Chapter 1

Introduction

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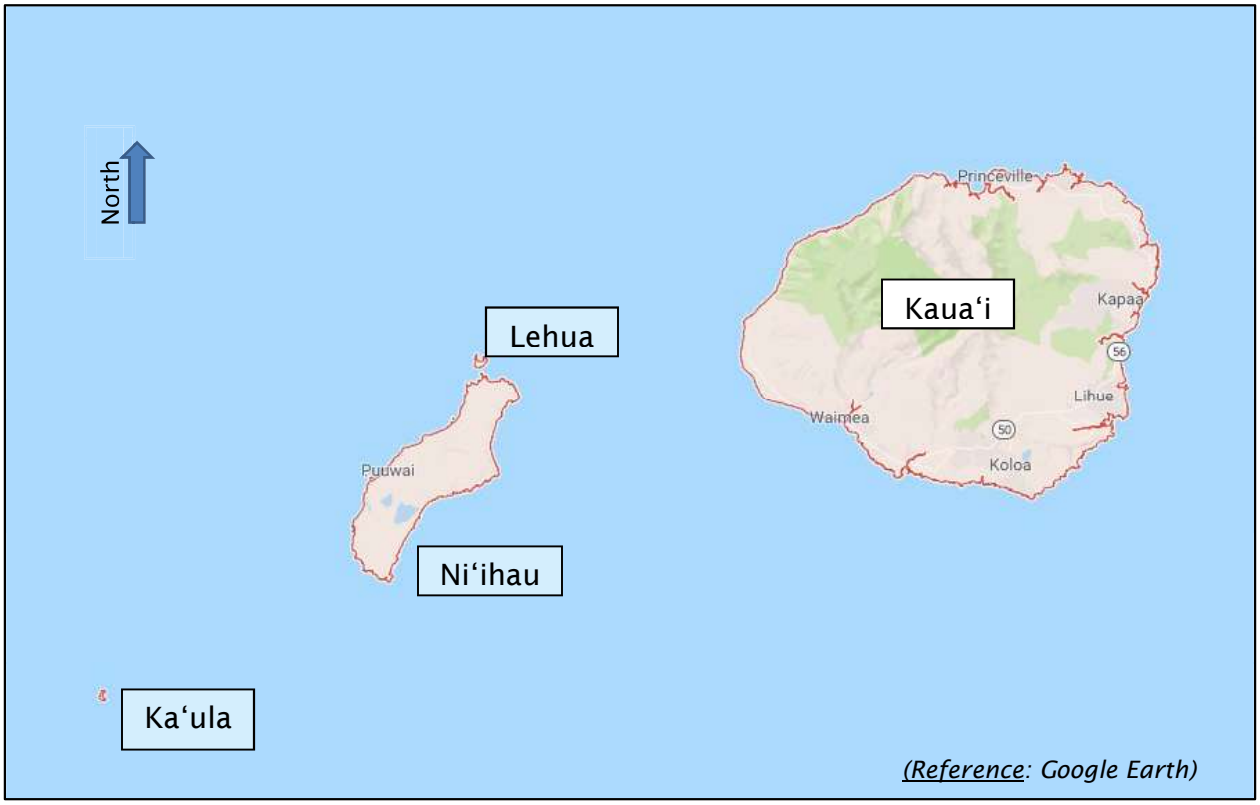
1 INTRODUCTION

1.1 BACKGROUND

Kauaʻi County includes the islands of Kauaʻi, Niʻihau, Lehua, and Kaʻula, see **Figure 1-1**. The latter two islands, Lehua and Kaʻula, are small uninhabited islands. The island of Niʻihau is privately owned by the Robinson family and public access to the island is only allowed with permission of the owners. For the purposes of this report, the focus will be limited to the island of Kauaʻi itself.

Figure 1-1 County of Kauaʻi Maps



1.1.1 State Water Code

In 1978, the Hawaiʻi State Constitutional Convention recognized the State's obligation to "protect, control, and regulate the use of Hawaiʻi's water resources for the benefit of its people."[1] This obligation is now called the public trust. The State Constitution, Article XI, §7 also provided for an agency to set overall water management policies and protection of Hawaiʻi's limited water resources. This set the foundation for the State Water Code and the establishment of the Commission on Water Resource Management.

[1] Constitution of the State of Hawaii, Article XI, §7.

The 1987 State Legislature enacted into law Hawai'i Revised Statutes, Chapter 174C - State Water Code[2] to protect Hawai'i's surface and ground water resources. The waters of the State are held in public trust and cannot be owned privately. The Public Trust Doctrine is a policy of the State Water Code and is stated as follows:

> *It is recognized that the waters of the State are held for the benefit of the citizens of the State. It is declared that the people of the State are beneficiaries and have a right to have the waters protected for their use. (HRS §174C-2(a)).*

The State recognizes four public trust purposes as established by the Hawai'i Supreme Court:

" a. Maintenance of waters in their natural state;
b. Domestic water use of the general public, particularly drinking water;
c. The exercise of Native Hawaiian traditional and customary rights; and
d. Reservations of water for Hawaiian Home Lands"[3]

The State Water Code (the Code) called for the establishment of a Commission on Water Resource Management (CWRM) to oversee the general administration of the Code. The Code also calls for the preparation of a Hawai'i Water Plan to serve as a dynamic, long-range planning guide for the CWRM. The definition of the terms, procedures, content, etc. for the Hawai'i Water Plan are spelled out in Hawai'i Administrative Rules Chapter 13-170, Hawai'i Water Plan[4].

The objectives of the Hawai'i Water Plan are as follows:

- Proper conservation and water development
- Reasonable and beneficial use of water
- Control of water for public purposes
- Attainment of adequate water quality
- Protection of public trust uses of water
- Implementation of water resource policies
- Utilization of reclaimed water for uses other than drinking and potable water needs in 100% of state and county facilities by December 31, 2045
- Linkage between land use and water by County "home rule"

[2] https://www.capitol.hawaii.gov/hrscurrent/vol03_ch0121-0200d/HRS0174C/HRS_0174C-.htm (link current as of June 2024)
[3] 2019 Water Resource Protection Plan, 2019, page 12.
[4] https://files.hawaii.gov/dlnr/cwrm/regulations/13-170.pdf (link current as of June 2024)

The Hawai'i Water Plan consists of five parts:

Table 1-1 Hawai'i Water Plan Components

Component	Responsible Agency
Water Resource Protection Plan (WRPP)	State Department of Land and Natural Resources (DLNR), CWRM
Water Quality Plan (WQP)	State Department of Health
State Water Projects Plan (SWPP)	DLNR, Engineering Division
Agricultural Water Use and Development Plan (AWUDP)[5]	State Department of Agriculture
County Water Use and Development Plans (WUDP)[6]	County Department of Water Supply

The initial Hawai'i Water Plan was completed and adopted by the CWRM in July 1990. As called for in the Code, all elements of the Hawai'i Water Plan are to be updated regularly to reflect the current needs of the State. Each of the Counties is responsible to update their respective WUDP as required. Updates of the various elements except the WQP and AWUDP were drafted in 1992, but were not officially adopted by the CWRM. Since then, various elements have been updated or are in the process of being updated. See **Section 1.1.4** for the update status of the Hawai'i Water Plan.

1.1.2 History and Objective of the Kaua'i Water Use and Development Plan

In compliance with the State Water Code, each of the four Counties is tasked with the development of its own WUDP. The primary objective of the WUDP is to set forth the allocation of water to land use to guide the county in its planning, management, and development of land use and water resource strategies and policies for sustainable development. As stipulated in Hawai'i Administrative Rules §13-170-31, the County WUDP shall include, but not be limited to:

(1) Status of water and related land development including an inventory of existing water uses for domestic, municipal, and industrial users, agriculture, aquaculture, hydropower development, drainage, reuse, reclamation, recharge, and resulting problems and constraints;

(2) Future land uses and related water needs; and

(3) Regional plans for water developments including recommended and alternative plans, costs, adequacy of plans, and relationship to the water resource protection and water quality plans.

The original Kaua'i WUDP was prepared by the County of Kaua'i Department of Water (DOW). The Kaua'i WUDP was adopted by Kaua'i County ordinance and endorsed by Mayor JoAnn Yukimura on April 27, 1990. The CWRM conditionally accepted the WUDP, on June 27, 1990, for incorporation into the Hawai'i Water Plan. The key condition stipulated that the WUDP was to be

[5] The AWUDP was added to the Hawai'i Water Plan by mandate under Act 101, Session Laws of Hawai'i (SLH) 1998, by the State Legislature.

[6] A separate WUDP is to be prepared by each of the four Counties.

reviewed and revised as necessary by the County to coincide with the review process of the Hawai'i Water Plan.

The "Kaua'i Water Use and Development Plan", dated February 1990, was adopted by County of Kaua'i Ordinance No. 568. The Ordinance stipulates that the DOW shall be responsible for the preparation and maintenance of the WUDP. It further stipulates that the "Board of Water and the DOW shall have the authority to amend the WUDP to reflect changes in the hydrologic or other scientific information and land use."

1.1.3 Statewide Framework for the Update of the Hawai'i Water Plan

The Statewide Framework for Updating the Hawai'i Water Plan (Framework), dated February 2000, was created by the CWRM to facilitate coordination, integration, and consistency for preparing/ updating of the various components of the Hawai'i Water Plan. In addition, the Framework provides guidelines for the preparation of WUDP updates to ensure its effective implementation by the County and utilization by the CWRM for resource management purposes.

The Framework requires data and analyses to be based on ground water and surface water hydrologic units designated by the CWRM.

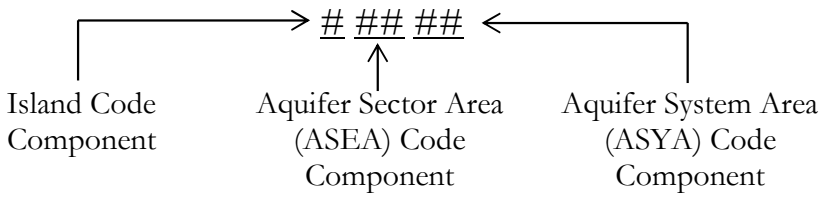
1.1.3.1 Ground Water Hydrologic Units

An aquifer is generally described as a water bearing stratum of permeable rock, sand or gravel and constitutes a source of ground water. The CWRM, as part of its Water Resource Protection Plan (WRPP), has established an aquifer classification and coding system to describe and identify aquifers in the State of Hawai'i. Under the aquifer coding system, each island is identified as the largest component in the coding hierarchy, followed by Aquifer Sector Areas (ASEA), and Aquifer System Areas (ASYA), respectively.

The ASEA reflects an area with broad hydrogeological (subsurface) similarities while maintaining traditional hydrographic (surface), topographic and historical boundaries where possible. The ASYA is an area within an ASEA and more specifically defined by hydrogeologic continuity among aquifers in the ASEA. Aquifer boundary lines should be recognized as management lines and not strict hydrologic boundaries that ground water flow does not cross. This classification scheme updates the hydrographic areas initially established for each island in 1959[7].

The ground water hydrologic unit code begins with the U.S. Geological Service identification number for each island (Island code): 1-Ni'ihau, 2-Kaua'i, 3-O'ahu, 4-Moloka'i, 5-Lāna'i, 6-Maui, 7-Kaho'olawe, and 8-Hawai'i. A two-digit Sector number and a two-digit System number, respectively, follow the Island code. The Sector Areas and System Areas are also assigned geographic names.

[7] Hawai'i Authority, 1959. Water Resources in Hawai'i: Hawai'i Division of Water and Land Development. Bulletin B14.



Three ASEAs and thirteen ASYAs have been identified for the island of Kauaʻi and are listed in **Table 1-2**. See **Figure 1-2** for locations. A description of each ASYA may be found in the WRPP component of the Hawaiʻi Water Plan.

Table 1-2 Kauaʻi Ground Water Hydrologic Units

Aquifer Sector Area (ASEA)		Aquifer System Area (AYSA)	
Code	**Name**	**Code**	**Name**
201	**LĪHUʻE**	20101	Kōloa
		20102	Hanamāʻulu
		20103	Wailua
		20104	Anahola
		20105	Kīlauea
202	**HANALEI**	20201	Kalihiwai
		20202	Hanalei
		20203	Wainiha
		20204	Nāpali
203	**WAIMEA**	20301	Kekaha
		20302	Waimea
		20303	Makaweli
		20304	Hanapēpē

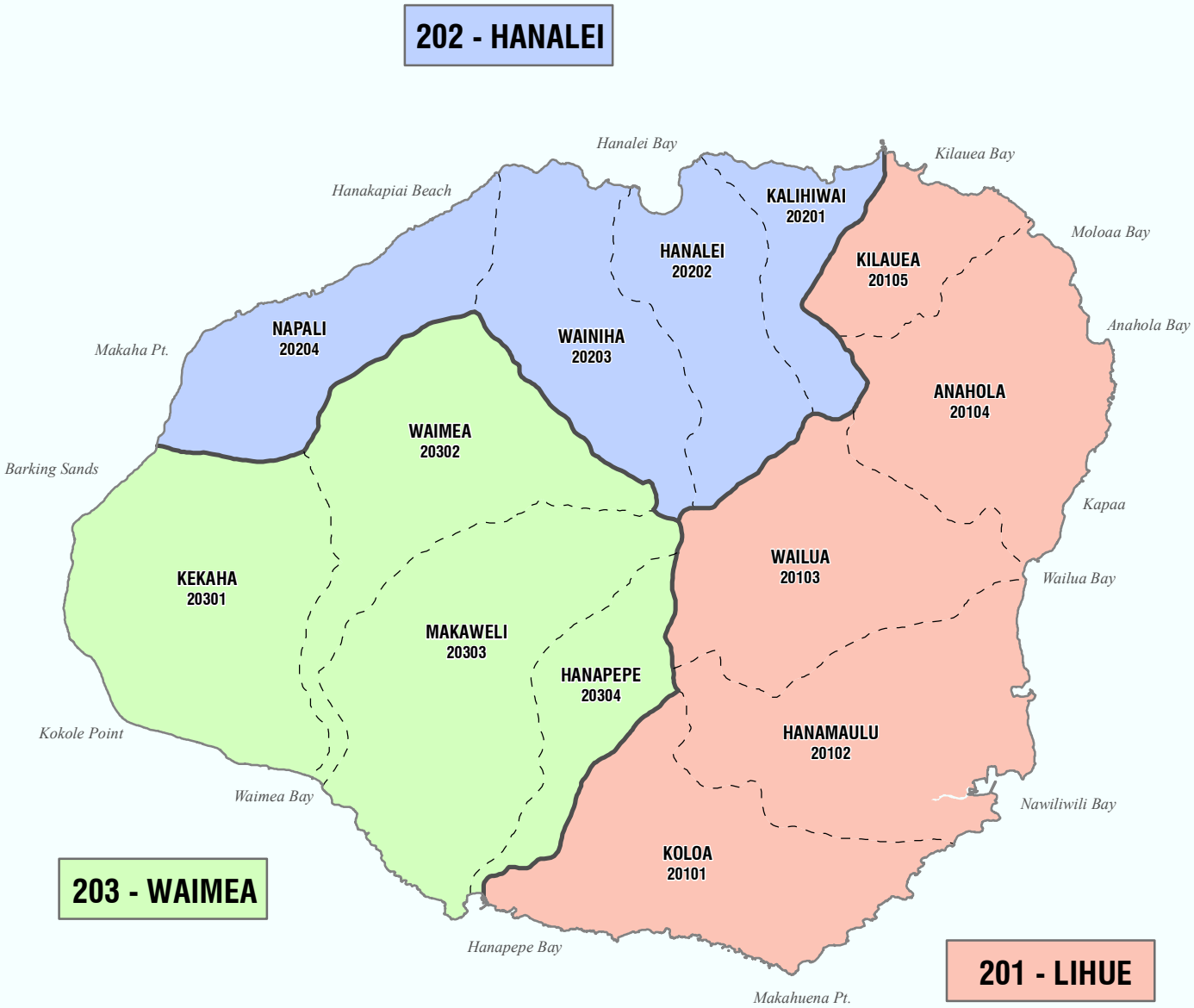
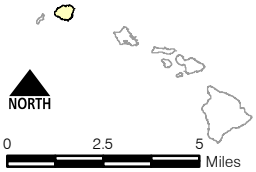


FIGURE 1-2

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Areas
- Aquifer System Areas

AQUIFER SECTORS AND SYSTEMS WITH AQUIFER CODES

1.1.3.1.1 Sustainable Yield

As provided for in the Code, Sustainable Yield (SY) is defined as "the maximum rate at which water may be withdrawn from a water source without impairing the utility or quality of the water source as determined by the commission."

As further defined and described in the WRPP:

> The amount of ground water that can be developed in any Hawai'i aquifer is limited by the amount of natural recharge. Additionally, not all natural recharge an aquifer receives can be developed. Some aquifer outflow or leakage must be maintained to prevent seawater intrusion or to maintain some perennial streamflow. Therefore, the SY of an aquifer normally represents a percentage of the natural recharge.
>
> The estimation of aquifer SYs is not an exact science. Insufficient hydrologic, geologic, and meteorological data require the estimation of critical input parameters in any SY model. Differences in estimates of these input parameters and in how they are incorporated in a model can produce a wide range in predicted SY values for a given aquifer.
>
> Given the range of predicted SYs for each aquifer, and the inherent uncertainty in each prediction, CWRM has applied the precautionary principle in selecting SYs for adoption in the WRPP. As the WRPP is a living document, SYs will be re-estimated continually based on the best information available as new information is acquired with time.

These SY estimates do not consider the feasibility of developing the ground water and should not be equated to available developable ground water. It is noted that in many regions, taking advantage of a high SY estimate would not necessarily be economically feasible. Additionally, SY represents the total water withdrawal rate, inclusive of both potable and non-potable ground water. It is stressed that the predicted SY estimates reflect the average daily pumpage over an entire AYSA (assuming wells are spaced optimally). Further, it was determined without consideration to the feasibility of developing the ground water; nor whether the ground water is potable or brackish. Therefore, caution should be exercised in comparing the Sustainable Yield to projected water demands. Estimates of the Sustainable Yield are treated as definitive constraints by CWRM in allocation decisions.

Table 1-3 lists the geographical area of coverage and estimated sustainable yield in million gallons per day (mgd), as published in the WRPP, for the three ASEA on the island of Kaua'i. **Figure 1-3** graphically shows sustainable yields for each of the island's thirteen AYSAs.

Table 1-3 Sustainable Yield by Aquifer Sector Areas

Sector Area Code	Sector Area Name	Area (Acres)	Sustainable Yield (mgd)
201	Līhuʻe	145,276	138
202	Hanalei	79,765	95
203	Waimea	129,980	95
	Total for Island	**355,021**	**328**

Reference: 2019 State Water Resource Protection Plan Update

1.1.3.2 Surface Water Hydrologic Units

As part of the 2008 WRPP update, the CWRM established surface water hydrologic units and an associated coding system in its publication, "Surface-Water Hydrologic Units: A Management Tool for Instream Flow Standards, PR-2005-01", dated June 2005. Key objectives of the CWRM Surface Water Hydrologic Units include the following:

"1) Define and delineate unique units that can accommodate the relational requirements in a database environment, while providing a system that can be easily understood by the general public.

2) Develop an information management system which utilizes the coding system to relate surface-water permits and other resource information to a given unit.

3) Define hydrologic units to be considered in the analysis and development of instream flow standards.

4) Provide a reference system that promotes better information management of other resource inventories.

5) Promote the sharing and collection of surface-water resource data between government agencies, the public, private entities, and community organizations.

6) Improve the overall coordination of monitoring, data collection, and field investigation efforts.

The CWRM Surface Water Hydrologic Units provides a practical approach to managing surface water information maintained by the CWRM, thereby allowing additional efforts to easily build upon or refer to this system. Through this effort, Commission staff will be able to better coordinate and improve surface water data collection and utilization between agencies and stakeholders, leading to better statewide resource management measures."

TOTAL = 328 MGD
GROUND WATER HYDROLOGIC UNITS
Sustainable Yield/Aquifer Code

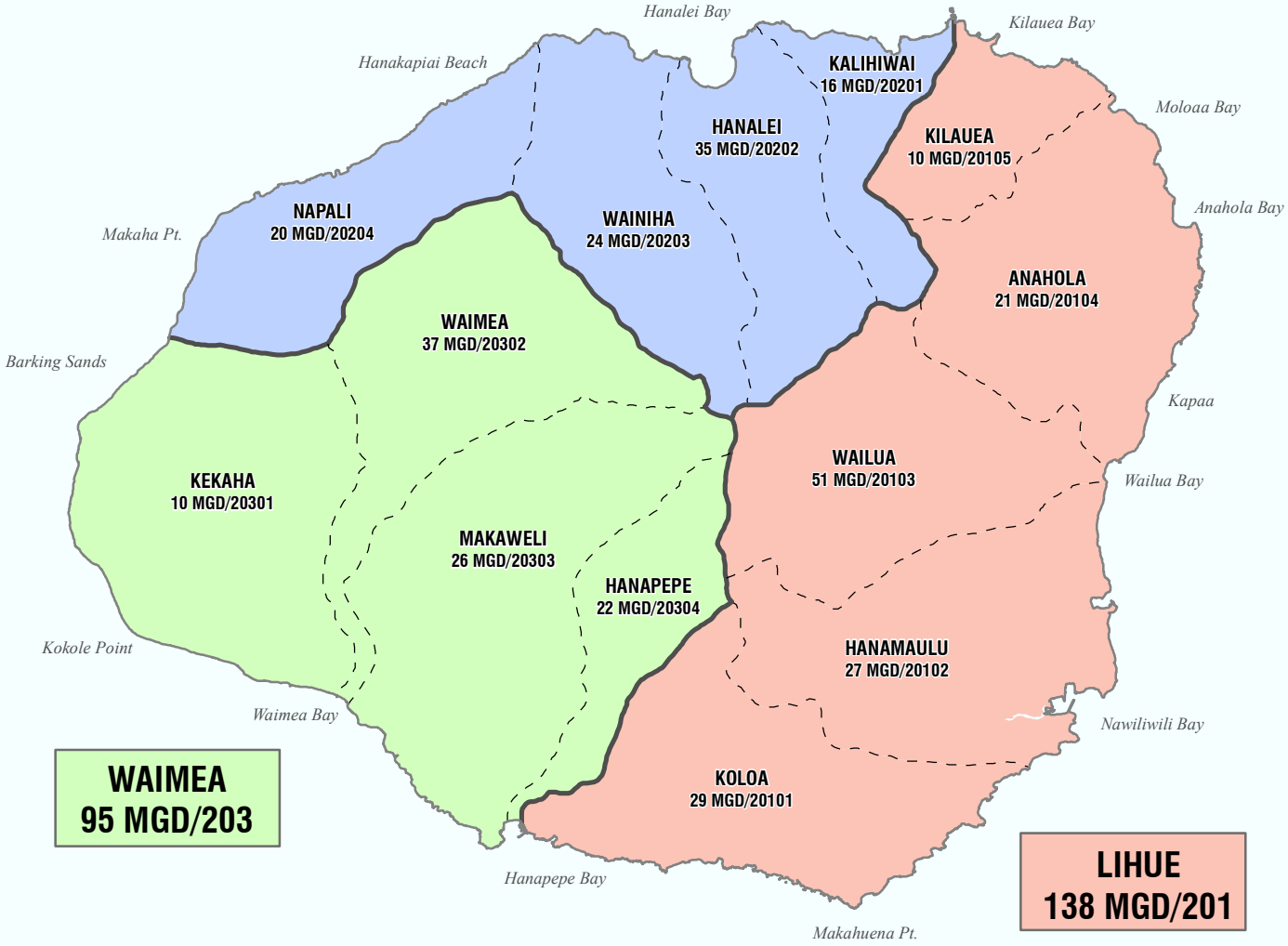
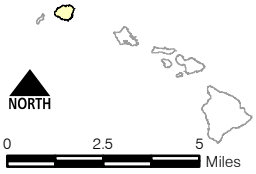


FIGURE 1-3

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Areas
- Aquifer System Areas

Sustainable Yields

A hydrologic unit, as defined by the Code, is "a surface drainage area or a ground water basin or a combination of the two." The majority of surface water hydrologic units have boundaries that closely match the drainage basins or watershed units. The CWRM defines a watershed unit in accordance with the State Definition and Delineation of Watersheds report as follows:

> "A watershed unit is comprised of a drainage basin (or basins) which include both stream and overland flow, whose runoff either enters the ocean along an identified segment of coastline (coastal segment) or enters an internal, landlocked drainage basin. The watershed units for an island are defined so that all segments of coastline are assigned to a unique watershed unit and so that all areas of an island are assigned to one, and only one, watershed unit."

