Maui County Water Use and Development Plan

Water Use and Demand

Department of Water Supply Systems

Draft

May 1, 2007

Carl Freedman
Haiku Design & Analysis
4234 Hana Hwy.
Haiku, Maui, HI. 96708

Maui County Water Use and Development Plan

Water Use and Demand
Department of Water Supply Systems

Table of Contents

I. Introduction

This chapter (Water Demand Chapter) is one component of a comprehensive update of the Maui County Water Use & Development Plan (WUDP). The purpose of the Water Demand Chapter is to characterize historical, current and future water use for purposes of developing a long term WUDP.

This chapter characterizes and presents projections of water use and demand for all DWS water systems and community plan districts in Maui County with the exception of Lanai. A separate Lanai WUDP update has been in progress for several years and is currently in draft form being reviewed by the Lanai WAC.

Water use and demand projections for non-DWS users and purveyors will be documented in a separate section of the WUDP.

The Water Demand Chapter is organized in several sections.

- **Conventions and Definitions**. This initial section identifies several conventions and definitions that are used in the water demand chapter.
- **Historical and Current Water Use**. This section characterizes past and present water use. Data is presented in the form of tables and charts. This draft includes information on DWS water use. It is expected that this will be supplemented by information regarding non-DWS users and purveyors when this information is provided.
- **Demographic and Land Use Planning Data and Projections**. This section presents the socioeconomic and land use projections that underlie projections of future water demand.
- **DWS Water Demand Projections**. This section presents forecasts of future water demand for DWS systems.

II. Conventions and Definitions

Several conventions and definitions have been adopted in order to clearly characterize and analyze water use and demand. Some of these conventions and distinctions are briefly summarized below.

Geographical Areas and Boundaries

There are several types of geographical areas and boundaries that are important in the analysis and planning of water resources. These include:

- **Community Planning Districts (CPD's)**. According to provisions in the Maui County charter and ordinances, the WUDP must be consistent with general and community plans. These plans are distinguished geographically by community plan districts.

- **DWS Districts and Subdistricts**. Historically the DWS has based its planning and accounting on the basis of five districts: Central, Upcountry (sometimes referred to as the Makawao district), West Maui (sometimes referred to as the Lahaina district), Molokai and East Maui (sometimes referred to as the Hana district). Each of the DWS districts is subdivided into several subdistricts.

- **Water System Boundaries**. DWS water systems do not all conform to the designation of DWS districts. The Central and West Maui districts each have one DWS water system. The Upcountry district has four interconnected water systems. The Molokai and East Maui districts have several independent DWS water systems. In addition to these DWS systems, private non-DWS water systems serve several areas of the county.

- **Hydrological and Regulatory Boundaries**. Surface water and ground water flow according to the characteristics of the topological and geological characteristics of the islands. Of particular current importance is the management and regulation of groundwater withdrawals in accordance with the assigned sustainable yields of basal groundwater aquifers defined by specific geographic boundaries.

- **Meteorological Areas**. Water demand is dependent upon climate. Climate differs dramatically between different areas of each island. In order to account for the affects of weather on water demand it is necessary to consider meteorological areas that do not correspond directly with the boundaries of water districts or systems. The Central system, for example, includes both the Kihei/Makena area and the Wailuku/Kahului areas which differ dramatically in climate. Similarly the Upcountry system includes both the dry and often irrigated Kula area and the wetter, seldom irrigated Haiku area.

- **Demographic Areas**. Economic and demographic characteristics that affect water demand also vary dramatically between different areas of the islands. These areas do not correspond directly with the boundaries of water districts or systems.

- **Census Divisions and Tracts**. A substantial amount of valuable data is available from the 2000 decennial census. This data is tabulated according to census designated places, divisions and tracts that do not correspond directly to the boundaries of water systems or districts.

A careful and methodical approach was taken with respect to all of the types of geographical areas and boundaries identified above. For characterization and projection of DWS water use

and demand the “least common denominator” of geographical boundaries is the DWS subdistrict. Generally, in this chapter water use and demand is characterized and projected for each individual DWS subdistrict. These characterizations and projections are then summed, as appropriate, to produce tabulations for each community plan district , each DWS district and each DWS water system.

Premises, Services, Meters, Accounts and Customers

The DWS uses several terms in reference to its own system that are applied with specific meanings. These terms are used consistently throughout the WUDP as follows:

A *premises* and a *service* are essentially equivalent terms which refer to a specific location of exactly one water *meter* that is treated as one *account*. A single location (a residence, business, lot or building, for example) could have several water meters installed and would be considered several premises (one premises per water meter). In other words, there is a one to one correspondence between premises, services, accounts and meters.

Each premises (meter) is registered to one *customer*. A customer, however, could and often does have more than one premises. In other words, there is a one to many correspondence between customers and premises. Each premises has one customer but one customer could have one or more than one premises.

Loosely speaking, a premises can be thought of as a location of one meter. A customer can be thought of as a person who pays a water bill.

In some instances using common industry terminology the term “customer” may refer loosely to what is more accurately termed “premises”. The terms “customer type” or “customer class”, for example, are used commonly but really refer to a characteristic of a premises, not a customer.

