
Chapter 20201

Kalihiwai Aquifer System Area

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20201 KALIHIWAI AQUIFER SYSTEM AREA

20201-1 SYSTEM AREA PROFILE

20201-1.1 General

The Kalihiwai [20201] Aquifer System Area (ASYA) is bound on the north by the Pacific Ocean from Princeville to roughly the western side of Kīlauea town, from about Kīlauea Point along the ridge above Kaumoku Stream along the east, to the peak of the Makaleha Mountains along the south, and back down to the ocean along the eastern ridge above the Hanalei River on the west. Urbanized areas within the Kalihiwai ASYA include Kalihiwai and portions of Princeville and Kīlauea town.

Average annual rainfall ranges from 65 inches per year along the coast to 140 inches in the mountains. The sustainable yield is 16 mgd.

20201-1.2 Economy and Population

20201-1.2.1 Economy

The largest industries within the Kalihiwai ASYA include real estate, rental and leasing, accommodation and food service and healthcare and social assistance. These activities are primarily concentrated in Princeville and Kīlauea.

20201-1.2.2 Population

The population contributing to the demand within the Kalihiwai ASYA is primarily located in Princeville and Kīlauea. A smaller portion of the population in Kalihiwai ASYA is located in the Kalihiwai area itself with residences primarily located in proximity to Kūhiō Highway. Historical population data for the Kalihiwai ASYA is summarized in **Table 20201-1**. Population projections through the year 2035 are summarized in **Table 20201-2a**. As shown in **Table 20201-2b**, it is estimated that the area will continue to experience growth rates between 1 and 6 percent per decade.

Table 20201-1: Historical Population – Kalihiwai ASYA

	Year		
	1990	2000	2010
Population	2,256	2,520	3,053
Percent Change		11.7	21.2

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

Table 20201-2a: Population Projection – Kalihiwai ASYA

Growth Rate	Population by Year								
	2015	2016	2017	2018	2019	2020	2025	2030	2035
A – Low	3,078	3,081	3,085	3,089	3,093	3,097	3,120	3,149	3,183
B – Med.	3,099	3,111	3,123	3,135	3,148	3,161	3,233	3,314	3,408
C – High	3,103	3,116	3,129	3,143	3,157	3,172	3,252	3,342	3,447

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

Table 20201-2b: Population Projection – Percent Change – Kalihiwai ASYA

Growth Rate	2015-2025 % Change	2025-2035 % Change
A – Low	1.4	2.0
B – Medium	4.3	5.4
C – High	4.8	6.0

20201-1.3 Land Use

20201-1.3.1 2000 Kaua‘i General Plan

The 2000 Kaua‘i County General Plan Land Use Designation Map for the Kalihiwai ASYA is shown on **Figure 20201-1**. The estimated land use allocation acreage for each land use designation within the system area is listed in **Table 20201-3**.

Table 20201-3: General Plan Estimated Land Use Allocation Acreage – Kalihiwai ASYA

General Plan Land Use Designation	Acreage	Percent of Total
Agricultural	3,890	34.3
Military	0	0.0
Open	6,500	57.3
Park	13	0.1
Residential Community	311	2.7
Resort	636	5.6
Transportation	0	0.0
Urban Center	0	0.0
DHHL	0	0.0
TOTAL	11,350	100.0

20201-1.3.2 Kaua‘i Zoning

Kaua‘i County Zoning Map for the Kalihiwai ASYA is shown on **Figure 20201-2**. The estimated land use allocation acreage for each zoning district within the system area is listed in **Table 20201-4**.

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 Kalihiwai ASYA is 6.84 dwelling units per acre. There are only a few parcels zoned as resort in the Kalihiwai ASYA, and the average number of dwelling units allowed on those resort-zoned parcels is 19.60 dwelling units per acre. However, it is noted that Princeville is generally considered a resort area and is designated as resort in the General Plan although most of the area is zoned as residential. Taking the residential-zoned areas into consideration, the average number of dwelling units allowed in resort areas in the Kalihiwai ASYA is 7.46 dwelling units per acre.

Table 20201-4: County Zoning Estimated District Allocation Acreage – Kalihiwai ASYA

Zoning District	Acreage	Percent of Total
Agriculture	3,380	30.1
Commercial – General	0	0.0
Commercial - Neighborhood	7	0.1
Conservation	5,253	46.7
Industrial – General	0	0.0
Industrial - Limited	15	0.1
Open	2,133	19.0
Residential	408	3.6
Resort	21	0.2
Project Development	0	0.0
Special Planning Area	0	0.0
Special Treatment	0	0.0
No Zoning	22	0.2
DHHL	0	0.0
TOTAL	11,239	100.0

PACIFIC OCEAN

202 - HANAIEI

Hanakapi'ai
Beach

Hanalei
Bay

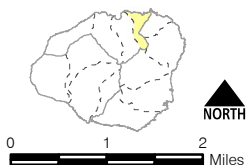
Kalihiwai
20201

FIGURE 20201-1

GENERAL PLAN LAND USE MAP

Aquifer Sector: HANAIEI - 202
Aquifer System:
KALIHIAI - 20201

INDEX MAP - Island of Kaua'i



LEGEND:

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

Land Use Allocation Guide

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

202 - HANAIEI

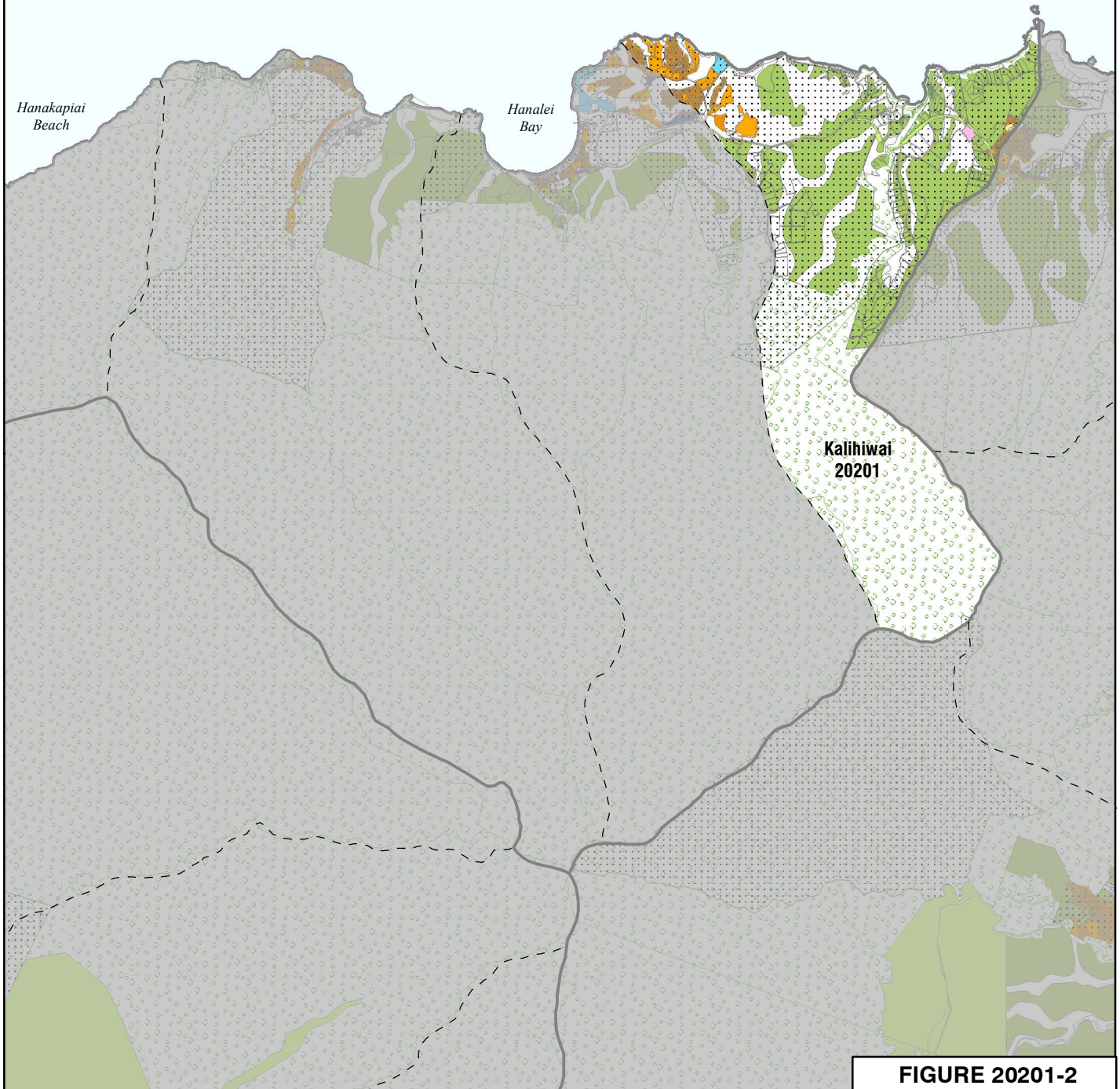
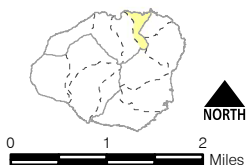


FIGURE 20201-2

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: HANAIEI - 202
 Aquifer System:
 KALIHIAWAI - 20201

20201-2 EXISTING WATER RESOURCES

20201-2.1 Ground Water

The Kalihiwai ASYA has a sustainable yield of 16 mgd. According to the 2014 CWRM database, there are 17 production wells in the system, 2 agriculture, 2 municipal (non-DOW), 12 domestic, and 1 irrigation well. There are also 8 wells drilled and categorized as “unused”. Refer to **Appendix A** for this database. **Figure 20201-3** shows the well locations.

20201-2.2 Surface Water

There are 5 streams classified as perennial in the Kalihiwai ASYA, all of which are considered continuous. These streams are the Waileia Stream, ‘Anini Stream, Kalihiwai River, Pu‘ukumu Stream, and an unnamed stream. The USGS has 1 active surface water gage in the system area. The gage is located on Pu‘ukumu Stream near Kīlauea, 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 need 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 13 declared stream diversions in the CWRM database shown on **Figure 20201-4**, which accounts for 4 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 Kalihiwai ASYA is 0.09 mgd.

The Kalihiwai Irrigation subsystem is managed by Porter Irrigation System. The subsystem is currently active, in relatively good condition, and diverts water from the Pōhakuho Stream. This subsystem is primarily located in and serving the Kalihiwai ASYA.

20201-2.3 Water Conservation

Water conservation increases the amount of water available and helps to ensure the long-term viability of water resources. Water conservation, including water loss management, may reduce water use. See **Section 1.5.7** for discussion of existing conservation efforts.

20201-2.4 Rainwater Catchment

Rainwater catchment is a viable resource for areas that are not served by ground water or surface water. **Figure 20201-5** 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.

20201-2.5 Recycled Water

There are no wastewater reclamation facilities in the Kalihiwai ASYA.

PACIFIC OCEAN

202 - HANAIEI

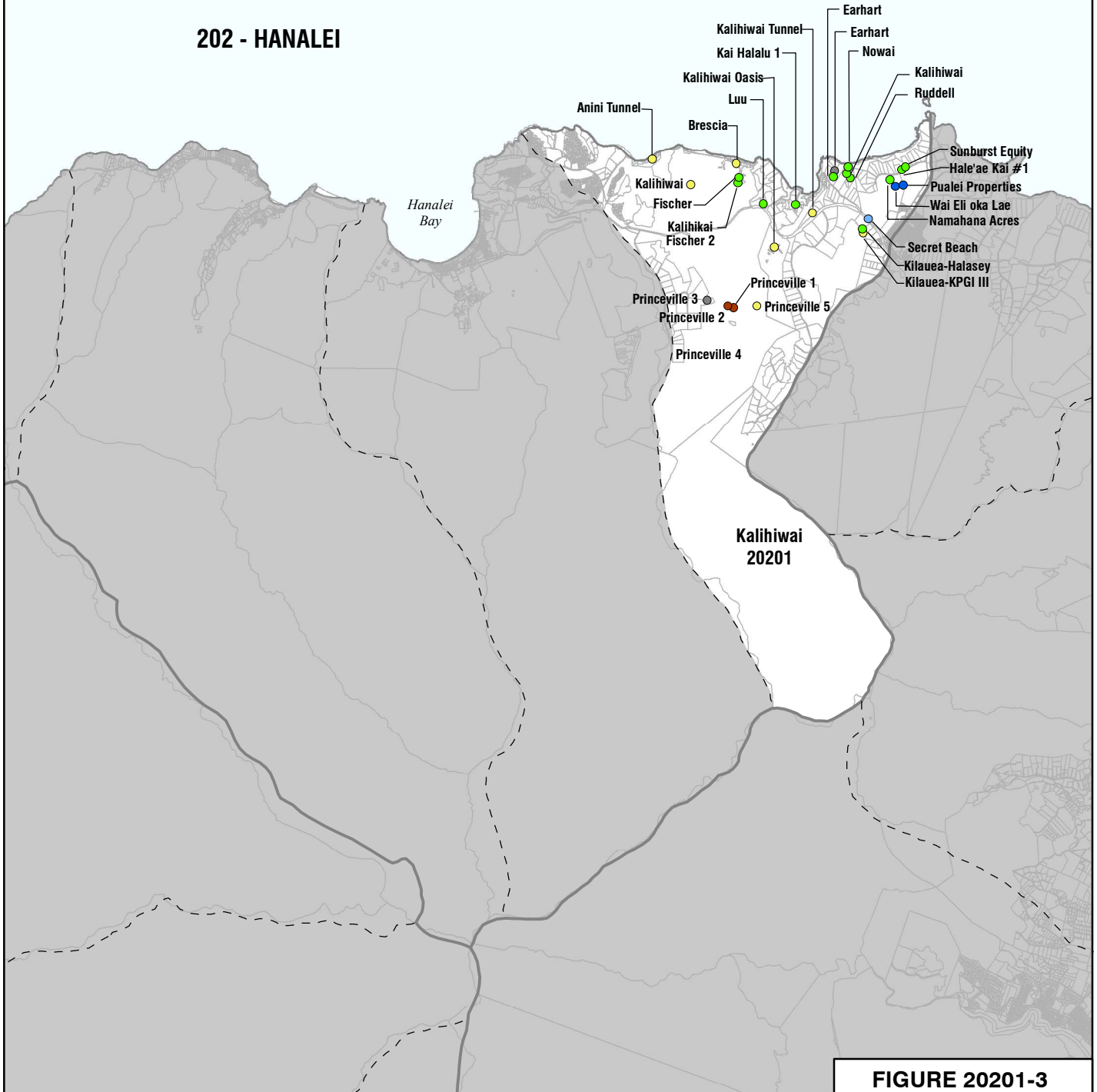
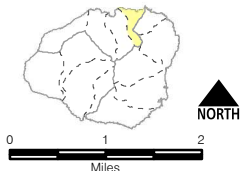