Similar to the coding system for ground water hydrologic units, the surface water hydrologic unit code begins with the U.S. Geological Service identification number for each island (Island code): 1-Niʻihau, 2-Kauaʻi, 3-Oʻahu, 4-Molokaʻi, 5-Lānaʻi, 6-Maui, 7-Kahoʻolawe, and 8-Hawaiʻi. A three-digit surface water hydrologic unit number is added, following the Island code. The surface water hydrologic units are also assigned geographic names.

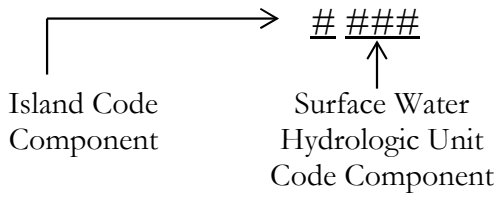


Figure 1-4 shows the boundaries of the 74 Kauaʻi surface water hydrologic units. Evaluation of the surface water hydrologic units indicate that their boundaries are generally very similar to those for the ground water hydrologic units.

It is noted that available historical data for each surface water hydrologic unit is extremely limited. The coding system is therefore provided as the first-step towards improving the organization and management of surface water information that CWRM collects and maintains.

Figure 1-5 presents an overlay of the surface water hydrologic units with the ground water hydrologic unit boundaries. Since the surface water hydrologic units and ground water hydrologic units are well-correlated, surface water data and analyses will be presented based on the ground water hydrologic units or aquifer systems.

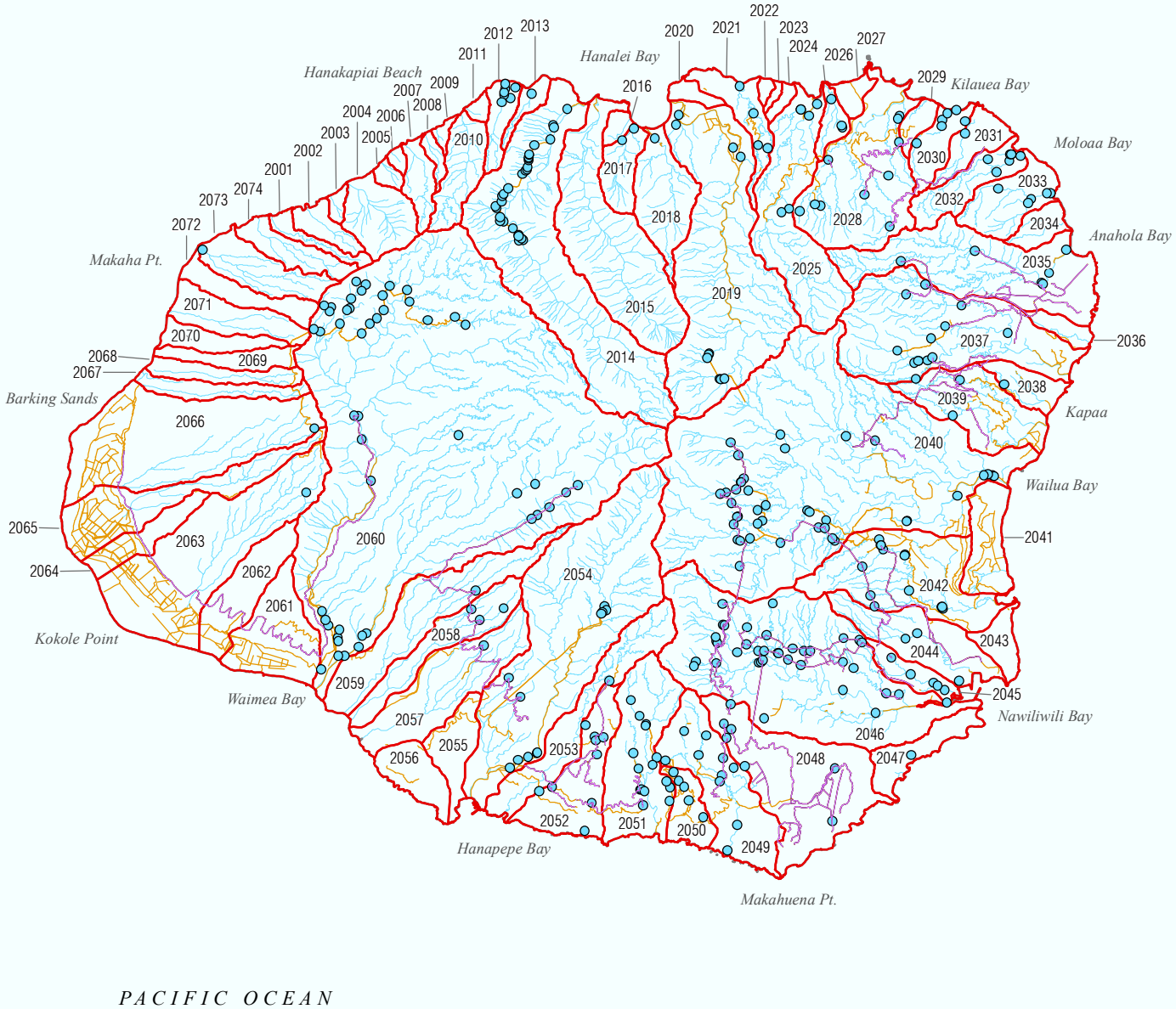
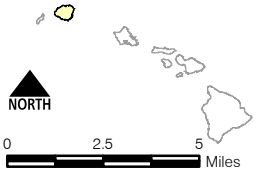


FIGURE 1-4

INDEX MAP - Island of Kaua'i



LEGEND:

- Diversions
- Ditches
- Irrigation Line
- Perennial Streams
- Hydrologic Units

SURFACE WATER HYDROLOGIC UNITS

Fukunaga & Associates, Inc.
Consulting Engineers

Kaua'i County - Department of Water

KAUA'I WATER USE AND DEVELOPMENT PLAN

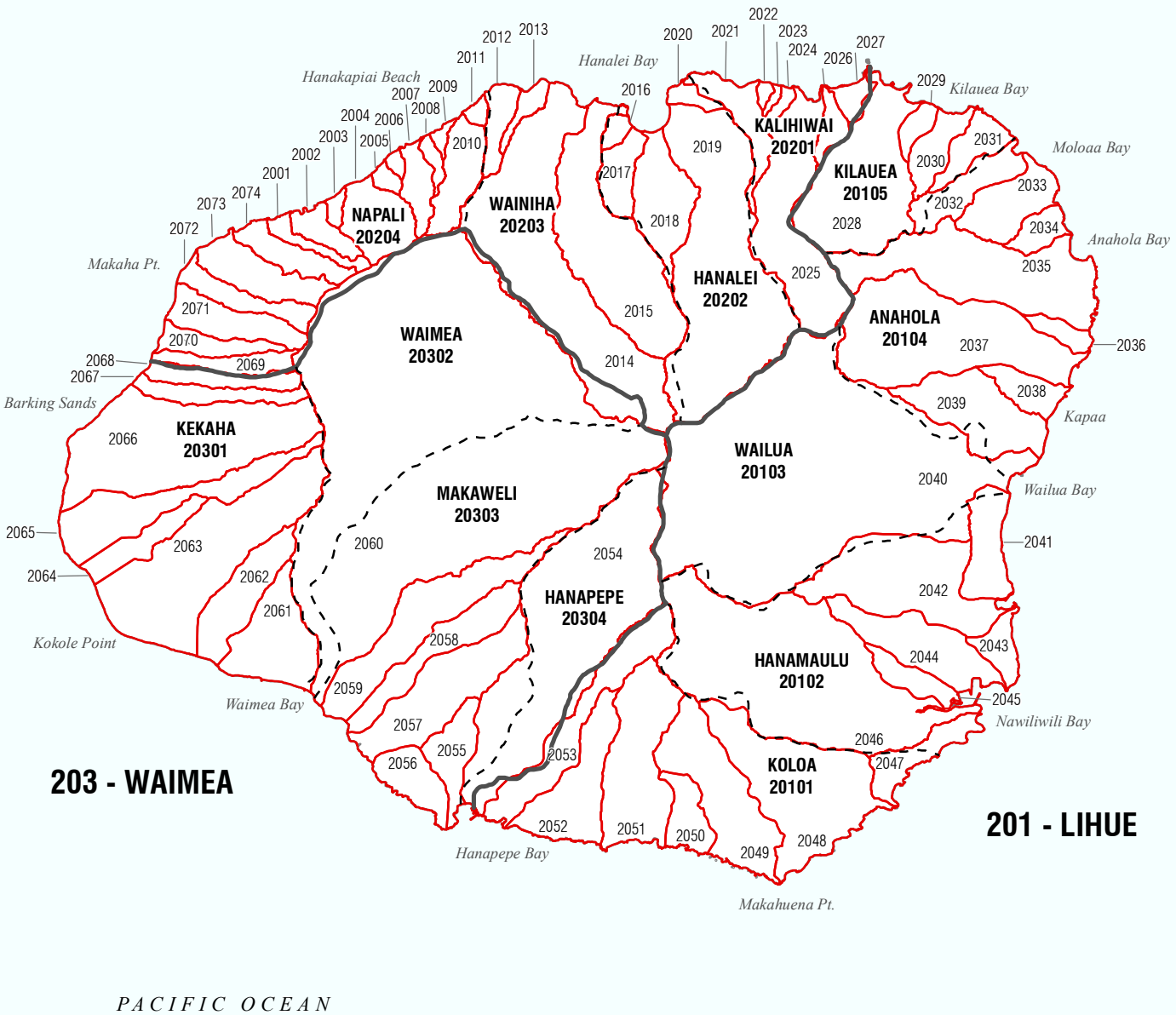
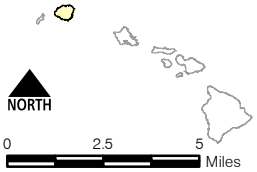


FIGURE 1-5

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Boundary
- Aquifer System Boundary
- Surface Water Hydrologic Unit Boundary

SURFACE WATER HYDROLOGIC UNITS WITH AQUIFER OVERLAY

1.1.4 The Hawai‘i Water Plan Update Status

The Code requires that the Hawai‘i Water Plan, inclusive of all its elements, be updated regularly to reflect the current needs of the State[8]. **Table 1-4** summarizes the update status for all elements of the Hawai‘i Water Plan.

Table 1-4 Status of Hawai‘i Water Plan Updates

PLAN ELEMENT	RESPONSIBLE AGENCY	STATUS
Water Resource Protection Plan	State of Hawai‘i, Department of Land and Natural Resources, CWRM	First update completed in 2008 Second update completed in 2019
Water Quality Plan	State of Hawai‘i, Department of Health	First update completed in 2019
State Water Projects Plan	State of Hawai‘i, Department of Land and Natural Resources, Engineering Division	First update completed in 2003 Second update completed in 2017 (limited to Department of Hawaiian Home Lands) Third update completed in 2021 (State-wide)
Agricultural WUDP[9]	State of Hawai‘i, Department of Agriculture	First update completed in 2003 and revised in 2004 Second update in progress
Kaua‘i WUDP	County of Kaua‘i	First update in progress
Maui WUDPs	County of Maui	Maui: first update in completed in 2023 Lāna‘i: first update completed in 2011 Moloka‘i: first update in progress
Hawai‘i WUDP	County of Hawai‘i	First update completed in 2011. Partial update in progress
O‘ahu WUDP	City and County of Honolulu	First update in progress (4 Watershed Management Plans completed, 2 in progress)

[8] See https://dlnr.hawaii.gov/cwrm/planning/hiwaterplan/ for links to the current Hawai‘i Water Plan reports.

[9] Act 101, SLH 1998 requires that the AWUDP provide a master inventory of irrigation systems, identify the extent of repair and rehabilitation that would be required over a 5-year period, and provide a long-range management plan. The Framework further expands the scope to provide for the development of agricultural water demand projections, which is essential for WUDP updates. The AWUDP, dated December 2003, and revised in December 2004, was prepared to meet the mandate of Act 101, and to review and discuss the potential for transitioning from monocrop corporate farming into diversified crop farming, along with the potential opportunities available in the new diversified farming. However, due to funding and time constraints, a comprehensive plan has not yet been completed.

1.2 PHYSICAL SETTING

1.2.1 Location and Size

Kauaʻi is the northwestern most island and geologically the oldest of the eight major islands in the Hawaiian archipelago. The total area of the island is approximately 552 square miles[10] - comprising less than 10 percent of the total land area of the State of Hawaiʻi.

It is known as the "Garden Isle" because of its lush greenery. The central portion of the island is mountainous and largely uninhabited. The islands' populated areas and roadways are generally along the coast and extend into the valleys. The developed areas of the island are generally comprised of small towns and agricultural lands.

The island is divided into five judicial districts as shown on **Figure 1-6**. With respect to water resources, the island is divided into three aquifer sector areas and thirteen ground water hydrologic units, as previously shown on **Figure 1-2**. The 2010 U.S. Census reports the island's resident population at 66,921 residents.

1.2.2 Climate

The climate of Kauaʻi is typically mild and equitable throughout the year due to the island's location on the northern fringe of the tropics and within the belt of cooling northeasterly trade winds. Humidity is generally within the 60 to 80 percent range.

The average temperature in the lowlands is 75° F, decreasing 4° F with each 1,000 feet increase in elevation. February is typically the coldest month, averaging about 73°F. The warmest is typically August, with temperatures averaging about 80°F. Maximum temperatures rarely exceed 90°F, and minimum temperatures hover around 50°F.

Annual average rainfall on Kauaʻi ranges from about 20 inches on the leeward coast to over 400 inches near Mount Waiʻaleʻale. The mountains intercept prevailing trade winds, the moisture carried by these winds is lifted, cooled and thereby condensed into rain. Rainfall is heaviest on Mount Waiʻaleʻale and decreased in the lower elevations and on the leeward side of the island.

Trade winds prevail throughout the year, but are least continuous from October through April, Hawaiʻi's winter season. During these months, tropical storms occasionally bring heavy rains.

[10] 2017 State of Hawaiʻi Data Book.

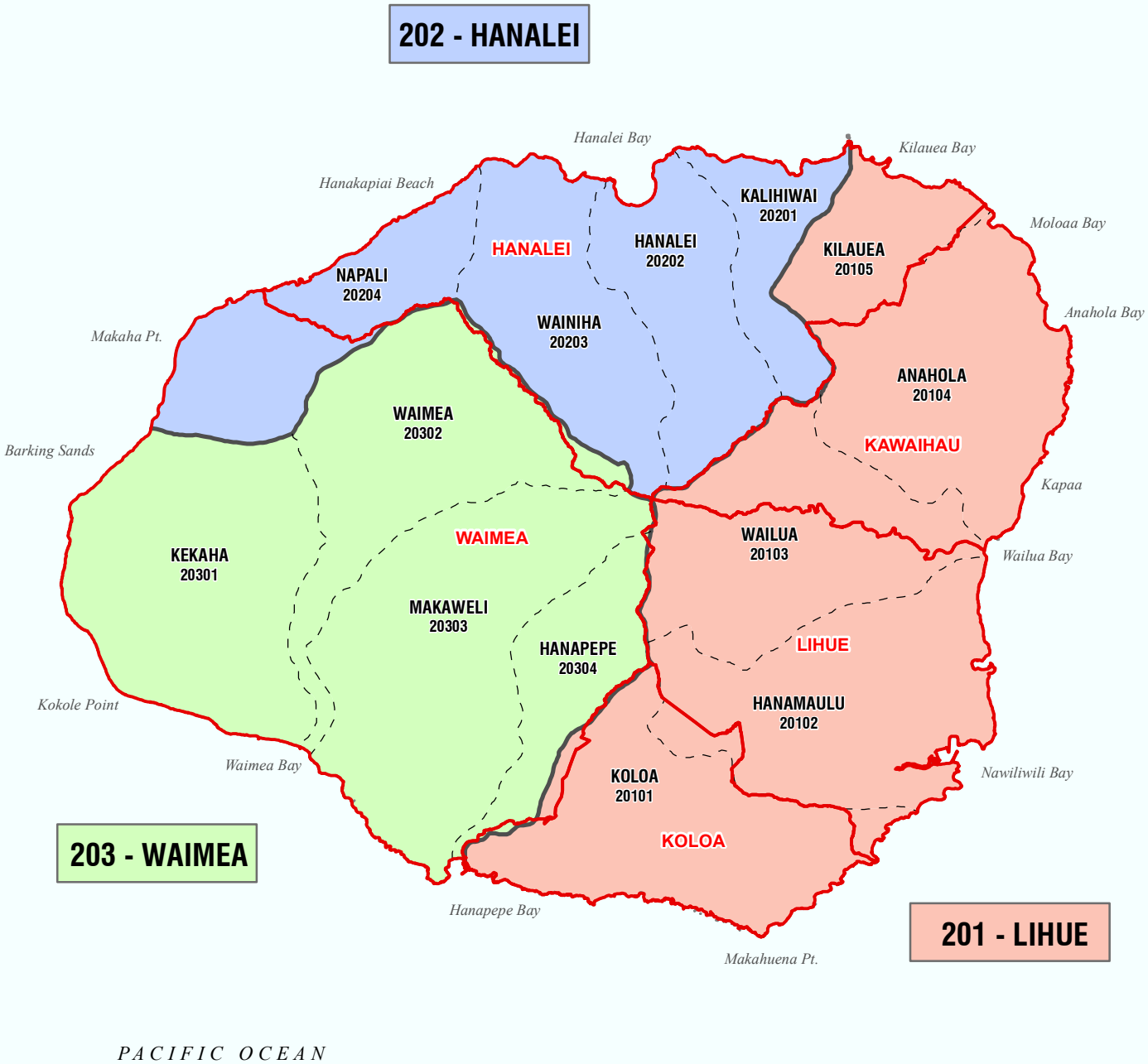
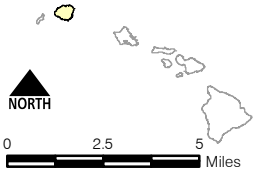


FIGURE 1-6

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Areas
- Aquifer System Areas
- Judicial Districts

JUDICIAL DISTRICTS VS. AQUIFER AREAS

1.2.3 Geology

The Hawaiian Islands are part of a chain of islands that extend approximately 1,500 miles in a southeasterly direction from the Aleutian Islands and rising about 20,000 feet from the sea floor below. The islands are located approximately in the center of the Pacific (tectonic) plate. The chain of islands was developed as the Pacific Plate slowly moved in a northwest direction over a hotspot in the earth's mantle. The oldest islands are therefore located at the northwestern end of the archipelago and the younger, larger main islands, on the southeastern end of the archipelago.

Due to its longer exposure to erosion, the majority of the islands along the northwest end of the Hawaiian archipelago have disappeared or only small portions of land (atolls) rise above the sea. These islands are called the Leeward Islands, or the Northwestern Hawaiian Islands, and include Midway Island, Kure Atoll and French Frigate Shoals. Eight of the youngest islands are of sufficient elevation to intercept trade wind moisture and large enough to permit settlement. These islands are located along the southwest end of the archipelago.

The island of Kauaʻi is over 5 million years old and is the fourth largest island of the eight major islands in the Hawaiian Archipelago. This island consists essentially of a single dome. Lava flows spread outward in all directions from the principal volcanic center near Mount Waiʻaleʻale. The dome is slightly elongated in the northeast to southwest direction, and a slight bulge was produced on the southeastern slope of the dome by another eruptive center of Hāʻupu. The smooth profile of the dome was also marred by the depression of the summit caldera; the smaller Hāʻupu caldera (the Makaweli depression) and a circular basin, the Līhuʻe depression, on the east side. Within the main caldera, eruptions built a small constructional dome, similar to the major dome but with gentler slopes.

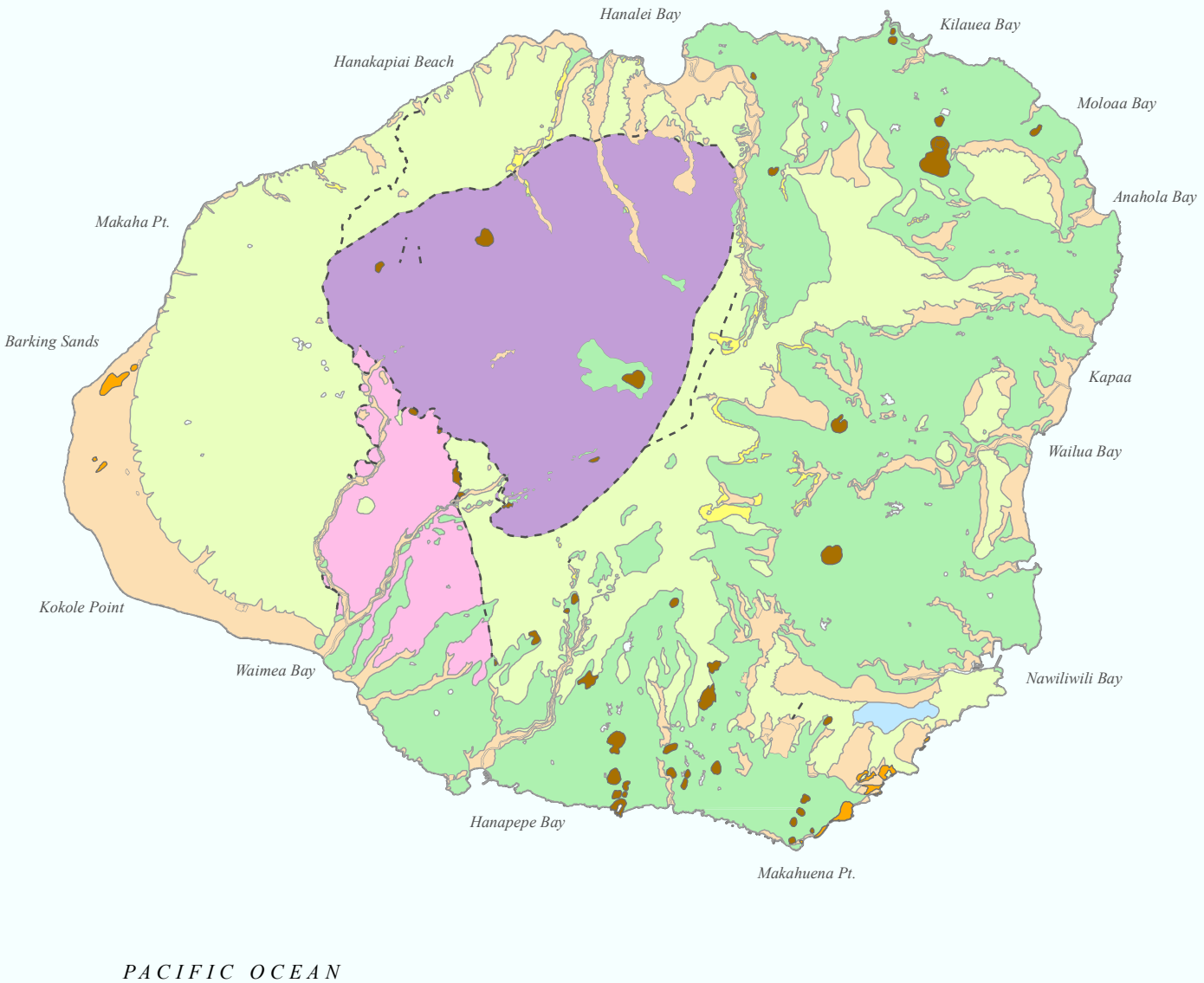
Figure 1-7 shows a geologic map of Kauaʻi Island[11]. Accompanying the geologic map is **Table 1-5** showing the stratigraphic sequence of the volcanic rock units on Kauaʻi Island[12].