Classes of Users and Uses

Water users and uses can be categorized according to several types of criteria. Although some of these classifications refer primarily to type of users and others refer primarily to types of uses the distinction is not always perfectly clear.

- **Use Class**. This is a common general type of classification used by water utilities. This is often referred to as “customer type” or “customer class”. There are many possible specific definitions or summarizations of categories. For example, an extensive system of Standard Industrial Classification (SIC) codes maintained by the U.S.Census Bureau is widely recognized and is sometimes used to classify water uses. Classifications used by the DWS are listed below:
    - Single family residential
    - Multi-family residential
    - Commercial
    - Hotel
    - Industrial
    - Government
    - Agricultural
    - Religious
    - General

- **Rate Class**. The DWS and various private water purveyors in Maui County have several rate classes. A rate class is a group of premises that are charged for water according to a specific rate schedule or "tariff". The DWS has two general rate classes: Agricultural and General. Several private water purveyors identify several rate classes by grouping the "premises types" listed above into summary categories. The Department of Public works also provides recycled water according to several rate class tariff schedules.

- **Potable / Non-potable / Recycled**. The DWS and several other water purveyors provide potable water to most premises. In some cases non-potable water (untreated surface water) is provided to some premises. The Department of Public Works also provides recycled water.[1]

- **End Use**. This classification refers to the specific uses for which water is ultimately used. End uses can be generally grouped into indoor uses and outdoor uses. Indoor end uses are typically more specifically identified by fixture/appliance type (such as toilet, kitchen sink, lavatory sink, dishwasher, washing machine). Outdoor end uses are typically more specifically identified by functional use (landscape irrigation, crop irrigation, car washing, swimming pool, etc.)

- **Land Use**. Land use categorization is particularly important for consideration in developing a WUDP. The State Water Code [HRS Chapter 174C] specifies that there will be "water use and development plans for each county which shall be prepared by each separate county and adopted by ordinance, setting forth the allocation of water to land use in that county." It is clear that the "allocation of water to land use" is a fundamental objective of a WUDP. It is substantially less clear how this allocation is to be performed or what classifications of land use are to be used. It is generally agreed that the allocation of water to land use has not been sufficient in previous WUDP's. It is also generally recognized that this exercise presents substantial challenges.

  There are several possible ways to categorize land use. These include some of the previously outlined methods to categorize uses listed above.

  - State land use designation
  - General Plan designation
  - Community Plan designation
  - Zoning designation
  - Permitted uses within zoning designations
  - Current occupancy uses (premises type)
  - Rate class (agricultural and non-agricultural)

  Although some categories are more clearly "land" use categories, all might possibly be considered consistent with the statutory charge to allocate water to land use.

In the Water Demand Chapter water users and uses are categorized according to the water use classifications for which sufficient data currently exist. The tables and charts presented in the chapter portray water use broken down by use class, rate class and by potable vs non-potable water. As data are developed in the assessment of water conservation potential, water use will

[1] Recycled water is the same as "reclaimed" water. DPW prefers use of the term "recycled water".

also be categorized end uses.

Definition of Water Demand

Several conventions regarding the definition of water demand have been adopted in the water demand chapter. These conventions have been adopted to promote the specific purposes of the demand characterization and projections for the analyses to be performed in the WUDP process.

Constrained vs Unconstrained Demand

Water demand can be defined in several ways with regard to possible constraints on economic, demographic or water system growth. In one sense water demand could be characterized as how much water would be required to meet unconstrained growth. In another sense water demand could be characterized as the amount of water needed to meet growth that is most likely to occur based on consideration of likely constraints. In some cases the constraints on growth could be the availability of water supply.

The projections of water demand presented in this chapter are based on the economic and demographic projections in the 2006 *Socio-Economic Forecast* prepared by the Maui County Planning Department. In the Socio-Economic Forecast, economic and demographic projections are made for each island and for each community plan district on the Island of Maui. The projections are based on long-term economic forecasts (unconstrained) with short term modifications based on known specific projects and issues. These assumptions are identified in the text of the Socio-Economic Forecast and in the spreadsheets used to generate the forecast. No other explicit assumptions are made in the water demand projections regarding specific constraints to economic, demographic or water system demand growth.

A broad range of five water demand growth scenarios are developed for DWS systems in this chapter. These scenarios are provided for each of several geographical breakdowns, including DWS districts, DWS subdistricts, meteorological/demographic areas and for each CPD. The five water demand growth scenarios include a base case, a high case and a low case which are based on the base, high and low demographic projections in the 2006 Socio-Economic Forecast. A medium-high and medium-low case are developed by interpolating between the base, high and low cases.

In the context of the WUDP process several demand growth scenarios will be used in resource planning analyses to represent a range of possible but uncertain future circumstances. It is expected that there will be some discussion regarding the selection, characterization and possible adjustments to the water demand projections during the WAC process. Part of this discussion is expected to clarify the extent to which existing or future economic, demographic or water system constraints are reflected in the demand projections used in the resource analyses.

Consumption vs Production Requirements

Water *consumption* is defined as the amount of water distributed to identified users, usually measured as metered water demand at the point of use. Water *production* requirements exceed water consumption to provide for “unaccounted-for-water” including unmetered uses (fire protection, unauthorized use, water department use) and transmission/distribution losses.