FIGURE 20201-3

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

WELL LOCATION

Aquifer Sector: HANAIEI - 202
Aquifer System:
KALIHIAWAI - 20201

202 - HANA LEI

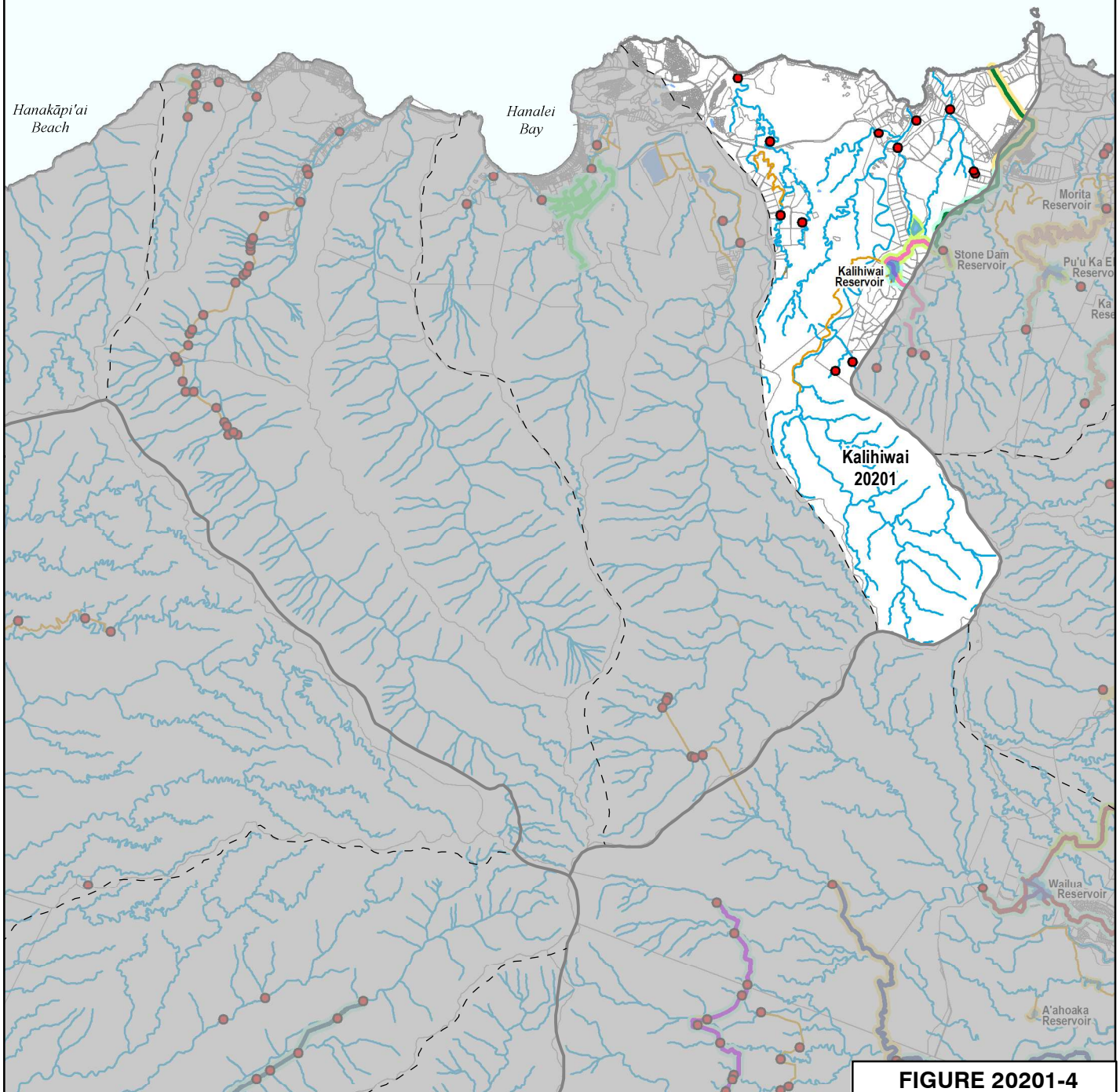
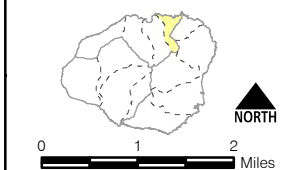


FIGURE 20201-4

STREAMS & DIVERSIONS

Aquifer Sector: HANA LEI - 202
 Aquifer System:
 KALIHIAI - 20201

INDEX MAP - Island of Kaua'i



LEGEND:

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

Irrigation Systems

- Stone Dam Irrigation Subsystem
- Kalihiwai Irrigation Subsystem Ditch

Status

- Active
- Inactive
- Unknown
- Abandoned

PACIFIC OCEAN

202 - HANA LEI

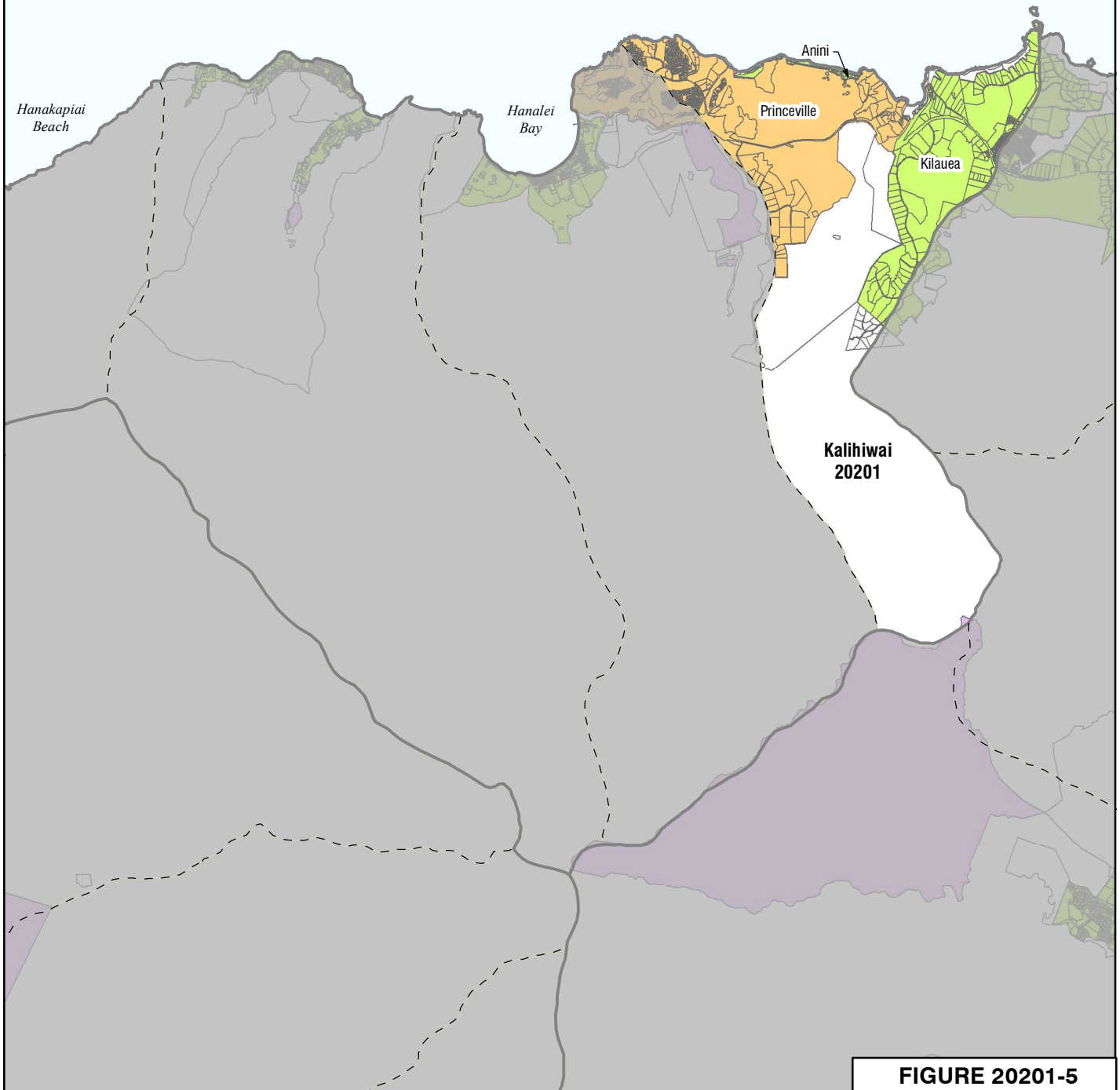
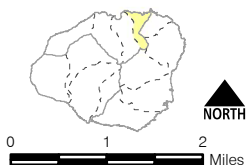


FIGURE 20201-5

WATER SYSTEM & SERVICE AREA

Aquifer Sector: HANA LEI - 202
Aquifer System:
KALIHIWAI - 20201

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)

