Chapter 20102

Hanamā‘ulu Aquifer System Area

CHAPTER 20102 - TABLE OF CONTENTS

FIGURES

TABLES

20102 HANAMĀʻULU AQUIFER SYSTEM AREA

20102-1 SYSTEM AREA PROFILE

20102-1.1 General

The Hanamāʻulu [20102] Aquifer System Area (ASYA) is roughly bound on the north by the South Fork of Wailua River and Kilohana Crater, on the east by the Pacific Ocean, and on the south by the Hāʻupu Mountain Range. The Hanamāʻulu ASYA lies almost entirely within the Līhuʻe Planning District and includes the communities of Līhuʻe, Hanamāʻulu, and Puhi. As the main urbanized area on Kauaʻi, the Līhuʻe District is planned to accommodate approximately half of Kauaʻi's future growth.

Average annual rainfall ranges from 50 inches per year along the coast to 160 inches in the mountains. The sustainable yield is 27 mgd.

20102-1.2 Economy and Population

20102-1.2.1 Economy

Līhuʻe is the largest business center on the island and is considered the "heart" of Kauaʻi with nearly 45 percent of Kauaʻi's working population working in Līhuʻe. Major employment centers in the Hanamāʻulu ASYA include the Līhuʻe Civic Center, the Hawaiʻi State Judiciary Building, police station and sports complex, Kauaʻi Marriott Resort, Kukui Grove Shopping Center, Walmart, and Kauaʻi Community College. Wilcox Hospital, which is the primary medical care facility for Kauaʻi, is also located in Līhuʻe. In addition, the Hanamāʻulu ASYA is home to Līhuʻe Airport and Nāwiliwili Harbor which are Kauaʻi's primary airport and primary commercial harbor.

20102-1.2.2 Population

The population contributing to the demand within the Hanamāʻulu ASYA is almost completely from the Līhuʻe Planning District. In accordance with the outlook and policies of the Kauaʻi General Plan as well as general community sentiment, the Līhuʻe Planning District is expected to have the highest growth rate and accommodate nearly half of Kauaʻi's population growth through 2035. As a result, the Hanamāʻulu ASYA has the highest projected growth of all the aquifer systems on Kauaʻi. Historical population data for the Hanamāʻulu ASYA is summarized in **Table 20102-1**.

Population projections are summarized through the year 2035 in **Table 20102-2a**. For planning purposes, a range of values (low, medium and high estimates) is provided. As shown in **Table 20102-2b**, it is estimated that the area will continue to experience growth rates between 15 and 21 percent per decade.

Table 20102-1: Historical Population – Hanamā‘ulu ASYA

	Year		
	1990	2000	2010
Population	11,184	12,523	14,701
Percent Change		16.0	11.8

Data Source: Socioeconomic Analysis and Forecasts (2014) Technical Report. Data redistributed and evaluated for Hanamā‘ulu ASYA.

Table 20102-2a: Population Projection – Hanamā‘ulu ASYA

Growth Rate	Population by Year								
	2015	2016	2017	2018	2019	2020	2025	2030	2035
A – Low	16,141	16,420	16,700	16,981	17,263	17,546	18,978	20,440	21,929
B – Med.	16,331	16,669	17,008	17,349	17,693	18,038	19,798	21,618	23,481
C – High	16,364	16,711	17,060	17,412	17,766	18,122	19,938	21,821	23,750

Data Source: Socioeconomic Analysis and Forecasts (2014) Technical Report. Data redistributed and evaluated for Hanamā‘ulu ASYA.

Table 20102-2b: Population Projection – Percent Change – Hanamā‘ulu ASYA

Growth Rate	2015-2025 % Change	2025-2035 % Change
A – Low	17.6	15.6
B – Medium	21.2	18.6
C – High	21.8	19.1

20102-1.3 Land Use

20102-1.3.1 2000 Kaua‘i General Plan

The 2000 Kaua‘i County General Plan Land Use Designation Map for the Hanamā‘ulu ASYA is shown on **Figure 20102-1**. The estimated land use allocation acreage for each land use designation within the system area is listed in **Table 20102-3**.

Table 20102-3: General Plan Estimated Land Use Allocation Acreage – Hanamā‘ulu ASYA

General Plan Land Use Designation	Acreage	Percent of Total
Agricultural	14,456	41.4
Military	0	0
Open	15,385	44.1
Park	340	1.0
Residential Community	982	2.8
Resort	264	0.8
Transportation	947	2.7
Urban Center	2,113	6.1
DHHL	400	1.1
TOTAL	**34,887**	**100.0**

20102-1.3.2 Kaua‘i Zoning

Kaua‘i County Zoning Map for the Hanamā‘ulu ASYA is shown on **Figure 20102-2**. The estimated land use allocation acreage for each zoning district within the system area is listed in **Table 20102-4**.

Table 20102-4: County Zoning Estimated District Allocation Acreage – Hanamā‘ulu ASYA

Zoning District	Acreage	Percent of Total
Agriculture	14,202	42.2
Commercial – General	415	1.2
Commercial - Neighborhood	25	0.1
Conservation	7,362	21.9
Industrial – General	1,113	3.3
Industrial - Limited	145	0.4
Open	7,982	23.7
Residential	1,494	4.4
Resort	121	0.4
Project Development	0	0
Special Planning Area	0	0
Special Treatment	36	0.1
No Zoning	266	0.8
DHHL	524	1.5
TOTAL	**33,685**	**100.0**

The number of dwelling units allowed in residential and resort districts varies by the type of residential or resort district. The average number of dwelling units allowed in residential districts in the Hanamā‘ulu ASYA is 7.41 dwelling units per acre. The average number of dwelling units allowed in resort districts in the Hanamā‘ulu ASYA is 18.97 dwelling units per acre.

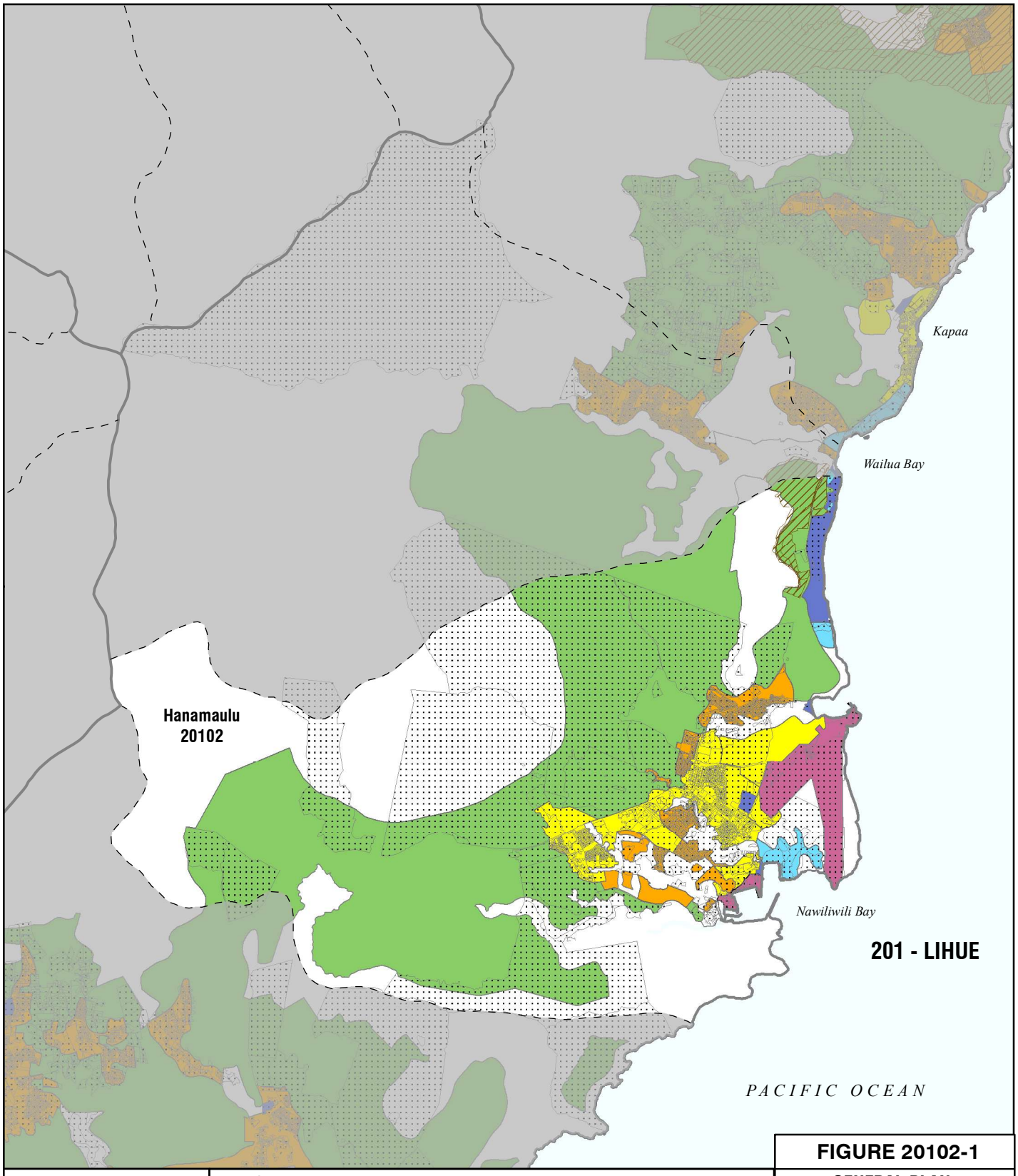
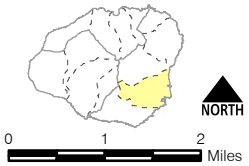


FIGURE 20102-1

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Areas
- Aquifer System Areas
- Hawaiian Home Lands
- Developed Properties

Land Use Allocation Guide

- Agricultural
- Open
- Park
- Military
- Residential Community
- Resort
- Transportation
- Urban Center

GENERAL PLAN
LAND USE MAP
Aquifer Sector: LIHUE - 201
Aquifer System:
HANAMAULU - 20102

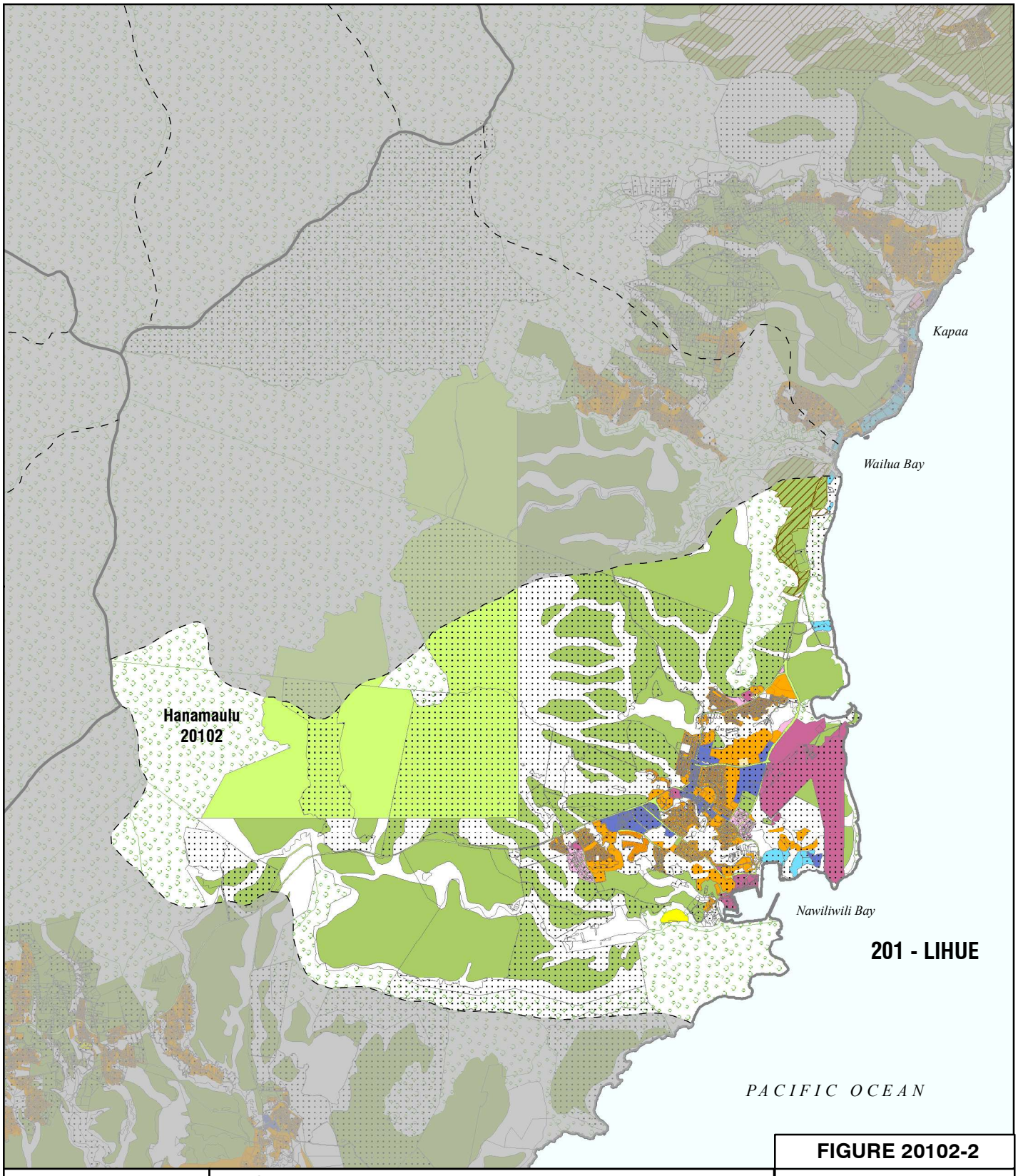
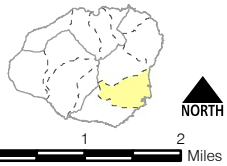