The projections of water demand presented in this chapter are based on levels of water consumption. Production requirements used in water resource analysis and planning will be separately determined based on the consumption projections identified in this chapter along

with explicit assumptions regarding sources of unaccounted-for-water. One reason for this approach is that programs or activities may be evaluated that are specifically designed to reduce water system losses, water department use or unauthorized water use.

The water use data in the tables and charts presented in this chapter are labeled as water "demand," "consumption" or "production" as appropriate. As noted above, the term water "demand" is expressed generally in terms of consumption (not production) needs.

Impacts of Demand Side Management Programs and Recycled Water Use

The characterization and projection of water demand presented in this chapter include the impacts of *past* water conservation programs and *existing* levels of recycled water use. Impacts of future programs and any increases in recycled water use are not included in the water use projections. These future measures will characterized and evaluated as potential resource options used to meet the projections of water demand identified in this Water Demand Chapter.

III. Historical and Current Water Use

DWS Historical Water Use: Summary Tables and Charts

This section presents information regarding water use on the DWS systems. Water use by non-DWS users and purveyors is presented in a separate section of the WUDP.

Historical DWS water consumption is documented in several tables and charts presented below. The tables and charts present consumption data summarized according to several geographical categories (CPD's, DWS districts, demographic/meteorological areas) and use categories (premises types, rate classes, potable/non-potable).

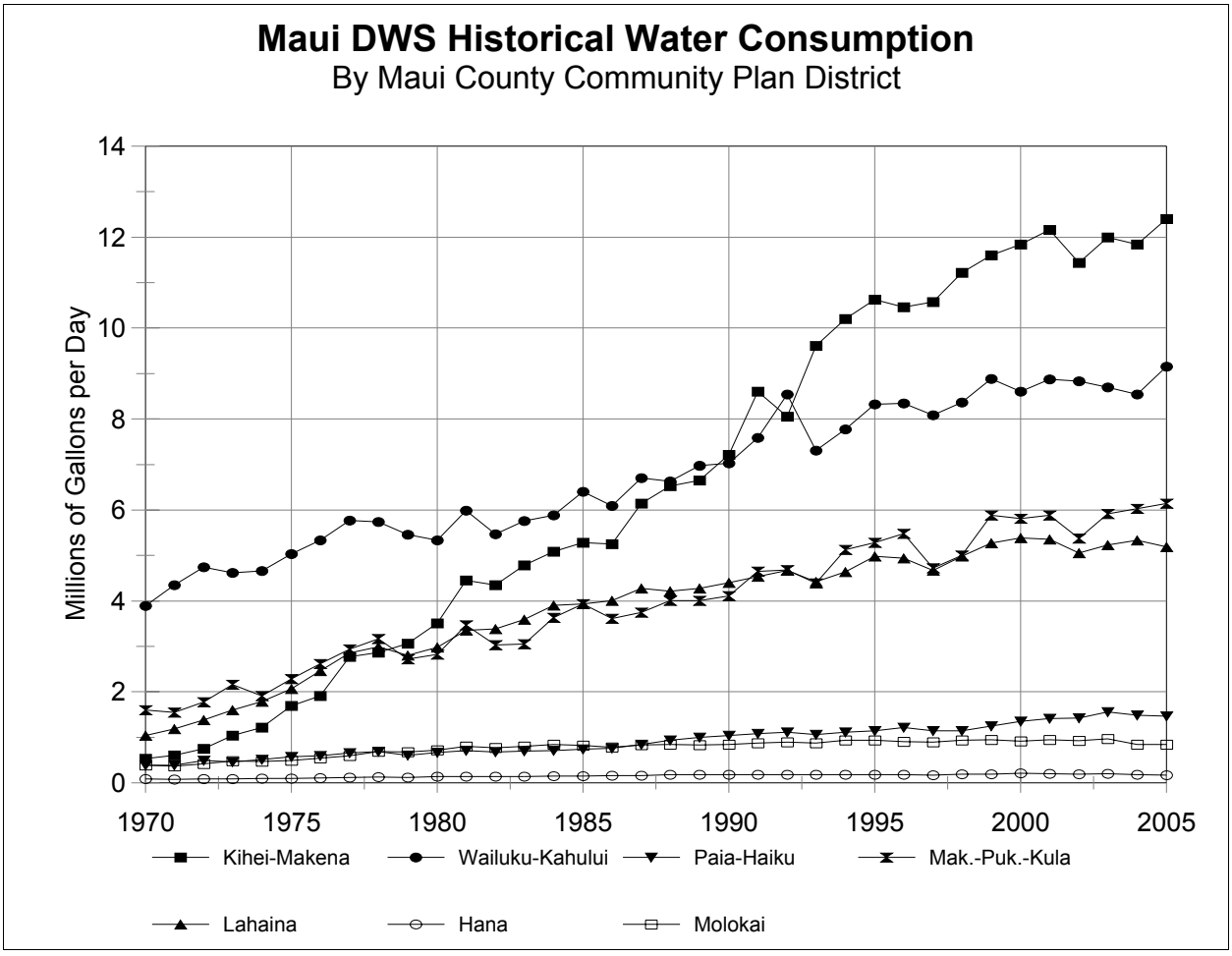

Figure 1 DWS Historical Consumption by Community Plan District

Historical Metered Consumption (Millions of Gallons per Day)

