CHAPTER 3
DESCRIPTION OF WATER SYSTEMS

DOW HISTORY

The County of Kauai water systems were initially developed in the 1920s with the construction of storage, transmission, and distribution systems serving individual communities. These water systems, several of which were initially developed by sugar plantations, eventually were organized as County-run systems under the old territorial government. By the late 1930s, nine of the thirteen water systems were providing service to the island's population. The water system continued to expand through the 1940s and 50s. The Board of Water Supply was established in 1961 and the Department of Water became a semi-autonomous agency of the County of Kauai.

In the late 1960s, following two decades of population decreases, Kauai began to experience steady population and economic growth that continued until Hurricane Iniki struck the island in 1992. Kauai's population increased from about 28,000 in 1965 to more than 50,000 in the early 1990s. The increase in resident population together with an increase in the visitor population resulted in an increase in the water demand for almost all of the water systems. As a result Kauai's water systems were in a growth mode between 1965 and 1992. Generally, the water systems have been expanded to their current extent from their early development--with the current systems benefiting from the legacy of past generations that developed the water system.

Each of the water systems was originally constructed to serve a particular geographic area or group of customers. Water systems were expanded and augmented to meet the development in adjacent areas. This method of development has resulted in service to a wide variety of customers with varying densities and land use development.

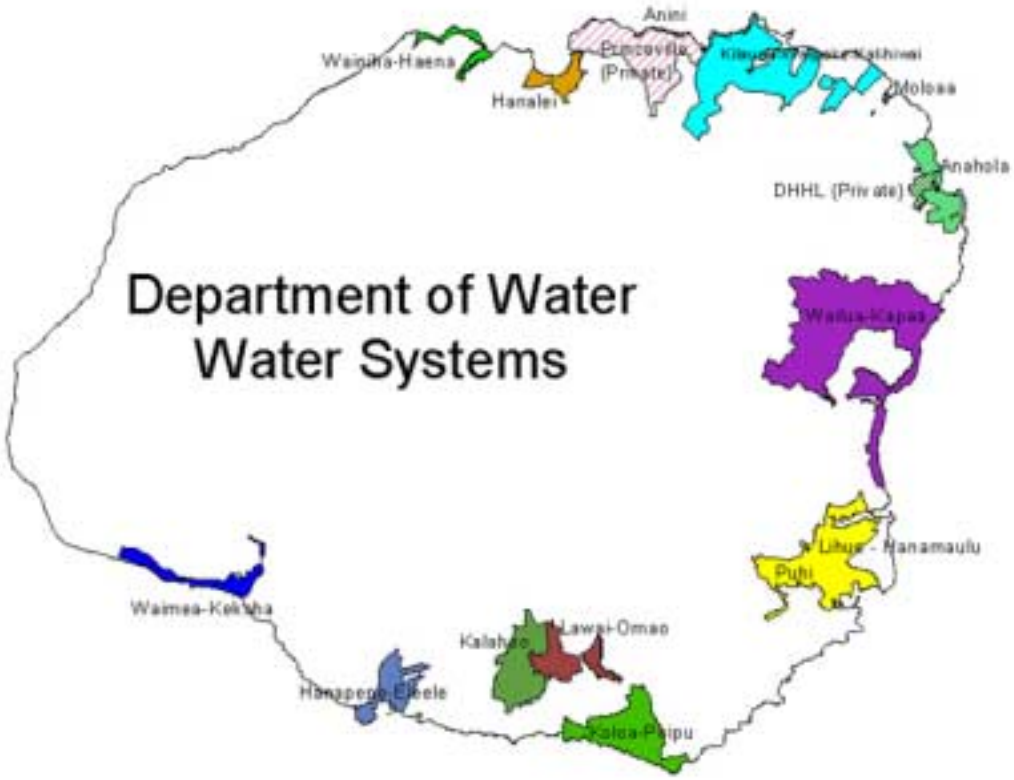
WATER SERVICE AREAS

Land use policies are established and governed by the County. DOW coordinates development effort with County and private developers seeking to connect to DOW-operated water systems in each of the 13 water system planning areas. Private developers provide all needed infrastructure improvements for their developments to be served by a DOW system.

The water systems and corresponding service areas can be used expressly for the purposes of planning or can be applied to guide service and development of future water service. Service areas are for planning purposes only and current county ordinances do not allow for the DOW to limit service to outside areas.

According to the *Kauai General Plan (2000),* the County of Kauai has sufficient land area zoned for urban development to accommodate projected visitor and resident population growth to 2020. Consistent with the *Kauai General Plan (2000)* and for purposes of Water Plan 2020, the DOW has taken a conservative approach in defining service areas of the existing water systems in effect, limiting them to areas that have appropriate planning and zoning approvals in place. The water service areas are defined as shown in Figure 3.1.