FIGURE 20102-2

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Areas
- Aquifer System Areas
- Hawaiian Home Lands
- Developed Properties

Zoning Designations:

- Agriculture
- Commercial - General
- Commercial - Neighborhood
- Conservation
- Industrial - General
- Industrial - Limited
- No Zoning
- Open
- Residential
- Resort
- Special District

COUNTY ZONING

Aquifer Sector: LIHUE - 201
Aquifer System:
HANAMAULU - 20102

20102-2 EXISTING WATER RESOURCES

20102-2.1 Ground Water

The Hanamāʻulu ASYA has a sustainable yield of 27 mgd. According to the 2014 CWRM database, there are 27 production wells in the system, 1 agriculture, 13 municipal, 2 domestic, 3 industrial, and 8 irrigation wells. There are also 19 wells drilled and categorized as "unused". Refer to **Appendix A** for the 2014 database. **Figure 20102-3** shows the well locations.

Ground water levels in the Līhuʻe Basin showed declining trends in the late 1990s and early 2000s. The declines in water level resulted in diminished productivity of some wells and tunnels and generated concern about the future reliability of ground water resources. Due to these concerns, the U.S. Geological Survey (USGS) in cooperation with the County of Kauaʻi Department of Water (DOW) developed reports on the effects of irrigation, drought, and ground water withdrawals on ground water recharge and ground water levels in the Līhuʻe Basin.

A report titled "Effects of Irrigation and Rainfall Reduction on Ground-Water Recharge in the Līhuʻe Basin, Kauaʻi, Hawaiʻi" by Scot K. Izuka, Delwyn S. Oki, and Chien-Hwa Chen found that the effect of drought was greater than the effect of reduced irrigation on ground water recharge. However, the report also noted that the effects of droughts are temporary conditions whereas decreases in irrigation may be permanent and have a greater long-term effect.

A report titled "Effects of Irrigation, Drought, and Ground-Water Withdrawals on Ground-Water Levels in the Southern Līhuʻe Basin, Kauaʻi, Hawaiʻi" by Scot K. Izuka describes the results of a numerical ground-water-flow model that was used to assess the effects of drought, irrigation changes, and ground-water withdrawals on ground-water levels. The results indicated that the primary cause of the observed decline in ground-water levels in the 1990s and early 2000s was irrigation reduction. The study also found that ground-water withdrawal had a long-duration but small-magnitude effect, while drought had a widespread, high-magnitude but short-duration effect. Also, since irrigation is unlikely to return to the same levels as during the period of peak sugarcane agriculture, the decline in ground-water levels resulting from the reduction and ultimate end of sugarcane irrigation can be considered permanent.

20102-2.2 Surface Water

There are 5 streams classified as perennial in the Hanamāʻulu ASYA, of which 4 are considered continuous and 1 is considered intermittent. Hanamāʻulu Stream, Nāwiliwili Stream, Pūʻali Stream, and Huleʻia Stream are classified as continuous streams, and Kawailoa Stream is classified as an intermittent stream. The USGS has 1 active surface water gage in the system area. The gage is located on Huleʻia Stream, which was previously listed in **Table 1-19**.

In accordance with the Code, the CWRM must establish and administer instream flow standards (IFS) on a stream-by-stream basis as necessary to protect public interests. IFS is defined as "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." Considerably more research and study needs to be completed to accumulate the data and perspective necessary to conduct a thorough and meaningful

assessment of IFS. Until permanent IFS are established, interim IFS have been adopted. The interim IFS are defined as the amount of water flowing in each stream at the time the administrative rules governing them were adopted in 1988 and 1989. In order to assess surface water sustainability, this KWUDP assumes that no additional diversions will be allowed from any stream without amendment of the interim IFS.

There are 39 declared stream diversions in the Hanamāʻulu ASYA identified in the CWRM database shown on **Figure 20102-4**, which accounts for 13 percent of the 292 declared stream diversions on the island. The declared stream diversions are listed in **Appendix B**. The total declared flow for the Hanamāʻulu ASYA is 6.87 mgd.

The East Kauaʻi Irrigation System (EKIS) is a complex system of interconnecting ditches, tunnels, flumes, and reservoirs and consists of three sections: the Kapaʻa Section, the Kālepa Section, and the Hanamāʻulu-Līhuʻe Section.

The Kapaʻa Section of EKIS is the northernmost section. It is primarily located in and serving the Anahola ASYA and will therefore be discussed in **Section 20104**.

The Kālepa Section of EKIS is the middle section. The Hanalei Tunnel previously diverted water from Hanalei River to a tributary of the North Fork of Wailua River. According to the 2004 AWUDP, there is a blockage in the Hanalei Tunnel, and as a result, the Hanalei Watershed no longer contributes water to EKIS. Stable Storm Ditch previously diverted water from the North Fork of the Wailua River; however, the Stable Storm Ditch is now abandoned and no longer in use. West of the Stable Storm Ditch, the ʻIliʻiliʻula-North Wailua Ditch diverts water from the North Fork of Wailua River, Waikoko Stream, and ʻIliʻiliʻula Stream to the Upper Waiahi Hydropower Plant. South of the ʻIliʻiliʻula-North Wailua Ditch, the North Intake Ditch diverts water from the ʻIliʻiliʻula Stream and Waiahi Stream to the Lower Waiahi Hydropower Plant. The Hanamāʻulu Ditch Intake diverts flow from both the ʻIliʻiliʻula-North Wailua Ditch and the South Fork of Wailua River into the Hanamāʻulu Ditch. The Hanamāʻulu Ditch contributes flow to Kapaia Reservoir. Water from the Kapaia Reservoir is treated by a private treatment plant and purchased by the DOW as a water source for DOW's Līhuʻe-Kapaʻa Water System. The Kālepa Section serves the Hanamāʻulu ASYA and the Wailua ASYA.

The Hanamāʻulu-Līhuʻe Section of EKIS is the southernmost section and is within the Hanamāʻulu ASYA. It consists of the Upper and Lower Līhuʻe Ditches. The Upper Līhuʻe Ditch diverts water at the Lower Waiahi Hydropower Plant. The Lower Līhuʻe Ditch is abandoned and is not operable. The Upper and Lower Līhuʻe Ditch system originally served former Līhuʻe Plantation Company's sugarcane fields in and around Līhuʻe and Hanamāʻulu. Currently, the ditch system is operated by Grove Farm Company and is maintained by an independent contractor. The Upper Līhuʻe Ditch diverts water to Demello Reservoir which is the water source for the State of Hawaiʻi's non-potable irrigation system.

The Upper Haʻikū Ditch system was formerly owned by Grove Farm Plantation to irrigate sugarcane fields in Haʻikū, Puhi, Nāwiliwili, and Kōloa. Currently, the system is owned and managed by Grove Farm Company, and diverts headwaters of Huleʻia Stream. A condition assessment on the ditch system was not performed as part of the 2019 draft AWUDP update. However, portions are known to be non-operational or abandoned.

20102-2.3 Water Conservation

Water conservation increases the amount of water available and helps to ensure the long-term viability of water resources. Water conservation measures for this ASYA are as described in **Section 1.5.7** of this report. There are no ASYA-specific conservation measures in place at this time.

20102-2.4 Rainwater Catchment

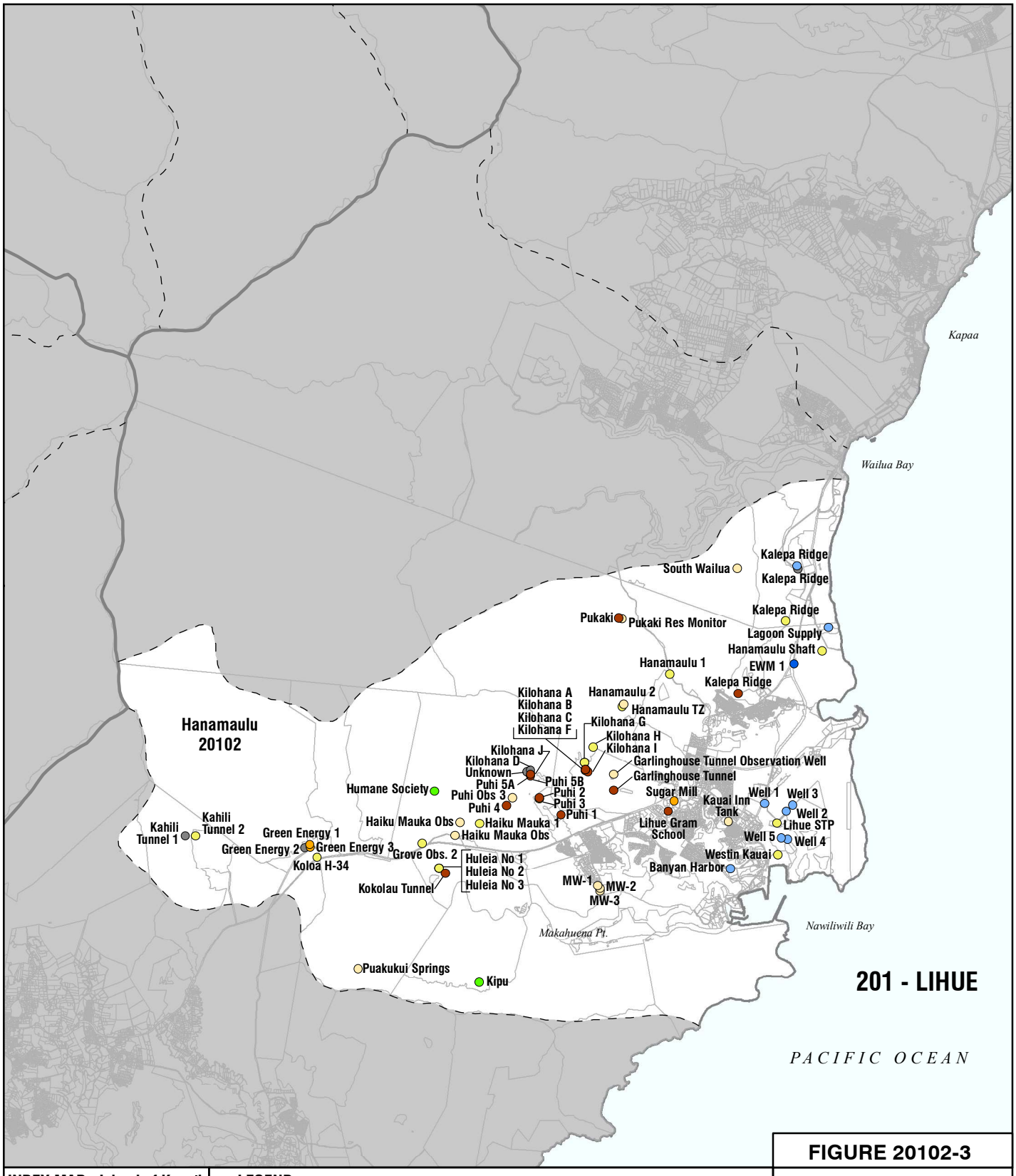
Rainwater catchment is a viable resource for areas that are not served by ground water or surface water. **Figure 20102-5** shows the possible catchment areas, or parcels with a building value greater than $20,000 and assumed to be developed but without a ground water or surface water source.