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Central	General	17.891	18.822	18.621	18.433	19.372	20.312	20.218	20.821	20.302	20.744	20.381	21.548
	Ag Potable	0.428	0.522	0.601	0.611	0.616	0.614	0.673	0.685	0.423	0.436	0.465	0.455
	Total Potable	18.319	19.344	19.222	19.045	19.988	20.926	20.891	21.506	20.725	21.180	20.846	22.003
	Ag Non Potable	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total	18.319	19.344	19.222	19.045	19.988	20.926	20.891	21.506	20.725	21.180	20.846	22.003
Upcountry	General	3.871	4.382	4.083	3.693	4.003	4.146	4.370	4.823	4.461	4.778	4.387	4.441
	Ag Potable	1.931	2.300	1.923	1.829	2.382	2.474	2.504	2.563	1.908	2.320	2.138	2.378
	Total Potable	5.802	6.682	6.007	5.521	6.384	6.620	6.873	7.387	6.368	7.098	6.525	6.820
	Ag Non Potable	0.504	0.634	0.481	0.374	0.512	0.555	0.505	0.690	0.433	0.582	0.575	0.571
	Total	6.306	7.317	6.487	5.895	6.897	7.175	7.379	8.077	6.801	7.680	7.100	7.391
West Maui	General	4.641	4.975	4.933	4.668	4.975	5.258	5.363	5.344	5.028	5.208	5.320	5.166
	Ag Potable	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	Total Potable	4.644	4.978	4.936	4.671	4.978	5.261	5.366	5.347	5.031	5.211	5.323	5.169
	Ag Non Potable	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total	4.644	4.978	4.936	4.671	4.978	5.261	5.366	5.347	5.031	5.211	5.323	5.169
Molokai	General	0.931	0.927	0.891	0.878	0.918	0.928	0.891	0.923	0.905	0.938	0.826	0.823
	Ag Potable	0.010	0.012	0.015	0.016	0.019	0.020	0.025	0.022	0.020	0.029	0.016	0.019
	Total Potable	0.941	0.939	0.906	0.894	0.937	0.949	0.916	0.946	0.925	0.967	0.842	0.842
	Ag Non Potable	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total	0.941	0.939	0.906	0.894	0.937	0.949	0.916	0.946	0.925	0.967	0.842	0.842
Hana - East Maui	General	0.179	0.181	0.174	0.165	0.181	0.186	0.197	0.199	0.180	0.200	0.173	0.164
	Ag Potable	0.003	0.004	0.007	0.009	0.010	0.010	0.015	0.007	0.009	0.005	0.004	0.005
	Total Potable	0.181	0.185	0.182	0.174	0.191	0.196	0.213	0.205	0.190	0.205	0.177	0.169
	Ag Non Potable	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total	0.181	0.185	0.182	0.174	0.191	0.196	0.213	0.205	0.190	0.205	0.177	0.169
DWS All Districts	General	27.512	29.287	28.703	27.838	29.449	30.830	31.040	32.111	30.875	31.868	31.088	32.142
	Ag Potable	2.374	2.841	2.549	2.467	3.030	3.122	3.220	3.280	2.363	2.793	2.626	2.860
	Total Potable	29.886	32.128	31.252	30.305	32.479	33.952	34.260	35.391	33.239	34.661	33.714	35.002
	Ag Non Potable	0.504	0.634	0.481	0.374	0.512	0.555	0.505	0.690	0.433	0.582	0.575	0.571
	Total	30.391	32.763	31.733	30.679	32.991	34.507	34.765	36.081	33.671	35.243	34.289	35.573

