandard lines for replacement.

3. Valve Exercising Program

Water valves may leak and large amounts of water may be lost through these connections. An active valve exercising program on an annual cycle can mitigate water loss.

4. Water Use Auditing

Unaccounted for water includes line flushing, customer meter calibration inaccuracies (due to aging) and theft. Regular comparison of water produced and delivered aids in the identification of potential water waste situations and acts as a backup to the other programs.

Demand Side Measures

1. Public Information and Education

Public education measures can include advertising, community events, and other outreach.

2. Regulatory Requirements

Maui County has adopted the following regulations and rules that support water conservation:

- Maximum flow rate standards for plumbing fixtures sold by local distributors (County Code, Chapter 16.20)

- Prohibition of discharging cooling system water into the public wastewater system (County Code, Section 14.21A.015)
- Plumbing code regulations that require low flow fixtures in new development (County Code, Chapter 16.20B)
- Requirements that all commercial properties within 100 feet of a reclaimed water line utilize reclaimed water for irrigation and other non-potable uses (County Code, Section 20.30.020A)
- A water waste prohibition with provision for discontinuation of service where negligent or wasteful use of water exists (County Code, Section 14.03.050)
- A provision enabling the Water Director to enact special conservation measures in order to forestall water shortages (County Code, Section 14.06.020)
- Regulations for the Control of Water Usage During Droughts (County Code, Chapter 14.06)

Expanded regulatory options could address landscaping and irrigation, grey water use for commercial and residential purposes, and compliance with EPA WaterSense Program.

3. Plumbing Retrofits and Sub Metering

Distribution of low flow fixtures and retrofit/direct installation programs can be especially effective in combination with water audits and sub-metering of multi-family units and multi-purpose buildings. Studies indicate that metering un-metered units is among the most effective conservation measures, by billing explicitly for water use rather than hiding this cost in the rent.

4. Rebates and incentives

Rebates and incentives can include hotel awards program, a building manager information program, agricultural user working groups/services, as well as energy production and efficiency measures. State and local government can enhance “green-building” efforts with county rebates and utility credits and state income tax credits directed specifically at water conservation.

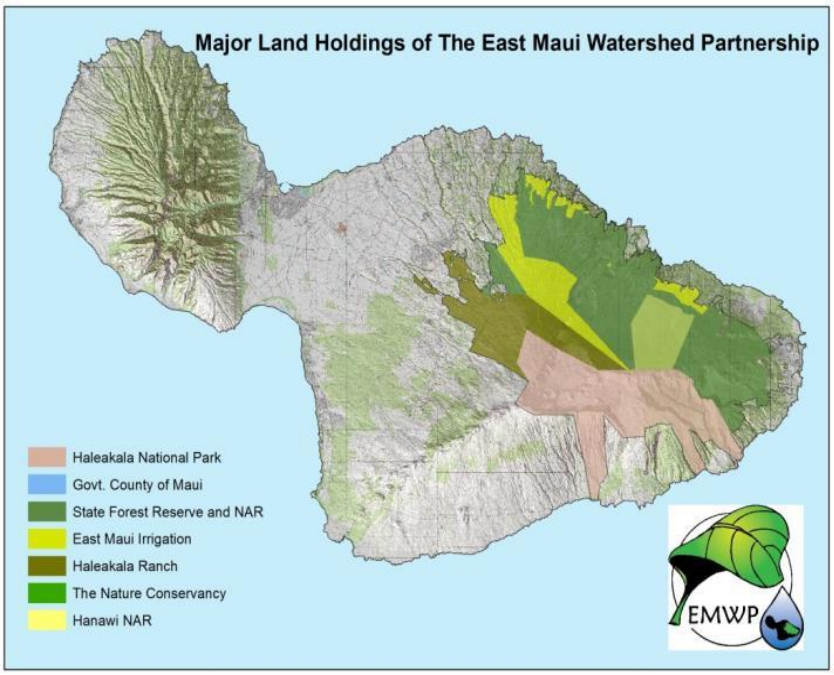
Resource Augmentation

Measures to protect, restore and enhance the resource include watershed management, wellhead protection, and stream restoration. Stream restoration can be an integral component of surface water use options and generally has strong community support. Shifting resource management to integrate the ahupua`a stream based mauka to makai concept is a more holistic approach to managing surface and groundwater rather than focusing on fragmented resources.