1.2.4 Hydrology

Hawaiʻi's water resources vary greatly between islands as well as within each island. There are perennial streams and ephemeral streams, rainforests and desert areas. There are ground water tunnels high in the mountains and low near sea level.

Key to the water supply for small oceanic islands like the Hawaiian islands is the hydrologic cycle or water cycle. As illustrated in **Figure 1-8**, this is the cyclical movement of water between air, land and sea. The water cycle includes evaporation of water from the ocean which then returns to the ground as precipitation (rain). Some of the precipitation may re-enter the atmosphere through evapotranspiration; some may become surface runoff or runoff into streams and empty into the ocean; and some may infiltrate the ground to become soil moisture or collect as ground water and eventually escape to the sea.

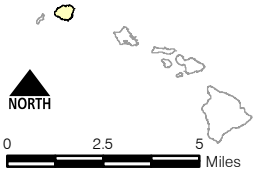
[11] G.A. MacDonald, D.A. Davis and D.C. Cox, 1960. Bulletin 13 - Geology and Ground-Water Resources of the Island of Kauaʻi, Hawaiʻi, p. 18.
[12] Ibid. p. 20.



Reference: McDonald, G.A., Davis, D.A., and Cox, D.C., 1960. Geology and Ground-Water Resources of the Island of Kauai, Hawaii: Hawaii Division of Hydrography Bulletin 13, 212 p.

FIGURE 1-7

INDEX MAP - Island of Kaua'i



LEGEND:

- Alluvium beach and dune sand, lagoonal clays and maris
- Lithified calcareous dune sand
- Breccia and conglomerate of Palikea formation
- Lavas of Koloa volcanic series
- Lavas of Makaweli formation
- Lavas of Olokele formation
- Lavas of Haupu formation
- Lavas of Napali formation
- Vents of Koloa and Waimea Canyon volcanic series
- Buried Fault Scarp

GEOLOGIC MAP

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Consulting Engineers

Kaua'i County - Department of Water

KAUA'I WATER USE AND DEVELOPMENT PLAN

Table 1-5 Stratigraphic Units on the Island of Kaua'i

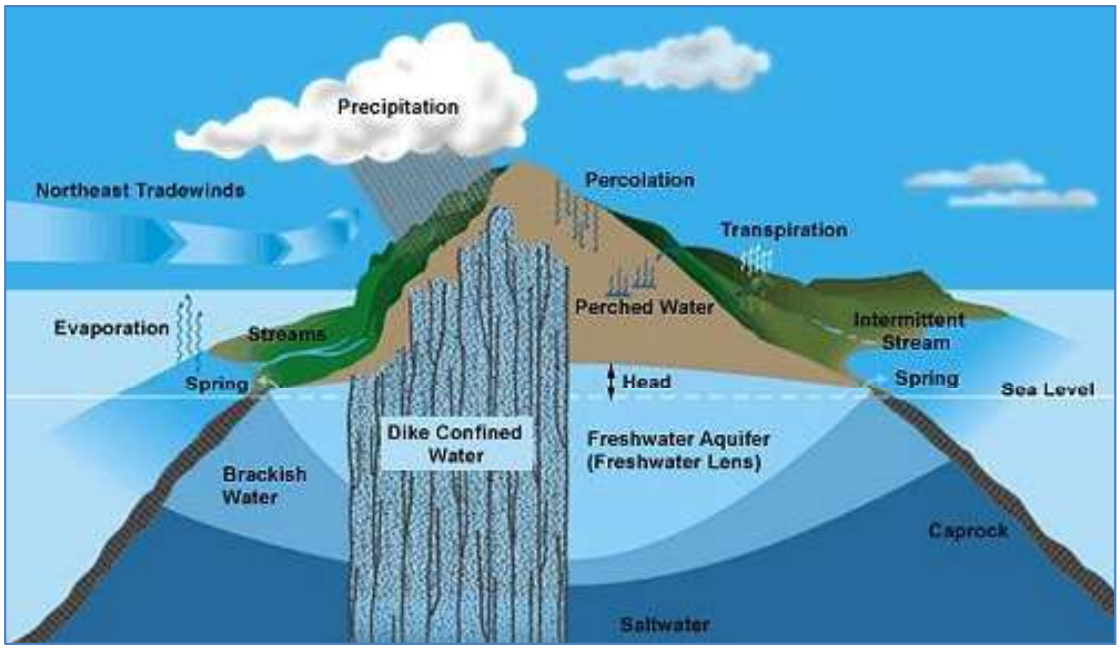
Major Geologic Unit		Rock Assemblage		Thickness (feet)	Symbol on Figure 1-7	General Character	Water-Bearing Properties
Recent	Sedimentary Deposits	Beach sand		5±	Rb	Loose sand, composed chiefly of fragments of calcareous algae, coral, mollusk shells, and skeletons of Foraminifera.	Very permeable; carries brackish or saline water at sea level.
		Unconsolidated calcareous dunes		10-100	Rd	Loose cream-colored crossbedded sand blow inland from the beaches and composed of the same materials.	Very permeable, but almost entirely above water table.
		Younger alluvium		5-200	Ra	Unconsolidated earthy deposits consisting of loose, poorly to moderately well sorted stream-laid gravel, sand and silt.	Poorly permeable, but contains small amounts of fresh or brackish water.
Local erosional uniformity							
Sedimentary deposits		Noncalcareous sediments	Lagoon deposits of Mana plain	.....	Pl	Poorly consolidated earthy and marly sediments accumulated in a lagoon between the volcanic rocks and the beach ridge.	Poorly permeable, but yield brackish water to wells.
			Older alluvium	100±	Pa	Poorly to well consolidated earthy deposits consisting of stream-laid gravel, sand, and silt.	Poorly permeable, but locally carries small amounts of fresh or brackish water.
		Consolidated calcareous dune sand		10-100	Pd	Moderately to well cemented crossbedded calcareous sand blown inland from beaches during former lower stands of the sea.	Permeable; contains brackish water at sea level.
Local erosional unconformity							
Pleistocene	Volcanic rocks and associated sedimentary rocks	Koloa volcanic series	Tuff cone at Kilauea Bay	350±	Pkt	Moderately to well indurated palagonite tuff containing fragments of basaltic rocks and calcareous reed rock.	Poorly permeable; fractures yield small amounts our fresh water.
			Ash and tuffaceous soil beds	1-10	Pka	Fresh to highly decomposed ash and cinder intercalated with lava flows of the Koloa volcanic series.	Locally highly permeable and yield water freely, but mostly poorly permeable and locally perch small bodies of fresh water.
			Cinder cones	25-250	Pkv	Heaps of fresh to highly decomposed cinders at vents of lava flows of the Koloa volcanic series.	Moderately to highly permeable, but too small to be important aquifers.
			Palikea formation	2-700	Pkp	Masses of poorly sorted breccia and beds of poorly to moderately well sorted conglomerate at the base of, or intercalated with, rocks of the Koloa volcanic series.	Poorly permeable; locally perches small bodies of fresh water.
			Lava flows	1,000±	Pkl	Aa and pahoehoe lava flows of nepheline basalt, melilitenepheline basalt, picrate-basalt, olivine basalt, and basanite.	Poorly to moderately permeable; carry fresh or brackish water at sea level but generally yield it slowly to well; locally contain small bodies of perched fresh water.

Table 1-5 Stratigraphic Units on the Island of Kauaʻi (Continued)

Major Geologic Unit		Rock Assemblage		Thickness (feet)	Symbol on Figure 1-7	General Character	Water-Bearing Properties
MAJOR EROSIONAL UNCONFORMITY							
Pliocene	Volcanic rocks and associated sedimentary rocks	Waimea Canyon volcanic series	Makaweli formation, including Mokuone member	1,500+ (Makaweli fm. Proper); 0-1,000 (Mokuone member)	Twm (Makaweli fm. Proper); Twmm, Mokuone member	Aa and pahoehoe lava flows of olivine basalt, basalt, and picrate-basalt accumulated in a graben on the southwest side of the major Kauaʻi shield volcano. Mokuone member, masses of poorly sorted breccia along the contact of lavas of the Makaweli formation with the older rocks, and beds of moderately well sorted conglomerate intercalated with lavas of the Makaweli formation	Moderately to poorly permeable; carry fresh or brackish water at sea level but generally yield its less readily to wells than the lavas of the Nāpali formation. Mokuone member, poorly permeable; carries no water.
			Hāʻupu formation	1,850+	Twh	Massive flows of olivine basalt and picrate-basalt accumulated in a small caldera on the southeast slow of the major Kauaʻi shield volcano.	Moderately to poorly permeable; may carry fresh water at sea level but would not yield readily to wells.
			Olokele formation	2,600+	Two	Thick, massive flows of olivine basalt, ballast, and the picrate-basalt accumulated in a broad caldera at the summit of the Kauaʻi shield volcano.	Moderately to poorly permeable; lavas probably carry fresh water at sea level, but would not yield it readily to wells. Locally ash beds perch small bodies of fresh water at high levels.
			Nāpali formation	2,700+	Twn	Thin flows of olivine basalt, basalt, and picrate-basalt accumulated on the flanks of the Kauaʻi shield volcano.	Highly permeable; carries fresh water at sea level over much of island, and yields it freely to wells; may contain water confined at high levels between dikes in some areas.

Reference: Macdonald, G.A., Davis, D.A., and Cox, D.C., 1960, Geology and ground-water resources of the island of Kauaʻi, Hawaiʻi: Hawaiʻi Division of Hydrography Bulletin 13, 212 p.

Figure 1-8 The Water Cycle



Reference: https://www.boardofwatersupply.com/water-resources/the-water-cycle

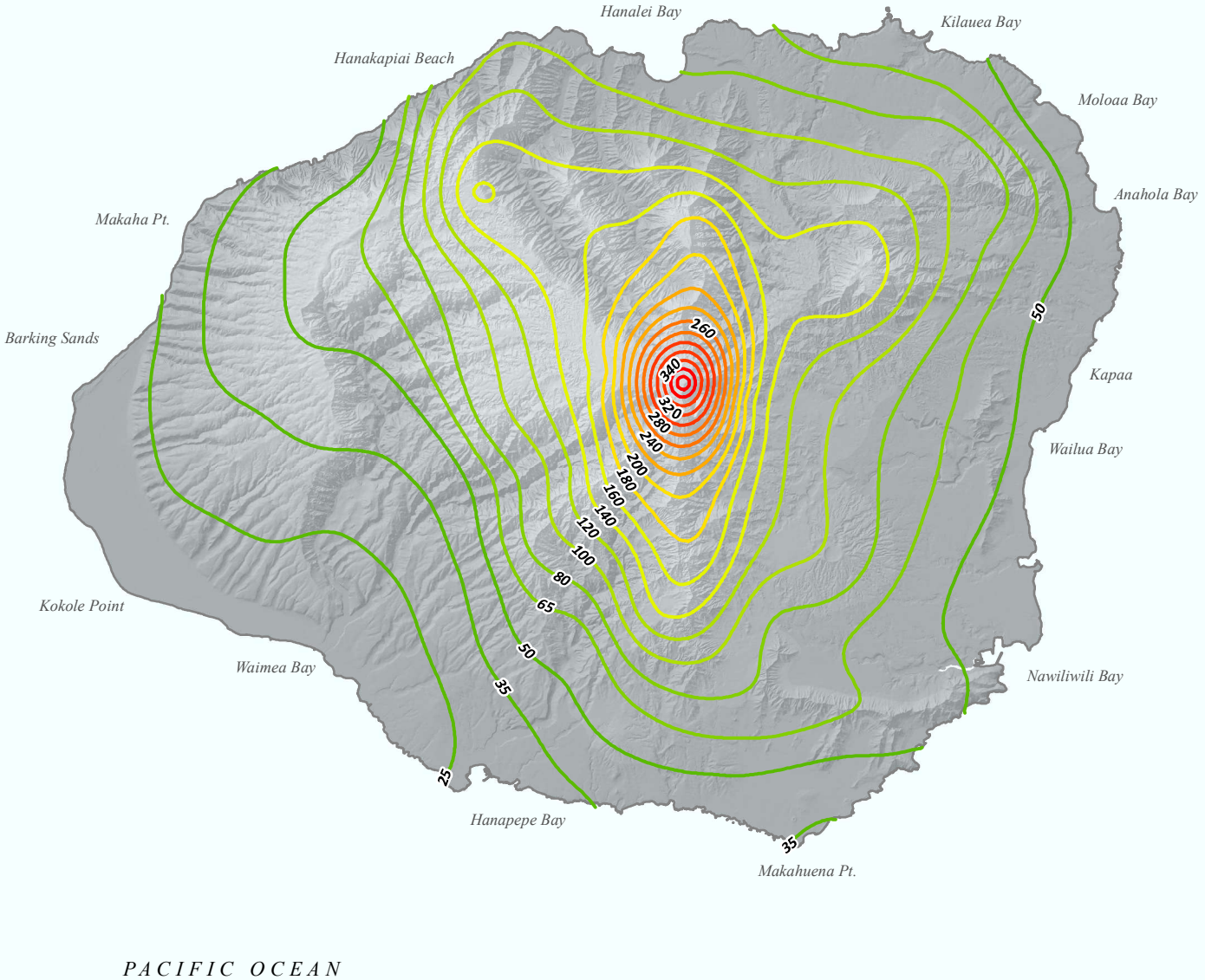
The island's water cycle may be altered as a result of various types of human activities. Human activities such as urban development have the potential to modify vegetative cover over the soil, impacting evapotranspiration and runoff patterns. Other activities such as the diversion of surface water for irrigation, ground water pumping, and disposal of wastewater effluent in the ocean also affect the island's water cycle.

Rainfall is the source of all fresh water in Kaua'i. The prevailing northeast trade winds over the island creates an orographic rainfall pattern[13]. This results in the heaviest rainfall occurring on the eastern or windward side of the island. The western (or leeward) side of the island typically receives little of the orographic trade wind rains. Rainfall on the leeward side of the island generally results from convective-type showers.

Average annual rainfall totals on the island can vary significantly within a relatively short distance – over 400 inches at the peak of the island, on Mount Wai'ale'ale, to only about 20 inches less than 20 miles to the southwest of the peak. (Refer to **Figure 1-9** for island rainfall isohyet map.) The island averages about 80-inches of rainfall annually. Distributed over the land area of the island, this equates to about 2.1 billion gallons of water per day. Annual rainfall totals can fluctuate from year to year.

The island's underlying volcanic rock and their residual soils have a very great capacity to absorb and percolate water. Much of the rainfall therefore infiltrates into the ground, creating the large groundwater bodies on which Kaua'i depends for its potable water supply. Runoff that is not absorbed into the soil flows overland into surface water streams and rivers to the sea.

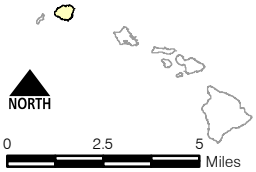
[13] Orographic precipitation is produced when moist air is lifted as it moves over a mountain range. As the air rises and cools, clouds form over the mountainous areas and serve as the source of the precipitation, most of which falls upwind of the mountain ridge.



Reference: 2011 Rainfall Atlas of Hawaii, Department of Geography, University of Hawaii at Manoa

FIGURE 1-9

INDEX MAP - Island of Kaua'i



LEGEND:

—50— Isohyets in Inches

MEAN ANNUAL RAINFALL

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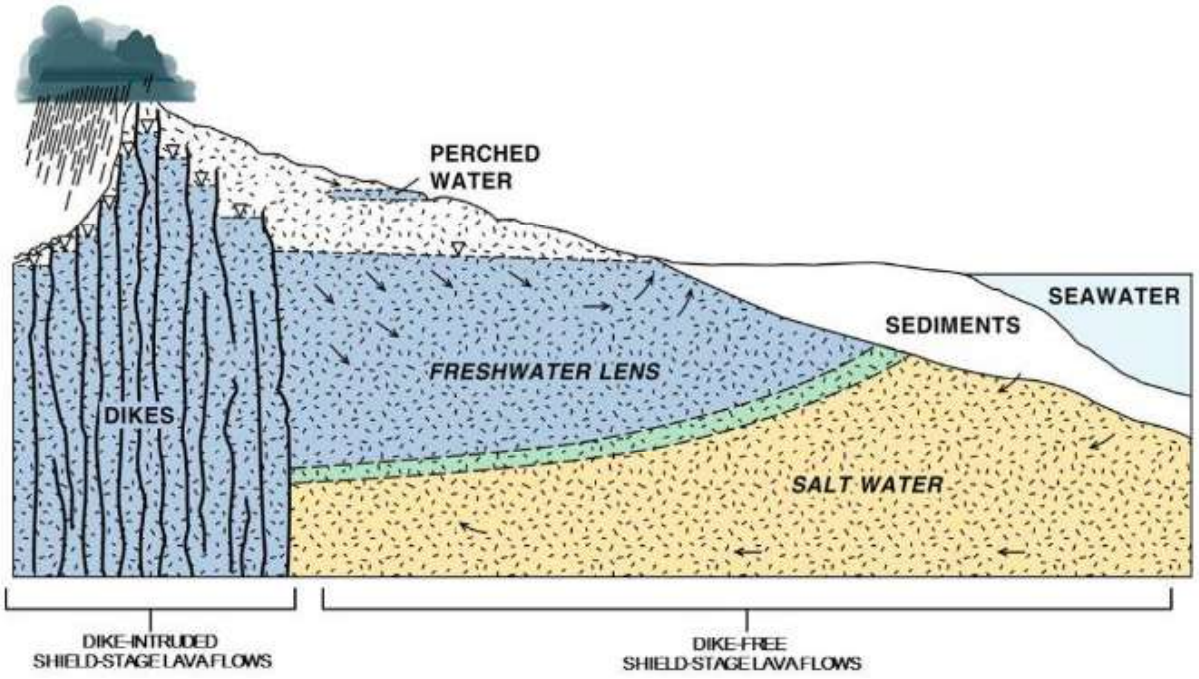
Kaua'i County - Department of Water

KAUA'I WATER USE AND DEVELOPMENT PLAN

Ground water resources are less susceptible to droughts and seasonal changes than surface water, and therefore is a more dependable water source. There are several types of general ground water bodies on Kaua'i. The most extensive is the "basal fresh water lens" that floats on seawater under much of the island[14], caprock sources are also found. Less widespread, but of singular importance in some areas, is ground water restrained between impermeable vertical rock structures called "dikes". The third type of minor significance is groundwater held up, or "perched", on horizontal impermeable beds such as volcanic ash (see **Figure 1-10**).

Of lesser importance to Kaua'i's drinking water resources, but very significant to agricultural pursuits, is stream flow from perennial and intermittent streams. Perennial streams flowing to the sea are found in almost all areas of Kaua'i. In comparison with the other main Hawaiian islands, the major streams on island are large and have relatively uniform flow. Stream flow is fed from direct runoff from rainfall in the mountains and have a perennial component fed by instream discharge water from high-level springs and seeps.

Figure 1-10 Ground Water Resources



Reference: https://hi.water.usgs.gov/studies/GWRP/hydrogeology.html

Smaller streams are very flashy in nature due to their steep profiles and small drainage areas. These streams are also affected by intense tropical storms. Stream flows, especially those on the windward side of the island, can rapidly reach peak rates within a matter of hours and return to normal just as quickly.

[14] This phenomenon is known as the Ghyben-Herzberg principle. Due to the difference in specific gravity of sea water and fresh water, theoretically for every foot of fresh water above sea level 40 feet of fresh water extend below sea level to maintain the equilibrium. However, in actuality, there is a zone of mixture (brackish water) or transition zone from sea water to fresh water.

Surface waters were extensively developed in the past by ancient Hawaiians to irrigate and grow taro, and later were further developed for use in the cultivation of sugarcane. Primarily to support the growth of sugarcane cultivation on drier lands, surface water irrigation systems were constructed to divert water from perennial streams and transport it over long distances. This involved the development of a complex system of ditches and included a number of small storage reservoirs to provide short-term storage of irrigation water.

With the conversion to drip irrigation of the sugarcane fields in the 1970s and the closure of the sugar plantations at the end of the twentieth century, the need for this level of extensive irrigation has changed. The need for and/or adaptation of the existing irrigation system infrastructure for the conversion of many agricultural lands to support diversified agriculture continues to be discussed and evaluated.

1.2.4.1 Climate Change

Climate change refers to long-term shifts in temperatures and weather patterns. These shifts can be natural or as a result of human activity. Climate change has been observed and is predicted to continue. Air and sea surface temperatures are increasing. An overall decline in rainfall has been observed in Hawai'i, and it is projected that Hawai'i will see more drought and heavy rains causing more flash flooding. Climate change models predict declining annual rainfall and wet season rainfall for all of Kaua'i. The climate change models predict dry season rainfall to decrease for the leeward side of Kaua'i and to increase for the windward side[15].

Per the WRPP, climate change is expected to result in many water resource changes, including intensified flooding and drought. Studies have found that decreases in rainfall have caused a decrease in stream base flows. This long-term base flow decline indicates a decrease in groundwater discharge to streams, which implies a decline in groundwater recharge and storage. Elevation of basal aquifers is expected to change due to sea level rise. Increase in water demand may result from increases in air temperature, increases in evapotranspiration, and longer and more frequent droughts.

The future impact of climate change on water resources is still being studied. This uncertainty requires a precautionary and adaptive approach to water management to ensure the long-term protection of our water resources. The impact of climate change on water resource availability, including sustainable yield, shall be considered in future updates of the WRPP.