Figure 2 Historical Metered DWS Consumption by DWS District

HISTORICAL METERED CONSUMPTION DWS DISTRICTS AND SUBDISTRICTS

Total All Classes Calendar Year **Millions of Gallons per Day (MGD)**

DISTRICT NAME	AREA NAME	SUBDIST NAME	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total All Classes														
Central	East Central	Paia-Kuau	0.333	0.378	0.398	0.379	0.397	0.421	0.422	0.449	0.441	0.472	0.451	0.434
		Spreckelsville	0.161	0.180	0.187	0.204	0.194	0.229	0.241	0.243	0.242	0.230	0.213	0.219
	East CentralTotal		0.495	0.559	0.584	0.583	0.591	0.650	0.663	0.692	0.683	0.703	0.663	0.653
	North Central	Kahului	3.917	4.363	4.317	4.099	4.302	4.504	4.298	4.487	4.495	4.449	4.428	4.870
		Puunene	0.124	0.132	0.140	0.130	0.104	0.111	0.102	0.108	0.096	0.095	0.061	0.080
		Waihee	0.067	0.070	0.079	0.080	0.072	0.076	0.084	0.080	0.074	0.074	0.067	0.077
		Waikapu	0.136	0.145	0.143	0.136	0.144	0.159	0.146	0.146	0.137	0.141	0.150	0.146
		Wailuku	3.161	3.202	3.253	3.223	3.311	3.546	3.504	3.580	3.556	3.475	3.414	3.547
		Wailuku Hts	0.211	0.238	0.234	0.217	0.242	0.268	0.246	0.242	0.245	0.243	0.217	0.225
	North CentralTotal		7.615	8.151	8.167	7.885	8.176	8.663	8.379	8.643	8.603	8.477	8.338	8.946
	South Central	Kihei	9.590	10.016	9.847	9.907	10.526	10.926	11.122	11.391	10.609	11.155	10.997	11.575
		Maalaea	0.228	0.212	0.212	0.232	0.214	0.227	0.249	0.249	0.233	0.230	0.212	0.219
		Makena	0.391	0.406	0.412	0.437	0.481	0.460	0.478	0.531	0.597	0.615	0.636	0.610
		Wailea												
	South CentralTotal		10.209	10.634	10.471	10.577	11.221	11.613	11.849	12.171	11.439	12.000	11.845	12.404
CentralTotal			18.319	19.344	19.222	19.045	19.988	20.926	20.891	21.506	20.725	21.180	20.846	22.003
Hana - East Maui	East Maui	Hana	0.142	0.148	0.143	0.134	0.150	0.156	0.174	0.170	0.155	0.156	0.137	0.133
		Kaupo	0.004	0.004	0.004	0.005	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.004
		Keanae	0.026	0.025	0.027	0.025	0.026	0.025	0.024	0.021	0.022	0.034	0.024	0.020
		Nahiku	0.010	0.008	0.008	0.011	0.011	0.011	0.011	0.011	0.010	0.012	0.012	0.012
	East MauiTotal		0.181	0.185	0.182	0.174	0.191	0.196	0.213	0.205	0.190	0.205	0.177	0.169
Hana - East MauiTotal			0.181	0.185	0.182	0.174	0.191	0.196	0.213	0.205	0.190	0.205	0.177	0.169
Molokai	Molokai	Halawa	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000
		Kalae	0.026	0.028	0.030	0.028	0.027	0.028	0.027	0.028	0.028	0.042	0.035	0.031
		Kawela-Kaunakakai	0.751	0.720	0.673	0.680	0.714	0.726	0.694	0.709	0.689	0.684	0.634	0.630
		Ualapue-Kamalo	0.163	0.189	0.202	0.185	0.195	0.194	0.195	0.209	0.208	0.240	0.172	0.181
	MolokaiTotal		0.941	0.939	0.906	0.894	0.937	0.949	0.916	0.946	0.925	0.967	0.842	0.842
MolokaiTotal			0.941	0.939	0.906	0.894	0.937	0.949	0.916	0.946	0.925	0.967	0.842	0.842
Upcountry	Haiku	Haiku-Pauwela	0.233	0.283	0.286	0.269	0.262	0.302	0.341	0.358	0.362	0.421	0.394	0.386
		Kokomo-Kaupakalua	0.330	0.371	0.414	0.389	0.371	0.402	0.445	0.479	0.487	0.507	0.484	0.482
		Kuiaha	0.102	0.118	0.126	0.115	0.116	0.127	0.149	0.136	0.136	0.165	0.156	0.162
	Haiku System		0.665	0.771	0.827	0.772	0.748	0.831	0.935	0.972	0.984	1.093	1.035	1.030
	Kula Ag Park	Kula Ag Park	0.541	0.672	0.512	0.383	0.522	0.564	0.511	0.690	0.433	0.582	0.590	0.599
	Lower Kula Syster	Lower Kula	1.996	2.429	1.962	1.879	2.376	2.313	2.310	2.520	1.912	2.306	1.995	2.184
		Ulupalakua-Kanaio	0.139	0.136	0.129	0.132	0.171	0.175	0.192	0.196	0.178	0.173	0.146	0.174
		Upper Kula	1.206	1.349	1.127	1.010	1.215	1.298	1.442	1.540	1.218	1.387	1.252	1.358
	Upper Kula System		1.344	1.485	1.256	1.142	1.385	1.474	1.634	1.737	1.396	1.560	1.398	1.532
	Makawao	Haliimaile	0.088	0.093	0.095	0.089	0.092	0.099	0.100	0.096	0.097	0.104	0.110	0.111
		Makawao	0.821	0.919	0.978	0.866	0.903	1.004	0.987	0.999	0.971	0.983	1.004	0.958
		Pukalani	0.851	0.948	0.858	0.765	0.870	0.889	0.903	1.063	1.008	1.052	0.969	0.976
	Makawao System		1.760	1.960	1.931	1.719	1.865	1.993	1.990	2.158	2.076	2.139	2.083	2.045
UpcountryTotal			6.306	7.317	6.487	5.895	6.897	7.175	7.379	8.077	6.801	7.680	7.100	7.391
West Maui	West Maui	Alaeloa-Kahana	0.844	0.934	0.983	1.000	0.986	1.045	1.106	1.146	1.137	1.266	1.268	1.350
		Honokohau	0.003	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.003	0.004
		Honokowai	1.602	1.751	1.713	1.585	1.661	1.769	1.667	1.621	1.586	1.624	1.823	1.563
		Lahaina	2.194	2.294	2.245	2.091	2.339	2.462	2.611	2.594	2.327	2.341	2.247	2.273
	West MauiTotal		4.644	4.983	4.943	4.679	4.989	5.279	5.388	5.365	5.054	5.235	5.342	5.190
West MauiTotal			4.644	4.983	4.943	4.679	4.989	5.279	5.388	5.365	5.054	5.235	5.342	5.190
Total All Districts			30.391	32.767	31.740	30.686	33.002	34.525	34.786	36.099	33.695	35.267	34.308	35.595