Figure 3.1
Water Service Areas



The water system service areas were drawn to include the following:

1. All existing service areas, including infill areas e.g., Agricultural areas within Wailua Homesteads, other homestead areas.

2. Areas which are planned and zoned for future urban development, particularly the three large, master-planned projects of Kukuiula (Koloa-Poipu), Lihue/Puhi Project District (Lihue-Puhi), and Lihue-Hanamaulu Infill (Lihue-Puhi). The developers of these projects are obligated under conditions of their zoning to develop water supply infrastructure that meets DOW standards. Currently, Lihue/Puhi Project District is about 30% developed; the other two master-planned projects have no substantial development as yet.

3. Agricultural subdivisions, which have tentative approval or are in the process of being approved. The developers of agricultural subdivisions are also obligated to develop water supply infrastructure to DOW standards or develop private water systems.

EXISTING SERVICE AREAS CHARACTERISTICS

Existing service areas are defined according to the DOW water systems described above. Mapped service areas also include Princeville, a resort community served by a private water utility; and the Anahola Agricultural Lots, served by a system belonging to the Department of Hawaiian Homelands. These service areas are identified in Table 3.1

Table 3.1
Existing Service Area Characteristics

Service Area	Description
Waimea-Kekaha	The service area is comprised of two relatively compact small towns. Waimea is the civic center of the West Side, home to the high school, hospital, and other community facilities as well as a variety of restaurants and retail stores. Kekaha includes a residential community that supports diversified agricultural and a small industrial area that was occupied by the former Kekaha Sugar Plantation. The area also supports the nearby Pacific Missile Range Facility and west side State parks.
Hanapepe-Eleele	The service area includes Kauai's second commercial harbor, Port Allen, the island's major electrical power generating station, and other industrial uses. Across the highway are Hanapepe Town and the residential community of Hanapepe Heights. Eleele has a small business area and residential communities.
Kalaheo	Kalaheo has small-town commercial uses concentrated along the highway and along Papalina Road.
Lawai-Omao	The west side has three small-town/rural service areas: Lawai-Omao, Kalaheo, and Waimea-Kekaha. The Kalaheo and Lawai-Omao service areas consist primarily of agricultural homestead lands that have been subdivided and developed at various densities of residential use.
Koloa-Poipu	The service area consists of a concentration of resorts along the coast, with residential communities clustered near the coast and around Koloa Town. Poipu is Kauai's fastest-growing resort destination, and the service area includes several projects yet to be constructed.
Puhi-Lihue-Hanamaulu	The most diverse customer base. The area includes Kauai's major airport and commercial harbor, the largest concentration of industrial uses, Wilcox Hospital, hotels, a broad range of government and business uses, and residential neighborhoods.
Wailua-Kapaa	The service area has hotel and business uses clustered along the coastal highway. Schools, hospitals, and urban residential neighborhoods are located along the highway, as well as along two major roads that extend inland towards the mountains at the north and south ends of the Wailua-Kapaa basin – Kuamoo Road and Kawaihau Road. The central part of the basin is comprised of old agricultural homesteads that are gradually transitioning to residential use.

Anahola	In Anahola, the major landowner is the Department of Hawaiian Homelands (DHHL), which develops residential lots and agricultural homesteads for lease to native Hawaiians. The Anahola service area also includes privately owned residential and agricultural lots in and around Anahola Valley. Portions of the water system are owned by either the DOW or DHHL. DOW operates the system in partnership with DHHL.
Moloaa	These east side rural communities include Moloaa and Anahola. Moloaa is the DOW's smallest service area consisting of two small clusters of residences. Water is purchased from a state well that is currently operated by a private landowner in the area. Water from this source also supplies the agricultural activities in the area.
Kilauea-Waipake-Kalihiwai	The service area is comprised of Kilauea Town and a number of non-contiguous agricultural subdivisions that extend towards the mountains or the coast on either side of the highway. While Kilauea Town is a compact node of urban-density residential use and neighborhood businesses, the largest part of the service area consists primarily of low-density residential use, mixed with small farms.
Anini	The service area consists of a narrow strip of beach residences. The water is purchased from Princeville Utilities
Hanalei	The service area consists of residences and small-town business uses. Narrow roadways and one-lane bridges limit development in these areas.
Wainiha-Haena	The system serves residences along the coast and in Wainiha Valley.