20201-3 EXISTING WATER USE

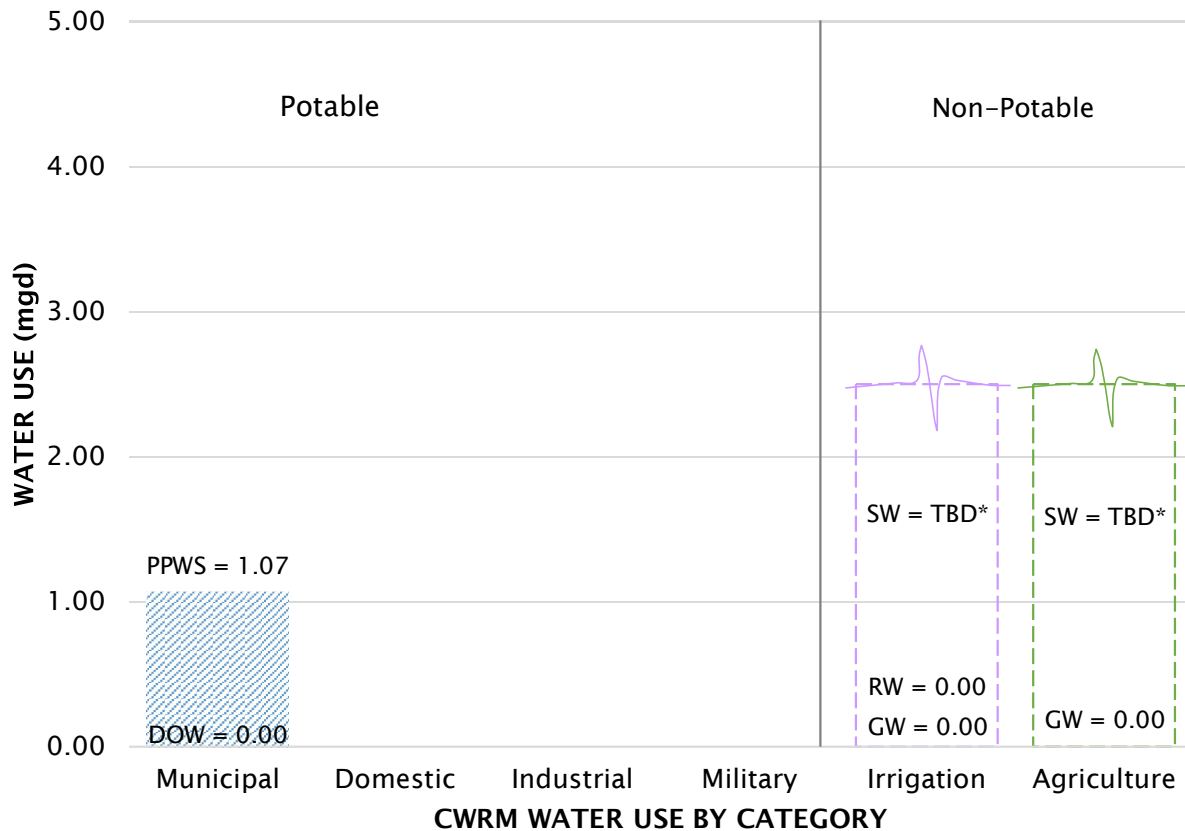
20201-3.1 General

The following section presents the total estimated average water use within the Kalihiwai 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 20201-5** and **Figure 20201-6** summarize the water use in accordance with CWRM categories.

Table 20201-5: Existing Water Use by Category – Kalihiwai ASYA

CWRM Category	Ground Water (mgd)	Other Sources (mgd)	Total (mgd)	Percent of Total
Domestic	0.00	TBD ¹	0.00	0.0
Industrial			0.00	0.0
Irrigation	0.00		0.00	0.0
Agriculture	0.00		0.00	0.0
Military			0.00	0.0
Municipal				
DOW System			0.00	0.0
Private-Public WS	1.07		1.07	100.0
TOTAL	1.07		1.07	100.0

¹ Surface Water – TBD from AWUDP

Figure 20201-6: Existing Water Use by Category – Kalihiwai ASYA

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

20201-3.2 Domestic Use

There are 12 wells classified as “Domestic” in the 2014 CWRM database; however, none have not reported pumpage.

Two additional DOMNOTH – Domestic, Other Non-Residential wells were added to the 2017 CWRM database, increasing the “domestic” well total to 14 wells.

20201-3.3 Industrial Use

There is no industrial water use in the Kalihiwai ASYA.

20201-3.4 Irrigation Use

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

20201-3.4.1 Ground Water

There is one well classified as “Irrigation” in the CWRM database owned by Secret Beach Plantation, LLC with no reported pumpage.

One additional well was added to the 2017 CWRM database, owned by Kauapea Papaya, LLC, which increases the “irrigation” well total to 2 wells.

20201-3.4.2 Recycled Water

The Princeville Makai Golf Course is irrigated with R-2 water from the Princeville WWRF in the Hanalei ASYA. The golf course is in the Kalihiwai and Hanalei ASYAs. The Princeville WWRF and Princeville Makai Golf Course are discussed further in **Section 20202**.

20201-3.4.3 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.

20201-3.5 Agricultural Use

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

20201-3.5.1 Ground Water

There are 2 wells classified as “Agriculture” in the CWRM database, with 1 well further classified as AGRCP - crops and processing. The AGRCP well is owned by Pualei Properties, LLC with no reported pumpage. The other well is owned by a private landowner with no reported pumpage.

20201-3.5.2 Recycled Water

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

20201-3.5.3 Surface Water

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

20201-3.6 Military Use

There is no military water use in the Kalihiwai ASYA.

20201-3.7 Municipal Use

There are 2 wells in the CWRM database classified as “Municipal,” none of which are MUNCO – Municipal County. These two wells are classified as MUNPR – Municipal Private. County Municipal can be subcategorized into the other water use categories: Domestic, Industrial, Agricultural, Military, and Municipal.

20201-3.7.1 County Water Systems

The DOW has two major water systems that serve the Kalihiwai ASYA; the ‘Anini Water System and the Kīlauea Water System.

‘Anini Water System

The ‘Anini water system is DOH Public Water System (PWS) No. 402 and serves 109 people through 61 service connections, per the 2009 DOH Sanitary Survey. This water system is considered a consecutive water system; water for this system is purchased from the Princeville (PWS 428 water system). The ‘Anini water system service area includes beach front residences along ‘Anini Beach Road, a public park, and a polo field. There are no DOW storage facilities or booster pump stations for this water system.

Kīlauea Water System

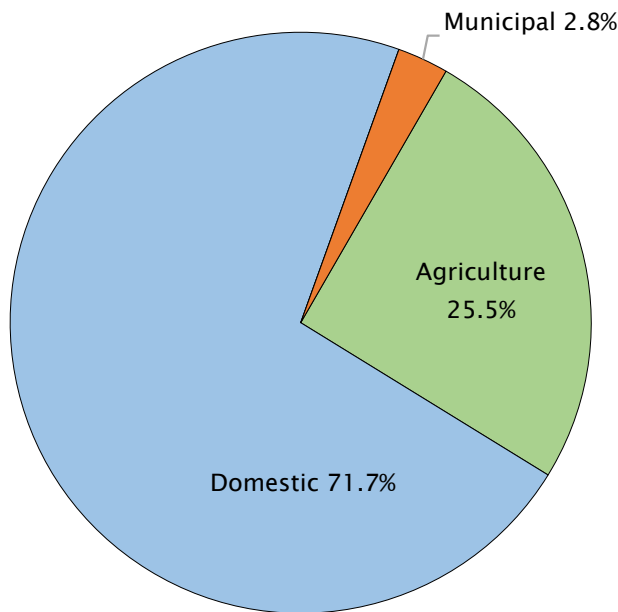
The Kīlauea water system is DOH PWS No. 407 and services areas in both the Kīlauea ASYA and Kalihiwai ASYA. This water system was discussed in **Section 20105** – Kīlauea ASYA.

DOW Water Use by Category

DOW water use is subcategorized in **Table 20201-6** to the extent possible based on available meter data and is depicted in **Figure 20201-7**.

Table 20201-6: DOW Existing Water Use by Category – Kalihiwai ASYA

CWRM Water Use Category	DOW Metered Water Use (mgd)	Percent of Total
Agricultural	0.070	25.5
Domestic	0.196	71.7
Industrial	0.000	0.0
Military	0.000	0.0
Municipal	0.008	2.8
Total	0.274	100.0

Figure 20201-7: DOW Existing Water Use by Category – Kalihiwai ASYA

20201-3.7.2 State Water Systems

There are no State water systems in the Kalihiwai ASYA regulated by the DOH.

20201-3.7.3 Federal Water Systems

There are no Federal water systems in the Kalihiwai ASYA regulated by the DOH.