Figure 3 Historical Metered Consumption: All Services by DWS District and Subdistrict

HISTORICAL METERED CONSUMPTION DWS DISTRICTS AND SUBDISTRICTS

General Potable

Calendar Year — Millions of Gallons per Day

DISTRICT NAME	AREA NAME	SUBDIST NAME	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Central	East Central	Paia-Kuau	0.328	0.371	0.389	0.371	0.391	0.412	0.417	0.444	0.435	0.465	0.444	0.426
		Spreckelsville	0.161	0.180	0.187	0.204	0.189	0.222	0.231	0.234	0.234	0.223	0.206	0.212
	East Central Total		0.489	0.551	0.576	0.575	0.580	0.635	0.649	0.678	0.668	0.688	0.651	0.637
	North Central	Kahului	3.914	4.360	4.316	4.098	4.301	4.501	4.295	4.485	4.493	4.448	4.427	4.868
		Puunene	0.024	0.032	0.031	0.028	0.041	0.042	0.034	0.030	0.017	0.032	0.017	0.018
		Waihee	0.067	0.070	0.079	0.080	0.072	0.076	0.084	0.080	0.074	0.074	0.067	0.077
		Waikapu	0.136	0.145	0.143	0.136	0.144	0.159	0.146	0.146	0.137	0.141	0.150	0.146
		Wailuku	3.149	3.186	3.238	3.209	3.295	3.528	3.487	3.559	3.537	3.460	3.402	3.530
		Wailuku Hts	0.211	0.238	0.234	0.217	0.242	0.268	0.246	0.242	0.245	0.243	0.217	0.225
	North Central Total		7.501	8.032	8.042	7.767	8.096	8.573	8.291	8.541	8.504	8.399	8.280	8.864
	South Central	Kihei	9.285	9.623	9.382	9.423	10.004	10.419	10.554	10.826	10.303	10.815	10.605	11.222
		Maalaea	0.228	0.212	0.212	0.232	0.214	0.227	0.249	0.249	0.233	0.230	0.212	0.219
		Makena	0.388	0.404	0.410	0.436	0.479	0.457	0.476	0.528	0.594	0.613	0.634	0.606
		Wailea												
	South Central Total		9.901	10.239	10.004	10.091	10.697	11.104	11.279	11.603	11.130	11.658	11.451	12.047
Central Total			17.891	18.822	18.621	18.433	19.372	20.312	20.218	20.821	20.302	20.744	20.381	21.548
Hana - East Maui	East Maui	Hana	0.139	0.145	0.136	0.125	0.140	0.146	0.158	0.163	0.146	0.151	0.133	0.128
		Kaupo	0.004	0.004	0.004	0.005	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.004
		Keanae	0.026	0.025	0.027	0.025	0.026	0.025	0.024	0.021	0.022	0.034	0.024	0.020
		Nahiku	0.010	0.008	0.008	0.011	0.011	0.011	0.011	0.011	0.010	0.012	0.012	0.012
	East Maui Total		0.179	0.181	0.174	0.165	0.181	0.186	0.197	0.199	0.180	0.200	0.173	0.164
Hana - East Maui Total			0.179	0.181	0.174	0.165	0.181	0.186	0.197	0.199	0.180	0.200	0.173	0.164
Molokai	Molokai	Halawa	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000
		Kalae	0.026	0.028	0.030	0.028	0.027	0.028	0.027	0.028	0.028	0.042	0.035	0.031
		Kawela-Kaunakakai	0.750	0.719	0.669	0.675	0.707	0.720	0.686	0.701	0.682	0.676	0.630	0.626
		Ualapue-Kamalo	0.154	0.178	0.191	0.174	0.183	0.180	0.178	0.194	0.194	0.218	0.160	0.165
	Molokai Total		0.931	0.927	0.891	0.878	0.918	0.928	0.891	0.923	0.905	0.938	0.826	0.823
Molokai Total			0.931	0.927	0.891	0.878	0.918	0.928	0.891	0.923	0.905	0.938	0.826	0.823
Upcountry	Haiku	Haiku-Pauwela	0.227	0.254	0.266	0.250	0.243	0.281	0.313	0.326	0.326	0.363	0.359	0.354
		Kokomo-Kaupakalua	0.307	0.343	0.384	0.361	0.341	0.364	0.397	0.432	0.439	0.457	0.435	0.434
		Kuiaha	0.079	0.093	0.100	0.094	0.096	0.100	0.112	0.104	0.103	0.115	0.109	0.114
	Haiku Total		0.613	0.691	0.750	0.705	0.681	0.745	0.822	0.863	0.869	0.935	0.903	0.903
	Kula	Kula Ag Park	0.037	0.037	0.032	0.009	0.010	0.009	0.006				0.015	0.028
		Lower Kula	0.707	0.874	0.719	0.672	0.733	0.750	0.753	0.868	0.734	0.831	0.676	0.679
		Ulupalakua-Kanaio	0.027	0.024	0.019	0.019	0.021	0.021	0.024	0.029	0.038	0.033	0.022	0.028
		Upper Kula	0.805	0.884	0.740	0.666	0.803	0.813	0.913	1.015	0.842	0.942	0.837	0.877
	Kula Total		1.576	1.820	1.509	1.367	1.567	1.593	1.697	1.911	1.614	1.805	1.550	1.612
	Makawao	Haliimaile	0.085	0.089	0.091	0.085	0.089	0.097	0.096	0.092	0.093	0.100	0.107	0.110
		Makawao	0.752	0.843	0.883	0.778	0.806	0.831	0.861	0.903	0.884	0.894	0.869	0.853
		Pukalani	0.845	0.940	0.850	0.757	0.861	0.880	0.895	1.054	1.000	1.044	0.958	0.964
	Makawao Total		1.682	1.871	1.824	1.620	1.755	1.808	1.851	2.049	1.977	2.038	1.934	1.927
Upcountry Total			3.871	4.382	4.083	3.693	4.003	4.146	4.370	4.823	4.461	4.778	4.387	4.441
West Maui	West Maui	Alaeloa-Kahana	0.844	0.934	0.981	0.998	0.984	1.041	1.101	1.140	1.129	1.256	1.260	1.341
		Honokohau	0.003	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.003	0.004
		Honokowai	1.601	1.744	1.705	1.576	1.650	1.753	1.648	1.607	1.569	1.607	1.809	1.548
		Lahaina	2.192	2.294	2.245	2.091	2.339	2.462	2.611	2.594	2.327	2.341	2.247	2.273
	West Maui Total		4.641	4.975	4.933	4.668	4.975	5.258	5.363	5.344	5.028	5.208	5.320	5.166
West Maui Total			4.641	4.975	4.933	4.668	4.975	5.258	5.363	5.344	5.028	5.208	5.320	5.166
General Potable Total			27.512	29.287	28.703	27.838	29.449	30.830	31.040	32.111	30.875	31.868	31.088	32.142