CHAPTER 4
BASIC PLANNING DATA AND WATER DEMAND FORECASTING

The planning data and water demand forecast serve as the building blocks for many aspects of a water comprehensive plan including supply, storage, and fire protection; therefore, projecting water use as accurately as possible for the planning horizons is critical. The basis for these projections is generally land use and demographic information. *Water Plan 2020* had the advantage of utilizing population and land use projections developed as part of the *Kauai General Plan (KGP)),* adopted in 2000.

The demand projections provide island-wide water use though 2020 and 2050. One of the primary purposes of the demand projections is for identification of future capital improvement projects. The parameters for these improvements are primarily dictated by the location and magnitude of the projected water demand; making this a critical component of the water long-range planning effort. The KGP served as the basis for forecasting the population and economic growth that will occur on the island. These forecasts have been used in conjunction with historical water use data to predict demands on a service area basis for two primary projection horizons, 2020 and 2050. The following sections describe the data and methodologies employed to make these projections and the resulting forecasts.

POPULATION PROJECTIONS AND DEMOGRAPHICS

Historical trends and economic development plans for the KGP were used to forecast growth or decline of various demographic categories on the island of Kauai. Projections were prepared as a part of the KGP process for the year 2020, expressed as a low-to-high range of growth considered being both realistic and desirable for the future of Kauai. These projections are used as the basis for developing water demand forecasts for Water Plan 2020.

The KGP projection of total jobs and resident population on Kauai in 2020 is based on the premise that the visitor industry, specifically the average daily visitor census (ADVC) drives employment, which, in turn, influences resident population growth. The visitor industry is expected to remain Kauai's single largest industry through 2020. The visitor industry is the most significant economic force on Kauai. The visitor arrivals in 1993 of 571,800, was an annual low after hurricane Iniki. The number of visitors has increased steadily in the following years to slightly over 1,000,000. Recently, the ADVC has been approximately 17,200 visitors per day.

Development of the KGP projections relied upon extensive historical data on the visitor industry from the Hawaii Convention and Visitors Bureau, on employment from the State Department of Labor and Industrial Relations, and on resident population from the State Department of Business, Economic Development, and Tourism. The high, medium, and low projections were generated using a simple linear regression model--historic data and relationships and a planned ADVC in 2020 of between 24,000 and 28,000. In addition, an assumption was made that ongoing efforts to diversify the economy will result in strong growth of diversified agriculture and aquaculture over the next two decades.

In order to ensure adequate future capital improvements, the high end of the visitor forecast range has been used. As such, *Water Plan 2020* projections are based on the

year 2020 ADVC of 28,000. With this ADVC, population and jobs on Kauai island-wide are projected to be 68,880 and 44,900 respectively

Table 4.1 shows population and forecasts for 2000, 2020, 2050 and build-out within DOW service areas. The year 2050 projections were prepared assuming that the forecasted growth rate from 2010 to 2020 will continue through 2050. This forecast will be used to develop water demand forecasts for the purposes of long-term planning. The build-out projections are based on the capacity of vacant lands based on a lot survey performed by DOW. The majority of sites have zoning and a few have the appropriate General Plan land use designation and/or a State land use designation of Urban. The analysis does not include potential development for additional development on existing developed parcels, such as an additional dwelling unit (ADU) added to an existing residence. It is assumed that the vacant sites are built-out to the maximum allowable single dwelling densities.

Table 4 .1
2000, 2050 and Build-out Population Projections

District/Water System	2000	2020	2050	Build-out Populations
West side	**9,124**	**11,273**	**14,809**	**17,959**
Waimea-Kekaha	4,827	5,595	6,858	8,550
Hanapepe-Eleele	4,297	5,678	7,951	9,409
Kalaheo-Poipu-Koloa	**11,467**	**14,733**	**20,071**	**35,563**
Kalaheo	4,889	5,596	6,762	10,790
Lawai-Omao	3,264	3,795	4,672	6,571
Koloa	1,666	3,250	5,825	8,109
Poipu	1,649	2,092	2,813	10,092
Lihue	**11,446**	**14,606**	**19,770**	**32,372**
Puhi-Lihue-Hanamaulu	11,446	14,606	19,770	32,372
Wailua-Kapaa	**17,595**	**21,263**	**25,588**	**35,637**
Wailua-Kapaa	16,038	18,346	22,151	32,200
Anahola	1,518	2,812	3,240	3,240
Moloaa	40	106	197	197
North Shore	**5,166**	**7,004**	**9,664**	**11,421**
Kilauea-Waipake-Kalihiwai	3,066	4,541	6,602	6,602
Anini	178	211	266	323
Hanalei	933	1,065	1,283	2,217
Wainha-Haena	989	1,187	1,513	2,279
TOTAL	**54,798**	**68,880**	**89,901**	**132,952**