[15] https://www.hawaii.edu/climate-data-portal/data-portal/ (link current as of June 2024)

1.3 ECONOMY AND POPULATION

1.3.1 Economy

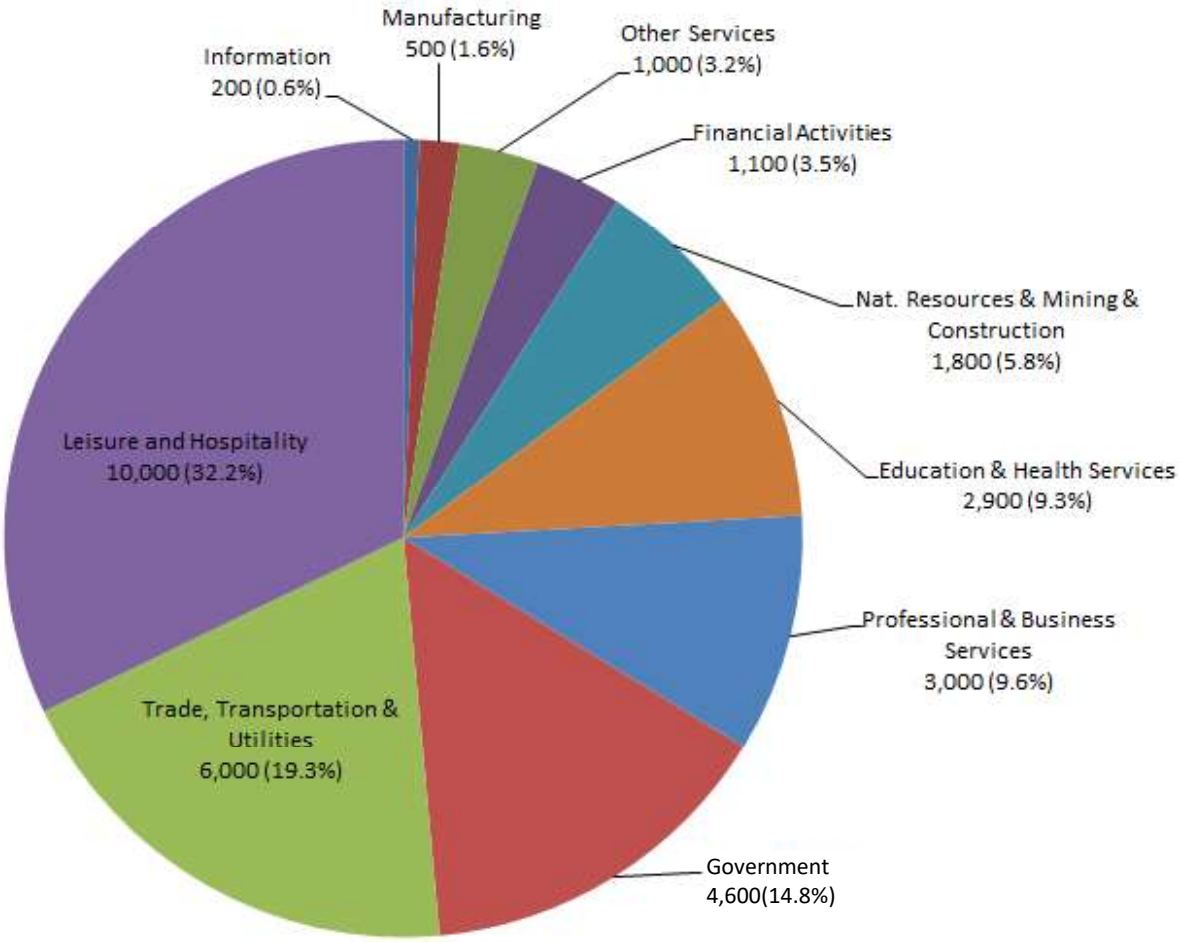
Based on information provided in second quarter 2018 economic outlook summary[16], economic expansion on Kauaʻi is anticipated to continue. With the resulting tight job market, further moderate increases in income are also projected through the end of the decade.

The tourism industry is the largest industry on the island of Kauaʻi. New resort development and renovations to existing visitor accommodations are currently underway and/or will be under construction over the coming years. Tourism growth and increasing population on the island puts additional pressures on existing public facilities, such as parks and roads, and additional demands on other utilities, such as water, wastewater, solid waste disposal, and energy resources. Increases in island population also will drive the need for additional affordable housing units.

As summarized on **Figure 1-11**, tourism currently accounts for about 30% of the island's non-farm jobs market. Trade, transportation and utilities and Government (State, County and Federal) comprise the next two largest non-farm employment sectors on the island at about 20 and 15 percent respectively.

[16] The Economic Research Organization at the University of Hawaiʻi, June 6, 2018. Kauaʻi Economic Outlook Summary, prepared for the County of Kauaʻi.

Figure 1-11 Non-Farm Jobs Summary (2017)



Reference: State of Hawai'i Department of Labor and Industrial Relations, Kaua'i County, 2017 Jobs Count by Industry

Based on data from the Bureau of Economic Analysis, US Department of Commerce, since the closure of the Gay and Robinson sugar mill in 2010, full and part-time farm related employment has averaged about 1025 jobs or about 2.4 percent of the island's jobs total. Refer to **Table 1-6** for summary of farm related employment data.

Table 1-6 Farm Employment Data

Major Sugar Still in Production				Post Sugar Mill Closure	
Year	Jobs	Year	Jobs	Year	Jobs
1969	2,404	1990	1,655	2010	987
1970	2,373	1991	1,546	2011	1,021
1971	2,286	1992	1,213	2012	987
1972	2,194	1993	1,669	2013	998
1973	2,202	1994	1,593	2014	1,101
1974	2,248	1995	1,457	2015	1,065
1975	2,305	1996	1,493	2016	1,018
1976	2,448	1997	1,363	**Average**	**1,025**
1977	2,375	1998	1,578		
1978	2,560	1999	1,560		
1979	2,307	2000	1,614		
1980	2,406	2001	1,325		
1981	2,079	2002	1,327		
1982	1,889	2003	1,303		
1983	2,000	2004	1,254		
1984	1,799	2005	1,247		
1985	1,844	2006	1,187		
1986	1,669	2007	1,085		
1987	1,753	2008	1,015		
1988	1,640	2009	1,039		
1989	1,520	**Average**	**1,752**		

Reference: Bureau of Economic Analysis, U.S. Department of Commerce website: https://www.bea.gov.data, Total Full-time and Part-Time Employment by Industry.

Based on economic value, Kauaʻi's largest agricultural crop currently is seed corn. Other crops of importance include coffee, guava and taro. Refer to **Figure 1-12** for island jobs distribution inclusive of farm sector jobs.

The island of Kauaʻi is divided into six planning districts. (Refer to **Figure 1-13** for planning districts map.) The Līhuʻe District is projected to continue as the main jobs center on Kauaʻi. Although, island-wide, tourism comprises the larger employment component, Līhuʻe District has fewer of these jobs than the rest of the county (20 percent vs. 22 percent in 2010). Līhuʻe District has the larger share of non-visitor jobs such as retail and trade, warehousing and utilities, finance, insurance and real estate, public administration wholesale trade, and information industry. Refer to **Table 1-7** for summary of County Jobs by Planning District.

Figure 1-12 Jobs Summary (Inclusive of Farm Sector Jobs)

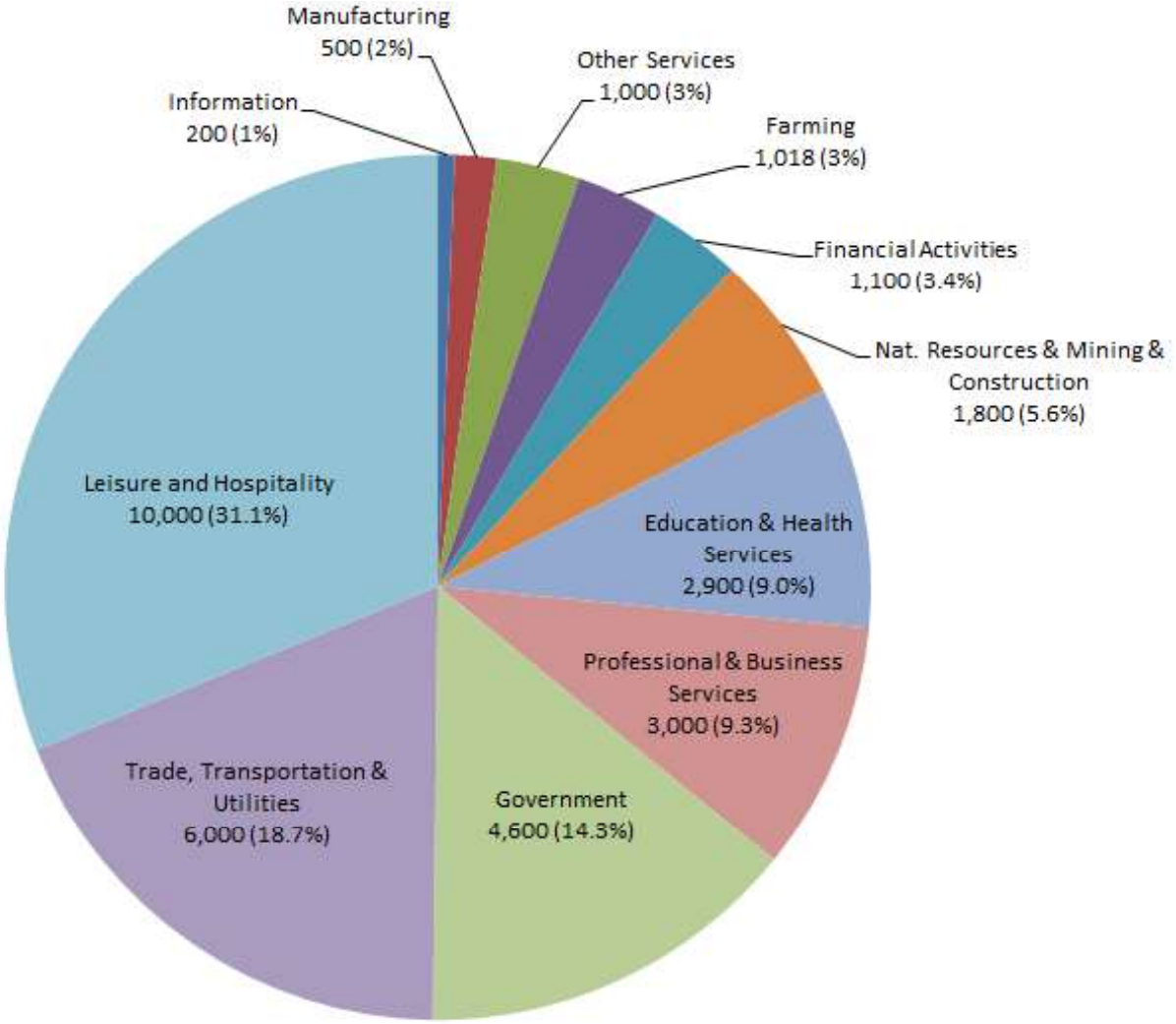


Table 1-7 Kaua'i County Jobs by Planning District (1990-2030)

District	Year				
	1990	2000	2010	2020	2030
Līhu'e	12,473	12,554	14,519	15,820	16,403
South Kaua'i	5,299	2,027	5,317	5,892	6,003
Hanapēpē – 'Ele'ele	999	695	779	821	838
Waimea - Kekaha	1,888	1,791	1,989	3,064	2,094
North Shore	4,143	3,513	3,802	3,839	3,838
East Kaua'i	5,548	4,570	5,199	5,565	5,724
Total	**20,350**	**28,150**	**31,900**	**34,000**	**34,900**

Reference: Kaua'i Kākou – Kaua'i County General Plan (2018), Appendix C, Table 3.

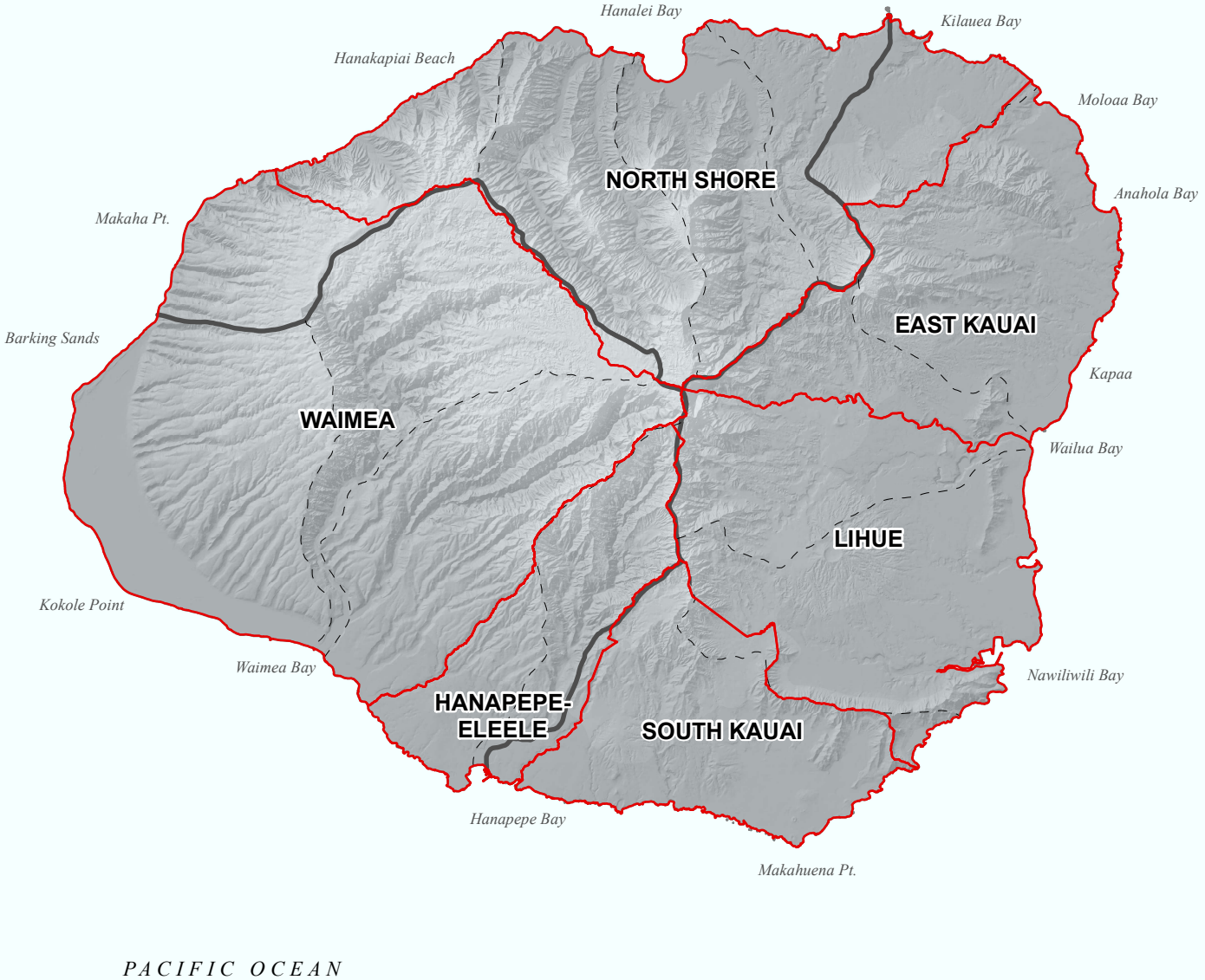
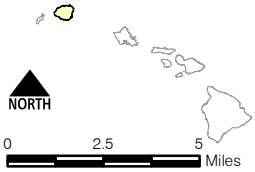


FIGURE 1-13

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Areas
- Aquifer System Areas
- Planning Districts

PLANNING AREAS MAP

1.3.2 Population

Between the years 2000 and 2010, the population in the State of Hawai'i grew by about 12 percent. In comparison, the population in the County of Kaua'i grew by about 15 percent for the same time. Refer to **Table 1-8**. The County General Plan population projections for the island to the year 2035, as listed in **Table 1-9**.

Table 1-8 Historical Population by Planning District – 2000 to 2010

District	Population by Year		Percent Change
	2000	2010	
Līhu'e	12,507	14,683	17.4
Kōloa – Po'ipū - Kalāheo	10,545	11,696	10.9
Hanapēpē – 'Ele'ele	4,362	6,157	41.2
Waimea	5,660	5,561	-1.7
Hanalei (North Shore)	6,605	8,002	21.2
Kawaihau – Kapa'a (East Kaua'i)	18,784	20,992	11.8
Total	**58,463**	**67,091**	**14.8**

Reference: Kaua'i Kākou – Kaua'i County General Plan (2018), Appendices. (Year 2000 and 2010 data extracted from Appendix C, Table 2.)

Table 1-9 Population Projections by Planning District – Year 2020 to 2035

District	Population by Year			
	2010	2020	2030	2035
Līhu'e	14,683	18,017	21,595	23,456
Kōloa – Po'ipū - Kalāheo	11,696	13,623	15,737	16,855
Hanapēpē – 'Ele'ele	6,157	6,463	6,860	7,094
Waimea	5,561	5,901	6,323	6,566
Hanalei (North Shore)	8,002	8,286	8,686	8,933
Kawaihau – Kapa'a (East Kaua'i)	20,992	22,403	24,128	25,110
Total	**67,091**	**74,693**	**83,328**	**88,013**
Average Annual Growth Rate	-	**1.08%**	**1.10%**	**1.10%**

Reference: Kaua'i Kākou – Kaua'i General Plan (2018), Appendix C, Table 2.

Through the year 2035, it is expected that the Līhu'e District will absorb about half of the projected island population growth. This is in line with the County's policy designating Līhu'e as the island's center of population and employment.

The Socioeconomic Analysis and Forecasts, dated February 2014, was prepared for the General Plan update to provide the basis for growth projections in population, housing, employment, and other demographic and socioeconomic characteristics. The forecasting model generated for the report looked at three population projections: a moderate or baseline estimate of 1.1 percent average annual rate of change; a high estimate of 1.15 percent average annual rate of change; and a low estimate of 0.08 percent average annual rate of change. **Table 1-10** shows the three population projections.

Table 1-10 Population Projection

Growth Rate	Population by Year					
	2010	2015	2020	2025	2030	2035
A - Low	67,091	70,090	72,938	75,903	78,988	82,199
B – Medium (Baseline)	67,091	70,717	74,693	78,893	83,328	88,013
C – High	67,091	70,822	74,989	79,401	84,073	89,020

Reference: Socioeconomic Analysis and Forecasts, February 2014.

1.4 LAND USE

1.4.1 State Land Use

Prior to the adoption of the State Land Use Law (HRS Chapter 205) by the State Legislature in 1961, the development of Hawai'i's lands was many times driven by the few to reap short-term gains while resulting in adverse long-term loss to the State's economy - losses in income and future growth potential. The State Land Use Law was adopted with the intent to preserve and protect Hawai'i's limited and valuable lands and encourage uses to which lands are best suited.

The State Land Use Law called for the establishment of a Land Use Commission (LUC) within the State's Department of Business and Economic Development and Tourism (DBEDT). The LUC is responsible for classifying lands into one of the following four land use districts:

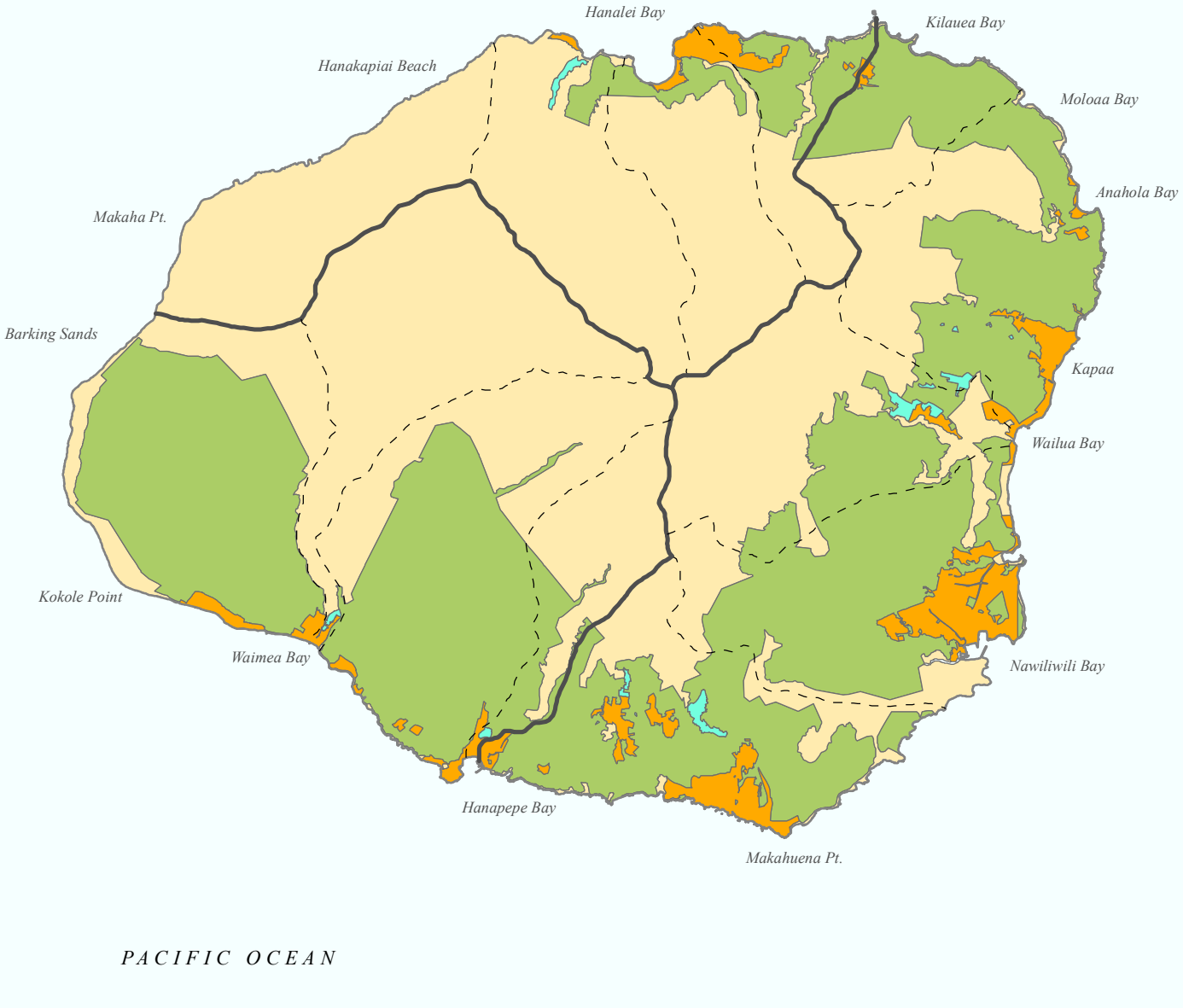
- Urban: Administered by the Counties
- Conservation: Administered by the State of Hawai'i Board of Land and Natural Resources
- Rural: Shared jurisdiction (Land Use Commission and the Counties)
- Agricultural: County jurisdiction

HRS Section 205-2 designates, in general terms, the types of uses permitted in the four districts. **Table 1-11** summarizes Kaua'i County State Land Use acreage by classification and shown graphically in **Figure 1-14**.

Table 1-11 Kaua'i County – State Land Use Classifications Summary by Acreage

State Land Use Classification	Acreage	Percent of Total
Urban	14,834	4.2%
Conservation	198,769	56.2%
Agricultural	139,044	39.3%
Rural	1,253	0.4%
TOTAL	**353,900**	**100.0%**

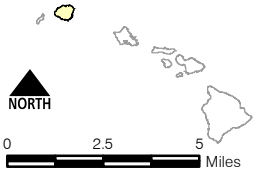
Reference: DEBEDT, 2017. State Data Book, Table 6.04



Reference: State of Hawaii Land Use Commision (http://planning.hawaii.gov/download-gis-data)

FIGURE 1-14

INDEX MAP - Island of Kaua'i



LEGEND:

Land Use Districts
- Agricultural
- Conservation
- Urban
- Rural

- Aquifer Sector Areas
- Aquifer System Areas

STATE LAND USE MAP (2017)

1.4.2 County General Plan

The General Plan for the County of Kauaʻi is a direction-setting policy document that is intended to serve as a guide to help plan and improve the physical environment and quality of life for the people of Kauaʻi and to address the overall development of the island. It states the County's vision for Kauaʻi and establishes supportive objectives and actions. The General Plan is not a regulatory document but is intended to guide County decision making by establishing priorities for managing growth and community development in the County over a 20-year planning timeframe.

The first General Plan was adopted in 1971 and updates to the plan were made 1982 and 2000. Updates to the General Plan were intended to occur every ten years, subject to funding availability. The current version of the County of Kauaʻi General Plan was adopted by the Council of the County of Kauaʻi on February 7, 2018 and was signed and approved by Mayor Bernard Carvalho, Jr. on March 15, 2018.

The 2018 Kauaʻi County General Plan (herein to be referred to as the "General Plan") was developed in compliance with 2013 Hawaiʻi Revised Statues (HRS), Title 13 - Planning and Economic Development, Section 226-8 – County General Plans, which required that "The county general plans and development plans shall be formulated with input from the state and county agencies as well and the public." As called for in Section 226-58, "County general plans or development plans shall indicate desired population and physical development patterns for each county and regions within each county."

The General Plan provides the County with direction for desired future growth through a set of written policies, while special policies are as depicted on the Future Land Use Map and other associated maps. The General Plan covers the six planning districts on the island of Kauaʻi, as previously shown on **Figure 1-13**. The island of Niʻihau, although part of the County of Kauaʻi, is not included since it is predominantly privately owned and managed.