20201-3.7.4 Private-Public Water Systems

The Princeville Water System (PWS 428) is the only private-public water system in the Kalihiwai ASYA regulated by the DOH. The water system is owned and operated by Princeville Utilities Company, Inc and serves 1,698 people through 1,029 service connections. This water system serves residents in the Princeville, Kalihiwai, and ‘Anini Vista communities, including the Princeville Resort and golf clubhouses. Water for this system is supplied by 3 wells. Two wells are located in the Kalihiwai ASYA: Princeville 1 (2-1126-001), Princeville 2 (2-1126-002) with total reported pumpage of 1.07 mgd. The third well, Princeville 4 (2-1127-002), is located in the Hanalei ASYA with reported pumpage of 0.32 mgd. The water is stored in 3 tanks and flows to the distribution system by gravity.

20201-3.7.5 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 20201-7**. The per capita use in the Kalihiwai ASYA is approximately 134% higher than the overall County of Kaua‘i per capita use largely due to the high PPWS use in the Princeville resort area.

Table 20201-7: Per Capita Use – Kalihiwai ASYA

	DOW Metered Water Use – Domestic (mgd)	Private-Public Water System (mgd)	90% of 2015 Population	Per Capita Use (gpd)
Kalihiwai ASYA	0.196	1.07	2,789	454
County of Kaua'i	9.360	2.951	63,462	194

20201-3.8 Existing Water Use by Resource

20201-3.8.1 Ground Water

Table 20201-8 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 20201-8: Pumpage – Kalihiwai ASYA

Pumpage (mgd)	SY (mgd)	Pumpage Portion of SY
1.07	16	6.7%

Based on available information from the CWRM database, the current ground water use is 6.7 percent of the sustainable yield.

20201-3.8.2 Surface Water

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

20201-3.8.3 Water Conservation

Water conservation, including water loss management, may reduce water use. See Section 20201-2.3 for existing conservation efforts.

20201-3.8.4 Rainwater Catchment

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

20201-3.8.5 Recycled Water

The Princeville Makai Golf Course is irrigated with recycled water from the Princeville WWRF, discussed further in Section 20202.

20201-4 FUTURE WATER USE

20201-4.1 Full Build-Out Water Demand Projections

The full build-out water demand projections based on the General Plan and County Zoning for the Kīlauea ASYA is listed in **Table 20201-9** and **20201-10**, respectively. Each land use class is associated with the most appropriate CWRM water use category.

Table 20201-9: General Plan Full Build-Out Water Demand Projection – Kalihiwai ASYA

General Plan Category	CWRM Category	Water Demand (mgd)
Agriculture	Agriculture/Domestic	0.51
Open	Domestic	0.04
Military	Military	0.00
Park	Irrigation	0.05
Residential	Domestic/Municipal	1.06
Resort	Domestic/Irrigation/Municipal	3.32
Transportation	Municipal	0.00
Urban Center	Domestic/Industrial/Municipal	0.00
DHHL	Domestic	0.00
TOTAL		4.98

Table 20201-10: Zoning Full Build-Out Water Demand Projection – Kalihiwai ASYA

Zoning Class	CWRM Category	Water Demand (mgd)
Agriculture	Agriculture/Domestic	0.51
Commercial	Municipal	0.04
Industrial	Industrial/Municipal	0.06
Open	Domestic	0.04
Residential	Domestic/Municipal	1.30
Resort	Domestic/Irrigation/Municipal	0.28
DHHL	Domestic	0.00
TOTAL		2.23

20201-4.1.1 Refined Land Use Based Water Projection

State Water Projects Plan

There are no future State water projects through the year 2034 within the Kalihiwai ASYA according to the 2021 SWPP Update.

State Department of Hawaiian Home Lands

There are no DHHL tracts in the Kīlauea ASYA.

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

1,306 acres of agricultural lands within the Kalihiwai 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 20201-11** 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 20201-11: Irrigation of Agricultural Lands

(1) Declared Surface Water Use from Diversions (mgd)	0.09
(2) Agricultural Lands with a Score $\geq$ 28 (Acres)	1,306
- How many acres can be sustained by (1) at a water rate of 3,400 gpad? (Acres)	26
- What percent of (2) can be sustained with a water rate of 3,400 gpad?	2%
- If all of (2) were to be irrigated, what is the water unit rate? (gpad)	69

20201-4.1.2 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., 6.84 dwelling units per acre for residential designation and 7.46 dwelling units per acre for resort designation).

20201-4.2 Water Demand Projections to the Year 2035

The following section presents water demand projections to the year 2035 for the Kalihiwai ASYA. The projected low, medium, and high growth rates are listed in **Table 20201-12** and are graphed in **Figure 20201-8**. Potable (domestic, industrial, municipal, and military water uses) and non-potable (irrigation) water demands are also differentiated.

Table 20201-12: Water Demand Projection – Kalihiwai ASYA

Water Use Category	Water Demand by Year (mgd)								
	2015	2016	2017	2018	2019	2020	2025	2030	2035
GROWTH RATE C (HIGH)									
TOTAL	1.07	1.07	1.08	1.08	1.09	1.09	1.12	1.15	1.19
Potable	1.07	1.07	1.08	1.08	1.09	1.09	1.12	1.15	1.19
Non-Potable	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GROWTH RATE B (MEDIUM)									
TOTAL	1.07	1.07	1.08	1.08	1.09	1.09	1.12	1.14	1.18
Potable	1.07	1.07	1.08	1.08	1.09	1.09	1.12	1.14	1.18
Non-Potable	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GROWTH RATE A (LOW)									
TOTAL	1.07	1.07	1.07	1.07	1.08	1.08	1.08	1.09	1.11
Potable	1.07	1.07	1.07	1.07	1.08	1.08	1.08	1.09	1.11
Non-Potable	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 20201-8: Water Demand Projection Summary – Kalihiwai ASYA