The forecasts prepared for the KGP have been reformatted for consistency with the Water Plan 2020 forecast categories:

1. Single-Family
2. Multi-Family/Resort
3. Commercial
4. Industrial
5. Agriculture
6. Government

These forecasts are presented in Table 4.2

Table 4.2
Demographic Projection SummaryWater Use Categories and Service Connections

	2000						2020					
	Resident	Single Family	MF/Resort	Commercial	Industrial	Government	Resident	Single Family	MF/Resort	Commercial	Industrial	Government
District/Water System	Population	(Units)	(Units)	(Sq. Feet)	(Sq. Feet)	(Capita)	Population	(Units)	(Units)	(Sq. Feet)	(Sq. Feet)	(Capita)
West Side	**9,124**	**2,721**	**129**	**435,007**	**228,306**	**3,119**	**11,273**	**3,353**	**358**	**581,700**	**391,991**	**3,908**
Waimea-Kekaha	4,827	1,450	80	212,763	43,720	2,438	5,595	1,682	280	291,976	95,452	2,980
Hanapepe-Eleele	4,297	1,271	49	222,244	184,586	681	5,678	1,671	78	289,724	296,539	928
Kalaheo-Poipu-Koloa	**11,467**	**3,386**	**2,514**	**321,860**	**68,870**	**1,225**	**14,733**	**4,275**	**4,111**	**520,728**	**71,101**	**1,737**
Kalaheo	4,889	1,440	65	106,102	5,488	635	5,596	1,653	67	191,778	5,779	778
Lawai-Omao	3,264	989	29	18,786	11,435	2	3,795	1,150	29	17,738	11,551	2
Koloa-Poipu *	3,315	957	2,420	196,972	51,947	588	5,342	1,472	4,015	311,212	53,771	957
Koloa	1,666	468	305	124,465	51,947	575	3,250	868	913	224,347	53,771	920
Poipu	1,649	489	2,115	72,507	0	14	2,092	604	3,102	86,865	0	37
Lihue	**11,446**	**2,892**	**2,296**	**2,130,519**	**1,707,739**	**7,550**	**14,606**	**3,742**	**3,040**	**2,640,479**	**2,086,869**	**9,702**
Puhi-Lihue-Hanamaulu	11,446	2,892	2,296	2,130,519	1,707,739	7,550	14,606	3,742	3,040	2,640,479	2,086,869	9,702
Wailua-Kapaa	**17,595**	**5,253**	**1,975**	**808,786**	**122,741**	**4,255**	**21,264**	**6,355**	**2,511**	**888,742**	**196,878**	**5,028**
Wailua-Kapaa	16,038	4,781	1,955	783,233	109,115	4,128	18,347	5,471	2,491	847,012	183,163	4,844
Anahola	1,518	460	20	25,553	13,626	127	2,812	852	20	41,730	13,715	184
Moloaa	40	12	0	0	0	0	106	32	0	0	0	0
North Shore	**5,166**	**1,559**	**162**	**180,114**	**96,338**	**793**	**7,004**	**2,116**	**162**	**251,163**	**127,134**	**1,027**
Kilauea-Waipake-Kalihiwai	3,066	929	30	57,449	92,418	412	4,541	1,376	30	116,611	122,813	565
Anini	178	54	0	0	0	0	211	64	0	0	0	0
Hanalei	933	279	58	106,542	3,920	379	1,065	319	58	118,352	4,321	458
Wainiha-Haena	989	297	74	16,123	0	2	1,187	357	74	16,200	0	4
TOTAL	**54,798**	**15,811**	**7,076**	**3,876,286**	**2,223,994**	**16,942**	**68,880**	**19,841**	**10,182**	**4,882,812**	**2,873,973**	**21,402**

* Water Plan 2020 has been developed for the 13 DOW water systems on Kauai. Koloa and Poipu are hydraulically connected and treated as a single service area throughout Water Plan 2020; however, this service area has been divided for demand projections. The subdivision of this water system was developed primarily to account for the high level of resort development within Poipu that is not present in Koloa. These development patterns create a significant variation in daily use per meter between the two areas. Therefore all tables contained in this section will contain 14 water systems to accommodate the distinction between Koloa and Poipu in the water demand forecast.