20102-2.5 Recycled Water

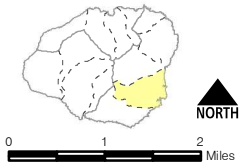
There are 3 wastewater reclamation facilities in the Hanamā‘ulu ASYA. **Table 20102-5** lists the wastewater facilities, reclaimed water classification, facility treatment capacity, current reuse amount, facility type, and current application. **Figure 20102-6** shows the facility locations.

Table 20102-5: Wastewater Reclamation Facilities – Hanamā‘ulu ASYA

WWRF/ WWTP	Recycled Water Classification	Design Capacity (mgd)	Quantity Produced (mgd)	Current Reuse Amount (mgd)	Owner	Irrigation Application
Līhu‘e WWRF	R-1	2.5	1.2	0.79	Public	Kaua‘i Lagoons Resort – golf course irrigation, roadway landscape irrigation
Līhu‘e-Puhi WWTP	R-1	1.0	0.4	0.37	Private	Puakea Golf Course, Costco, Kukui Market Place, Pikake Circle
Wailua WWRF	R-2	1.5	0.5	0.19	Public	Wailua Golf Course, Lydgate Park (athletic field irrigation)



INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Areas
- Aquifer System Areas
- TMK

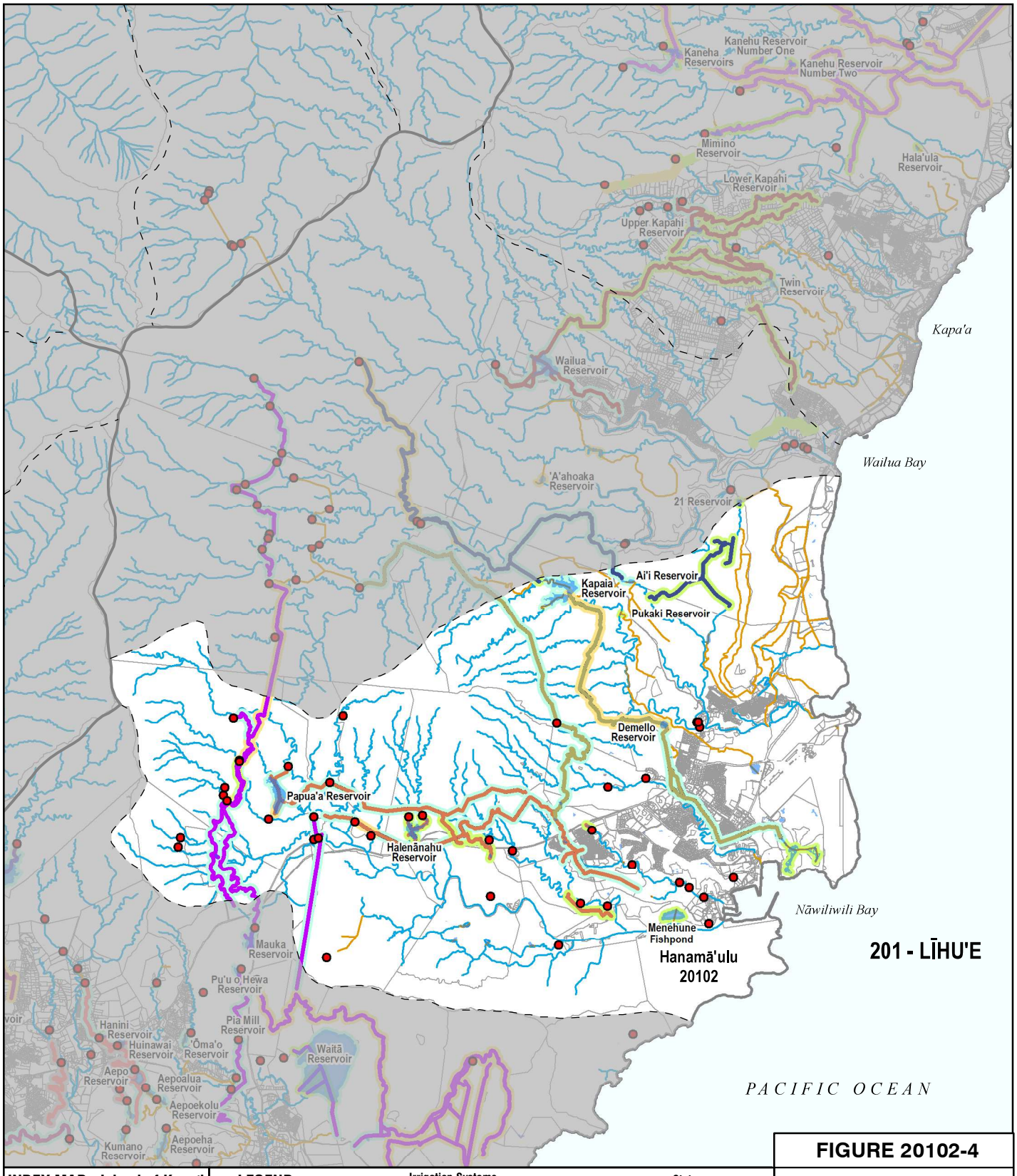
Well Use Types

- Abandoned
- Agriculture
- Domestic
- Industrial
- Irrigation
- Military
- Municipal
- Observation
- Other
- Unused

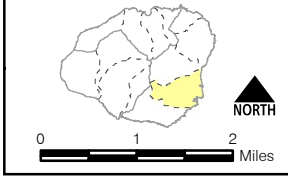
FIGURE 20102-3

WELL LOCATION

Aquifer Sector: LIHUE - 201
Aquifer System:
HANAMAULU - 20102



INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Areas
- Aquifer System Areas
- Perennial Streams
- Irrigation Systems
- Diversions
- Reservoirs, Ponds
- TMK

Irrigation Systems

- Hanamā'ulu System
- Upper and Lower Ha'ikū Ditches
- Waiahi-Kuia AQ, Waiahi-Hiiʻiʻula, Kōloa-Wilcox
- Upper and Lower Līhu'e Ditches

Status

- Active
- Inactive
- Unknown
- Abandoned

FIGURE 20102-4

STREAMS & DIVERSIONS

Aquifer Sector: LĪHU'E - 201
Aquifer System:
HANAMĀ'ULU - 20102

Fukunaga & Associates, Inc.
Consulting Engineers

Kaua'i County - Department of Water

KAUA'I WATER USE AND DEVELOPMENT PLAN UPDATE

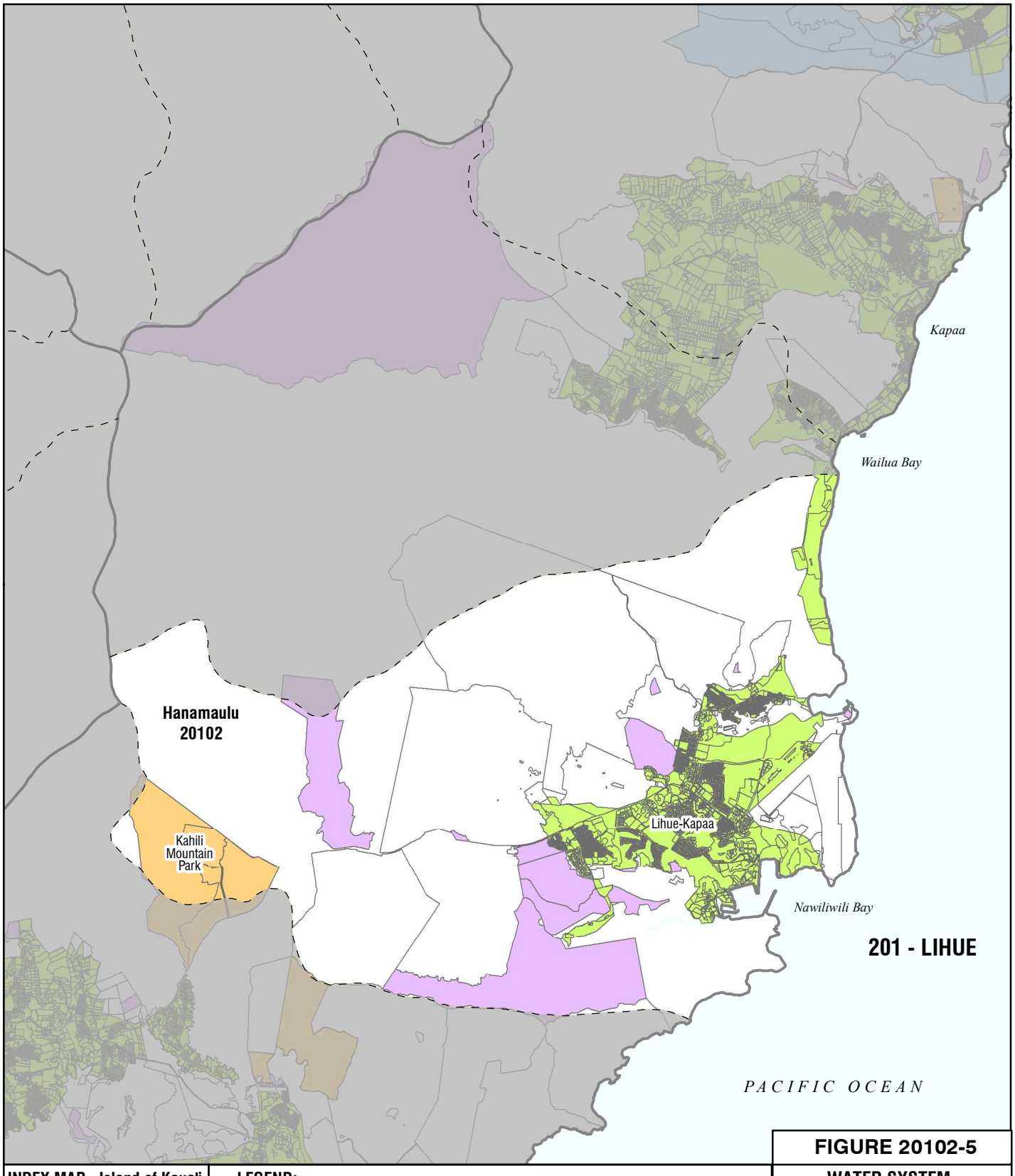
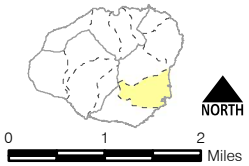


FIGURE 20102-5

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Areas
- Aquifer System Areas
- DOW Service Area
- Private Water System
- State Water System
- Federal Water System
- Possible Catchment Area (Building Value > $20,000)

WATER SYSTEM & SERVICE AREA
Aquifer Sector: LIHUE - 201
Aquifer System:
HANAMAULU - 20102