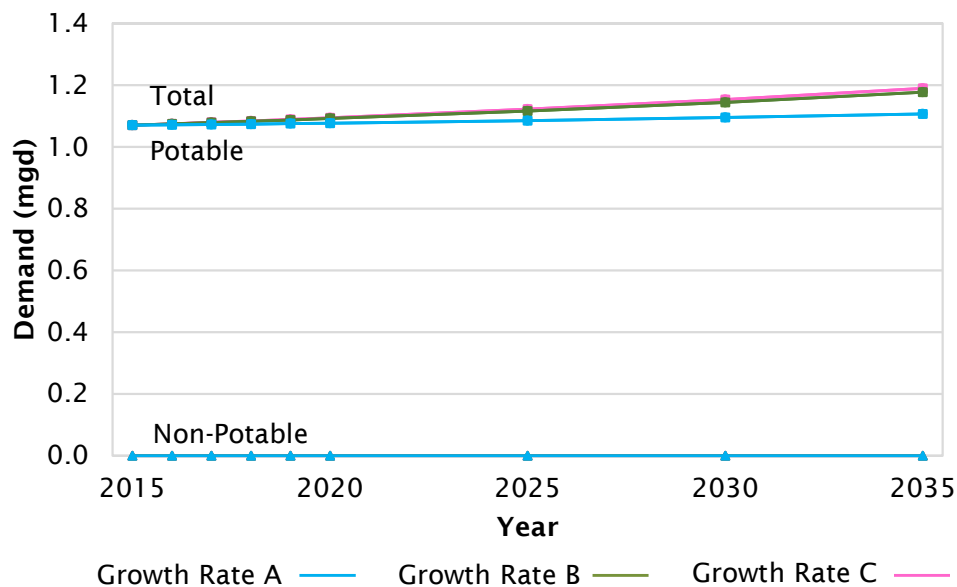
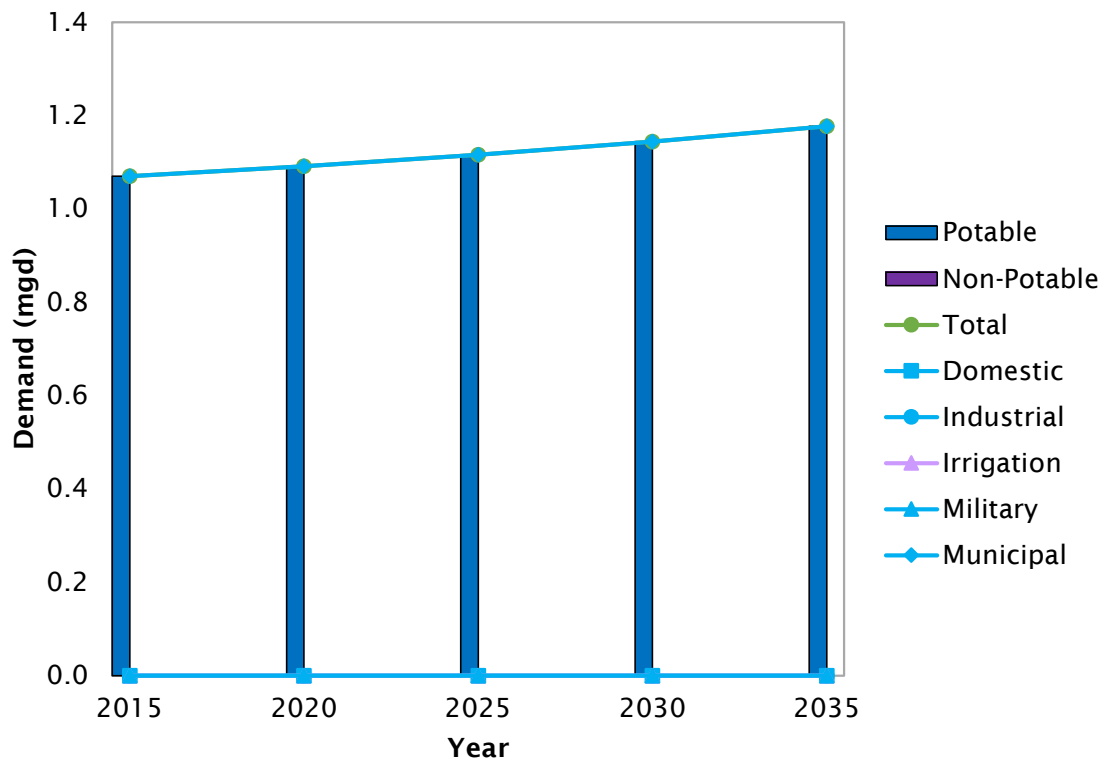


Figure 20201-9 shows the breakdown of water demand projections for a medium growth rate by CWRM categories through the year 2035. Table 20201-13 summarizes this figure.

Figure 20201-9: Medium Growth Rate B Water Demand Projection by Category – Kalihiwai ASYA**Table 20201-13: Medium Growth Rate B Water Demand Projection by Category – Kalihiwai ASYA**

Water Use Category	Water Use by Year (mgd)								
	2015	2016	2017	2018	2019	2020	2025	2030	2035
Total	1.07	1.07	1.08	1.08	1.09	1.09	1.12	1.14	1.18
Potable	1.07	1.07	1.08	1.08	1.09	1.09	1.12	1.14	1.18
Non-Potable	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Military	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal	1.07	1.07	1.08	1.08	1.09	1.09	1.12	1.14	1.18
DOW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