WATER USE CATEGORIES AND SERVICE CONNECTION

The customer billing records, from bi-monthly meter readings, provide information on historic water demand. This method of water demand estimation is limited by the accuracy and installation of service meters and does not account for non-metered water. Historical demands within a water system are typically determined by comparing the amount of water produced by groundwater or surface water sources to the amount of water sold, based on meter readings. The difference between water produced and water sold is called non-metered water and is generally attributed to leaks, inaccurate meters, and unaccounted water uses such as fire hydrants. Historical source production records for the DOW systems are not complete enough to use in forecasting future water demands due to inaccurate or inoperable source meters. The DOW is currently implementing meter replacement at all sources and designing a SCADA telemetry system for accurate monitoring, reporting, and recording of source flow data.

Future water demands were estimated based on the demographic forecasts presented earlier and shown in Table 4.2. The future demand forecasts are broken down into the water use categories that were correlated to the DOW meter types, for which current water usage rates exist. Water demand forecasts were developed for 2005, 2010, 2020 and 2050 conditions.

The DOW customers are classified into a number of water use categories for billing, planning and engineering purposes based primarily on land use designations. Table 4.3 shows the relationship between the types of water use included in the demand projections and the customer classes used in the DOW billing system.

Table 4.3
DOW Customer Classes and Service Connections

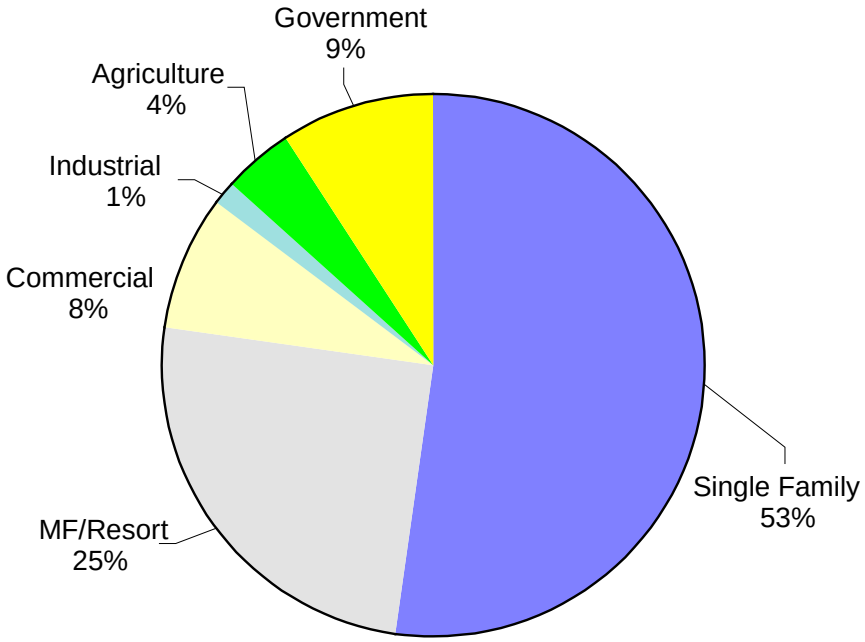
Water Use Category	Description	Number of meters in 1998-99
Single Family	Single-Family and Duplex	15,644
Multi-family/ Resort	Multi-Family, including apartments, condominiums and townhouses	
	Hotel, motels and resorts.	282
Commercial	Commercial, including structures used primarily for non-residential purposes, convalescent homes, and sanitariums	
	Religious Institutions	692
Industrial	Industrial Complex, including all producing, manufacturing and processing establishments.	55
Agriculture	Agriculture	343
Government	U.S. Military Installation	
	U.S. Non-Military Installation	
	State Government	
	City Government	197
	Total	**17,213**

The total services by meters equal 17,213 as of June 1999.

HISTORICAL WATER USE

Residential single-family water use comprises the majority of the DOW's consumption with more than 50 percent of the total water use. Water usage data has been summarized for the single-family category based on an average of the 1995-98 meter records. Daily water use in the service areas varies from a low of 315 to a high of 772 gallons per unit. The range in water use patterns may be attributed to differences in development, weather patterns, meter accuracy, or other factors. The combined multi-family/resort category makes up about one quarter of the water use and the remaining categories of commercial, industrial, agriculture, and government comprise the remaining 25 percent. Figure 4.1 graphically describes the breakdown of water use by category.

Figure 4.1
Percentage of water use by category in 1998-99



The majority of the water use is concentrated in a few of the service areas. The service areas of Wailua-Kapaa, Puhi-Lihue-Hanamaulu and Koloa-Poipu comprise approximately 65 percent of the annual average water use. With the inclusion of Waimea-Kekaha and Hanapepe-Eleele, these top five service areas use more than 80 percent of the water delivered to DOW systems on the island. During the past five years, from 1995 through 1999, DOW's Average Daily Demand has been 14 mgd; this includes a 25 percent allowance for non-metered use.