In the process of developing the General Plan, the various communities involved concurred that the overall vision in the 2000 General Plan was still relevant; however, the accomplishments achieved over the subsequent years fell short of the vision. The process was found to be in need of fixing. With this in mind, the current General Plan was developed to provide clear policy, measures of progress, and a system for evaluation and accountability. The General Plan therefore identifies nineteen key policies "to guide growth and includes a discussion of each policy's rationale and intended outcomes." See **Figure 1-15** for the nineteen key policies, as provided in the General Plan.

The General Plan also identifies ten sectors which represent the areas that must be considered in policy implementation. Each sector is composed of several subsections, and each subsection has an objective and actions. The two sectors that are most closely related to water resources are the watershed and critical infrastructure.

Figure 1-15 General Plan – Policies to Guide Growth

Reference: Kaua'i Kākou – Kaua'i County General Plan (2018).

- One of the subsections of the watershed is kahawai – middle watershed, drainage, and freshwater resources. Its objective is "1) To protect, restore and enhance freshwater resources to support aquatic, environmental, and cultural resources; and, 2) to recognize and mitigate impacts from the built environment to the mid-watershed area." The subsection addresses the topics of understanding our reliance on aquifers and streams, protecting drainage systems and water quality, protecting perennial streams and instream flow, and utilizing community partnerships in water management.
- One of the subsections of critical infrastructure is domestic water. Its objective is "To ensure water for Kaua'i's water needs under the Public Trust Doctrine and integrate traditional ahupua'a methods of preserving water for future generations – not taking more than is needed and leaving enough for everyone." The subsection addresses the topics of reconciling water supply and infrastructure, improving system reliability and addressing growth, and enhancing water conservation.

The policies developed in the General Plan are implemented spatially through the Land Use Map (see **Figure 1-16**). It serves as the "backbone of the General Plan and is a critical element in the State and County's land use and regulatory planning system." A summary of associated acreage for each General Plan Land Use designation is provided in **Table 1-12**.

Table 1-12 County General Plan Land Use Designations

General Plan Land Use Designation	Acreage	Percent of Total
Agricultural	76,037	21.5
Military	2,032	0.6
Open	239,250	67.6
Park	1,008	0.3
Residential Community	9,208	2.6
Resort	2,229	0.6
Transportation	957	0.3
Urban Center	2,613	0.7
DHHL	20,350	5.8
TOTAL	**353,685**	**100.0**

Reference: County of Kaua'i Planning Department, GIS Data

The Department of Hawaiian Home Lands (DHHL) is exempt from State and County land use classifications and determines the land use classifications for its land.

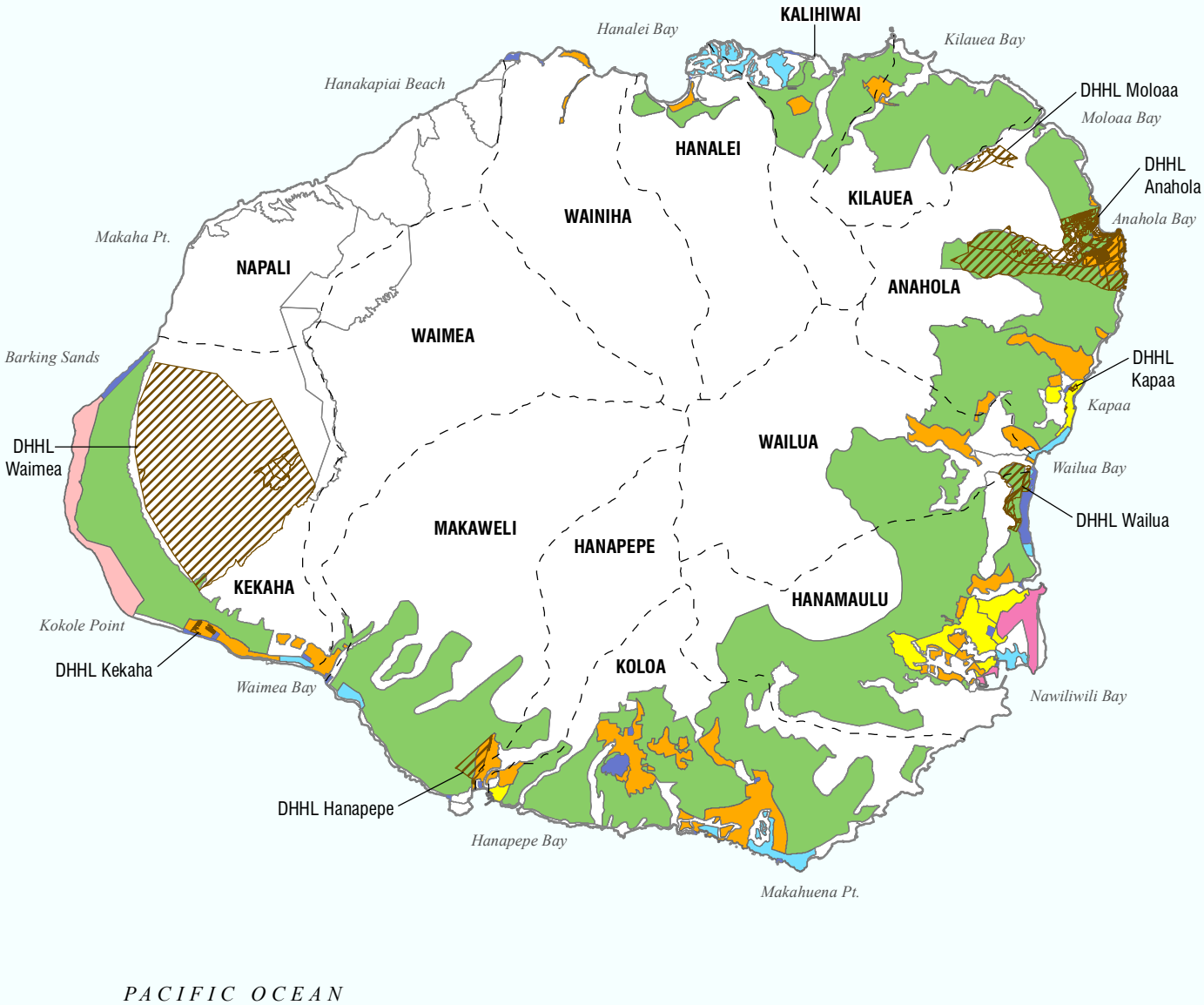
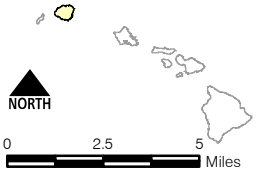


FIGURE 1-16

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer System Areas
- Hawaiian Home Lands

Land Use Allocation Guide

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

COUNTY GENERAL PLAN LAND USE MAP

Projections identified in the General Plan with regards to the island's population, housing units, jobs growth, and visitor arrivals are summarized in **Tables 1-13 through 1-16**, respectively.

Table 1-13 Kaua'i County Population, Island Wide and by District (2010-2035)

	Census Year			
Planning District	2010	2020	2030	2035
Līhu'e	14,683	18,017	21,595	23,456
South Kaua'i	11,696	13,623	15,767	16,855
Hanapēpē-'Ele'ele	6,157	6,463	6,860	7,094
Waimea-Kekaha	5,561	5,901	6,323	6,566
North Shore	8,002	8,286	8,686	8,933
East Kaua'i	20,992	22,403	24,128	25,110
TOTAL	67,091	74,693	83,328	88,013

Table 1-14 Housing Unit Demand, Forecast to 2040

	Census Year			
	2010	2020	2030	2040
County of Kaua'i, Unit Total	29,793	33,553	37,519	39,676
County of Kaua'i Available Units	24,915	28,085	31,379	33,169
County of Kaua'i, Occupied Units	23,240	25,902	28,788	30,349
Average Annual Growth Rate	-	1.3%	1.2%	1.1%

Table 1-15 Job Growth, Forecast to 2040

	Census Year			
	2010	2020	2030	2040
County of Kaua'i	23,550	31,900	34,000	34,900
Average Annual Growth Rate		1.33%	0.66%	0.53%

Table 1-16 Visitor Arrivals, Forecast to 2040

	Year			
	2010	2020	2030	2040
County of Kaua'i (x1000)	955	1,302	1,418	1,480
Change this Decade	-11.2%	26.7%	8.1%	4.2%
Average Annual Rate of Change	-1.2%	2.7%	0.8%	0.4%

1.4.3 Community Development Plans

A development plan is "intended to direct physical development and public improvements within a specific geographic area of the County within the framework of the General Plan." Development plans establish more detailed policy than the General Plan. Not every community needs or desires a development plan since some communities may not require more specific, detailed policy than what is established in the General Plan.

The County has completed and adopted the Community Plans for South Kauaʻi, Līhuʻe, and West Kauaʻi in 2014, 2015, and 2020 respectively. The development of an East Kauaʻi Community Plan for is presently underway.

The development plans summarize the vision for future land use, growth and development specific to each of the districts identified. These plans were developed with input from members of the community in each of the respective districts. Highlights specific to the each of these communities, particularly those that impact water resources and infrastructure, are provided in respective sections of this report.

1.4.4 County Zoning

The County of Kauaʻi adopted the Comprehensive Zoning Ordinance on September 1, 1972. Since its adoption, several amendments to specific provisions have been approved. The CZO has not been updated in a comprehensive manner since its adoption. The County Planning Department is in the process of updating the CZO and has divided the project into two phases:

- Phase 1: Focus on organizational and format changes
- Phase 2: Provision of more substantive changes

On December 3, 2012, Phase 1 of the CZO update was approved through the adoption of County Ordinance 935. This adopted Phase 1 update of the CZO and will serve as the official zoning code until Phase 2 of the project is completed.

The CZO is the County's legal instrument to regulate land development in accordance with adopted land use policies, including the General Plan and Development plans.

The CZO provides more specific designations than in the General Plan. Zoning designations have been established for almost all parcels on the island. The CZO also provides more detailed information regarding development and design standards for the location, height and size of structures, yard areas, off-street parking facilities, and open spaces, and the use of structures and open areas, and the use of structures and land for agriculture, industry, business, residences or other purposes.

Refer to **Figure 1-17** for County Zoning Map. **Table 1-17** provides a summary by County zoning classifications and associated acreages.

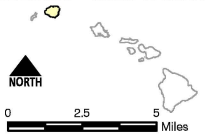
Table 1-17 County Zoning

Zoning Class	Zoning Designation	Acreage	Percent of Total
Agriculture	A	87,322	24.6
Commercial	C		
General Commercial	CG	586	0.2
Neighborhood Commercial	CN	124	0.0
Conservation	CON	193,207	54.4
Industrial	I		
General Industrial	IG	1,183	0.3
Limited Industrial	IL	217	0.1
NO ZONING		1,491	0.4
Open	O	42,287	11.9
Project Development	P	38	0.0
Residential	R	7,473	2.1
Resort	RR	625	0.2
Special Planning Area	SPA-A	26	0.0
Special Treatment	ST	168	0.0
DHHL	DHHL	20,428	5.8
	TOTAL	**355,174**	**100.0**

Source: County of Kaua'i Planning Department, GIS Data

FIGURE 1-17

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer System Areas
- Hawaiian Home Lands

Zoning Designations:

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

COUNTY ZONING MAP

Fukunaga & Associates, Inc.
Consulting Engineers

1.5 EXISTING WATER RESOURCES

1.5.1 General

Naturally occurring water resources on the island of Kauaʻi include ground water, surface water, and rainwater catchment. Conservation is vital to preservation of these valuable water resources. Water supply can be further augmented by wastewater reclamation, desalination, and storm water reuse. Water quality varies with the source, and depending on the proposed use, treatment requirements also vary. Water quality protection is covered under the WQP. The WQP describes programs under the Department of Health and other programs that protect existing and potential sources of drinking water. It is noted that only limited information is available for water resources, and only very limited records related to individual catchment systems are available.

1.5.2 Ground Water

Ground water is the primary water source for many users on the island. As previously discussed, the SY for the island of Kauaʻi is 328 mgd.

1.5.2.1 Wells

As defined in the State Water Code, a well is "an artificial excavation or opening into the ground, or an artificial enlargement of a natural opening by which ground water is drawn or is or may be used or can be made to be usable to supply reasonable and beneficial uses within the State." The inventory of wells was obtained from the CWRM database. The CWRM database on wells was developed from information gathered through the Well Registration program, and since 1988, supplemented with information gathered through the well construction/pump installation permitting process. Refer to **Appendix A** for this database.

The database provides the best available information on wells and was used to evaluate existing ground water resources. However, for some wells, the database is missing information that is pertinent to the WUDP, such as installed pump capacity and chloride concentrations. Installed pump capacity indicates the rate at which the installed pump is capable of withdrawing water. Data related to chloride concentrations provides important information regarding the potablility of the water being pumped from the well. Caprock and saltwater withdrawals do not count against the sustainable yield.

Current State Water Code and Administrative Rules do not require well owners in non-designated water management areas to report changes in well ownership or use category; however, these changes are updated by the CWRM when it these types of changes become known. As of July 1995, certification of well construction and pump installation completion was begun by the CWRM. The certificate requires that landowners notify the CWRM of changes in the well operator and landowner changes.

Based on the CWRM well database and limited additional update information, the island of Kauaʻi has 284 production wells, which are shown on **Figure 1-18.** According to the WRPP, production wells are all wells that are not classified as abandoned, observation, or unused. The number of wells by CWRM category are shown in **Table 1-18**. There are also 83 wells classified as "unused".

Table 1-18 Summary of Installed Pumps in Existing Well Sources

Category	Number of Wells	Capacity* (mgd)	Percent of Total Capacity
Agriculture	50	119.6	55.2
Domestic	117	5.1	2.3
Industrial	8	21.7	10.0
Irrigation	29	13.6	6.3
Military	3	3.2	1.5
Municipal	70	53.3	24.7
Other	7	0.0	0.0
Total	284	216.5	100.0

* Capacity based on available installed pump capacity data from CWRM; many well pump capacities are not listed in the database. It is also noted that the potability of the water being pumped from some of the wells is not known.

Reference: CWRM Well Database (2017)

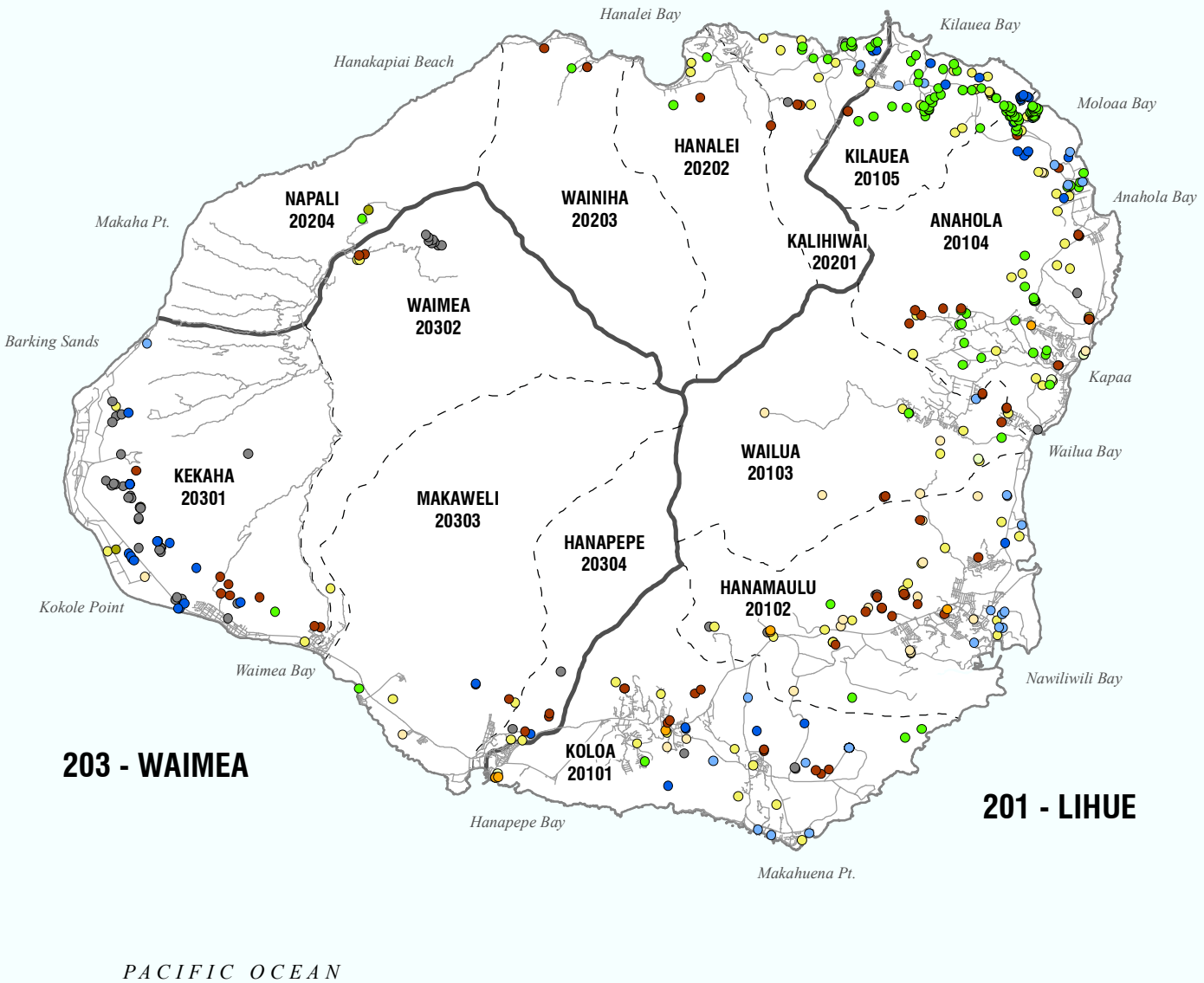
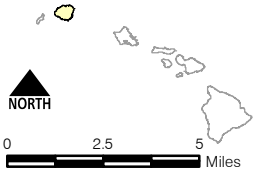


FIGURE 1-18

INDEX MAP - Island of Kaua'i



LEGEND:

- Aquifer Sector Areas
- Aquifer System Areas
- State Highway/ County Roads

Well Use Types

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

REGISTERED WELLS

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Consulting Engineers

1.5.3 Surface Water

The annual rainfall on the island of Kauaʻi generally tends to be greater than the rest of the major Hawaiian Islands, with Mount Waiʻaleʻale reputed to be one of the world's wettest spot with annual rainfall of 450 inches per year. The island's wet climate has provided substantial surface water sources, which supported major agricultural production (primarily sugarcane) in the past.

Of the 376 perennial streams identified in the Hawaiʻi Stream Assessment[17] (HSA), 61 are located on the island of Kauaʻi. As noted in the HSA, on the island of Kauaʻi, perennial streams are evenly distributed across the island. A list of available USGS stream gaging records from the HSA on the island of Kauaʻi is summarized in **Table 1-19**.

The CWRM also manages a database of gage data. See **Table 1-20** for a summary of the active gages on the island of Kauaʻi as of 2024.

In accordance with the Code, instream flow standards (IFS) must be established and administered by the CWRM on a stream-by-stream basis as necessary to protect public interests. An 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."

Instream use is defined by the Code as "beneficial uses of stream water for significant purposes which are located in the stream and which are achieved by leaving the water in the stream. Instream uses include, but are not limited to:

- Maintenance of fish and wildlife habitats
- Outdoor recreational activities
- Maintenance of estuarine, wetland, and stream ecosystem
- Aesthetic values such as waterfalls and scenic waterways
- Navigation
- Instream hydropower generation
- Maintenance of water quality
- The conveyance of irrigation and domestic water supplies to downstream points of diversion; and
- The protection of traditional and customary Hawaiian rights."

The CWRM recognizes that considerably more research and study is needed to accumulate adequate data and gain a better perspective to develop meaningful IFS. Accomplishing this work is highly dependent on policy and program direction, availability of funding, and staffing. Until permanent IFS are established, interim IFS have been adopted. Interim IFS for Kauaʻi (HAR §13-169-45) were adopted on June 15, 1988 and have been in effect as of October 10, 1988. The interim IFS for Kauaʻi are listed in **Table 1-21**.

[17] Hawaiʻi Cooperative Park Service Unit, 1990. Hawaiʻi Stream Assessment: A Preliminary Appraisal Of Hawaiʻi's Stream Resources. State of Hawaiʻi, Department of Land and Natural Resources, Commission on Water Resource Management, Report R84, 294 p

Table 1-19 USGS Gaging Records

CODE:	Gage is associated with stream with this HSA code	QUAL DATA	USGS assessment of quality of records
NAME	USGS Station Name	DRAIN	Drainage area above gage (square miles, sq. mi.)
GAGE #	USGS number of gage station. If all zeros, median and average are calculated flows	DIV	Diversion per USGS
		Y	Diversion is present above gage
		N	No diversion is present above gage
		D	Gage is on a ditch
ACTIVE	A – Active in January, 1991		
MEDIAN	Flow at gaging station exceeded 50% of time in cubic feet per second (cfs)	TYPE DATA	Type of data collected
		C	Continuous record
		E	Extreme flows only, low and/or peak
		C-E	Converted from continuous to extreme
		L	Low flow
		P	Peak Flow
AVERAGE	Average of yearly mean flow in cubic feet per second (cfs) at gaging station		
YRS REC	Years of record 19.. – 19..		