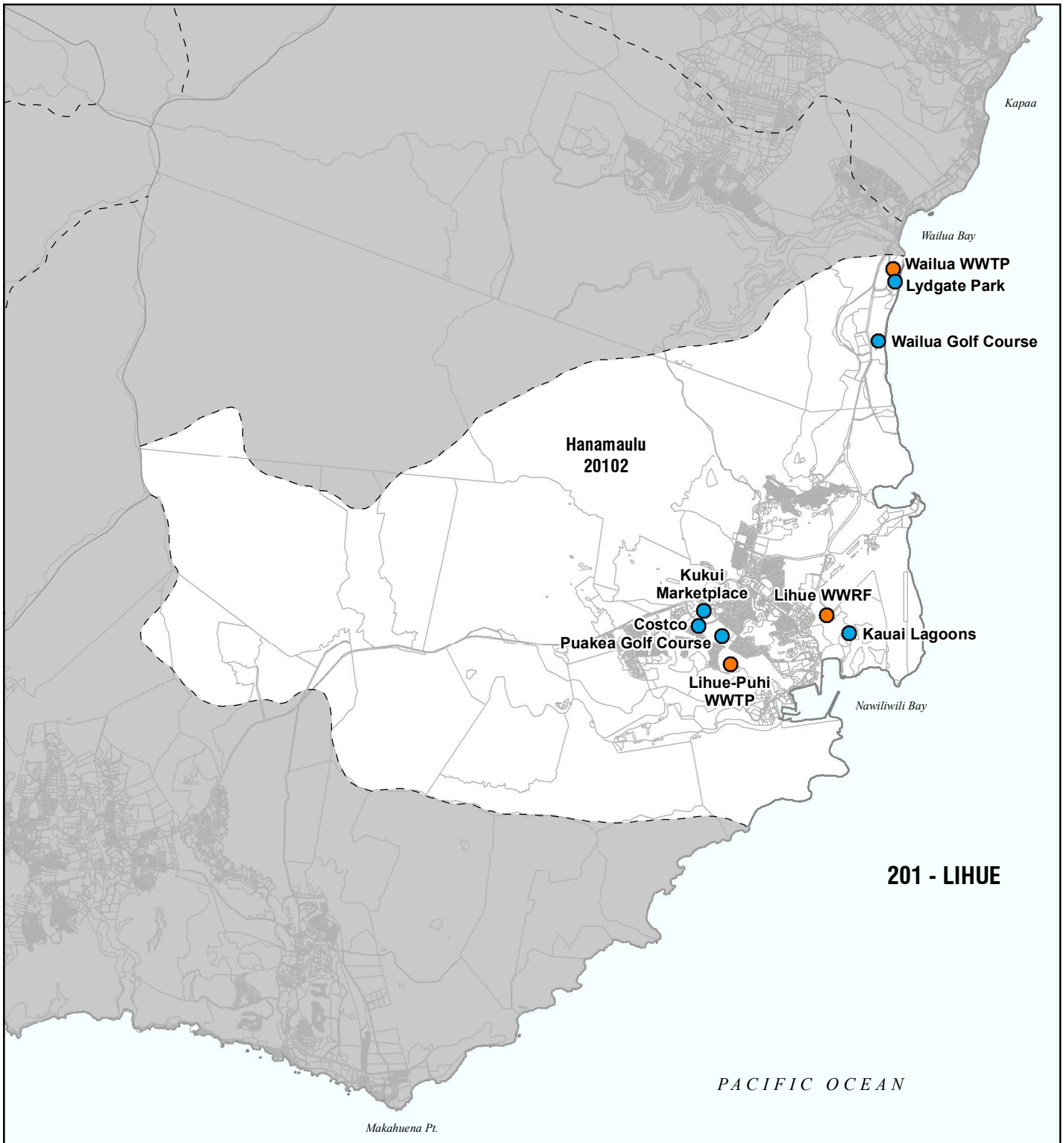
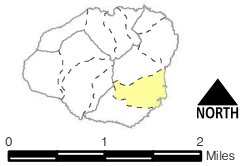


FIGURE 20102-6

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Areas
- Aquifer System Areas
- TMK
- Wastewater Facilities
- Area irrigating with recycled water

WASTEWATER RECLAMATION FACILITIES

Aquifer Sector: LIHUE - 201
Aquifer System:
HANAMAULU - 20102

20102-3 EXISTING WATER USE

20102-3.1 General

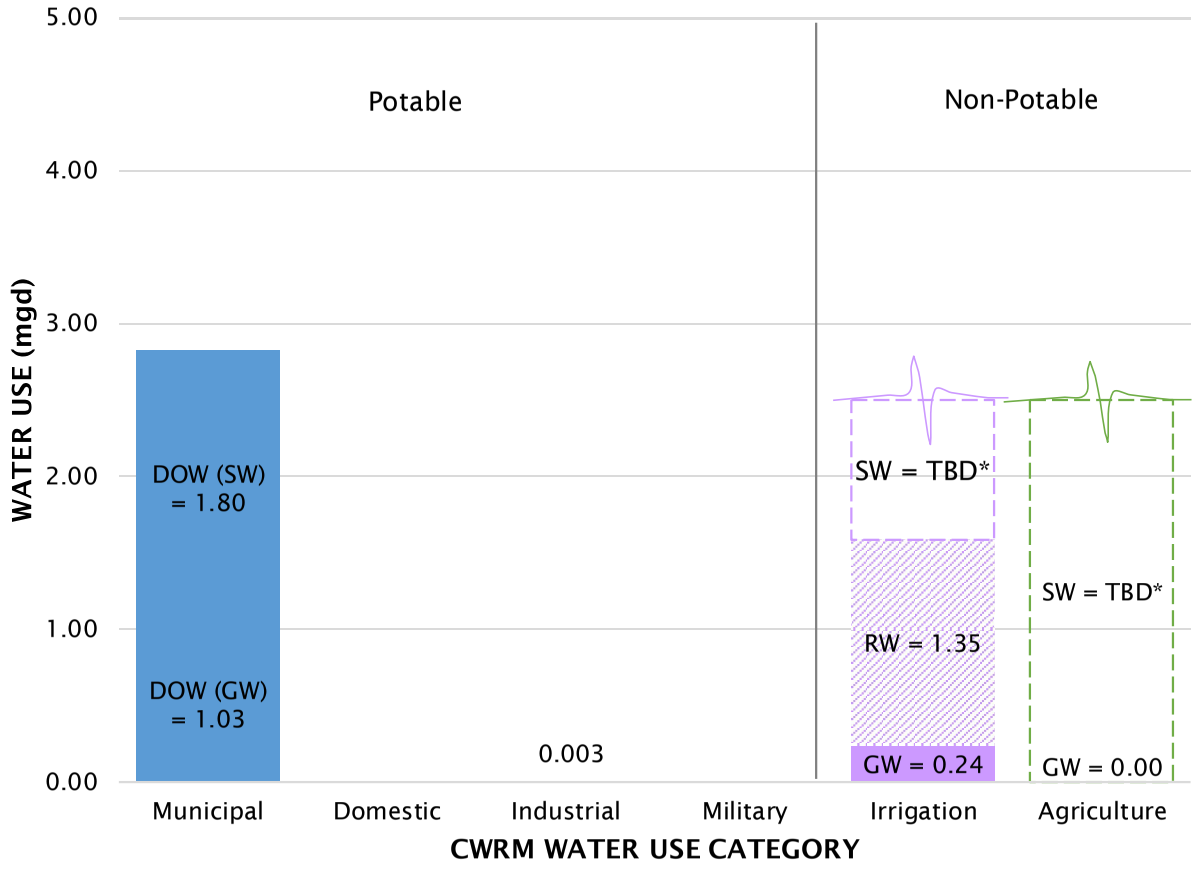
The following section presents the total estimated average water use within the Hanamā'ulu ASYA. The total estimated average water use was based on data from CWRM (well pumpage) and DOH (Sanitary Surveys for Public Water Systems and estimated recycled water usage) for the year of 2014. Well classification changes since 2014 are noted in the sub-sections below. **Table 20102-6** and **Figure 20102-7** summarize the water use in accordance with CWRM categories.

Table 20102-6: Existing Water Use by Category – Hanamā'ulu ASYA

CWRM Category	Ground Water (mgd)	Other Sources (mgd)	Total (mgd)	Percent of Total
Domestic	0.00		0.00	0.0
Industrial	0.003		0.00	0.0
Irrigation	0.24	1.35[1]	1.59	36.0
Agriculture	0.00	TBD[2]	0.00	0.0
Military			0.00	0.0
Municipal				
DOW System	1.03	1.80[3]	2.83	64.0
Private-Public WS	0.00		0.00	0.0
TOTAL	**1.27**	**2.18**	**4.42**	**100.0**

[1] Recycled Water
[2] Surface Water – TBD from AWUDP
[3] Surface Water – Estimated

Figure 20102- 7: Existing Water Use by Category – Hanamā'ulu ASYA



*Values to be determined by other components of the Hawai'i Water Plan

20102-3.2 Domestic Use

There are two wells classified as "Domestic" in the CWRM database; however, neither has reported pumpage.

20102-3.3 Industrial Use

There are three wells classified as "Industrial" in the CWRM database. Two are owned by Green Energy Team LLC and have reported pumpage totaling 0.003 mgd. One is owned by LPC corporation and does not have reported pumpage.

20102-3.4 Irrigation Use

Irrigation use has been divided into ground water, recycled water, and surface water.

20102-3.4.1 Ground Water

There are eight wells classified as "Irrigation" in the CWRM database. Five wells are owned by Kaua‘i Lagoons Resort and have reported pumpage totaling 0.22 mgd for golf course irrigation. One well is owned by Banyan Harbor and has reported pumpage totaling 0.02 mgd for landscape irrigation. One well is owned by the County of Kaua‘i. It is classified for non-domestic, non-agriculture irrigation and does not have reported pumpage. One well is owned by Aqua Kaua‘i Beach Resort. It is classified for hotel irrigation and does not have reported pumpage.

20102-3.4.2 Recycled Water

There are three golf courses in the Hanamā‘ulu ASYA, all of which are irrigated with recycled water.

The Kaua‘i Lagoons Resort receives R-1 water from the Līhu‘e WWRF and has been irrigating its Kiele golf courses since 1986. The R-1 water is stored in two irrigation ponds on resort property and during summer months, irrigation is blended with brackish water to meet the high demands.

The Puakea Golf Course uses a blend of R-1 water from the Līhu‘e-Puhi WWTP and stream water for irrigation. The blend of R-1 water from the Līhu‘e-Puhi WWTP and surface water is also used for irrigation at Costco, Kukui Market Place, and the Pikake Circle.

The Wailua Golf Course receives R-2 water from the Wailua WWRF and has been irrigating its golf course since 1969. Similar to the Kaua‘i Lagoons Resort, brackish water is typically blended with the R-2 water for to supplement demands.

Lydgate Park also receives R-2 water from Wailua WWRF, but needs to supplement it with potable water as the R-2 water's high nutrient content clogs the irrigation subsurface drip system.

20102-3.4.3 Surface Water

Information on surface water use for irrigation is to be determined by the AWUDP. However, typically, due to the location of parks and other landscaped areas within communities, it is assumed that it is unlikely for landscaping to be irrigated with surface water. In the Hanamā‘ulu ASYA, there is a non-potable irrigation line that delivers approximately 0.36 mgd from Demello Reservoir to three users: Līhu‘e Airport, the Kaua‘i Police Department, the Kaua‘i Judiciary Complex, the Līhu‘e Gateway project, and the Vidinha Soccer Fields. Also, as noted in **Section 20102-3.4.2**, some stream water is blended together with R-1 water from the Līhu‘e-Puhi WWTP to irrigate Puakea Golf Course, Costco, Kukui Market Place, and the Pikake Circle.

20102-3.5 Agricultural Use

Agricultural use has been divided into ground water, recycled water, and surface water.

20102-3.5.1 Ground Water

There is one well classified as "Agriculture" in the CWRM database; however, it has not reported pumpage. It is owned by EWM Kaua‘i LLC and is subcategorized as Agriculture - Livestock & Processing and Pasture.

20102-3.5.2 Recycled Water

There are no agriculture demands served by recycled water in the Hanamāʻulu ASYA.

20102-3.5.3 Surface Water

Information on surface water use for agriculture is to be determined by the AWUDP.

Several irrigation systems deliver surface water for agricultural use in the Hanamāʻulu ASYA, and description and status of the irrigation systems are discussed in **Section 20102-2.2**.

11,206 acres of agricultural lands owned by Grove Farm Company, Inc. are designated as IAL and are located predominantly within the Hanamāʻulu ASYA. Irrigation water for the IAL is provided by rainwater and the Haʻikū and Līhuʻe Ditch systems. The area receives 60 to 100 inches of rainfall annually and is adequate for rain-fed production of many crops. The IAL are used for cattle ranching, diversified agriculture, biomass production (for renewable energy), and bioenergy crops such as trees and grasses.[1]

20102-3.6 Military Use

There is no military use in the Hanamāʻulu ASYA.

20102-3.7 Municipal Use

There are 13 wells in the CWRM database classified as "Municipal" (MUNCO – Municipal County). Municipal can be subcategorized into the other water use categories: Domestic, Industrial, Agricultural, Military, and Municipal.