FUTURE WATER DEMANDS

The historical water use data from 1995 to 1998 was used in conjunction with population (demographic) projections and water use categories, to develop future water demands in 2005, 2010, and 2020. It was assumed that water usage rates remained the same over the planning horizon through 2020 for each of the water use categories. Therefore, the water was forecast to increase at the same rate as the demographic forecast, with the exception of the agriculture category. Future water demands were estimated based on the demographic forecasts presented earlier and shown in Table 4.2. The future water demand forecasts are broken down into separate customer classes and were determined by multiplying the population (demographic) projections by the historical average per unit water demand for each water system. A summary of the forecast methodology is presented in Table 4.4.

Table 4.4
Forecast Methodology

Category	Forecast Water Use Methodology
Single Family	Projected number of Single Family units multiplied by the 1995-99 average single-family water use per unit per day in each water service area
Multi-family/Resort	Projected number of Multi-family/ Resort units multiplied by the 1995-99 average Multifamily/Resort water use per unit per day in each water service area
Commercial	Projected square feet multiplied by the 1995-99 average Commercial water use per square foot per day in each water system. Commercial square footage is based upon categories included in the KGP; commercial, shopping center, office and hospital. In service areas where no historical water use existed an island wide average of 0.25 gallons per square feet per day was used
Industrial	Projected number of Industrial square feet multiplied by the 1995-99 average Industrial water use per square foot per day in each water service area.
Government	Projected number of Government employees multiplied by the 1995-99 average Government employee water use on a capita per day basis in each service area. Government employees include the KGP categories ; County, State, and Federal employees, public and private students, private school employees and college students.
Agriculture	All service areas with the exception of Kilauea-Waipake-kalihiwai are projected to grow at 20% between 2000 and 2020. Kilauea-Waipake-Kalihwai is projected to grow 43% between 2000 and 2020 based on 1995-99 historical data. The 1998-99 fiscal year, historical agriculture water use on a service area basis is used as the starting point for these calculations.

A reduction in non-metered water from 25 to 15 percent by 2020 was used and some service areas are forecast to have limited growth and show decreases in overall water use during the 2000 to 2020 planning period. This reduction was based on improved metering the source expanding the leak detection program and pipeline replacements. The water demand forecast is presented in Table 4.5.

Table 4.5
Historical and Forecasted Water Use

	Historical Water Use (1,000 gallons/day)				Forecast Water Use (1,000 gallons/day)		
Water System	**1995-96**	**1996-97**	**1997-98**	**1998-99**	**2005**	**2010**	**2020**
Waimea-Kekaha	1,444	1,279	1,457	1,621	1,590	1,701	1,918
Hanapepe-Eleele	1,020	994	1,093	1,071	1,149	1,218	1,361
Kalaheo	702	658	719	666	704	717	746
Lawai-Omao	441	425	413	415	435	443	458
Koloa	459	421	413	391	520	614	798
Poipu	1,980	1,917	2,247	2,325	2,454	2,628	2,953
Lihue- Puhi-Hanamaulu	3,054	3,283	3,359	3,321	3,570	3,733	4,066
Wailua-Kapaa	3,600	3,213	3,194	3,220	3,426	3,501	3,648
Anahola	256	237	264	290	321	367	460
Moloaa	2	1	5	9	7	9	13
Kilauea-Waipake-Kalihiwai	663	604	699	718	779	842	969
Anini	36	44	47	45	40	41	43
Hanalei	168	171	162	161	174	177	181
Wainiha-Haena	157	156	156	154	166	169	179
TOTAL	**13,982**	**13,403**	**14,226**	**14,407**	**15,335**	**16,160**	**17,793**

Historical and forecasted water demands include estimated non-metered water (25% in 1995-1999, 22.5% in 2005, 20% in 2010, 15% in 2020)

Most capital improvement projects such as pipelines and pump stations are designed to last more than 20 years. Therefore to ensure that facilities will not be undersized past the 20-year planning period, demands have been forecast through 2050 for each service area. Accurately forecasting growth more than 20 years in advance can prove to be difficult due to many highly variable factors. These factors include such unknowns as U.S. and Asian economic trends and natural disasters.