Note: cfs x 0.642 = MGD

CODE	NAME	GAGE #	AC-TIVE	MED-IAN	AVE-RAGE	YRS REC	QUAL DATA	DRAIN	DIV	TYPE DATA
2-1-04	Kalalau Str. nr Hanalei	117000		5.2	6.89	31-55			N	C
2-1-07	Nanakoa Str. nr Hanalei	116000		1.8	5.51	31-52			N	C
2-1-10	Hanakapiai Strn nr Hanalei	115000		8.4	16.90	31-52			N	C
2-1-14	Wainiha R. nr Hanalei	108000	A	79.0	138.00	52-	G	10.20	N	C
2-1-14	Wainiha Canal at intake nr Wainiha	110000				10-16				E
2-1-14	Wainiha R. nr Wainiha	113000				12-16			N	E
2-1-15	Lumahaʻi R. nr Hanalei	106000		67.0	117.00	14-33		7.50	N	C
2-1-18	Waiʻoli Str. nr Hanalei	105000		20.0	31.60	14-33			N	C
2-1-19	Hanalei Ditch Kīlauea	099500				56-62			D	C
2-1-19	Hanalei Tunnel outlet nr Līhuʻe	100000		28.0	27.30	32-85	G		D	C
2-1-19	Hanalei at alt 625 ft nr Hanalei	101000		49.0	83.40	14-55			Y	C
2-1-19	Combined records if stations 1600000, 16101000	101003		68.0		32-55			N	C
2-1-19	China Ditch nr Hanalei	102000		29.0	27.20	11-80			D	C-L
2-1-19	Hanalei R. nr Hanalei	103000	A	130.0	212.00	12-	G	19.10	Y	C
2-1-19	Kuna Ditch nr. Hanalei	104000				12-19			D	E
2-1-19	Hanalei R. at Hwy 56 Bridge nr Hanalei	104200	A			62-			Y	P

Table 1-19 USGS Gaging Records (Continued)

CODE	NAME	GAGE #	AC-TIVE	MED-IAN	AVE-RAGE	YRS REC	QUAL DATA	DRAIN	DIV	TYPE DATA
2-1-25	Kalihiwai R. nr Hanalei	098000		32.0	47.70	14-23			N	C
2-1-26	Puʻukumu Str. nr Kīlauea	097900	A			64-			N	P
2-1-28	Puʻu Ka Ele Ditch nr Kīlauea	095000		3.4		32-67			D	C
2-1-28	Ross Ditch nr Kīlauea	095200		3.1		56-67			D	C
2-1-28	Kalihiwai Ditch above wasteway nr Kīlauea	095900		4.3		60-68			D	C
2-1-28	Kīlauea	096000		2.8		34-67			D	C
2-1-28	Pōhakuhonu Str. nr Kīlauea	097000		3.5	8.21	34-67	G	1.80	Y	C
2-1-28	Hālaulani Str. nr Kīlauea	097300		2.7		57-72			N	C
2-1-28	Hālaulani Str. at alt 400 ft nr Kīlauea	097500	A	7.2	11.50	57-	G	1.90	N	C
2-2-01	Anahola Str. nr Keālia	089000		9.7	22.40	10-85	P	4.27	N	C
2-2-01	Anahola Str. at Anahola	093200		15.0	34.20	62-82	F	9.24	Y	C
2-2-04	Combined records of 16079000, 16080000	080001		13.0		36-85			N	C
2-2-04	Kapaʻa str. nr Keālia	078000		27.0	36.10	10-20			Y	C
2-2-04	Kapaʻa str. at Kapahi Ditch intake nr Kapaʻa	080000	A	5.9	21.50	36-			Y	C-E
2-2-04	Kapaʻa Str. at old Hwy crossing nr Keālia	084500	A			62-			N	P
2-2-04	Kapahi Ditch nr Keālia	079000	A	4.5	6.16	09-	G		D	C
2-2-04	Kaneha Ditch nr Keālia	081200	A			64-			Y	P
2-2-06	Konohiki Str. nr Kapaʻa	073500	A			64-			Y	P
2-2-08g	Wailua R. System	000000		110.0	238.56					
2-2-08	Wailua R. nr Kapaʻa	071800	A			62-				P
2-2-08.01	Left branch Opaekaʻa nr Kapaʻa	071500	A	1.8	2.56	60-	G	0.65	N	C
2-2-08.02	N. Fork Wailua R. at alt 650 ft nr Līhuʻe	063000		50.0	73.10	14-85	G	5.29	Y	C
2-2-08.02	E. branch of N. Fork Wailua R. nr Līhuʻe	068000	A	32.0	48.00	12-	G	6.27	N	C
2-2-08.02	N. Fork Wailua R. nr Līhuʻe	068700		0.0		10-14			Y	E
2-2-08.02	N. Fork Wailua R. nr Kapaa	071000	A	73.0	122.00	52-	G	17.90	Y	C
2-2-08.03	S. Fork Wailua R. Līhuʻe	060000	A	36.0	114.00	11-	G	22.40	Y	C
2-2-08.03	S. Fork Wailua R. nr rock quarry nr Līhuʻe	058500				74-			Y	L
2-2-15	Huleʻia Str. nr Līhuʻe	055000	A	10.0	28.00	12-	G	17.60	Y	C-P
2-2-15	Kamoʻoloa Str. nr Puhi	053800		0.6	17.00	63-71	G	5.94	Y	C
2-2-15	Kuia Str. nr Puhi	054500		3.5		63-66			Y	C
2-2-15	Kamoʻoloa Str. nr Puhi	053800		0.6	17.00	63-71	G	5.94	Y	
2-3-04	Lāwai Str. nr Kōloa	052500	A	3.0		49-			Y	C-P
2-3-04	Hanapēpē R. at Hanapēpē	052000	A			49-			Y	P
2-3-07	E Fork Kōʻula R. nr. ʻEleʻele	041000				11-15			Y	E
2-3-07	Kōʻula R. at Kula nr ʻEleʻele	047000		34.0	74.30	10-16			Y	C

Table 1-19 USGS Gaging Records (Continued)

CODE	NAME	GAGE #	AC-TIVE	MED-IAN	AVE-RAGE	YRS REC	QUAL DATA	DRAIN	DIV	TYPE DATA
2-3-07	Hanapēpē R. below Manuahi Str. nr ʻEleʻele	049000	A	32.0	84.70	17-	G	18.50	Y	C
2-3-07	Hanapēpē Ditch at Hanapepe Falls nr ʻEleʻele	042000				11-15			D	E
2-3-07	Hanapēpē Ditch below intake nr ʻEleʻele	043000			42.50	30-38			D	C
2-3-07	Hanapēpē Ditch at Kōʻula nr ʻEleʻele	044000			38.50	10-49			D	C
2-4-04g	Waimea R. System	000000		63.0	253.00					
2-2-04	Waiakoali Str. nr Waimea	011000		3.5	8.88	09-80			N	C-L
2-2-04	Kōkeʻe Ditch nr Waimea	014000		20.0	24.20	26-82	G		D	C
2-2-04	Kauaikinana Str nr Waimea	012000		2.2	6.24	19-80			N	C-L
2-2-04	Waimea R. at alt 3,420 ft nr Waimea	016000		19.0	44.90	16-68			Y	C
2-2-04	Waialae Str at alt 800 ft nr Waimea	019000	A	6.7	21.80	20-	G	1.79	N	C
2-2-04	Waialae Str. nr Waimea	020000		9.9		10-16			N	C
2-2-04	Waialae Str. at alt 800 ft nr Waimea	021000		16.0		16-21			N	C
2-2-04	Waimea R. below Kekaha Ditch intake nr Waimea	028000		1.4	67.90	21-69			Y	C
2-2-04	Waimea R. near Waimea	031000	A	15.0	124.00	10-	G	57.80	Y	C
2-2-04	Combined records for stations 16031000, 16036000	031001		50.0		43-68			Y	C
2-2-04	Waimea R. at Waimea	038000	A			43-			Y	P
2-2-04	Kekaha Ditch at Camp 1, nr Waimea	022000		55.0	57.10	09-68			D	C
2-2-04	Kekaha Ditch below tunnel 12 nr Waimea	027000		51.0	50.00	08-34			D	C
2-2-04.01	Makaweli R. nr Waimea	036000	A	29.0	85.5	43-	G	26.00	Y	C
2-2-04.01	Makaweli R. below Poowaiomahaihai Ditch nr Waimea	037100		23.0	105.00	11-17			Y	C
2-2-04.02	Mokihana Str. nr Waimea	029500				62-80			N	L
2-2-04.04	Koalie Str. at alt 3.770 ft nr Waimea	017000		8.2	24.6	19-68			N	C
2-2-04.04	Koaiʻe Str. nr Waimea	018000				15-71			N	E
2-5-04-06.1	Mōhihi Str. nr Waimea	015000				09-17			N	C
2-5-04-06.1	Mōhihi Str. at alt. 3,420 ft nr Waimea	013000		3.0	8.62	20-71	P	1.60	N	C
2-5-04-06.3	Kawaikoi Str. nr Waimea	010000	A	13.0	34.40	09-	G	3.95	N	C
2-5-08	Nahomalu Valley nr Mana	130000	A		0.42	62-	F	3.77	N	C-P

Reference: Hawaiʻi Cooperative Park Service Unit, 1990. Hawaiʻi Stream Assessment: A Preliminary Appraisal Of Hawaiʻi's Stream Resources. State of Hawaiʻi, Department of Land and Natural Resources, Commission on Water Resource Management, Report R84, 294 p

Table 1-20 CWRM Gaging Records

Gage ID	Gage Name	Flow Type	Operator	Gage Information
23	North Wailua Ditch below Waikoko Stream	Diverted Flow	KIUC	Water data measures flow diverted from Waikoko Stream at DivID: 713 to ʻIliʻiliʻula North Wailua Ditch
24	North Wailua Ditch below North Fork Wailua Stream	Diverted Flow	KIUC	Water data measures flow diverted from Waiʻaleʻale Stream (North Fork Wailua River) at DivID: 716 to ʻIliʻiliʻula North Wailua Ditch.
49	Kōkeʻe Ditch-Puʻulua Reservoir	Diverted Flow	KAA	Water data measures flow in Kōkeʻe Ditch above Puʻu Lua Reservoir and records amount entering the reservoir. Water data represents the SUM of water diverted from three main diversions: Waiokoali (620), Kawaikōī (616), and Kauaʻikinana (607); several smaller diversions: Kumuwela #1, #2, #3, and #5 (619, 614, 603, 615), Poʻomau (621), and Halemanu (619); PLUS or MINUS water diverted or returned at the Kōkeʻe Intake/Outflow (622) ("fake waterfall"), MINUS water returned (dumped) at the Kōkeʻe Ditch Gaging Station (Kauhau Gulch) (610). The Mōhihi Intakes (#1, #2, and #3) (612, 617, and 606) are inactive. (as of 9/2016).
50	Kekaha Ditch @ Hukipo Flume	Diverted Flow	KAA	Water data from January 2018 is the measured flow in Kekaha Ditch at Hukipo Flume. Water data from January 2018 represents diverted flow from Koaie Stream (DivID: 609), Waiahulu Stream (DivID: 605), and Waimea River below the confluence with Waialae Stream (DivID: 604), MINUS amount returned to Waimea River at the Mauka Hydro Plant, and amount distributed to the Menehune Ditch and water treatment plant. Prior to January 2018, water data is the estimated flow at Hukipo Flume plus 2 mgd (estimate upstream distribution to Menehune Ditch).
75	Princeville Sump Pump #1	Diverted Flow	Princeville Prince Golf Course, LLC	Water data is the metered diverted flow from ʻAnini Stream.
92	Alexander	Diverted Flow	McBryde Resources, Inc.	Water data calculated flow in Kauaʻi Coffee Ditch (aka Powerhouse Ditch) below Alexander Reservoir on Wahiawa Stream (divID: 837).
93	Wainiha	Diverted Flow	McBryde Resources, Inc.	Water data is the calculated flow that passes through the Wainiha Hydroelectric Plant. Water data represents flow diverted from Maunahina and Wainiha Streams into the Wainiha Powerhouse Ditch. Water is returned to the stream on exit from the powerhouse. (Exclude from island-wide statistics - non-consumptive use.)
94	Lāwaʻi Intake	Diverted Flow	McBryde Resources, Inc.	Water data represents flow in Lāwaʻi Intake Ditch from Lāwaʻi Stream (DivID: 812).
95	Olokele Ditch Weir (Nonopahu Gage?)	Diverted Flow	Gay & Robinson	Water data is the estimated flow in Olokele Ditch at the hydroelectric plant. Water data represents the sum of flows diverted from from Kalāhiki, Kaluawai, Olokele, and Waiānuenue Streams (DivID: 374, 379, 377, 980, 378).
104	Upper Līhuʻe Ditch (USGS 16057000)	Diverted Flow	Grove Farm	Water data is the measured flow in the Upper Līhuʻe Ditch at the site of former USGS Gage station 16057000. Water data represents flow diverted from ʻIliʻiliʻula, North Fork Wailua, South Fork Wailua, Waiahi, Waiaka, and Waikoko Streams (DivID: 699, 700, 702, 703, 704, 705, 706, 707).
105	Waitā Ditch above Waitā Reservoir	Diverted Flow	Grove Farm	Water data is the measured flow in Kōloa Tunnel (aka Waitā Ditch) above Waitā Reservoir. Water data represents flow into Waitā Reservoir from Kōloa Tunnel. Kōloa Tunnel source is stream diversions on Komoʻoloa Stream (DivID: 816) and Kuʻia Stream (DivID: 842).

Table 1-20 CWRM Gaging Records (Continued)

Gage ID	Gage Name	Flow Type	Operator	Gage Information
106	Hanamā‘ulu Ditch (USGS 16058000)	Diverted Flow	Grove Farm	Water data is the measured flow in the Hanamā‘ulu Ditch at the site of former USGS gage station 16058000. Water data represents flow diverted from Waiahi Stream at DivID: 688
107	Papua‘a Reservoir Intake from Kamo‘ola Stream	Diverted Flow	Grove Farm	Water data measures flow in the Upper Ha‘ikū Ditch above Papua‘a Reservoir. Water data represents flow diverted from Kamo‘ola Stream to Papua‘a Reservoir.
110	Kapahi Ditch Lateral #9 at USGS 16079000	Diverted Flow	East Kaua‘i Water Users’ Cooperative	Water data is the estimated flow from Kapa‘a Stream at Intake 36 (diversion ID: 689) into Upper Kapahi Reservoir.
111	North Wailua Ditch above Wailua Reservoir	Diverted Flow	East Kaua‘i Water Users’ Cooperative	Water data is the estimated flow in the North Wailua Ditch above Wailua Reservoir. Water data represents flow diverted from North Fork Wailua River at DivID: 675 to Wailua Reservoir.
112	Kealia Ditch above Kaneha Res	Diverted Flow	Kaua‘i Ranch	Water data is the estimated flow in Kealia Ditch above Kaheha Reservoir. Water data represents flow diverted from Kealia Stream to Kaneha Reservoir via Kealia Ditch.
159	Hanamā‘ulu-ADC Ditch	Diverted Flow	CWRM	Water data is the measured flow in the portion of the Hanamā‘ulu Ditch that bypasses the Kapaia Reservoir and terminates at Ai‘i Reservoir at the site of former USGS gage station 16058000. Water data represents the portion of flow measured at Gage 106 that serves ADC lands. (Exclude from island-wide water statistics to avoid "double-counting.")
162	Kōke‘e Ditch below Waiakoali Intake	Diverted Flow	KIUC	Water data represents flow diverted from Waiakoali Stream at DivID: 620 into Kokee Ditch.
178	Waiahi SWTF Raw Inflow	Diverted Flow	Grove Farm	Water data is the metered volume of raw water pulled from the Kapaia Reservoir to the Waiahi Water Treatment Plant. (Exclude from island-wide water statistics to avoid "double-counting.)
179	Waiahi SWTF Return Inflow	Diverted Flow	Grove Farm	Water data represents the volume of water returned to Kapaia Reservoir. 'Volume returned' is (estimated) 10% of the (measured) potable/finished water produced by the plant (Subtract from island-wide total?)
191	NF Wailua Stream below Blue Hole Intake	Instream Flow	CWRM	Water data represents flow in North Fork Wailua River (Waialeale Stream) below ‘Ili‘ili‘ula-North Wailua Ditch Intake (DivID: 24 on Waialeale Stream)
192	Upper Waiahi Hydro Tailrace	Return Flow	KIUC	Water data is the calculated flow returned to Waiahi stream from the Upper Waiahi Hydroelectric Power Plant. (Subtracted from island-wide water-use statistics.)
193	Lower Waiahi Hydro Tailrace	Return Flow	KIUC	Water data is the calculated flow returned to Waiahi stream from the Lower Waiahi Hydroelectric Power Plant. (Subtracted from island-wide water-use statistics.)
194	Lāwa‘i Stream below Lāwa‘i Ditch Intake	Instream Flow	CWRM	Water data is the measured flow in Lāwa‘i Stream below Lāwa‘i Irrigation System intake.
199	Farmer’s Ditch Intake from Pump 3 Ditch	Diverted Flow	McBryde Resources, Inc. (Myra Amisone)	Staff plate on flume at Farmer's Ditch downstream of control point from Pump 3 Ditch.
200	Waikoko Stream below Ditch	Instream Flow	CWRM	Water data is the measured flow in Waikoko Stream below ‘Ili‘ili‘ula North Wailua Ditch intake (DivID: 713 - Intake #11).

Table 1-20 CWRM Gaging Records (Continued)

Gage ID	Gage Name	Flow Type	Operator	Gage Information
205	NTBG Limahuli Gardens	Diverted Flow	National Tropical Botanical Garden Irrigation System (Chipper Wichman)	Water data is the estimated flow in transmission pipeline from Limahuli Stream (DivID: 1262 at 320 ft elev). Estimate based on metered flow from 11/2010 to 11/2019. End Use: ~120,000 gpd for micro hydro returned to stream. Remainder for irrigation of taro
207	Pake Stream Intakes	Diverted Flow	Maile Walters (Kalihiwai Bay Estates Water Association)	Water data is estimated flow from unnamed Kalihiwai tributary (aka: Pake Stream) based on "bucket method".
210	Kalihiwai Reservoir Intake	Diverted Flow	Porter Irrigation (Jennifer Luck)	Water data represents flow diverted from Pohakuhonu Stream to Kalihiwai Reservoir via the Kalihiwai Ditch.
241	Kōkeʻe Ditch – Left Branch	Diverted Flow	KAA (Michael Faye)	Water data is the measured flow in Kōkeʻe Ditch below the Puʻu Moe Divide - Left Branch (Eastern Branch).
248	Waimea Canyon Comfort Station	Diverted Flow	DLNR, Division of State Parks Kauaʻi	Meter on pipeline measures flow pumped from Kokee Ditch at DivID: 1074 to the Waimea Canyon Comfort Station.
250	Kōʻula Ditch Weir	Diverted Flow	Gay & Robinson, Inc. (Howard Greene)	
261	Pump 3 Ditch Intake from Hanapēpē	Diverted Flow	Mcbryde Resources Inc. (Myra Amisone)	Water data represents flow diverted from Hanapepe River to Pump 3 Ditch and Farmers Ditch from Diversion ID: 834.
283	Kekaha Ditch at Camp 1 (aka: Top of Ditch)	Diverted Flow	KAA (Michael Faye)	Water data represents flow in Kekaha ditch at Camp 1 (aka: Top of Ditch), below Mauka Hydro Tunnel exit into ditch.
284	East Wai'oli Ditch	Diverted Flow	Waiʻoli Valley Taro Hui	Water data is the estimated average daily flow diverted from Diversion_ID: 1412 ('East Waiʻoli Ditch Intake from Waiʻoli trib') into the East Waiʻoli Ditch based on once weekly staff plate reading. Rating curve developed by CWRM staff on 9/9/2021.

Interim IFS is generally defined as "the 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 off-stream 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]."

The Code states that "adequate provisions shall be made for the protection of traditional and customary Hawaiian rights, the protection and procreation of fish and wildlife, the maintenance of proper ecological balance and scenic beauty, and the preservation and enhancement of waters of the State for municipal uses, public recreation, public water supply, agriculture, and navigation." The Code also specifically discusses the protection of Native Hawaiian water rights.

Water resource strategies should be reviewed for potential impact to instream uses and Native Hawaiian rights. Water supply reliability and quality, feasibility, environmental and cultural impacts, and water rights will be considered as projects and programs develop. More detailed and site-specific evaluation of these impacts will be required and accomplished through the environmental review process (HRS Chapter 343).

1.5.3.1 Native Hawaiian Water Rights

Section 174C-101 of the Code discusses the protection of Native Hawaiian water rights in greater detail addressing reservation of water for Hawaiian Home Land allotments, and traditional and customary (T&C) rights, including appurtenant rights. Hawaiian Home Lands are discussed further in **Section 2.2.2.5.2** of this document. In describing traditional and customary rights, Section 174C-101 states that "traditional and customary rights of ahupua'a tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778 shall not be abridged or denied by this chapter [the Code]. Such traditional and customary rights shall include, but not be limited to, the cultivation or propagation of taro on one's own kuleana and the gathering of hīhīwai, 'ōpae, 'o'opu, limu, thatch, tī leaf, aho card, and medicinal plants for subsistence, cultural, and religious purposes." As noted in the Code, instream use includes the protection of traditional and customary Hawaiian rights. These rights primary rely on adequate streamflow and/or ground water supply and are therefore an integral component of IFS.

A comprehensive database of the significant T&C areas is unlikely to be developed. Therefore, in collaboration with CWRM staff, a consultation process could be proposed and established to evaluate how the impact of specific source development projects on T&C issues may be assessed and how such impacts can be mitigated.

The CWRM staff currently seeks input on and addresses T&C issues in its well construction/pump installation permit application (WCPIPA) process through several steps:

1. Comments it solicits from the Department of Land and Natural Resources (DLNR) State Historic Preservation Division (SHPD) and Office of Conservation and Coastal Lands (OCCL), and from County Special Management Areas (SMA).

2. Other agency and public notification of WCPIPAs is via the CWRM's monthly bulletin posted on its website and directly emailed to over 100 individuals and agencies that includes the Office of Hawaiian Affairs (OHA) and DLNR Aquatic Resources Division (DAR). Although only required for water use permit applications, the bulletin also includes information for pending well construction and pump installation permit applications and stream diversion works permit (SDWP) applications. The applications are listed in the bulletin for 60 days after the permit is granted.

3. Staff review of OHA's online Kipuka database (http://kipukadatabase.com/kipuka/) and Papakilo (http://www.papakilodatabase.com/main/main.php).

4. Standard conditions in well construction and pump installation permits.

5. Conditions on certificates of completed well construction and pump installation.

CWRM staff is developing an additional process with the intent that it would apply to water source development projects involving well construction/pump installation permit application requests through the CWRM. Staff is proposing that T&C issues could be further vetted through the permitting process by including a more thorough Ka Pa'akai analysis in the WCPIPA. Ka Pa'akai analysis is an analytical framework to be applied when making decisions with potential impacts to

T&C as directed by the Supreme Court ruling in the Ka Paʻakai o ka ʻĀina v. Land Use Commission case. The three questions to be answered under Ka Paʻakai include:

1. Identification and scope of "valued cultural, historical, or natural resources" in the impacted area, including the extent to which traditional and customary native Hawaiian rights are exercised in the area;

2. The extent to which those resources, including traditional and customary native Hawaiian rights, will be affected by the proposed actions;

3. The feasible action, if any, to be taken to reasonably protect native Hawaiian rights if they are found to exist.

These questions can be added to the WCPIPAs for the applicant to address and for staff to vet. CWRM staff has identified ʻAha Moku as a potential liaison between applicants/landowners for a WCPIPA and practitioners that could be impacted by the specific project during the WCPIPA review process. Act 288, signed into law in 2012, formally recognizes the ʻAha Moku System and establishes the ʻAha Moku Advisory Committee within the Department of Land and Natural Resources (DLNR). ʻAha Moku's function is to serve in an advisory capacity on issues related to land and natural resources management through the ʻAha Moku System, and to integrate the native Hawaiian cultural and traditional values into the fabric of State policy. The ʻAha Moku System includes several tiers from the Individual Ahupuaʻa, which includes traditional practitioners within an ahupuaʻa, to the ʻAha Moku Advisory Committee, which includes a State-wide Committee of traditional practitioners consisting of one representative from each island. Vetting T&C issues using ʻAha Moku as a resource during the permitting process could therefore satisfy the Ka Paʻakai analysis. CWRM staff has begun discussions with ʻAha Moku, and development of this process is ongoing.

Other steps in the aforementioned process still need to be developed and vetted, notably the procedures by which T&C issues will be identified, reviewed and adjudicated. The latter is of particular importance, as proper dispute resolution procedures may be critical to the success of the process.

1.5.3.2 Diversions

As defined in the State Water Code, a diversion is "the act of removing water from a stream into a channel, pipeline, or other conduit." In 1989, CWRM began registering declarations of water use and stream diversion works. At the time, staffing and funding constraints largely prevented CWRM from completing field verifications for the majority of stream diversions statewide. In 2007, the CWRM initiated a statewide field investigation project to verify registered stream diversions. While the existence of many stream diversions was verified, there was difficulty in quantifying the diverted quantities.

CWRM maintains a database of diversions. There are 292 declared diversions on Kauaʻi as shown on **Figure 1-4** and listed in **Appendix B. Table 1-21** summarizes the number of diversions and the 1989 declared surface water use for each surface water hydrologic unit. Due to the difficulty quantifying diverted amounts, most of the quantities are unverified. CWRM is continually working to verify and update diversion information and to increase water use reporting. Stream diversion

records are improving. However, verification of surface water diversions and quantification of diverted stream flows continues to be difficult to assess due to issues related to program funding, accessibility to diversion sites, and the large variety of existing diversion types. The verification of registered and permitted diversion structures is the first critical step required for the establishment of a long-term monitoring program and improving regulation of stream diversion structures.