20102-3.7.1 County Water Systems

The DOW has one major water system that services the Hanamāʻulu ASYA. The Līhuʻe-Kapaʻa water system is DOH Public Water System (PWS) No. 400 and is the largest water system on Kauaʻi. This water system serves 31,337 people through 9,560 service connections with a demand of 6.12 mgd, per the 2014 DOH Sanitary Survey. This water system was created after a merger of the Līhuʻe-Hanamāʻulu water system (PWS 410), Puhi water system (PWS 412), and the Wailua-Kapaʻa water system (PWS 413) in 2006. The Līhuʻe-Kapaʻa water system services areas in three ASYAs and consists of three subsystems – 1) Līhuʻe-Hanamāʻulu subsystem, 2) Puhi subsystem, and 3) Wailua-Kapaʻa subsystem. The Līhuʻe-Hanamāʻulu and Puhi subsystems are entirely within the Hanamāʻulu ASYA and are discussed below. The Wailua-Kapaʻa subsystem services areas in the Hanamāʻulu ASYA, Wailua ASYA, and Anahola ASYA; however, the majority of the service area is within the Anahola ASYA and will therefore be discussed with the Anahola ASYA in **Section 20104**.

[1] DR12-48 Grove Farm Company, Incorporated – Findings of Fact, Conclusions of Law, and Decision and Order, dated February 2013

Līhu‘e-Hanamā‘ulu Subsystem

The Līhu‘e-Hanamā‘ulu Subsystem serves Hanamā‘ulu, the port complex at Nāwiliwili and the adjoining Niumalu residences, Kaua‘i High School and Chiefess Kamakahelei Middle School, Wilcox Hospital, Līhu‘e Airport, and the surrounding residential, commercial, and industrial communities/districts. Water for this subsystem is supplied by 8 wells, 1 tunnel, and the Waiahi surface water treatment plant (WTP). **Table 20102-7a** lists the water sources, well number, pumping capacity, pressure zone, and pumpage amount.

Table 20102- 7a: DOW Līhu‘e-Hanamā‘ulu Subsystem Water Sources

WELL NAME	WELL NUMBER	PUMPING CAPACITY (gpm)	PRESSURE ZONE (ft)	PUMPAGE (mgd)
Kilohana Well A	2-5923-001	420	393	0.13
Kilohana Well B	2-5923-002	700	393	0.00
Kilohana Well I	2-5923-007	700	393	0.23
Garlinghouse Tunnel	2-5823-001	800	393	0.25
Waiahi WTP	N/A	N/A	393	N/A
Hanamā‘ulu Well No. 3*	2-0124-002	160	510	0.00**
Hanamā‘ulu Well No. 4*	2-0124-003	160	510	0.03
Pukaki Well	2-0023-002	120	393	0.01**
Kālepa Well	2-5921-001	120	319	0.04
Līhu‘e Grammar School Well	2-5822-002	150	295	0.02**

* Well located in Wailua ASYA

** Well currently inactive

There are 5 primary pressure zones (510’, 393’, 319’, 295’, and 173’) and 8 storage tanks in the Līhu‘e-Hanamā‘ulu subsystem. The water sources are primarily located in the upper pressure zones and feed the lower zones through pressure reducing valves.

Source water for the Waiahi WTP is from the 75 acre Kapaia Reservoir, adjacent to the WTP. The WTP is rated for a capacity of 3 mgd and has a maximum capacity of 4 mgd. Finished water from the WTP and the 0.1 MG Hanamā‘ulu 510’ Tank are combined at the Control Valve Station (CVS), which is owned by Grove Farm and operated by the DOW. By agreement between the DOW and Grove Farm, the DOW is required to accept a minimum of 2 mgd from the Grove Farm WTP. Water from the CVS can reach the entire Līhu‘e-Kapa‘a water system.

The Hanamā‘ulu Booster Station originally boosted water from the Wailua-Kapa‘a subsystem to the Līhu‘e-Hanamā‘ulu subsystem on an “as needed” basis. When the Grove Farm WTP went online, the booster station was no longer needed. Now, water flows in the opposite direction via gravity from the Līhu‘e-Hanamā‘ulu subsystem to the Wailua-Kapa‘a service areas. The flow rate is regulated by a valve.

Puhi Subsystem

The Puhi Subsystem serves the Kaua'i Community College (KCC) campus and small commercial and residential areas directly below KCC. Water for this subsystem is supplied by 5 wells, summarized in **Table 20102-7b.**

Table 20102- 7b: DOW Puhi Subsystem Water Sources

WELL NAME	WELL NUMBER	PUMPING CAPACITY (gpm)	PRESSURE ZONE (ft)	PUMPAGE (mgd)
Puhi Well No. 1 (KCC Deep Well)	2-5824-001	200	510	0.00*
Puhi Well No. 3	2-5824-005	300	510	0.10
Puhi Well No. 4	2-5824-006	200	510	0.04
Puhi Well No. 5A	2-5824-008	400	510	0.21
Puhi Well No. 5B	2-5824-009	700	510	0.01

* Well currently inactive

There is one primary pressure zone (510') and two storage tanks for the Puhi subsystem.

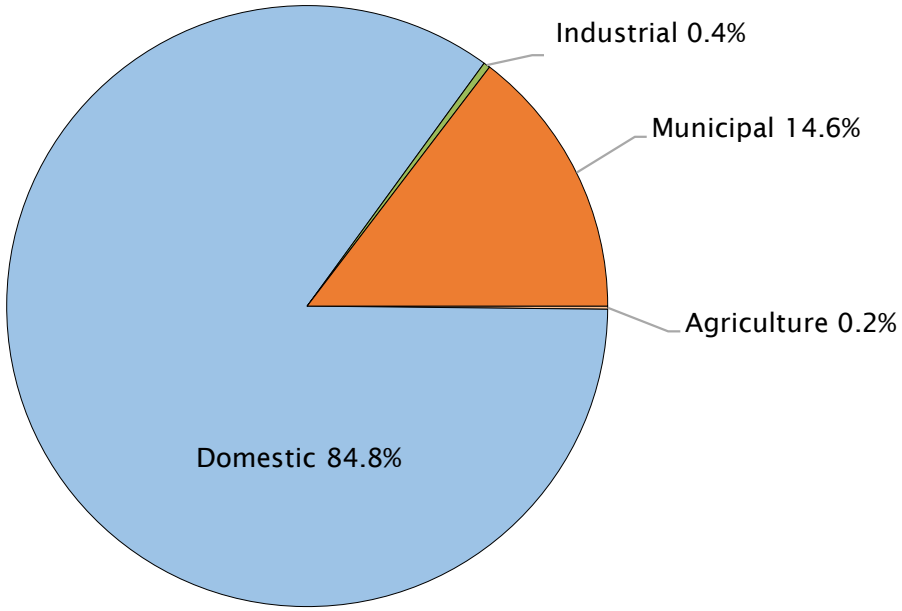
DOW Water Use by Category

DOW water use is subcategorized in **Table 20102-8** to the extent possible based on available meter data and is depicted in **Figure 20102-8**.

Table 20102-8: DOW Existing Water Use by Category – Hanamā'ulu ASYA

CWRM Water Use Category	DOW Metered Water Use (mgd)	Percent of Total
Agricultural	0.005	0.2
Domestic	2.402	84.8
Industrial	0.010	0.4
Military	0.000	0.0
Municipal	0.414	14.6
Total	**2.831**	**100.0**

Figure 20102-8: DOW Existing Water Use by Category – Hanamā‘ulu ASYA



20102-3.7.2 State Water Systems

There are no State water systems in the Hanamā‘ulu ASYA regulated by the DOH.

20102-3.7.3 Federal Water Systems

There are no Federal water systems in the Hanamā‘ulu ASYA regulated by the DOH.

20102-3.7.4 Private-Public Water Systems

The Kāhili Mountain Park Water System (PWS 422) is the only private-public water system in the Hanamā‘ulu ASYA regulated by the DOH. The water system is owned by Knudsen Trust and diverts water from Knudsen Trust's Kōloa water system (PWS 421), whose principal water source is Kāhili Tunnel #1. When water is diverted into the Kāhili Mountain Park tank, flow into the Kōloa water system stops entirely. The Kāhili Mountain Park water system is a non-transient, non-community water system that serves 150 people through 38 service connections and has average daily water consumption is 0.03 mgd.

20102-3.7.5 Per Capita Use

The per capita existing water use consumption based on domestic DOW metered water use and private-public water system use is presented in **Table 20102-9**. The per capita use in the Hanamā‘ulu ASYA is approximately 15.8% lower than the overall County of Kaua‘i per capita use.

Table 20102-9: Per Capita Use – Hanamā'ulu ASYA

	DOW Metered Water Use – Domestic (mgd)	Private-Public Water System (mgd)	90% of 2015 Population	Per Capita Use (gpd)
Hanamā'ulu ASYA	2.402	0	14,698	163
County of Kaua'i	**9.360**	**2.951**	**63,462**	**194**

20102-3.8 Existing Water Use by Resource

20102-3.8.1 Ground Water

Table 20102-10 summarizes the current production, sustainable yield (SY), and percentage of SY for the current production. Current production is represented by the 2014 average yield calculated from the actual pumping data.

Table 20102-10: Pumpage – Hanamā'ulu ASYA

Pumpage (mgd)	SY (mgd)	Pumpage Portion of SY
1.27	27	4.7%

Based on available information from the CWRM database, the current ground water use is 4.7 percent of the sustainable yield.

20102-3.8.2 Surface Water

The Kapaia Reservoir is the water source for the Grove Farm Waiahi Surface Water Treatment Plant (WTP). The WTP is rated for a capacity of 3 mgd and has a maximum production rate of 4 mgd. Currently, the WTP is typically set to produce 1700 gpm, or 2.45 mgd.

The Demello Reservoir is the water source for Grove Farm's non-potable irrigation line. Current demand is approximately 0.36 mgd.

Information on surface water use for agriculture is to be determined by the AWUDP.

20102-3.8.3 Water Conservation

Water conservation, including water loss management, may reduce water use. See **Section 20102-2.3** for existing conservation efforts.

20102-3.8.4 Rainwater Catchment

Developed parcels that are not supplied by ground water or surface water are assumed to be supplied by rainwater catchment.

20102-3.8.5 Recycled Water

Recycled wastewater from the three wastewater treatment facilities is used for golf course, landscape, and athletic field irrigation. Refer to **Table 20102-5** presented earlier.

20102-4 FUTURE WATER USE

20102-4.1 Full Build-Out Water Demand Projections

The full build-out water demand projections based on the General Plan and County Zoning for the Hanamā'ulu ASYA is listed in **Table 20102-11a** and **20102-12**, respectively. Each land use class is associated with the most appropriate CWRM water use category.

Table 20102-11a: General Plan Full Build-Out Water Demand Projection – Hanamā'ulu ASYA

General Plan Category	CWRM Category	Water Demand (mgd)
Agriculture	Agriculture/Domestic	0.94
Open	Domestic	0.08
Military	Military	0.00
Park	Irrigation	1.36
Residential	Domestic/Municipal	3.64
Resort	Domestic/Irrigation/Municipal	3.51
Transportation	Municipal	0.00
Urban Center	Domestic/Industrial/Municipal	10.57
DHHL	Domestic	0.60
	TOTAL	**20.69**

The General Plan was further refined by replacing the portion of the General Plan that coincides with the Līhu'e Community Plan and its associated demand with the Līhu'e Community Plan and its associated demand as shown in **Figure 20102-9**. **Table 20102-11b** is the full build-out water demand projection based on the Līhu'e Community Plan.