Year 2050 water demands have been developed for all service areas based on population forecasts beyond 2020. Due to the fact that 2050 projections were not developed as part of the KGP for any customer classes other than single and multi-family residences, the water use methodology used through 2020 could not be employed. Water demand forecast for 2050 is based on the assumption that the water demand growth rate between 2010 and 2020 will continue through 2050. 2050 forecasts have been calculated using the 2020 water use projections as a baseline and increasing water demand by the percentage in population growth to 2050 for each DOW service area. Population growth between 2020 and 2050 has been forecast at 34 percent, which corresponds to an overall 34 percent increase in water use during this period. The forecasts are shown in Table 4.6

Table 4.6
2020 and 2050 Water Use Projection

District/Water System	Population			Water Use (1,000 gallons/day)		
	2020	2050	Percent Increase	2020	2050	Percent Increase
West Side	**11,273**	**14,809**	**31**	**3,278**	**4,307**	**31**
Waimea-Kekaha	5,595	6,858	23	1,918	2,351	23
Hanapepe-Eleele	5,678	7,951	40	1,361	1,905	40
Kalaheo-Poipu-Koloa	**14,733**	**20,071**	**36**	**4,955**	**6,751**	**36**
Kalaheo	5,596	6,762	21	746	902	21
Lawai-Omao	3,795	4,672	23	458	564	23
Koloa	3,250	5,825	79	798	1,430	79
Poipu	2,092	2,813	34	2,953	3,970	34
Lihue	**14,606**	**19,770**	**35**	**4,066**	**5,503**	**35**
Lihue-Puhi	14,606	19,770	35	4,066	5,503	35
Wailua-Kapaa	**21,264**	**25,588**	**20**	**4,121**	**4,960**	**20**
Wailua-Kapaa	18,346	22,151	21	3,648	4,404	21
Anahola	2,812	3,240	15	460	531	15
Moloaa	106	197	87	13	25	87
North Shore	**7,004**	**9,664**	**38**	**1,372**	**1,894**	**38**
Kilauea-Waipake-Kalihiwai	4,541	6,602	45	969	1,409	45
Anini	211	266	26	43	54	26
Hanalei	1,065	1,283	20	181	219	20
Wainiha-Haena	1,187	1,513	28	179	229	28
TOTAL	**68,879**	**89,901**	**31**	**17,794**	**23,224**	**31**

Including non-metered water

WATER CONSERVATION PROGRAMS

Current conservation activities in the Department include 100% customer metering, meter repair/replacement program, non-metered water analysis/report, leak detection, tank overflow controls/alarms, plumbing code water efficient fixture and pressure reducing valve requirement, voluntary water restriction notice, and public outreach/ education programs. The following Table 4-7 describes the Department's current water conservation activities and programs.

Table 4.7
Current Water Conservation Activities Intermediate Guidelines

Water conservation measures	Implementation Date
DOW Conservation (supply side)	
100% customer metering	1963
Displacement meter replace, test & repair program	1970
Defective meter program	1970
Unmetered water analysis/ report	1969
Leak detection program	2001
Customer Conservation (demand side)	
Plumbing code – water efficient fixtures	1993
Voluntary water shortage notice	2001
Public outreach / education	1996

SUPPLY SIDE CONSERVATION PROGRAM

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 Department depending on the availability of adequate water supply.

Meter Replacement, Repair, Defective Meter Programs

All water supplied by the Department is measured by suitable water metering devices. The Department maintains a water-meter-shop test and repair program. According to standard operating procedures, testing of all 5/8-inch to 2-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 repaired by the Operations Division.

The current meter placement and repair program is noticeably lagging. The delayed upkeep and repair of supply production master meters at wells etc, prevent accurate unaccounted water analysis in many systems.

Non-metered Water Analysis/Report

The non-metered 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-metered water that is pumped into the system but not

sold. Non-metered water includes line flushing, reservoir cleaning, fire fighting, sewer flushing, street cleaning and is 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. Meter repair backlog problems has effected the reliability of the analysis. The Department is replacing its defective production and master source meters with new metering devices and is also installing a SCADA system to monitor and record pump data.

Leak Detection Program

The Department conducts case-by-case leak detection investigations and repair for suspected section of leaking pipeline. The Department 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 Department maintains and operates tank overflow alarms and automatic valves to prevent system losses to unnecessary overflows. The implementation of the SCADA program will improve system operations and reduce system losses.

DEMAND SIDE PROGRAMS

Plumbing Code Regulation

In July 1993, the County amended the County Plumbing Code to require the installation of water saving fixtures for new construction. This regulatory approach for low flow water fixtures will result in a shift to more efficient water using fixtures on a permanent basis. The installation of water efficient fixtures in new construction will provide the greatest long-term reliable savings in indoor water use.
The Plumbing Code also requires installation of pressure reduction valves in order to maintain a maximum 80-pound per square inch building service pressure. Lower leak rates and less wear on plumbing fixtures and pipelines will result in water savings to the consumer and a beneficial reduction in water loses for the Department.