Figure 4 Historical Metered DWS Consumption General Potable Service by DWS District and Subdistrict

Figure 5 Historical Metered DWS Consumption Agricultural Uses by DWS District and Subdistrict

Historical Metered Consumption (Millions of Gallons per Day)

Total All Classes

CPD NAME		SUBDIST NAME	Calendar Year 1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Wailuku - Kahului		Kahului	3.917	4.363	4.317	4.099	4.302	4.504	4.298	4.487	4.495	4.449	4.428	4.870
		Puunene	0.124	0.132	0.140	0.130	0.104	0.111	0.102	0.108	0.096	0.095	0.061	0.080
		Waihee	0.067	0.070	0.079	0.080	0.072	0.076	0.084	0.080	0.074	0.074	0.067	0.077
		Waikapu	0.136	0.145	0.143	0.136	0.144	0.159	0.146	0.146	0.137	0.141	0.150	0.146
		Wailuku	3.161	3.202	3.253	3.223	3.311	3.546	3.504	3.580	3.556	3.475	3.414	3.547
		Wailuku Hts	0.211	0.238	0.234	0.217	0.242	0.268	0.246	0.242	0.245	0.243	0.217	0.225
		Spreckelsville	0.161	0.180	0.187	0.204	0.189	0.222	0.231	0.234	0.234	0.223	0.206	0.212
	Total		7.777	8.332	8.353	8.089	8.365	8.886	8.611	8.877	8.837	8.700	8.544	9.157
Kihei - Makena		Kihei	9.590	10.016	9.847	9.907	10.526	10.926	11.122	11.391	10.609	11.155	10.997	11.575
		Maalaea	0.228	0.212	0.212	0.232	0.214	0.227	0.249	0.249	0.233	0.230	0.212	0.219
		Makena	0.391	0.406	0.412	0.437	0.481	0.460	0.478	0.531	0.597	0.615	0.636	0.610
		Wailea												
	Total		10.209	10.634	10.471	10.577	11.221	11.613	11.849	12.171	11.439	12.000	11.845	12.404
Paia - Haiku		Haiku-Pauwela	0.233	0.283	0.286	0.269	0.262	0.302	0.341	0.358	0.362	0.421	0.394	0.386
		Kokomo-Kaupakalua	0.330	0.371	0.414	0.389	0.371	0.402	0.445	0.479	0.487	0.507	0.484	0.482
		Kuiaha	0.102	0.118	0.126	0.115	0.116	0.127	0.149	0.136	0.136	0.165	0.156	0.162
		Paia-Kuau	0.333	0.378	0.398	0.379	0.397	0.421	0.422	0.449	0.441	0.472	0.451	0.434
	Total		0.998	1.150	1.224	1.151	1.146	1.252	1.357	1.421	1.426	1.566	1.485	1.465
Makawao - Pukalani - Kula		Kula Ag Park	0.541	0.672	0.512	0.383	0.522	0.564	0.511	0.690	0.433	0.582	0.590	0.599
		Lower Kula	1.996	2.429	1.962	1.879	2.376	2.313	2.310	2.520	1.912	2.306	1.995	2.184
		Ulupalakua-Kanaio	0.139	0.136	0.129	0.132	0.171	0.175	0.192	0.196	0.178	0.173	0.146	0.174
		Upper Kula	1.206	1.349	1.127	1.010	1.215	1.298	1.442	1.540	1.218	1.387	1.252	1.358
		Haliimaile	0.088	0.093	0.095	0.089	0.092	0.099	0.100	0.096	0.097	0.104	0.110	0.111
		Makawao	0.821	0.919	0.978	0.866	0.903	1.004	0.987	0.999	0.971	0.983	1.004	0.958
		Pukalani	0.851	0.948	0.858	0.765	0.870	0.889	0.903	1.063	1.008	1.052	0.969	0.976
	Total		5.641	6.545	5.661	5.123	6.148	6.345	6.444	7.105	5.817	6.587	6.066	6.360
Lahaina		Alaeloa-Kahana	0.844	0.934	0.983	1.000	0.986	1.045	1.106	1.146	1.137	1.266	1.268	1.350
		Honokohau	0.004	0.010	0.011	0.012	0.014	0.019	0.023	0.018	0.022	0.021	0.017	0.019
		Honokowai	1.601	1.744	1.705	1.576	1.650	1.753	1.648	1.607	1.569	1.607	1.809	1.548