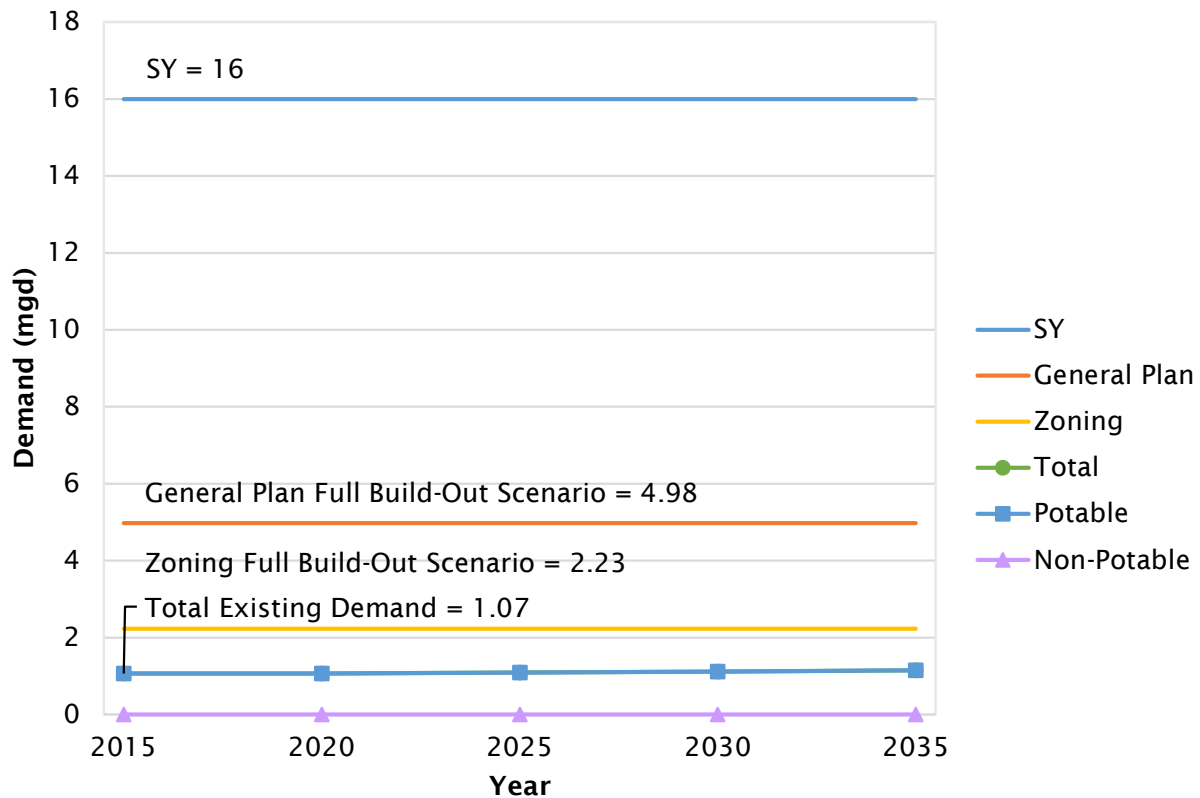
20201-4.3 Summary

Figure 20201-10 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 20201-14** summarizes the General Plan, Zoning, and 20-year water demand projection scenarios for the Kalihiwai ASYA. The sustainable yield is presented to draw comparisons. All demands are in mgd.

Table 20201-14: 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
16	4.98	2.23	1.07	1.07	1.08	1.08	1.09	1.09	1.12	1.14	1.18

Figure 20201-10: Medium Growth Rate B Water Demand Projections and Full Build-Out – Kalihiwai 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 20201-4.1.1 County of Kaua'i Important Agricultural Lands Study.

20201-5 RESOURCE AND FACILITY RECOMMENDATIONS

20201-5.1 Water Source Adequacy

20201-5.1.1 Full Build-Out

Development to the highest extent allowed by the General Plan and County Zoning within the Kalihiwai ASYA is sustainable, with General Plan and County Zoning full build-out water demands requiring 31 and 14 percent of the 16 mgd sustainable yield, respectively.

20201-5.1.2 Twenty-Year Projection

The 2035 water demand projection for the Kīlauea ASYA is sustainable and is only 7 percent of the 16 mgd sustainable yield.

20201-5.2 Source Development Requirements

20201-5.2.1 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 Kalihiwai ASYA contains basal and perched ground water. All reported pumpage is from the basal zone.

The 2035 water demand projection for the Kalihiwai ASYA is only 7 percent of the 16 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 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. 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 Princeville Water System serves the Princeville, Kalihiwai, and ‘Anini Vista communities and is owned and operated by the Princeville Utilities Company, Inc. This water system also provides

water to DOW's 'Anini Water System. Development of ground water to meet projected demands is feasible since projected potable water needs are within the sustainable yield of this area.

Surface Water

The Kalihiwai ASYA has 13 declared diversions. Until permanent instream flow standards are established, interim instream flow standards have been adopted. According to Section 13-169-46, Hawai'i Administrative Rules, "Interim Instream Flow Standard for all streams on Hawai'i, 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 couple of small existing irrigation lines in the Kalihiwai ASYA, as shown on **Figure 20201-4**, but there are no major irrigation systems.

Water Transfer

Some existing irrigation systems have the capability to transfer surface water to adjacent ASYAs. Water can also be transferred between ASYAs through public water systems. The DOW's Kīlauea water system services areas in the Kīlauea ASYA and Kalihiwai ASYA. The sources for the water system, including a proposed well, are in the Kīlauea ASYA, while its service area is in both the Kīlauea ASYA and Kalihiwai ASYA. The Princeville water system services areas in the Kalihiwai ASYA and Hanalei ASYA. Two of its wells are in the Kalihiwai ASYA, and one well is located in the Hanalei ASYA.

Water Conservation

The per capita use in the Kalihiwai ASYA is approximately 134% higher than the overall County of Kaua'i per capita use largely due to the high PPWS use in the Princeville resort area. 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 but did not identify any storm water reclamation and reuse opportunities in the Kalihiwai ASYA.

Recycled Water

Recycled water is a valuable resource; an increase in its use may lower the dependence on potable sources. However, there are no wastewater reclamation facilities (WWRFs) in the Kalihiwai ASYA.

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.

20201-5.2.2 Demand-Side Management

Development Density Control

The full build-out demand for the Kalihiwai ASYA based on County Zoning is 2.23 mgd which is 14 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 Kalihiwai ASYA, the average number of dwelling units allowed by County Zoning is 6.84 dwelling units per acre in residential districts and 19.60 dwelling units per acre in resort districts.

The full build-out demand for the Kalihiwai ASYA based on the General Plan is 4.98 mgd which is 31 percent of sustainable yield. This full build-out demand is sustainable, but it is noted that it is based on 7.46 dwelling units per acre on lands designated as resort in the General Plan. As discussed in **Section 20201-1.3.2**, Princeville is designated as resort in the General Plan but is mostly zoned as residential, and the average number of dwelling units allowed in Princeville is 7.46 dwelling units per acre. If Princeville were to be rezoned as resort and the allowed number of dwelling units increased, this would increase water demand. For example, if the average number of dwelling units per acre increased from 7.46 to 15, the water demand for the area could potentially double. It is assumed that most residents would like their communities, including the development density, to remain similar in the future, and therefore, it is assumed that the development density will remain at about 8 dwelling units per acre. If an increase in development density is considered in the future by the Planning Department, it is recommended that the effect on water demand be assessed.

20201-5.3 Recommended Alternatives

To optimize appropriate use of water resources, the quality of the water source should be matched to the quality of 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 Kalihiwai ASYA:

Alternative Water Resources

Use of alternative water sources can reduce demands on both ground and surface water resources and conserve water resources as a whole. However, aside from rainwater, there are no available alternative water sources in the area. Alternative water sources are unlikely to be developed when other water resources are readily available.

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

Meeting future demands at a reasonable cost is a planning objective, and conventional sources, such as ground water, are typically the most cost-effective means for meeting projected water demands. Projected potable water needs are within the sustainable yield for this area. Therefore, ground water resources could continue to be used and developed to meet potable water needs now and into the future. However, as noted above, development of conventional water resource measures can have

challenges, and water supply reliability and quality, feasibility, environmental and cultural impacts, and water rights shall be considered as projects and programs develop.

Development of ground water resources is the primary strategy to serve future potable demands in the Kalihiwai ASYA.

Surface Water

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 is 31 percent of sustainable yield. At this projection, implementation of development density control by the County Planning Department is not needed. However, as discussed previously, this full build-out demand is based on development density of approximately 8 units per acre, and an increase in the average development density will increase demand. Therefore, if an increase in development density is considered, the effect on water demand should be assessed.