Voluntary Emergency Water Shortage Notice

The Department has requested voluntary water conservation during dry periods and emergency water outages. High consumption during dry summers has resulted in distribution of water shortage notices for effected areas. Water customers are asked to voluntarily reduce consumption by 10-25 percent 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

Since 1996 the Department has participated in four annual CAK Building Exposition Home Shows sponsored by the Contractors Association. In 1996, the Department provided an exhibit at the County Fair. During 1998 and 1999 other public exhibits included the County General Plan Update Future Fair and the first Water Week exhibit at Kukui Grove shopping center. The Department participated in the highly successful 1998, 1999, and 2000 Agricultural & Environmental Awareness Day activities. During this event, which is sponsored by the Department of Education and the University of Hawaii, 1,200 elementary and intermediate students learn about the island's environment and agricultural programs. Information regarding the potable water system and the water conservation programs are presented and passed on to the public at these events.

The existing and future water conservation programs are expected to reduce existing and future water demand projections. An island-wide reduction in non-metered water is expected during the next 20-year period as a result of water savings from implemented conservation programs. The Water Plan 2020 demand projections are based upon water savings that will reduce non-metered water estimates from 25-15 percent island wide. In addition to an island-wide program, Water Plan 2020 intends to implement a specific water conservation program to defer supply improvements for Hanapepe-Eleele over the next 20-year planning period.

DOW WATER CONSERVATION PLAN

The Department has prepared a water conservation plan as guidance to the DOW in meeting long-range water conservation goals of the Board of Water Supply. The Water Conservation Plan is based upon the Environmental Protection Agency's (EPA) water conservation plan guidelines. The EPA guidelines emphasize goal-oriented planning which can help water systems improve their capacity to provide safe and reliable water service, as well as to eliminate, downsize, or delay infrastructure projects.

Goals

The plan goals are listed below:

A. Water demand reduction by:
   2.2 million gallons per day Average Day Demand
   3.2 million gallons per day Maximum Day Demand
   B. Improve the utilization and extending the life of facilities
   C. Lower variable operating costs
   D. Educate the public about water conservation
   E. Protect and preserve environmental resources

Conservation Measures

The plan analyzed and selected the following thirteen conservation measures for implementation as shown in Table 4.8 below.

Table 4.8
The DOW Selected Conservation Measures

Conservation Measure	Implementation Date
Low Flow Shower Head (LFSH) Distribution	2001
Residential Retrofit Kit Distribution	2001
Public Presentations	Prior to 2000
Public Community Events	Prior to 2000
Public Display Exhibits	Prior to 2000
Public Publications / Brochures	Prior to 2000
Demonstration Conservation Garden	2002
Pressure Management	Prior to 2000
Leak Detection & System Audit	2002
School Program	2002
Residential Audit	2002
Ultra Low Flow Toilet (ULFT) Retrofit Rebate	2002
Low Water Landscape Audit	2002

Public outreach is an important part of the plan and will be used in the implementation of each measure. The objective is to inform, educate and gain support from the public. All measures will involve meetings and coordination with selected community groups.

The monitoring process should include baseline surveys of customer characteristics, program design to facilitate monitoring, and pilot studies of conservation measures. A database for each measure should be incorporated into a database designed for retrieval of statistics. The monitoring database would assess the overall impacts of the water conservation plan.

The water conservation plan should be reviewed and updated at least once every five years in order to provide the opportunity for the Department and its customers to keep the plan current over time and account for the systems actual experience with conservation. The Department may want to expand or revise its planning goals and to address new water conservation requirements for conservation planning.

Water Savings

The DOW water conservation staff analyzed the demand and supply-capacity forecast to estimate potential conservation savings that may be achievable through these measures. The estimated Average-Day Demand reduction was 2,168,000 gallons per day, and the estimated Maximum-Day Demand reduction was 3,228,000 gallons per day.

The plan also analyzed savings in capital cost and operating costs based on reductions in the supply capacity forecast. The estimated total cost savings in total capital costs was approximately $10.1 million and the estimated annual operating cost savings was approximately $60,000 per year.

Conservation will help reduce variable costs (such as energy, chemical, and purchase water costs). In the long term, conservation also will help the Department reduce fixed costs (associated with new capital facilities). However, short-term reductions in sales can lead to shortfall in revenues needed to cover fixed costs. The increasing block rate structure and associated charges consider this while encouraging conservation and efficient water use.