Unlike ground water aquifer systems with an associated sustainable yield, most streams on Kauaʻi do not have quantitative interim instream flow standards. Streams that do have quantitative interim instream flow standards are noted in **Table 1-21**. In order to assess surface water sustainability, it is assumed that no additional diversions will be allowed from any stream without amending the interim IFS. Each existing declared diversion will be assigned to an aquifer system to estimate the amount of surface water that may be used in each aquifer system. The potential capability of irrigation systems to transfer surface water to adjacent aquifer systems will be noted.

Table 1-21 Inventory of Surface Water Resources

Unit Code	Unit Name	Area (sq. mi.)	Demand (MGD)[18]	No. of Diversions	No. of Gages	Active Gages	Interim IFS
2001	Awaʻawapuhi	1.29	0.000	0	0	0/0	HAR §13-169-45
2002	Honopū	1.74	0.000	0	0	0/0	HAR §13-169-45
2003	Nakeikionaiwi	0.49	0.000	0	0	0/0	HAR §13-169-45
2004	Kalalau	4.23	0.000	0	1	0/0	HAR §13-169-45
2005	Pōhakuao	0.58	0.000	0	0	0/0	HAR §13-169-45
2006	Waiolaʻa	0.36	0.000	0	0	0/0	HAR §13-169-45
2007	Hanakoa	2.01	0.000	0	1	0/0	HAR §13-169-45
2008	Waiahuakua	0.66	0.000	0	0	0/0	HAR §13-169-45
2009	Hoʻolulu	0.38	0.000	0	0	0/0	HAR §13-169-45
2010	Hanakāpīʻai	3.76	0.000	0	1	0/0	HAR §13-169-45
2011	Maunapuluo	0.45	0.000	0	0	0/0	HAR §13-169-45
2012	Limahuli	1.92	0.649	7	1	0/0	HAR §13-169-45. Amended to include SCAP KA-155 on Limahuli Stream for diversion of 0.115 MGD for landscape irrigation (07/19/1995).
2013	Mānoa	1.04	0.000	1	0	0/0	HAR §13-169-45
2014	Wainiha	23.71	0.000	29	3	1/0	HAR §13-169-45
2015	Lumahaʻi	14.44	0.000	0	1	0/0	HAR §13-169-45. Amended to include SDWP.3936.2 for diversion of 0.54 MGD
2016	Waikoko	0.69	0.000	0	0	0/0	HAR §13-169-45
2017	Waipā	2.52	0.000	2	0	0/0	HAR §13-169-45
2018	Waiʻoli	5.48	0.000	1	1	0/0	HAR §13-169-45
2019	Hanalei	23.96	0.026	10	3	1/0	HAR §13-169-45
2020	Waileia	0.82	0.000	0	0	0/0	HAR §13-169-45
2021	ʻAnini	3.20	0.092	4	0	0/0	HAR §13-169-45
2022	Kalihikai West	0.30	0.000	0	0	0/0	HAR §13-169-45

[18] 1989 Declared Surface Water Use

Table 1-21 Inventory of Surface Water Resources (Continued)

Unit Code	Unit Name	Area (sq. mi.)	Demand (MGD)	No. of Diversions	No. of Gages	Active Gages	Interim IFS
2023	Kalihikai Center	0.24	0.000	0	0	0/0	HAR §13-169-45
2024	Kalihikai East	0.49	0.000	0	0	0/0	HAR §13-169-45
2025	Kalihiwai	11.36	0.000	6	2	0/0	HAR §13-169-45. Amended to include SCAP KA-060 on Pake Stream for diversion of 0.028 MGD for aquaculture (10/18/1989).
2026	Puʻukumu	1.28	0.002	3		0/0	HAR §13-169-45
2027	Kauapea	1.05	0.000	0	0	0/0	HAR §13-169-45
2028	Kīlauea	12.87	0.000	9	3	1/0	HAR §13-169-45
2029	Kulihaili	1.10	0.000	0	0	0/0	HAR §13-169-45
2030	Pilaʻa	2.58	0.159	4	0	0/0	HAR §13-169-45
2031	Waipake	2.46	0.164	1	0	0/0	HAR §13-169-45
2032	Moloaʻa	3.67	0.001	7	0	0/0	HAR §13-169-45
2033	Pāpaʻa	4.41	0.013	5	0	0/0	HAR §13-169-45
2034	Aliomanu	1.64	0.000	0	0	0/0	HAR §13-169-45
2035	Anahola	13.86	0.001	6	3	0/0	HAR §13-169-45
2036	Kumukumu	1.21	0.000	0	0	0/0	HAR §13-169-45
2037	Kapaʻa	16.74	2.793	13	2	0/0	HAR §13-169-45
2038	Moikeha	2.26	0.053	1	0	0/0	HAR §13-169-45
2039	Waikaea	7.13	0.100	2	5	0/0	HAR §13-169-45. Amended to include SCAP KA-396 on Waikaea and Konohiki Streams for streams are impacted by a pumped well (07/12/2006).
2040	Wailua	53.34	7.564	30	7	3/1	HAR §13-169-45
2041	Kawailoa	3.94	0.000	0	0	0/0	HAR §13-169-45
2042	Hanamāʻulu	11.65	0.004	4	1	0/0	HAR §13-169-45
2043	Līhuʻe Airport	1.83	0.000	0	0	0/0	HAR §13-169-45
2044	Nāwiliwili	6.40	0.004	3	0	0/0	HAR §13-169-45
2045	Pūʻali	2.05	1.637	6	0	0/0	HAR §13-169-45
2046	Huleia	28.32	5.228	26	5	0/0	HAR §13-169-45
2047	Kipu Kai	3.04	0.018	1	0	0/0	HAR §13-169-45
2048	Mahaulepu	13.43	0.000	6	0	0/0	HAR §13-169-45
2049	Waikomo	9.12	1.000	11	0	0/0	HAR §13-169-45
2050	Aepo	2.58	0.000	5	0	0/0	HAR §13-169-45
2051	Lāwaʻi	9.73	1.739	11	2	0/0	HAR §13-169-45
2052	Kalāheo	6.56	0.000	9	0	0/0	HAR §13-169-45
2053	Wahiawa	7.34	7.175	1	0	0/0	HAR §13-169-45
2054	Hanapēpē	27.09	19.820	9	4	1/0	HAR §13-169-45
2055	Kukamahu	3.21	0.000	0	0	0/0	HAR §13-169-45
2056	Kaumakani	3.09	0.000	0	0	0/0	HAR §13-169-45
2057	Mahinauli	8.78	0.000	1	0	0/0	HAR §13-169-45
2058	Aʻakukui	5.27	0.216	3	0	0/0	HAR §13-169-45
2059	Waipao	9.26	0.000	1	0	0/0	HAR §13-169-45

Table 1-21 Inventory of Surface Water Resources (Continued)

Unit Code	Unit Name	Area (sq. mi.)	Demand (MGD)	No. of Diversions	No. of Gages	Active Gages	Interim IFS
2060	Waimea	86.50	17.693	46	15	3/0	Natural flow on Kōkeʻe Stream; 0.7 MGD on Kauaʻikinana Stream below Kōkeʻe Ditch; 4.9 MGD on Kawaikōī Stream below Kōkeʻe Ditch; 1.4 MGD on Waiakoali Stream below Kōkeʻe Ditch; 2.0 MGD on Koaiʻe Stream below Kekaha Ditch; 8.0 MGD on Waimea River below Kekaha Ditch (Waiahulu diversion); 25 MGD at USGS gaging station 16031000 on Waimea River with a minimum flow of 6.0 MGD in the Kekaha Ditch (04/18/2017).
2061	Kapilimao	6.44	32.847	1	0	0/0	HAR §13-169-45
2062	Paua	5.10	0.000	0	0	0/0	HAR §13-169-45
2063	Hōʻea	16.64	0.000	1	0	0/0	HAR §13-169-45
2064	Niu	2.82	0.000	0	0	0/0	HAR §13-169-45
2065	Kaʻawaloa	7.50	0.000	0	0	0/0	HAR §13-169-45
2066	Nahomalu	17.63	0.000	1	1	0/0	HAR §13-169-45
2067	Kaʻulaʻula	2.55	0.000	0	0	0/0	HAR §13-169-45
2068	Hāʻeleʻele	2.45	0.000	0	0	0/0	HAR §13-169-45
2069	Hikimoe	2.20	0.000	0	0	0/0	HAR §13-169-45
2070	Kāʻaweiki	2.15	0.000	0	0	0/0	HAR §13-169-45
2071	Kauhao	3.98	19.010	1	0	0/0	HAR §13-169-45
2072	Mākaha	2.80	0.000	0	0	0/0	HAR §13-169-45
2073	Miloliʻi	4.34	0.000	1	0	0/0	HAR §13-169-45
2074	Nuʻalolo	2.83	0.000	0	0	0/0	HAR §13-169-45

Reference: Water Resource Protection Plan 2019 Update, Appendix F Table F-21 and Appendix N

1.5.4 Rain Water Catchment

Private and municipal water systems primarily service the more heavily populated areas of the island, typically along the perimeter of the island. Developed properties located in more isolated areas, outside of identified water service areas, may rely on catchment systems as a source of water. **Figure 1-19** shows areas serviced by water systems and areas possibly served by rainwater catchment. These possible catchment areas are parcels that have building value greater than $20,000 but do not appear to be serviced by a water system or private well.

Rainwater is typically a pure and free source of water, and is dependent upon the prevailing climate. Rainwater catchment systems are set up to collect the rainwater that falls on rooftops or other surfaces before it reaches the ground. This water is stored in water tight vessel for later use onsite. Depending on the intended use of the collected rainwater, particularly if it is intended for domestic/potable uses, the catchment system may also include further water treatment components.

The State Department of Health (DOH) does not regulate rainwater catchment systems on individual homes. To provide greater assurances with regard to keeping these systems safe for consumption, the DOH, Safe Drinking Water Branch website[19] lists some considerations for rainwater catchment systems. A University of Hawai'i, College of Tropical Agriculture publication, "Guidelines on Rainwater Catchment Systems in Hawai'i"[20], provides additional suggestions for the development of rainwater catchment systems.

1.5.5 Recycled Water

Recycled water is wastewater that has been treated and can be used for other useful purposes. Most commonly, recycled water is used as a source of non-potable water such as for irrigation. Used for these purposes, recycled water helps to decrease demands on valuable potable water resources and to reuse water that might otherwise be disposed.

The County of Kaua'i, Department of Public Works operates four municipal wastewater treatment plants (WWTPs) on the island. These municipal wastewater systems collect, treat, and dispose wastewater from the more densely populated areas of the island. Three of the facilities produce recycled water from the wastewater. **Table 1-22** summarizes the County's WWTPs, along with their associated treatment capacities, current reuse amounts, and a short description of where the recycled water is used.

[19] http://health.hawaii.gov/sdwb/raincatchment/

[20] Macomber, Patricia S.H., 2010. Guidelines on Rainwater Catchment Systems for Hawai'i. University of Hawai'i at Mānoa, College of Tropical Agriculture and Human Resources, CTAHR Resource Management publication no. RM-12 ISBN 1-929325-23-1.

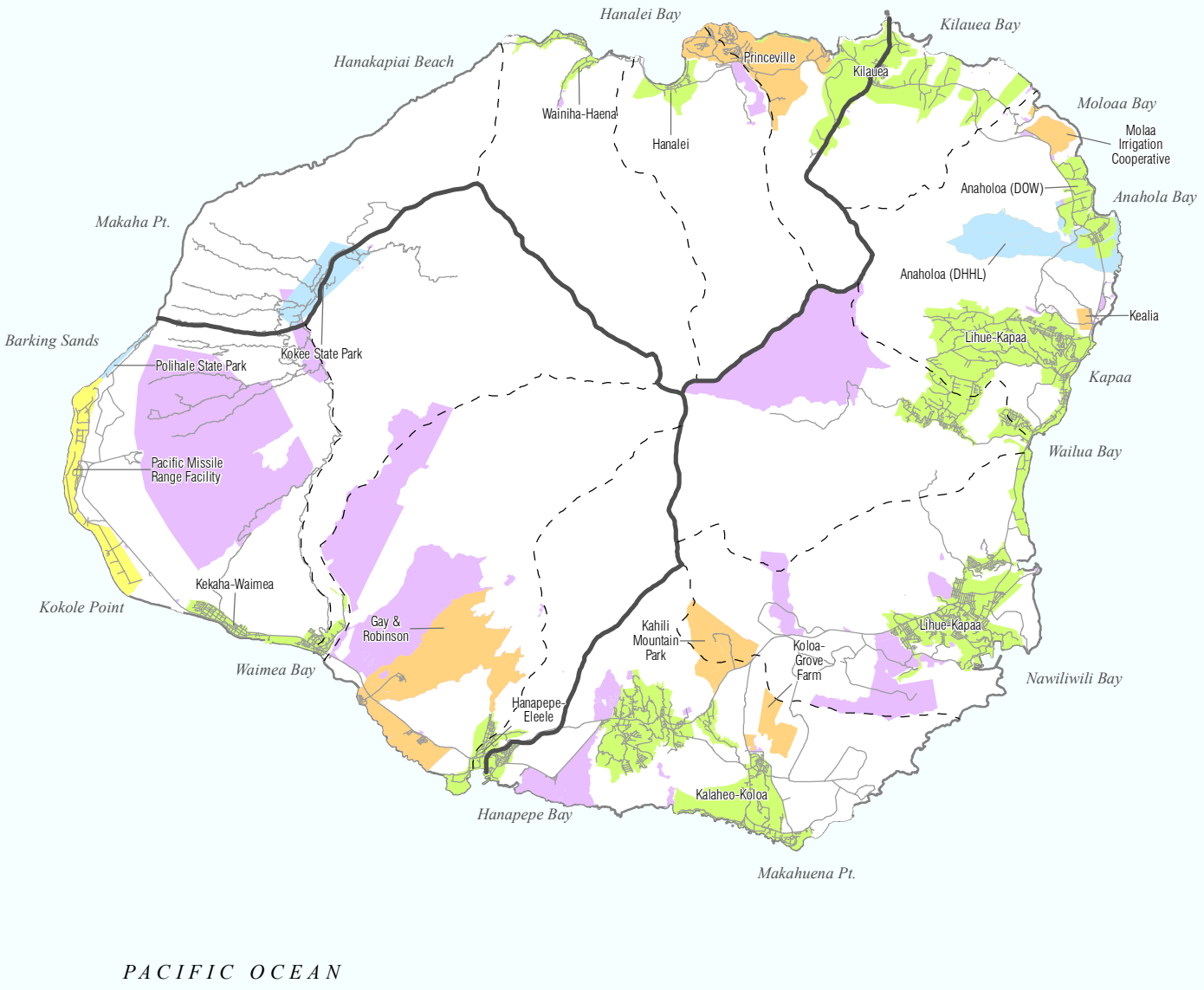
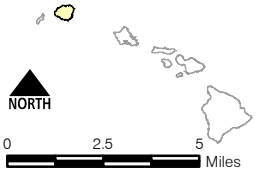


FIGURE 1-19

INDEX MAP - Island of Kaua'i



LEGEND:

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

PUBLIC AND PRIVATE WATER SYSTEMS MAP

Table 1-22 County of Kaua'i WWTPs

Facility	Aquifer Code	Recycled Water Classification	Design Capacity (MGD)	Quantity Produced (MGD)	Current Reuse (MGD)	Irrigation Application
'Ele'ele WWTP	20101	N/A (Secondary)[21]	0.8	N/A	0	N/A
Līhu'e Wastewater Reclamation Facility (WWRF)	20102	R-1[22]	2.5	1.2	0.79	Kaua'i Lagoons Resort – golf course irrigation; Roadway irrigation – landscape irrigation
Wailua WWTP	20102	R-2[23]	1.5	0.5	0.19	Wailua Golf Course – golf course irrigation; Lydgate Park – athletic field irrigation
Waimea WWTP	20301	R-1	0.7	0.3	0.18	Kikiaola Land Company – agriculture irrigation

References:
1) State of Hawai'i, Department of Health, Wastewater Branch.
2) The Limtiaco Consulting Group, July 2013. 2013 Update of the Hawai'i Water Reuse Survey and Report. Prepared for the Department of Land and Natural Resources, Commission on Water Resource Management.

There are also four privately owned WWTPs on the island that produce recycled water. **Table 1-23** summarizes these facilities, along with their associated treatment capacities, current reuse amounts, and a short description of where the recycled water is used.

[21] Secondary: Secondary treatment
[22] R-1: Recycled water that has been oxidized, filtered and disinfected. R-1 is considered the highest grade of recycled water.
[23] R-2: Recycled water that has been oxidized and disinfected.

Table 1-23 Privately Owned Wastewater Treatment Facilities Producing Recycled Water

Facility	Aquifer Code	Recycled Water Classification	Design Capacity (MGD)	Quantity Produced (MGD)	Current Reuse (MGD)	Irrigation Application
Poʻipū Water Reclamation Facility (WRF)	20101	R-1	1.0	N/R	0.30	Kiahuna Golf Club – golf course irrigation; Kōloa Landing – landscape irrigation
Grand Hyatt WWRF	20101	R-2	0.25	N/R	0.11	Poʻipū Bay Resort Golf Course – golf course irrigation
Līhuʻe-Puhi WWTP	20102	R-1	1.0	0.4	0.37	Puakea Golf Course – golf course irrigation; Costco, Kukui Market Place, and Pikake Circle – landscape irrigation
Princeville WWRF	20202	R-2	1.0	0.6	0.53	Princeville Makai Golf Course – golf course irrigation

N/R: Not reported

References: Ibid.

See **Figure 1-20** for the location of wastewater treatment facilities that produce recycled water.

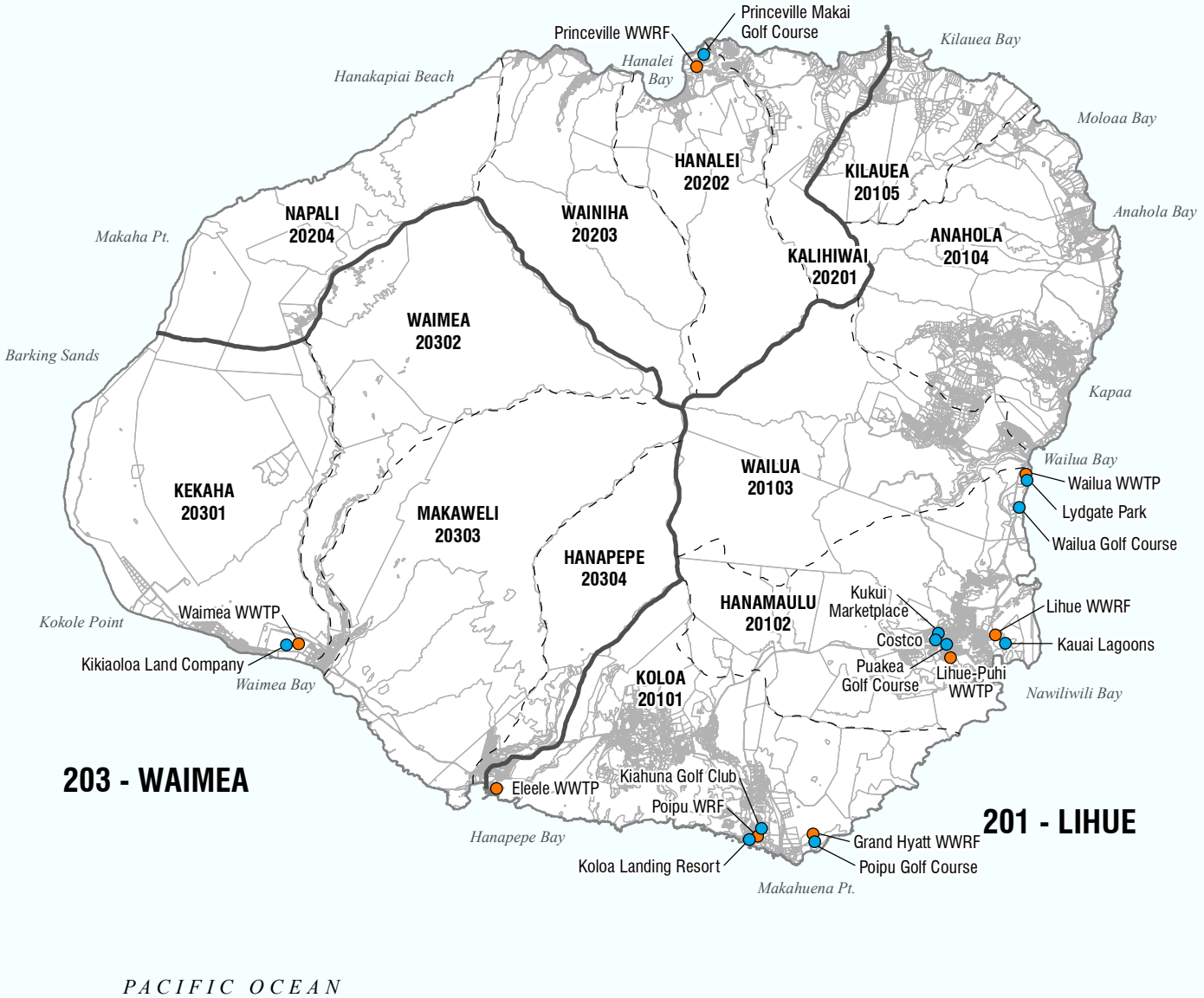
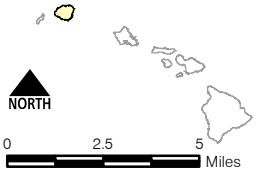


FIGURE 1-20

INDEX MAP - Island of Kaua'i



LEGEND:

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

WASTEWATER RECLAMATION FACILITIES

1.5.6 Storm Water Reuse

Storm water reclamation and reuse is a relatively new concept and is a resource that is currently underutilized. Storm water reuse has the potential to be used as a source of non-potable water (e.g., irrigation), to be integrated with recycled water, or even to serve as potable and/or non-potable ground water recharge. Depending on the quality of the storm water and its intended use, required treatment may vary from screening to disinfection. The higher the level of treatment, the more expensive it will cost to reuse storm water. See **Table 1-24** for the required treatment based on storm water end use.

Table 1-24 Storm Water Reuse Treatment

End Use	Treatment						Comments
	Screening	Grit Removal	Sedimentation	Chemical Addition	Filtration	Disinfection	
Ground water Recharge							
Injection Well (Potable)	Y	Y	Y	Y	Y	Y	
Injection Well (Non-Potable)	Y	Y	Y	*	N	N	
Recharge Trench	Y	Y	Y	N	N	N	
Spreading Basin	Y	N	N	N	N	N	O&M required to ensure infiltration
Excavated Pond	Y	N	N	N	N	N	Series operation
Industrial Reuse	Y	Y	Y	Y	Y	N	
Direct Irrigation							
Contact w/ edible portion of crop	Y	Y	Y	Y	Y	Y	Not specific to stormwater; based on Hawai'i's recycled water guidelines
No contact w/ edible portion of crop	Y	Y	*	N	N	N	
Human contact	Y	Y	Y	Y	Y	Y	

* Depends on the quality of storm water

Reference: An Appraisal of the Statewide Framework for Stormwater Reclamation and Reuse in Hawai'i, Element 3, Table 4

The U.S. Department of the Interior, Bureau of Reclamation published an Appraisal of Stormwater Reclamation and Reuse Opportunities in Hawai'i in 2008 that identified two areas on the island of Kaua'i that has the opportunity to use storm water reclamation and reuse. Both areas are within the Hanamā'ulu ASYA and are discussed further in **Section 20102-5.2.1**:

1) Nāwiliwili Diversion
2) Līhu'e Airport

The County of Kaua'i does not operate a storm water utility that could be used to fund storm water infrastructure development for the purposes of storm water reclamation and reuse. The City and

County of Honolulu is in the process of developing a storm water utility which could serve as a model should the County of Kaua'i choose to pursue storm water reuse as an alternative water source.