Table 20102-11b: Līhuʻe Community Plan Full Build-Out Water Demand Projection – Hanamāʻulu ASYA

Community Plan Category	CWRM Category	Water Demand (mgd)
Agriculture	Agriculture/Domestic	0.00
Industrial	Industrial	0.00
Open	Domestic	0.00
Military	Military	0.00
Mixed Use	Domestic/Municipal	5.03
Park	Irrigation	1.40
Residential	Domestic/Municipal	3.95
Resort	Domestic/Irrigation/Municipal	0.18
Urban Center	Domestic/Industrial/Municipal	9.39
DHHL	Irrigation/Municipal	0.00
	TOTAL	**19.95**

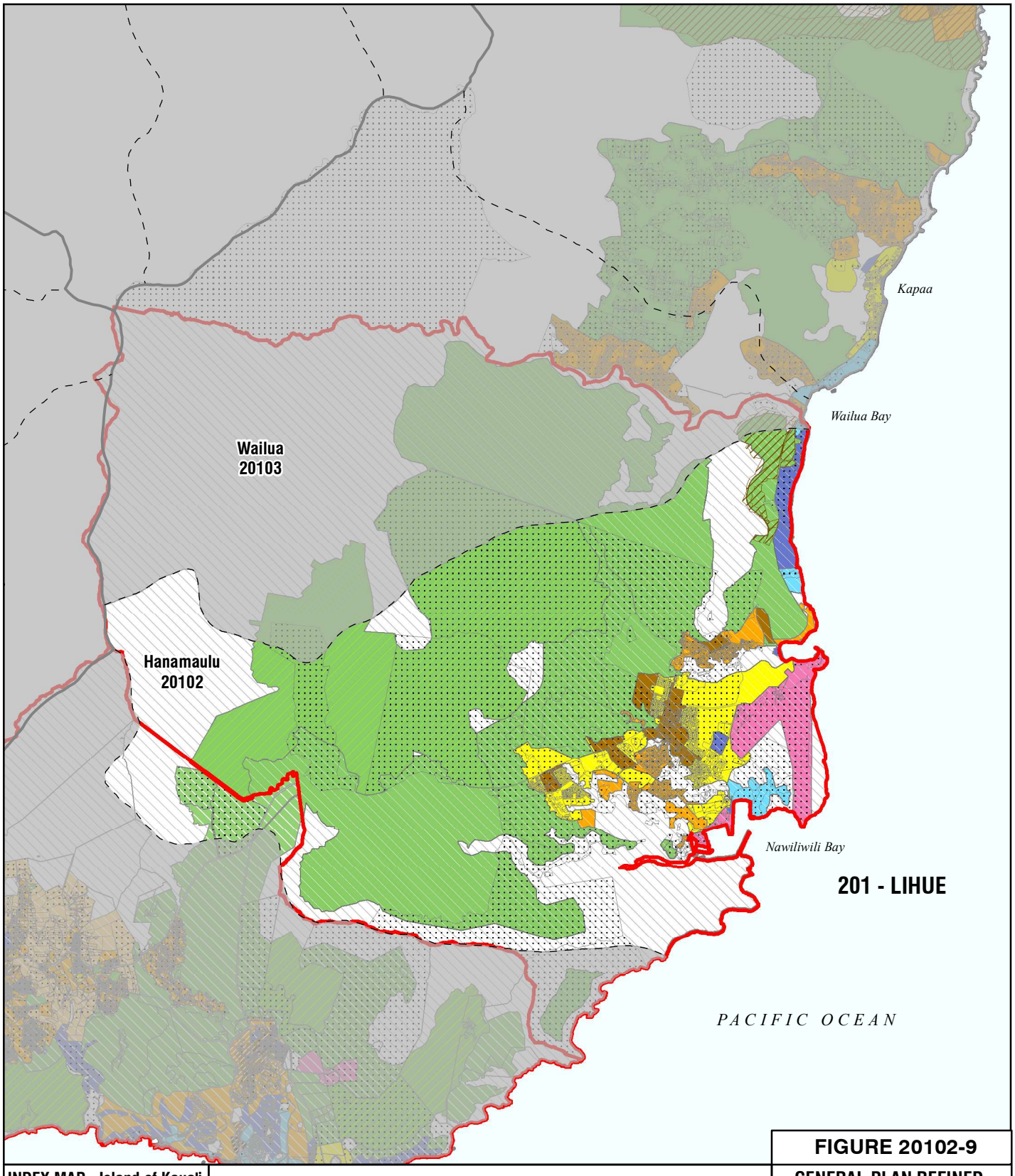
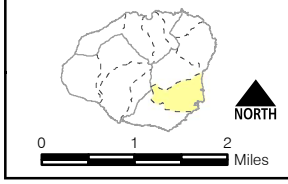


FIGURE 20102-9

GENERAL PLAN REFINED BY COMMUNITY PLAN
Aquifer Sector: LIHUE - 201
Aquifer System:
HANAMAULU - 20102

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Areas
- Aquifer System Areas
- Community Plan Boundaries
- Hawaiian Home Lands
- Developed Properties

Community Plan

- Agricultural (IAL)
- Agricultural (Other)
- Industrial
- Mixed Use
- Natural
- Parks and Recreation
- Residential
- Resort
- Urban Center

The full build-out water demand projection for the General Plan refined by the Līhu'e Community Plan is 23.32 mgd. See calculation below:

(1) General Plan full build-out water demand projection = 20.69 mgd

(2) Portion of General Plan full build-out water demand projection that coincides with the Līhu'e Communtiy Plan = 17.32 mgd

(3) Līhu'e Community Plan full build-out water demand projection = 19.95 mgd

Refined General Plan full build-out water demand projection = (1) – (2) + (3)
= 20.69 – 17.32 + 19.95
= **23.32 mgd**

Estimated full build-out projected water demands for the Hanamā'ulu ASYA are summarized by zoning class in **Table 20102-12**.

Table 20102-12: Zoning Full Build-Out Water Demand Projection – Hanamā'ulu ASYA

Zoning Class	CWRM Category	Water Demand (mgd)
Agriculture	Agriculture/Domestic	0.94
Commercial	Municipal	2.20
Industrial	Industrial/Municipal	5.03
Open	Domestic	0.08
Residential	Domestic/Municipal	4.83
Resort	Domestic/Irrigation/Municipal	1.61
DHHL	Domestic	0.60
	TOTAL	**15.29**

20102-4.1.1 Refined Land Use Based Water Projection

State Water Projects Plan

Table 20102-13 lists future State water projects reported in the 2021 SWPP update. The total projected demand to the year 2034 for these 10 State water projects within the Hanamā'ulu ASYA is 0.15 mgd, 0.09 mgd using potable and 0.06 mgd non-potable using potable sources.

Table 20102-13: Future State Water Projects – Hanamāʻulu ASYA

Project Name	State of Hawaiʻi Department	Primary Use	Water Development Strategy	2034 Demand (mgd)
Kauaʻi Community Correctional Center New Segregation Housing	DAGS (Planning Branch)	Potable	REMAIN	0.0030
Kauaʻi Community Correctional Center Restroom and Shower Improvements	DAGS (Planning Branch)	Potable	REMAIN	0.0045
Kauaʻi Community Correctional Center New Medium Security Housing	DAGS (Planning Branch)	Potable	REMAIN	0.0105
King Kaumualiʻi Elementary School Administration Building	DOE	Potable	REMAIN	0.0003
Līhuʻe 1 New School (Non-Potable using Potable)	DOE	Non-potable using Potable	REMAIN	0.0600
LIH ConRAC	DOT (Airport Div.)	Potable	REMAIN	0.0530
Nāwiliwili Hawaii Gas	DOT (Harbors Div.)	Potable	REMAIN	0.0101
Nāwiliwili Kauaʻi Petroleum Fuel Terminal	DOT (Harbors Div.)	Potable	REMAIN	0.0079
Kauaʻi Community College – Food Innovation Center	University of Hawaiʻi	Potable	REMAIN	0.0021
Kauaʻi Community College – Imu	University of Hawaiʻi	Potable	REMAIN	0.0021
			TOTAL REMAIN	0.1500
			TOTAL HANAMĀʻULU ASYA SWPP 2034 DEMAND	0.1500

As mentioned in **Section 2.2.2.5.1**, State water projects with the water development strategy of REMAIN are located within the service areas of County water systems which need to be coordinated with the respective County water departments. All 10 of the State water projects within the Hanamāʻulu ASYA were assigned the REMAIN water development strategy and results in a total 2034 demand of 0.1500 mgd. This accounts for 0.56 percent of the 27 mgd sustainable yield for the Hanamāʻulu ASYA.

State Department of Hawaiian Home Lands

A portion of DHHL's Wailua Tract is located within the Hanamāʻulu ASYA. The State Water Projects Plan – DHHL Update (SWPP), dated May 2017, discusses the projected water demands for DHHL and the proposed water development strategies to meet these water demands. According to the 2017 SWPP, the projected potable water demand for the portion of the Wailua Tract located

within the Hanamā‘ulu ASYA is 0.60 mgd. The 2017 SWPP suggests that this demand be met by a new State well in the Wailua ASYA.

The 2017 SWPP also discussed non-potable demands. It projects that non-potable demand for the Wailua Tract will be 0.34 mgd, and that the need will be met by the East Kaua‘i Irrigation System.

Agricultural Water Use and Development Plan

The AWUDP dated 2003 (revised 2004) was limited in scope. More recent, comprehensive information on agricultural lands is available in the County of Kaua‘i Important Agricultural Lands (IAL) Study.

In 2019, a public review draft of the AWUDP was released and it is anticipated that the next phase of the AWUDP will provide agricultural water demand projections in greater detail and will supersede information in the KWUDP when it becomes available.

County of Kaua‘i Important Agricultural Lands Study

11,520 acres of agricultural lands within the Hanamā‘ulu ASYA received a score of 28 or better in the County of Kaua‘i Important Agricultural Lands (IAL) Study. Lands that receive a score of 28 or better were determined to have met all eight IAL criteria to some degree. Only a subset of lands with a score of 28 or better is expected to be designated as IALs. **Table 20102-14** compares these lands that received a score of 28 or better to the declared surface water use from diversions and to the diversified water use rate of 3,400 gallons per acre per day (gpad) estimated in the 2004 AWUDP.

Table 20102-14: Irrigation of Agricultural Lands

(1) Declared Surface Water Use from Diversions (mgd)	6.87
(2) Agricultural Lands with a Score ≥ 28 (Acres)	11,520
- How many acres can be sustained by **(1)** at a water rate of 3,400 gpad? (Acres)	2,021
- What percent of **(2)** can be sustained with a water rate of 3,400 gpad?	18%
- If all of **(2)** were to be irrigated, what is the water unit rate? (gpad)	596

In 2013, 11,206 acres of agricultural lands owned by Grove Farm Company, Inc. were designated as IAL and are located predominantly within the Hanamaulu ASYA. The IAL is served by rainwater and surface water. Grove Farm Company, Inc. noted that the area receives 60 to 100 inches of rainfall annually and is adequate for rain-fed production of many crops.

20102-4.1.2 Water Use Unit Rates

Water use unit rates are based on the *Water System Standards* (WSS), as discussed in Chapter 2.

The General Plan provides only broad density guidelines for residential and resort designations. For these designations, under the assumption that most residents would like their communities, including the development density, to remain similar in the future, the average number of dwelling units as allowed by zoning was used as the density (i.e., 7.41 dwelling units per acre for residential designation and 18.97 dwelling units per acre for resort designation).

20102-4.2 Water Demand Projections to the Year 2035

The following section presents water demand projections to the year 2035 for the Hanamā'ulu ASYA. The projected low, medium, and high growth rates are listed in **Table 20102-15** and are graphed in **Figure 20102-10**. Potable (domestic, industrial, municipal, and military water uses) and non-potable (irrigation) water demands are also differentiated.

Table 20102-15: Water Demand Projection – Hanamā'ulu ASYA

Water Use Category	Water Demand by Year (mgd)								
	2015	2016	2017	2018	2019	2020	2025	2030	2035
GROWTH RATE C (HIGH)									
TOTAL	**4.42**	**4.51**	**4.60**	**4.69**	**4.78**	**4.87**	**5.35**	**5.85**	**6.36**
Potable	2.83	2.89	2.95	3.01	3.07	3.13	3.44	3.76	4.09
Non-Potable	1.59	1.62	1.65	1.68	1.71	1.74	1.91	2.09	2.27
GROWTH RATE B (MEDIUM)									
TOTAL	**4.42**	**4.51**	**4.60**	**4.69**	**4.78**	**4.87**	**5.35**	**5.85**	**6.35**
Potable	2.83	2.89	2.95	3.01	3.07	3.13	3.44	3.76	4.08
Non-Potable	1.59	1.62	1.65	1.68	1.71	1.74	1.91	2.09	2.27
GROWTH RATE A (LOW)									
TOTAL	**4.42**	**4.50**	**4.58**	**4.66**	**4.74**	**4.82**	**5.21**	**5.61**	**6.02**
Potable	2.83	2.88	2.93	2.98	3.03	3.08	3.33	3.59	3.85
Non-Potable	1.59	1.62	1.65	1.68	1.71	1.74	1.88	2.02	2.17

Figure 20102-10: Water Demand Projection Summary – Hanamā'ulu ASYA

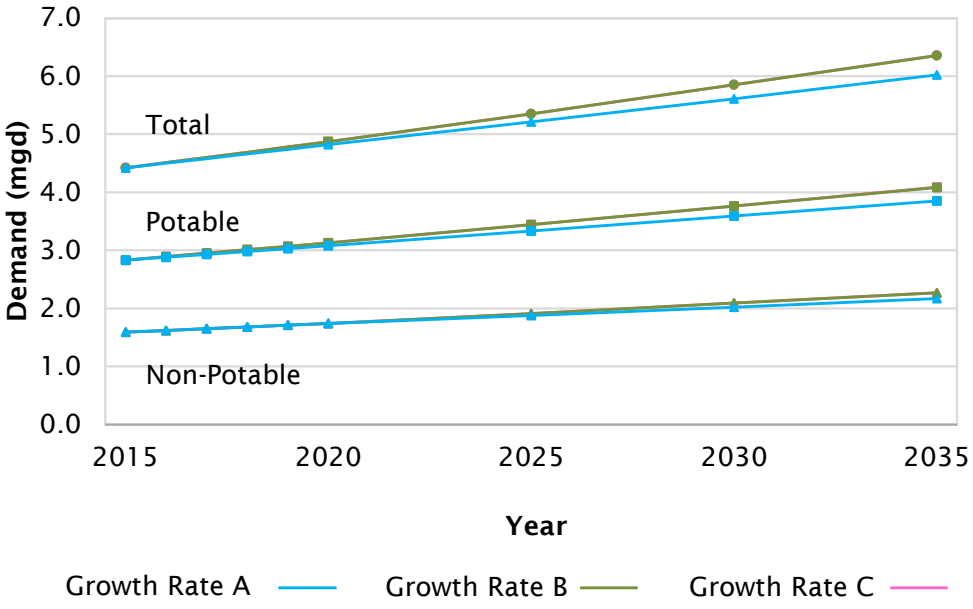


Figure 20102-11 shows the breakdown of water demand projections for a medium growth rate by CWRM categories through the year 2035. **Table 20102-16** summarizes this figure.