Watershed Management

Maintaining healthy forests is essential to maintaining the healthy streams and groundwater aquifers. When the forest is damaged, it loses its capacity to capture rainwater and increase condensation and rainfall. The single greatest threat to the native forest is the destruction caused by non-native, invasive animals and plants. Deforestation for agriculture and urbanization disrupts the native ecosystem resulting in an increase in erosion, siltation and impacts to the watershed, beaches and the tourist economy. Nearly two-thirds of Maui’s original forests have already been lost. State and county agencies as well as private purveyors can provide financial support and participation in watershed protection partnerships and reforestation programs. An across-the-board fee for water use can impart a conservation price indicator, and fund the cost of water management and conservation.

DWS through its customers has provided more than $6M to watershed partnerships in the region in addition to funding invasive weed eradication efforts through the Maui Invasive Species Committee throughout East Maui.



The collective land holdings of the East Maui Watershed Partnership provide water for Upcountry residents from Hāʻiku to Kanaio, and residents in Hāʻiku, Paʻia, Keʻanae and Hāna through a combination of surface water collection and aquifer recharge.
Source: East Maui Watershed Partnership

Wellhead Protection

The County DWS initiated the Wellhead Protection Program to protect ground waters that supply, or potentially supply, drinking water to wells operated by the DWS. The Draft Wellhead Protection Ordinance proposed for adoption delineates two Wellhead Protection Overlay Zones based on the time it takes groundwater to migrate to the drinking water well. The ordinance would institute zoning controls that restrict land uses that pose a high risk of contamination within each Wellhead Protection Overlay Zone. Protection strategies and the Draft Ordinance were developed with community input at ten public meetings throughout Maui County; as of 2016 the ordinance continues to be under review. This program to protect the water sources is consistent with state and county objectives and is very viable from a sustainability and cost benefit perspective.

RECOMMENDATIONS

Based on identified planning objectives and regional community input, a combination of strategies are recommended on the next page to address regional and island-wide needs. Addressing resource protection, conventional and alternative resources island-wide also mitigates the need for surface water transports out of the region. Further input on the acceptability of the following strategies is sought.

Planning Objectives	Strategies
Maintain sustainable resources Minimize adverse environmental impacts Protect and restore streams Minimize Adverse Environmental Impacts Protect Cultural Resources	• Apply an ecosystem ahupua'a based, precautionary approach based on science, local knowledge, collaboration and community education • Consult with Native Hawaiian community/moku representative on regional resource use and management • No new stream diversions for off-stream uses • Promote and fund watershed partnership programs for invasive plant and ungulate control • Expand watershed protection mauka to makai, promote reforestation • Support improved groundwater, surface water and stream diversion monitoring programs by CWRM • Scientific studies necessary to support decision making, including drought impacts • Protect and recharge ground water during non-drought periods to stabilize supply
Manage Water Equitably	• Use drought conditions as baseline to evaluate water supply and effects of water use • Quantify the impact of watershed management on groundwater recharge and distribute funding proportionally • Use the appropriate level of water for the use
Provide for Department of Hawaiian Homelands Needs	• Maintain plantation ditch systems for continued transport to DHHL projects
Provide for Agricultural Needs	• Maintain plantation ditch systems for affordable non-potable water conveyance • Focus on climate appropriate crops • Maintain subsidies for non-potable water supply
Minimize Cost of Water Supply	• Diversify to the most cost-effective combination of groundwater, surface water, and aggressive conservation • When IFS adopted, support water transport for municipal needs in wet season
Maximize Water Quality	• Restrict land uses with high risk of well contamination near drinking water wells
Maximize Reliability of Water Service Provide Adequate Volume of Water Supply	• Develop basal groundwater as contingency for agricultural irrigation in dry season • Develop surface water storage for seasonal use of surface water • Diversify conventional resources to account for climate change and longer droughts
Maximize Efficiency of Water Use	• Maximize R-1 reclaimed wastewater system capacity and use • Require commercial properties >100 feet to connect and use R-1 water • Explore greywater system programs and incentives for catchment • Low impact project design for onsite water retention • WaterSense standard for new development, retrofit programs for existing development • Climate appropriate landscaping • More aggressive landscape water conservation measures in dry areas than wet areas to minimize water transport • Combination tiered water rates, water waste control, incentive programs and targeted community education
Establish Viable Plans Maintain Consistency with General and Community Plans	• Implement MIP and provide infrastructure in planned growth areas