1.5.7 Water Conservation

Within the State of Hawai'i, due to our isolated location, access to fresh water supplies is a very limited and is a very valuable resource. To effectively utilize the state's fresh water resources, establishment of and adherence to an effective water conservation program is needed. Although water conservation (in itself) does not increase the supply of water, conservation practices make more of the supply available for needed uses by decreasing waste of available resources. Incorporating conservation measures into planning for future water system improvements helps to ensure the long-term viability of Hawai'i's water resources.

The State Water Code (HRS Chapter 174C, §174-C-5: General powers and duties) mandates that the CWRM shall:

> "plan and coordinate programs for the development, conservation, protection, control, and regulation of water resources, based upon the best available information, and in cooperation with federal agencies, other state agencies, county or other local governmental organizations, and other public and private agencies created for the utilization and conservation of water."

Ongoing CWRM water conservation plans and programs are summarized in **Table 1-25**. Additional detailed information for each of these programs/plans can be found at the respective links provided in **Table 1-25**.

Table 1-25 CWRM Water Conservation Plans and Programs

Program/Report	Purpose
Hawai'i Water Conservation Plan (February 2013) http://files.Hawai'i .gov/dlnr/cwrm/planning/hwcp2013.pdf	Provide coordination and collaboration between various State and County water conservation programs
Prototype Water Conservation Plan for the Department of Land and Natural Resources (February 2005) http://files.Hawai'i .gov/dlnr/cwrm/planning/pwcp2005.pdf	Provide a framework for water conservation plans for all State agencies, and conservation program options and strategies for water purveyors throughout Hawai'i.
Conservation Manual for State of Hawai'i Facilities (May 2007) http://files.Hawai'i .gov/dlnr/cwrm/planning/wcmshf2007.pdf	Facilitate State agency implementation of water conservation programs.
Water Loss Audit Program[24] (2016)	Establishes a water loss audit program for public water systems, including technical assistance. Annual validated audits are required by affected systems.
Water Security Grant Program (2016) https://dlnr.hawaii.gov/wp-content/uploads/2017/10/CW18-Water-Security-Grant-Rpt-FY17.pdf	Created in response to Act 172, SLH 2016. Establishes a two-year pilot program to enable public-private partnerships that increase water security.

Reference: Water Resource Protection Plan 2019 Update (Public Review Draft October 2018).

Of these programs/plans, the water audit helps a utility understand how much water is lost from a distribution system through the detailed analysis of data. The DOW and other large capacity water systems are participating in the on-going Water Audit program and has submitted necessary information to CWRM to fulfill the requirements of the Water Audit program. Smaller water systems that do not serve a population of 1,000 or more or are not in a water management area do not meet the requirements to participate in the water loss audit program.

On a County level, water conservation practices typically include improving the efficiency of water delivery and identifying losses in the system. This includes reducing system leaks and losses, adopting universal metering, development and support of consumer water conservation and public education programs, influencing consumer water demand through adjusting water rates, and as a last resort during severe shortages, water rationing (as provided by county rules and ordinances).

Ongoing on-island conservation related programs/promotions are summarized in the following subsections.

[24] 2016 Hawai'i Legislature, Act 169: Requires the CWRM to establish a water audit program and to provide technical assistance and training to affected public water systems.

1.5.7.1 Kaua'i DOW Supply-Side Conservation Programs

• 100% Customer Metering	Currently all customer accounts are metered, including temporary fire hydrant meter and temporary construction meter accounts. Separate landscape meter services are available from the Kaua'i DOW depending on the availability of adequate water supply.
• Meter Replacement, Repair, and Defective Meter Programs	All water supplied by the DOW is measured by suitable water metering devices. DOW maintains a water-meter-shop test and repair program. According to standard operating procedures, testing of all 5/8-inch displacement water meters that were not tested within 10 years is required. Removed meters should be replaced with new or re-built meters. Large meters (compound, propeller, torrent, turbine, and crest meters,) should be tested every two years. Potential defective meters are reported by the Billing Section of the Fiscal Division for replacement or repair by the Operations Division.
• Non-revenue Water Analysis Report	The non-revenue water estimates are valuable in deciding whether a leak detection program is justified. The report is designed to monitor source/supply production and customer consumption on a bi-monthly basis. The difference between metered source production and metered sales to consumers is the non-revenue water that is pumped into the system but not sold. Non-revenue water includes line flushing, reservoir cleaning, firefighting, sewer flushing and street cleaning, and it's also a result of leaks, unauthorized water use, and inaccurate metering. The Fiscal Division monitors the report and informs the Operations Division if non-metered water is excessive.
• Leak Detection Program	The Kaua'i DOW conducts case-by-case leak detection investigations and repair for suspected section of leaking pipeline. The Kaua'i DOW is evaluating the purchase of leak detection equipment and/or use of contracted leak detection services to expand its program.
• Storage Tank Reservoir Overflow Alarm and Automatic Level Controls	The DOW maintains and operates tank overflow alarms and automatic valves to prevent system losses to unnecessary overflows.

1.5.7.2 Kaua'i DOW Demand-Side Conservation Programs

- Plumbing Code Regulation

  In July 1993, the County of Kaua'i amended the County Plumbing Code to require the installation of water saving fixtures for new construction. The plumbing code also requires installation of pressure reduction valves in order to maintain a maximum 80-pound per square inch building service pressure. Since then, the County of Kaua'i has adopted the Uniform Plumbing Code, 2012 Edition.

- Voluntary Emergency Water Shortage Notice

  The Kaua'i DOW requests voluntary water conservation during dry periods and emergency water outages. High consumption during dry summers has resulted in distribution of water shortage notices for affected areas. Water customers are asked to voluntarily reduce consumption by 10-25% in systems that are unable to meet higher peak demands. During emergencies (i.e., pump failure, pipeline breaks, storm damage, etc.) water conservation notices are issued to customers.

- Public Outreach/Education Program

  Kaua'i DOW's existing and future water conservation programs involves targeting both adults and children through printed brochures, advertisements, public service announcements, presentations, workshops, the Kaua'i DOW website, and other media. Every year, the Kaua'i DOW coordinates an island-wide water education festival for fifth grade students called, Make a Splash with Project WET (Water Education for Teachers). Project WET is an international-interdisciplinary-environmental education program. This festival brings together parents, students, teachers, government resource agencies and enthusiasts of all kinds for a common goal: to educate and promote awareness of water resources in a fun and interactive environment. Learning stations and exhibits are set up and led entirely by volunteer Kaua'i DOW employees, educators and community members.

1.5.7.3 Kaua'i DOW Conservation Promotions

- Low Flow Shower Head Distribution
- Low Flow Kitchen Aerator Distribution
- Shower Timer Distribution
- Leak Detection Tablet Distribution
- Public Education – Presentations; Community Events; Publications and Brochures
- Water conservation brochure "35 Tips to Save Water"
- Free low-flow water fixture forms
- Tips for conserving water around the house and outdoors
- Leak detection and instructions on fixing a leaky faucet
- Kids page with educational activities
- Public education programs for schools, clubs, and organizations

1.5.8 Watershed Protection

Watershed management is a critical source protection measure that enhance aquifer recharge and protect the native Hawaiian plants, which act as a "sponge" to capture and absorb rain and fog drip to replenish the aquifers and streams. There are three major groups that are dedicated to protecting Kauai's watersheds: 1) DLNR – Division of Forestry and Wildlife, 2) Kauaʻi Watershed Alliance, and 3) Kauaʻi Invasive Species Committee.

1.5.8.1 DLNR – Division of Forestry and Wildlife Watershed Partnerships Program

The Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) is the lead State agency responsible to protect 30% of Hawaiʻi's priority watershed forests by 2030. DOFAW has a Watershed Partnerships Program that was established to coordinate watershed protection efforts across private and public land ownership boundaries within the State of Hawai'i. There are currently 11 Watershed Partnerships across five of the main Hawaiian Islands with over 70 private and public landowners and partners covering over 2 million acres of land. Kauaʻi's Watershed Partnership is the Kauaʻi Watershed Alliance, which is described in more detail in **Section 1.5.8.2**.

Work to protect the watershed includes invasive plant and ungulate removal and control, restoration, and installation of ungulate-proof fences.

1.5.8.2 Kauaʻi Watershed Alliance

The Kauaʻi Watershed Alliance (KWA) was formed in 2003 for the long-term protection of Kauaʻi's uppermost watershed areas. The KWA consists of 11 partners and include the following members:

- County of Kauaʻi, Department of Water
- State of Hawaiʻi, Department of Land and Natural Resources, Division of Forestry and Wildlife
- State of Hawaiʻi, Department of Land and Natural Resources, Division of State Parks
- State of Hawaiʻi, Department of Land and Natural Resources, Land Management Division
- Kamehameha Schools
- McBryde Sugar Company, Ltd.
- Grove Farm Company, Inc.
- Līhuʻe Land Company
- Kealia Ranch, LLC
- B.A. Dyer
- Princeville Development, LLC

The DOW supports the KWA by providing a grant to help fund natural resource management activities, which includes construction of ungulate barriers, removal of non-native invasive weeds and ungulates, surveying and monitoring forest conditions, and developing plans and technology to increase the impact of management efforts.

During Fiscal Year 2017, the KWA achieved the following: field staff reduced the population of pigs in the fenced headwaters of the Wainiha valley to a single known individual; intensive ungulate control work began in the newly-completed Halehaha management unit of the ʻAlakai Plateau; the second pass of aerial Australian tree fern control was completed in Wainiha Valley; Resource Mapping Hawaiʻi completed collection and delivered the analysis of high-resolution imagery of Lumahaʻi Valley following the first pass; and staff finished scouting and flagging the proposed KWA fencelines in Lumahaʻi Valley and scouted the back "bowl" area of the valley.

1.5.8.3 Kauaʻi Invasive Species Committee

The Kauaʻi Invasive Species Committee (KISC) was formed in 2001 and is a project of the Pacific Cooperative Studies Unit at the University of Hawaiʻi. KISC is a voluntary partnership of government, private, and non-profit organizations, and individuals, working to prevent high-risk invasive species from becoming established and widespread on Kauaʻi. KISC's mission is to prevent, control, or eliminate the most threatening invasive species in order to preserve Kauaʻi's native biodiversity and minimize adverse ecological, agricultural, economic, and cultural impacts.

KISC's intended role is to supplement existing programs: to fill the gaps between the island's natural resource management entities, and to complement work by Federal, State, County, and private organizations. Invasive plants, animals, insects, and pathogens are able to spread across Kauaʻi's landowner boundaries and overlap jurisdictions. KISC is uniquely positioned to address this with species-driven management strategies.

The KISC consists of 6 members:

- State of Hawaiʻi, Department of Land and Natural Resources, DOFAW
- University of Hawai'i College of Tropical Agriculture and Human Resources
- Hawaiʻi Invasive Species Council
- National Tropical Botanical Garden
- The Nature Conservancy Hawai'i
- Kauai Invasive Species Committee Staff

KISC prioritizes species that are recognized as having the greatest potential to impact Kauaʻi's watershed and ecosystem functions. High-risk invasive species, if left unchecked, have the potential to alter ecosystem functions and lead to increased soil erosion, increased runoff, decreased aquifer recharge, and modified stream and river hydrology. KISC works across the island's mid and lowland watershed areas on both private and public land to detect new invasive species early and control target species before they make lasting impacts to Kauaʻi's watersheds.

In 2022, the KISC surveyed 7,545 acres to detect invasive species. 1,881 individual targets were removed and 14 high-risk species were controlled including but not limited to: 521 immature and 8 mature miconia plants; 168 immature long thorn kiawe plants; 974 immature and 17 mature ivy gourd plants; 63 mature false kava plants, and 58 mature Arundo plants. In addition, 16 coqui frogs were captured from 6 locations and 195 acres were surveyed for little fire ants infestation, of which 54 acres were treated.

1.6 EXISTING WATER USE

CWRM classifies water use information based on six categories as listed in **Table 1-26** taken from the WRPP. Water use in this update report is categorized in accordance with this list and definitions to the extent possible.

Table 1-26 CWRM Water Use Categories

Well Operator	Category	Sub-Category
Individual Operator	Agriculture	• Aquatic plants and animals • Crop irrigation and processing • Livestock water, pasture irrigation, and processing • Ornamental and nursery plants • Taro • Other agricultural applications
	Domestic Residential Domestic, includes potable and non-potable water needs	• Single- and multi-family households, including non-commercial gardening
	Non-residential Domestic, includes potable (and non-potable) water needs	• Commercial businesses • Office buildings • Hospitals • Religious Institutes • Hotels • Schools • Other
	Industrial	• Fire protection • Mining, dust control • Geothermal, thermoelectric cooling, power development, hydroelectric power • Other industrial applications
	Irrigation	• Golf course • Hotel • Landscape and water features • Parks • Schools • Habitat maintenance • Other
Agency Operator	Military*	All military use
	Municipal*	• State • County • Private

* May also include agriculture, domestic, industrial, and irrigation uses

Estimated average water use is based on the best available information and is summarized in **Table 1-27**. DOW water meter data was obtained for the year of 2014. Well pumpage from CWRM for the same time period was also obtained. Sanitary surveys for public water systems were obtained from DOH, and public water systems were queried. Estimated recycled water use was also provided by DOH.

Table 1-27 Existing Water Use by Category

ASYA	Domestic (mgd)	Industrial (mgd)	Irrigation (mgd)	Agriculture (mgd)	Military (mgd)	Municipal (mgd)
20101 Kōloa	0.00	0.00	0.41	0.09	0.00	3.37
20102 Hanamā'ulu	0.00	0.003	1.59	0.00	0.00	2.83
20103 Wailua	0.00	0.00	0.00	0.00	0.00	0.98
20104 Anahola	0.01	0.00	0.00	0.14	0.00	2.18
20105 Kīlauea	0.00	0.00	0.03	0.03	0.00	0.78
20201 Kalihiwai	0.00	0.00	0.00	0.00	0.00	1.07
20202 Hanalei	0.00	0.00	0.53	0.00	0.00	0.46
20203 Wainiha	0.00	0.00	0.00	0.00	0.00	0.15
20204 Nāpali	0.00	0.00	0.00	0.00	0.00	0.00
20301 Kekaha	0.00	0.00	0.18	0.03	0.22	1.18
20302 Waimea	0.00	0.00	0.00	0.00	0.00	0.04
20303 Makaweli	0.00	0.00	0.00	0.00	0.00	1.51
20304 Hanapēpē	0.00	0.00	0.00	0.00	0.00	0.51
TOTAL	0.01	0.003	2.74	0.29	0.22	15.06

1.6.1 Domestic Use

Domestic use includes residential and non-residential water use for potable and non-potable needs. Existing water use for this category is based on well pumpage reported to CWRM. There are 117 wells on Kaua'i classified as "domestic" in the CWRM database.

1.6.2 Industrial Use

Industrial use can include fire protection, mining, dust control, geothermal, thermoelectric cooling, power development, and hydroelectric power. Existing water use for this category is based on well pumpage reported to CWRM. There are 8 wells on Kaua'i classified as "industrial" in the CWRM database.

1.6.3 Irrigation Use

Irrigation use consists of non-potable water demands including irrigation for golf courses, hotels, landscape and water features, parks, schools, and habitat maintenance. Irrigation demands can be met by ground water, recycled water, or surface water. There are 29 wells on Kaua'i classified as "irrigation" in the CWRM database. As noted in **Section 1.5.5**, there are 7 wastewater treatment plants that produce recycled water that is used for irrigation. Information on surface water 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.

1.6.4 Agricultural Use

Agricultural use includes water use for aquatic plants and animals, crop irrigation and processing, livestock and pasture, ornamental/nursery plants, taro, and other agricultural applications. This does not include demand met by rainfall. Agriculture demands can also be met by ground water, recycled water, or surface water. There are 50 wells on Kauaʻi classified as "agriculture" in the CWRM database. The Waimea wastewater reclamation facility (WWRF) in Kekaha is currently the only WWRF on Kauaʻi that produces recycled water that is used for agriculture use.

Currently, agricultural water use is extremely difficult to determine due to the absence of comprehensive, island-wide data. Defining existing agricultural water demands is an objective of the AWUDP, which is a major effort. It is anticipated that additional information on agriculture use will be provided in future AWUDP updates.

1.6.5 Military Use

There is one potable water system serving military use on the island. The Pacific Missile Range Facility is served by Public Water System 430. Three wells are classified as "military" in the CWRM database. One of these wells, Mana Shaft, is the main water source for the water system. The system can also receive water from the DOW Kekaha-Waimea water system.

1.6.6 Municipal Use

Municipal use includes use served by County, State, Federal, or private-public water systems. The Department of Health (DOH) regulates public water systems. A public water system is defined as "a system which provides water for human consumption, through pipes or other constructed conveyances if the system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least sixty days out of the year." **Table 1-28** lists the Kauaʻi public water systems, owners, number of service connections, and population served. The information was obtained from the DOH sanitary surveys. Refer to **Figure 1-19**, shown previously, for the general service area of the public water systems.

Table 1-28 Kauaʻi Public Water Systems

PWS No.	Name	Owner	No. of Connections	Population Served
400	Līhuʻe-Kapaʻa	DOW	9,560	31,337
401	Anahola	DOW	620	2,174
402	ʻAnini	DOW	61	109
403	Hanalei	DOW	349	988
404	Hanapēpē-ʻEleʻele	DOW	1,710	4,430
406	Kekaha-Waimea	DOW	1,880	5,135
407	Kīlauea	DOW	1,468	3,758
415	Hāʻena-Wainiha	DOW	357	1180
417	Gay & Robinson	Gay & Robinson	325	999
421	Kōloa	Knudsen Trust	19	40
422	Kāhili Mountain Park	Knudsen Trust	38	150
423	Keālia	Keālia Water Co. Holdings, LLC	69	260
425	Kōkeʻe State Park	DLNR	93	2,000
426	Polihale State Park	DLNR	1	300
428	Princeville	Princeville Utilities, Co., Inc.	1,029	1,698
430	Pacific Missile Range Facility	U.S. Dept. of Navy	185	1,200
432	Anahola Farm Lots	DHHL	77	385
434	Kalāheo-Kōloa	DOW	4,799	15,108
436	Moloaʻa	DLNR	3	29
437	Moloaʻa Irrigation Cooperative	Moloaʻa Irrigation Cooperative	57	47

1.6.6.1 County Water Systems

The DOW owns and operates 9 water systems on the island and services approximately 21,000 customers. DOW meter data provides the most detailed water use. In 2014, DOW water systems delivered an average of 10.5 mgd based on meter data. Descriptions of the individual water systems are covered in the pertinent aquifer system chapters of this KWUDP.

Ground water is the primary water source for the DOW systems. There are 57 wells classified as DOW wells in the CWRM database. Additionally, the Līhuʻe-Kapaʻa water system is also supplied by surface water from the Kapaia Reservoir.

1.6.6.2 State Water Systems

The State owns four public water systems on Kauaʻi: Kōkeʻe State Park Water System, Polihale State Park Water System, Anahola Farm Lots Water System, and Moloaʻa Water System. The Kōkeʻe State Park Water System and Polihale State Park Water System are located on the west side of the island and are owned by the Department of Land and Natural Resources (DLNR). The Moloaʻa

Water System is located in the Anahola ASYA and is also owned by DLNR. The Anahola Farm Lots Water System is located in Anahola and owned by the Department of Hawaiian Home Lands (DHHL). Descriptions of the water systems are covered in the pertinent aquifer system chapters of this KWUDP.

1.6.6.3 Federal Water Systems

The federal government owns one water system on Kauaʻi – the Pacific Missile Range Facility (PMRF) Water System, which is located in the Kekaha ASYA and owned by the United States Department of the Navy.

1.6.6.4 Private-Public Systems

There are six privately-owned public water systems on Kauaʻi: Gay & Robinson Water System, Kahili Mountain Park Water System, Kōloa-Grove Farm Water System, Keālia Water System, Moloaʻa Irrigation Cooperative Water System, and Princeville Water System. Descriptions of the water systems are covered in the pertinent ASYA chapter of this KWUDP.

1.6.7 Water Use by Resource

Existing water resources include ground water, surface water, water conservation, rainwater catchment, and recycled water. This KWUDP update also organizes available water consumption data by type of resource.

1.6.7.1 Ground Water

The CWRM has data on well pumpage as provided by well owners. However, as of 2016, water use is reported for only 139 wells, equaling a compliance rate of approximately 48%. The DOW reports pumpage for all of its production wells. Better reporting is needed for non-municipal wells.

The Code requires owners and operators of wells and stream diversion works to measure their water use and submit regular monthly reports. Initially, the monthly water use reporting requirement was difficult to implement and enforce. CWRM focused its efforts on water use monitoring and reporting for large ground water uses and drinking-water wells, and a list of priorities and exemptions, including exemptions for small users, was approved in 1992. In 2014, CWRM unanimously approved rescinding the 1992 priorities and exemptions and replacing it with the following:

> "The following exemptions from the requirement to measure and report monthly water use for the activities listed below are allowed, UNLESS the Commission determines a specific need for this data to resolve disputes, establish instream flow standards, or quantify the amount of water use for a water use permit in a water management, or for similar needs.
>
> 1. Passive agricultural consumption (e.g., when crops are planted in or adjacent to natural springs and natural wetland areas);
>
>   - Livestock drinking from dug wells or stream channels;

- In non-surface water management areas, individual end uses on multi-user ditch systems where IFS or water use permits are not an issue;

- Salt-water wells may continue to report monthly estimates of pumpage and monthly actual measured water-levels and salinity on an annual basis.

2. Affirmatively require that unused and observation wells report monthly water-levels and salinity as determined by staff."

CWRM is currently focused on obtaining pumpage reports from all users in designated water management areas and from large users in non-designated areas. Subsequently, CWRM will pursue statewide reporting of pumpage, water-level, and chloride (or conductivity) data from all water use reporters. In the effort to manage all its water resource information more efficiently and effectively, CWRM launched its Water Resource Information Management System (WRIMS) in 2012. This online water use reporting database allows water users to file their reports online and monitor their historical use via the internet.

Table 1-29 summarizes current production, sustainable yield (SY), and percentage of SY for the current production. Current production is represented by the 2014 pumpage reported to CWRM.

Table 1-29 Well Production and Sustainable Yield

ASYA	ASYA Code	Pumpage (mgd)	SY (mgd)	Pumpage Portion of SY (%)
Kōloa	20101	3.47	29	12.0
Hanamā'ulu	20102	1.27	27	4.7
Wailua	20103	0.26	51	0.5
Anahola	20104	2.34	21	11.1
Kīlauea	20105	0.84	10	8.4
Kalihiwai	20201	1.07	16	6.7
Hanalei	20202	0.46	35	1.3
Wainiha	20203	0.15	24	0.6
Nāpali	20204	0	20	0
Kekaha	20301	1.43	10	14.3
Waimea	20302	0.04	37	0.1
Makaweli	20303	1.52	26	5.8
Hanapēpē	20304	0.51	22	2.3
Kaua'i	**Total**	**17.76**	**328**	**5.4%**

1.6.7.2 Surface Water

As noted above, owners and operators of stream diversion works are required to measure their water use and submit monthly reports. Unfortunately, CWRM's focused effort on ground water resources has resulted in a lack of historical surface water data. Additionally, the lack of guidelines for surface water monitoring and the wide range of methods for diverting water has made it difficult to regulate the amount of water diverted via registered and permitted stream diversion works. To date, few users report surface water use to CWRM. However, these users represent many of the large irrigation systems which use the majority of surface water statewide, and CWRM is making progress on verifying and updating information and increasing water use reporting.

1.6.7.3 Water Conservation

Water conservation, including water loss management, may reduce water use. See **Section 1.5.7** for existing conservation efforts.

1.6.7.4 Rainwater Catchment

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

1.6.7.5 Recycled Water

Recycled water information was obtained from the Department of Health (DOH), Wastewater Branch, as previously listed in **Table 1-22** and **Table 1-23.** Approximately 2.5 mgd of recycled water is used on the island, primarily for irrigation of golf courses, landscaping, and agriculture.