Figure 20102-11: Medium Growth Rate B Water Demand Projection by Category – Hanamā'ulu ASYA

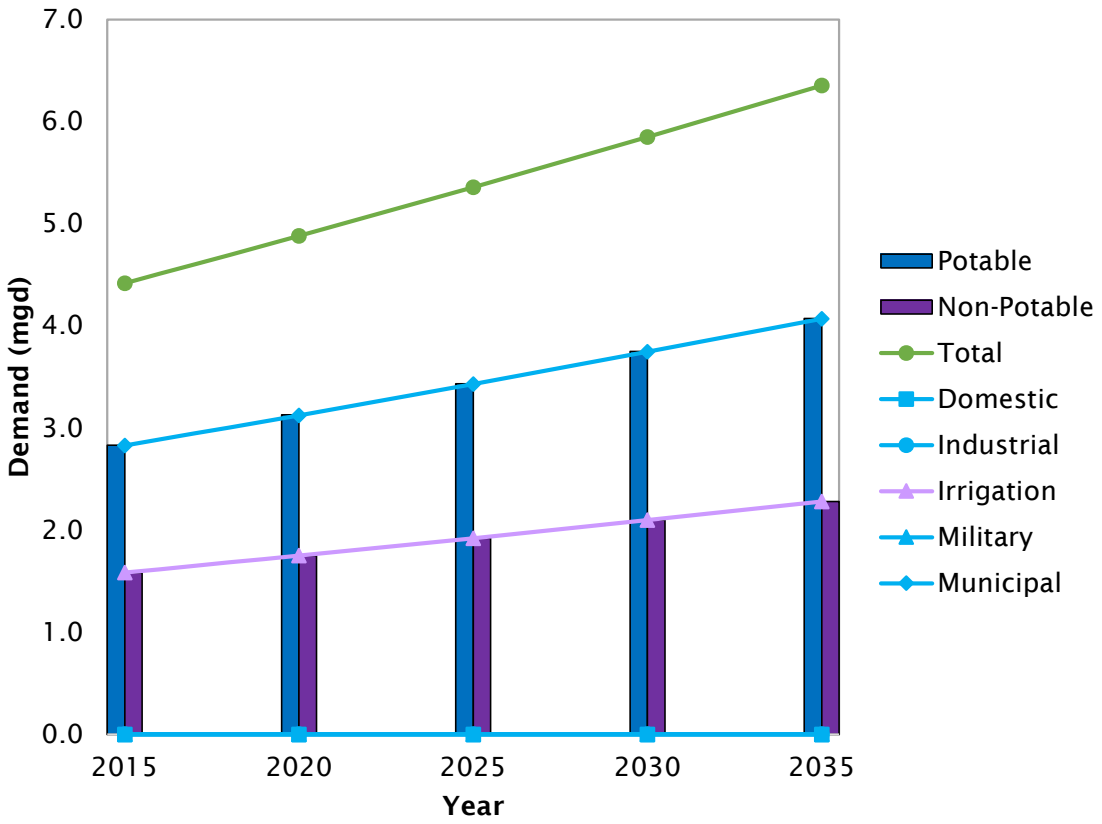


Table 20102-16: Medium Growth Rate B Water Demand Projection by Category – Hanamā'ulu ASYA

Water Use Category	Water Use by Year (mgd)								
	2015	2016	2017	2018	2019	2020	2025	2030	2035
Total	**4.42**	**4.51**	**4.60**	**4.69**	**4.79**	**4.88**	**5.36**	**5.85**	**6.35**
Potable	2.83	2.89	2.95	3.01	3.07	3.13	3.43	3.75	4.07
Non-Potable	1.59	1.62	1.65	1.68	1.72	1.75	1.92	2.10	2.28
Domestic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Irrigation	1.59	1.62	1.65	1.68	1.72	1.75	1.92	2.10	2.28
Military	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal	2.83	2.89	2.95	3.01	3.07	3.13	3.43	3.75	4.07
DOW	2.83	2.89	2.95	3.01	3.07	3.13	3.43	3.75	4.07

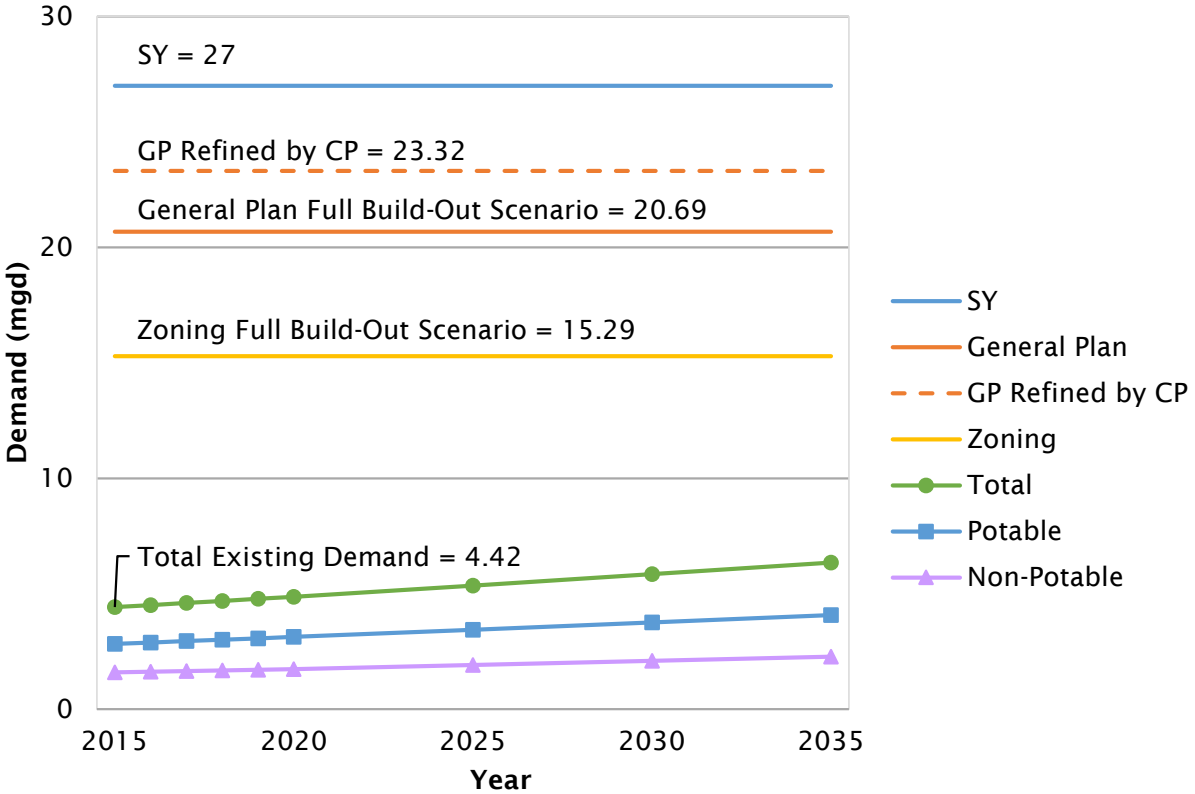
20102-4.3 Summary

Figure 20102-12 illustrates the magnitude of the sustainable yield, both General Plan and Zoning full build-out water use projections, and water use projection through the year 2035 focusing on Medium Growth Rate B. **Table 20102-17** summarizes the General Plan, Zoning, and 20-year water demand projection scenarios for the Hanamā'ulu ASYA. The sustainable yield is presented to draw comparisons. All demands are in mgd.

Table 20102-17: Summary of Demand Projections

SY (mgd)	FBO (mgd)		Medium Growth Rate Demand by Year (mgd)								
	GP	Zoning	2015	2016	2017	2018	2019	2020	2025	2030	2035
27	20.69	15.29	4.42	4.51	4.60	4.69	4.79	4.88	5.36	5.85	6.35

Figure 20102-12: Medium Growth Rate B Water Demand Projections and Full Build-Out – Hanamā'ulu ASYA



Note: Total existing demand includes municipal, domestic, industrial, military, and irrigation water uses. It does not include agriculture water use. For future agricultural water use analysis, please see Section 20102-4.1.1 County of Kaua'i Important Agricultural Lands Study.

20102-5 RESOURCE AND FACILITY RECOMMENDATIONS

20102-5.1 Water Source Adequacy

20102-5.1.1 Full Build-Out

Development to the highest extent allowed by the General Plan and County Zoning within the Hanamā‘ulu ASYA is sustainable, with General Plan and County Zoning full build-out water demands requiring 77 and 57 percent of the 27 mgd sustainable yield (SY), respectively.

20102-5.1.2 Twenty-Year Projection

The 2035 water demand projection for the Hanamā‘ulu ASYA is sustainable, requiring only 24 percent of the 27 mgd sustainable yield.

20102-5.2 Source Development Requirements

20102-5.2.1 Supply-Side Management

Supply-side management, including conventional water resource measures, water conservation, and alternative water resource measures, were evaluated to meet projected water demands.

Conventional Water Resource Measures

Ground Water

The Hanamā‘ulu ASYA contains basal, perched, and high level ground water resources. Most reported pumpage is from the perched zone, followed by from the basal zone. Little to no high level water is removed.

The 2035 water demand projection for the Hanamā‘ulu ASYA is only 24 percent of the 27 mgd sustainable yield. This indicates that theoretically, more water could be pumped from the aquifer without impairing the utility or quality of the water resource if wells are optimally placed and the proper due diligence with regard to traditional and customary rights and impacts has been completed. However, it is noted that the sustainable yield does not consider the feasibility of developing the ground water resources, and that the safe yield of an individual production well may be limited by localized ground water behavior near the well as a result of pumpage. As discussed in **Section 20102-2.1**, ground water levels in the Līhu‘e Basin showed declining trends in the late 1990s and early 2000s. The declines in water level resulted in diminished productivity of some wells and tunnels and generated concern about the future reliability of ground water resources. Water supply reliability and quality, feasibility, environmental and cultural impacts, and water rights shall be considered as projects and programs develop. More detailed and site-specific evaluation of these impacts shall be required and accomplished through the environmental review process (HRS Chapter 343) for source development projects and programs utilizing public funding, and CWRM could consider requiring compliance with the environmental review process for private source development projects and programs also. **Section 1.5.3.1** provides additional information regarding the protection of traditional and customary rights.