Partial List of References:

- Commission on Water Management, various data reports
- Johnson, A.G., Engott, J.A., and Bassiouni, Maoya, 2014, Spatially distributed groundwater recharge estimated using a water-budget model for the Island of Maui, Hawai‘i, 1978–2007: U.S. Geological Survey Scientific Investigations Report 2014–5168, 53 p., http://dx.doi.org/10.3133/sir20145168
- Maui Water Use and Development Plan, 1990
- State of Hawai‘i Water Plan
- Water Resources & Climate Change Adaptation in Hawai‘i: Adaptive Tools in the Current Law and Policy Framework, 2012

County of Maui DWS Water Resources & Planning
Water Use and Development Plan Issues/Solutions Summary

Hana Meetings (4/19/2016, 5/21/2016)

Issues	Comments	Solutions
Streamflow	Water rights are being abused How to determine kuleana appurtenant, traditional and customary rights? Cultivatable parcels? Stream use applications? Permits?	Return water to streams Adopt instream flow standards If water to support kuleana uses is returned to streams, consider transporting water to Kula to support diversified 'sustainable' ag
Environmental Protection	Develop with sensitivity to land. Stop or slow it	
Alternative Sources	Maximize alternative sources	Maximize reclaimed water use R-2 water reuse, rainwater catchment in all areas. Holistic description of conservation (big picture conservation costs less)
Water availability	Hawaiian Homelands Water Meter Waitlist and meter costs; development held back in Kahikinui	
Costs		Pay upfront for new development
WUDP Process and Development	Involve local community in assessments, give respect to local knowledge Perception of being left out from conservation efforts. Call to stop planning until court case is resolved.	3 bullet point email for people to come to meetings Act as water advocates Public education outreach Focus on access to water Visual aids Plan with water issues as closely related High hopes for a relevant plan

Hana Surveys

- **Hana (~3)**
  - Write-in Water Issues
    - Stream Flows++
    - Wastewater Treatment and Injection wells
    - Return of East Maui Water
    - "Mauka to Makai"+
  - Write-in Water Solutions
    - Graywater Irrigation
    - Composting Toilets
    - Restoration of Stream flows++
      - With enough to go to high pop. Areas
      - All back to streams+++

        - With future assessment to determine distribution
    - Stop All Development
    - Rainwater Catchment
        - Relax regulations on rainwater catchment for county users
- **Hana High School (~19)**
    - Write-in Water Issues
        - Return of East Maui Water (100% mentioned)
            - "People are in need of water where the water is being taken for the rest of the people"
        - East Maui Streams (100% mentioned)
            - Stream Health++++
        - Estuaries++
            - Fishing and prawning impacts
        - "Mauka to Makai"
        - Hana Bay waste effluent contamination
        - Taro (Kalo) Farmers+++++
            - Keanae
        - Water Pressure
        - Perceived continuance of depravation of East Maui Taro Farmers even after HC&S stoppage
        - Perception of being lied to/talked down to++++
    - Write-in Water Solutions
        - Give Back East Maui waters for stream flow (100% mentioned)
            - Complete restoration++++
            - New development should only get water from rainwater catchment, not from streams
            - Develop a plan to equally share water between east and the Rest of Maui
            - Extraction from east Maui "out of the question"
            - To insure right to water use before other uses+
        - Incorporate Cultural uses into water plan.
            - Cultural and water resources often viewed as same thing
            - Common complaint – why put redundant things on the questionnaire?
        - Follow Public Trust Doctrine (not said directly but spoke of laws relating to water rights by public) with respect to East Maui water++++++++++
            - Water code Ch. 174C
            - Perception that A&B actions are Illegal++
        - Throw out HB2501
        - Increase Outreach and education efforts regarding how water system functions+++++++++
            - Specific knowledge++
            - How to survive drought conditions
            - Available online
            - Simple concise language
            - Market outreach efforts+
            - Direct outreach in schools+++
            - More information about laws regarding water++