The DOW's Puhi-Līhuʻe-Hanamāʻulu system serves Hanamāʻulu, the port complex at Nāwiliwili and the adjoining Niumalu residences, Kauaʻi High School and Chiefess Kamakahelei Middle School, Wilcox Hospital, Līhuʻe Airport, and the surrounding residential, commercial, and industrial communities/districts. This system will need to accommodate growth as the Līhuʻe Planning District is expected to accommodate nearly half of Kauaʻi's population growth through 2035. The DOW's Water Plan 2020 identified water supply projects to meet the growing demand of its service areas. For DOW's Puhi-Līhuʻe- Hanamāʻulu system, several well projects were proposed and completed. The completed wells are included in **Table 20102-7a** and **Table 20102-7b**. A project to drill and develop horizontal wells was also proposed, but the project is currently on hold indefinitely. As demand continues to grow, additional water sources will need to be identified. DOW will need to consider the past well productivity concerns mentioned above if additional ground water wells are considered. Further study and monitoring may assist in determining if more ground water development is viable.

The DOW's Water Plan 2020 also identified potential storage and distribution system upgrades. As a result of the Water Plan 2020, a number of existing tanks in the Puhi-Līhuʻe-Hanamāʻulu system were rehabilitated, and a few water mains were replaced. An additional fifteen water main replacement projects are proposed, including replacement of a 16-inch water main in Kūhiō Highway that is currently being designed.

Surface Water

The Hanamāʻulu ASYA has 39 declared diversions. Until permanent instream flow standards are established, interim instream flow standards have been adopted. According to Section 13-169-46, Hawaiʻi Administrative Rules, "Interim Instream Flow Standard for all streams on Hawaiʻi, as adopted by the commission on water resource management on June 15, 1988, shall be 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 commission]." Therefore, for the purposes of assessing surface water availability, it is assumed that no additional diversions will be allowed without amendment of the interim IFS.

The existing declared diversions have the potential to meet additional demands. However, a challenge with developing surface water is transmission of these resources from source to location of need. Farmers generally grow what is feasible for the area; therefore, it is anticipated that agricultural water use will follow the availability of irrigation water. Increase in the availability of surface water would likely promote additional usage and could thereby minimize ground water being used for irrigation.

There are a few existing irrigation systems in the Hanamāʻulu ASYA, including the East Kauaʻi Irrigation System (EKIS) and the Upper and Lower Haʻikū Ditch system. Due to the cessation of sugarcane cultivation, many of these irrigation systems may not be functioning as efficiently as they once were. The Agricultural Water Use and Development Plan (AWUDP) should include an inventory of large irrigation systems and provide information on their rehabilitation and maintenance needs. The AWUDP should also include a more detailed assessment of agricultural water demand projections that will supersede information in the KWUDP when it becomes available.

Surface water in the Hanamā‘ulu ASYA also serves potable uses due to difficulties with ground water well production in the area. The Kapaia Reservoir is the water source for the Waiahi Surface Water Treatment Plant. Expansion of the surface water treatment plant is proposed by Grove Farm to meet the projected demands of its Līhu‘e-Hanamā‘ulu Master Planned Community.

Water Transfer

Some existing irrigation systems have the capability to transfer surface water to adjacent ASYAs. The AWUDP should study irrigation system services areas and provide information on irrigation systems' water transfer.

Water can also be transferred between ASYAs through public water systems. The DOW's Līhu‘e-Hanamā‘ulu subsystem, located completely within the Hanamā‘ulu ASYA, is interconnected with the DOW's Wailua-Kapa‘a subsystem, which services areas in the Hanamā‘ulu ASYA, Wailua ASYA, and Anahola ASYA. Currently, there is some water transfer from the Līhu‘e-Hanamā‘ulu subsystem to the Wailua-Kapa‘a subsystem. Flow between these subsystems is regulated by a valve. In the past, water from the Wailua-Kapa‘a subsystem was boosted into the Līhu‘e-Hanamā‘ulu system by the Hanamā‘ulu Booster Station. To meet future demands, DOW could utilize the interconnection between these two subsystems to transfer any surplus supply from one system to the other.

Water Conservation

The per capita use in the Hanamā‘ulu ASYA is approximately 15.8% lower than the overall County of Kaua‘i per capita use. There are no ASYA-specific conservation measures in place at this time; however, there are general water conservation programs that are described in **Section 1.5.7**. Water conservation, including water loss management, can increase the amount of water available and help to ensure the long-term viability of water resources.

Alternative Water Resource Measures

Rainwater Catchment

Rainwater can be utilized as a water resource in several ways.

Rainwater can be harvested in rainwater catchment systems which can be utilized to supply domestic potable water needs. These systems are viable in areas that receive abundant rainfall and are a suitable source of potable water for individual domestic users in areas outside the limits of municipal water systems. Generally, these are remote areas and are not expected to expand significantly because most development is anticipated to be concentrated within existing urban areas. Therefore, use of rainwater catchment systems is not anticipated to increase significantly.

Rainwater can also be used to supplement or satisfy agricultural non-potable water needs through ambient rainfall.

See the Storm Water Reuse section below to see how rainwater as storm water runoff can be reclaimed and reused.

Storm Water Reuse

Rainfall can turn into storm water runoff. Storm water runoff from impervious surfaces in urban areas can be significant. This water could be captured, treated, and used as a source of non-potable water (e.g., irrigation), integrated with recycled water, or even as potable and/or non-potable ground water recharge. However, due to the lack of storm water reuse standards, the high initial infrastructure costs, and the treatment requirements, storm water reclamation and reuse on a small or large scale may not be feasible and requires further assessment as noted in the Water Resource Protection Plan.

The U.S. Department of the Interior, Bureau of Reclamation published An Appraisal of Stormwater Reclamation and Reuse Opportunities in Hawai‘i (Storm Water Report) in 2008 that identified two areas in the Hanamā‘ulu ASYA that has the opportunity to use storm water reclamation and reuse:

1) Nāwiliwili Diversion
2) Līhu‘e Airport

The Nāwiliwili Diversion opportunity involves diverting storm water before or after entering Nāwiliwili Stream for the purposes of recharging ground water and reducing the pollutant levels in Hanamā‘ulu Bay and the impaired waters of Nāwiliwili Stream and Bay. Diversion structures, surface spreading basins or infiltration trenches, and pipelines will need to be constructed with the assistance and cooperation from the KDOW, KDPW, DOH, and CWRM. Permits would also need to be obtained from the CWRM for the Nāwiliwili Stream diversion(s). The Storm Water Report estimated this opportunity would cost $2.8 million (2008 dollars).

The Līhu‘e Airport opportunity involves collecting storm water runoff from the Līhu‘e Airport for ground water recharge and reuse as irrigation of the airport green space and the Hōkūala Golf Course. A storm water conveyance system and recharge trench will need to be constructed with the assistance and cooperation from the DOT Airports Division and Hōkūala Golf Course. The Storm Water Report estimated this opportunity would cost $13.9 million (2008 dollars) and was indicated to be less feasible than the Nāwiliwili Diversion opportunity.

Recycled Water

Recycled water is a valuable resource; an increase in its use may lower the dependence on potable sources. There are three wastewater reclamation facilities (WWRFs) in the Hanamā‘ulu ASYA. Līhu‘e WWRF and Līhu‘e-Puhi WWTP produces R-1 water; Wailua WWRF produces R-2 water. Comparing the current reuse amount to the design capacity of each facility, it appears that there is recycled water available to meet additional demands, see **Table 20102-18** below. However, the actual additional recycled water use will depend on several factors, including the quantity of wastewater generated (which may be significantly less than the design capacity), the demand for recycled water, and the number of viable users within close proximity to the facility.

Table 20102-18: Wastewater Reclamation Facilities Available Capacity – Hanamā‘ulu ASYA

WWRF/ WWTP	Recycled Water Classification	Design Capacity (mgd)	Quantity Produced (mgd)	Current Reuse Amount (mgd)	Available Capacity (mgd)
Līhu‘e WWRF	R-1	2.5	1.2	0.79	1.71
Līhu‘e-Puhi WWTP	R-1	1.0	0.4	0.37	0.63
Wailua WWRF	R-2	1.5	0.5	0.19	1.31

Desalination

Desalination of brackish ground water is a potential alternative; however, due to its high capital and operational costs, it likely would not be considered when other potable water sources are readily available.

20102-5.2.2 Demand-Side Management

Development Density Control

The full build-out demand for the Hanamā‘ulu ASYA based on County Zoning is 15.29 mgd, which is 57 percent of the sustainable yield. This indicates that there are adequate water resources to sustain the level of development that is allowed by law. In the Hanamā‘ulu ASYA, the average number of dwelling units allowed by County Zoning is 7.41 dwelling units per acre in residential districts and 18.97 dwelling units per acre in resort districts.

The full build-out demand for the Hanamā‘ulu ASYA based on the General Plan is 20.69 mgd which is 77 percent of sustainable yield. The full build-out demand based on the General Plan refined by the Līhu‘e Community Plan is 22.73 mgd, which is 84 percent of sustainable yield. Although it is highly unlikely that full build-out will occur within the time frame of these plans, these full build-out demands are sustainable; there are adequate water resources to sustain the long-range land use vision for this area. Therefore, development density control may not be necessary. However, the County Planning Department could consider development density control for areas where there is the flexibility to do so, such as areas that are not yet zoned as residential or resort, and promote sustainable development. Further, it is noted that these full build-out scenarios are unlikely to occur since it assumes all land is developed to maximum extent.

Nevertheless, with full build-out demand based on the General Plan and the General Plan refined by the Līhu‘e Community Plan at 77 and 84 percent of sustainable yield, respectively, the County Planning Department should promote sustainable development and exercise caution when making land use decisions that cannot easily be undone. Development density control could be considered for areas where there is the flexibility to do so, such as areas that are not yet zoned as residential or resort. Growth beyond the vision of the General Plan and Līhu‘e Community Plan may be possible, but impacts on water resources should be considered and reevaluated.

20102-5.3 Recommended Alternatives

To optimize appropriate use of water resources, the quality of the water source should be matched to the quality of the water required. The highest quality of water shall be reserved for the most valuable end use. Potable water is considered the highest quality water, and the sustenance of life is the most valuable end use. Recycled water, brackish water, untreated surface water, and other lower quality water sources should be used for landscaping and agriculture when available, thereby reserving potable water for human consumption. If there is a practical alternative water source available, that alternative source should be used in lieu of ground water or surface water. With this in mind, the following recommendations are made for the Hanamā‘ulu ASYA:

Alternative Water Resources

Alternative water sources, such as recycled water generated from wastewater reclamation facilities, should be used where available to reduce demands on both ground and surface water resources and to conserve water resources as a whole. Recycled water is available from the Līhu‘e WWRF, Līhu‘e-Puhi WWTP, and Wailua WWRF; however, as discussed previously, successfully increasing use of recycled water is dependent on several factors, including the number of viable users within close proximity to the facilities.

Conservation

Water resources are a finite resource that should be managed and used wisely. It should be conserved and not wasted. Implementation of conservation measures should continue to be encouraged.

Ground Water

Ground water is typically the preferred source for drinking water and for meeting other potable water needs. However, developing ground water in this area has been difficult historically, and there have been concerns about the future reliability of ground water resources. Further study and monitoring could assist in determining if more ground water development is viable to meet potable water demands. In addition, environmental and cultural impacts and water rights shall be considered as projects and programs develop.

Development of ground water resources, where feasible, is the primary strategy to serve future potable demands in the Hanamā‘ulu ASYA. However, as noted above, there has historically been difficulty with developing ground water in this area.

Surface Water

Surface water requires treatment before being used to meet potable water needs. One source for the DOW’s Līhu‘e-Hanamā‘ulu subsystem is surface water that is treated at the Waiahi Surface Water Treatment Plant and purchased by DOW. Expansion of the surface water treatment plant is proposed by Grove Farm to meet the projected demands of its Līhu‘e-Hanamā‘ulu Master Planned Community.

Due to well productivity concerns, development of surface water resources is the secondary strategy to serve future potable demands in the Hanamā'ulu ASYA.

Surface water, where available, should be used to meet non-potable demands if alternative water resources are not available. To achieve this, it will be critical to maintain and improve existing irrigation systems. Making surface waters more readily available to meet non-potable water demands has the potential to minimize future dependence on the use of ground water. It is therefore recommended that the AWUDP provide information on the rehabilitation and maintenance needs of large irrigation systems.

Demand-Side Management

Full build-out demand based on the General Plan and the General Plan refined by the Līhu'e Community Plan are 77 and 84 percent of sustainable yield, respectively. At these projections, implementation of development density control by the County Planning Department is not needed since it is highly unlikely that full build-out will occur within the time frame of these plans.

Although these projections are sustainable, the County Planning Department should exercise caution and consider potential impacts on available water resources when considering any future zoning modifications. Modifications that may result in increased development density within the area will increase demands on water resources.