		Lahaina	2.194	2.294	2.245	2.091	2.339	2.462	2.611	2.594	2.327	2.341	2.247	2.273
	Total		4.644	4.983	4.943	4.679	4.989	5.279	5.388	5.365	5.054	5.235	5.342	5.190
Hana - East Maui		Hana	0.142	0.148	0.143	0.134	0.150	0.156	0.174	0.170	0.155	0.156	0.137	0.133
		Kaupo	0.004	0.004	0.004	0.005	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.004
		Keanae	0.026	0.025	0.027	0.025	0.026	0.025	0.024	0.021	0.022	0.034	0.024	0.020
		Nahiku	0.010	0.008	0.008	0.011	0.011	0.011	0.011	0.011	0.010	0.012	0.012	0.012
	Total		0.181	0.185	0.182	0.174	0.191	0.196	0.213	0.205	0.190	0.205	0.177	0.169
Molokai	Molokai	Halawa	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000
		Kalae	0.026	0.028	0.030	0.028	0.027	0.028	0.027	0.028	0.028	0.042	0.035	0.031
		Kawela-Kaunakakai	0.751	0.720	0.673	0.680	0.714	0.726	0.694	0.709	0.689	0.684	0.634	0.630
		Ualapue-Kamalo	0.163	0.189	0.202	0.185	0.195	0.194	0.195	0.209	0.208	0.240	0.172	0.181
	Total		0.941	0.939	0.906	0.894	0.937	0.949	0.916	0.946	0.925	0.967	0.842	0.842
All DWS	Total		30.391	32.767	31.740	30.686	32.997	34.519	34.777	36.090	33.687	35.259	34.301	35.588
DWS All Systems	Grand Total		30.459	32.839	31.819	30.767	33.071	34.595	34.861	36.170	33.762	35.334	34.370	35.665

Figure 6 Historical Metered DWS Consumption - All Services by Community Plan District and DWS Subdistrict

Historical Metered Consumption (Millions of Gallons per Day)

AG Non-Potable			Calendar Year											
CPD NAME		**SUBDIST NAME**	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Makawao - Pukalani - Kula		Kula Ag Park	0.504	0.634	0.481	0.374	0.512	0.555	0.505	0.690	0.433	0.582	0.575	0.571
		Makawao												
	Total		0.504	0.634	0.481	0.374	0.512	0.555	0.505	0.690	0.433	0.582	0.575	0.571
AG Non-Potable	Total		0.504	0.634	0.481	0.374	0.512	0.555	0.505	0.690	0.433	0.582	0.575	0.571
AG Potable														
Wailuku - Kahului		Kahului	0.003	0.003	0.001	0.001	0.001	0.003	0.003	0.003	0.001	0.001	0.001	0.002
		Puunene	0.100	0.100	0.109	0.102	0.063	0.069	0.068	0.079	0.080	0.062	0.044	0.063
		Wailuku	0.011	0.016	0.015	0.014	0.016	0.018	0.017	0.021	0.018	0.015	0.013	0.017
	Total		0.114	0.119	0.125	0.117	0.080	0.090	0.089	0.102	0.099	0.078	0.058	0.082
Kihei - Makena		Kihei	0.305	0.393	0.465	0.484	0.522	0.507	0.568	0.566	0.306	0.341	0.392	0.354
		Makena	0.003	0.003	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.002	0.003	0.004
	Total		0.308	0.396	0.467	0.486	0.524	0.510	0.570	0.569	0.309	0.343	0.394	0.357
Paia - Haiku		Haiku-Pauwela	0.005	0.029	0.020	0.019	0.019	0.021	0.028	0.031	0.035	0.059	0.035	0.032
		Kokomo-Kaupakalua	0.023	0.028	0.031	0.028	0.029	0.038	0.048	0.046	0.048	0.049	0.049	0.048
		Kuiaha	0.023	0.025	0.026	0.020	0.020	0.027	0.037	0.031	0.033	0.050	0.047	0.048
		Paia-Kuau	0.006	0.008	0.008	0.008	0.007	0.009	0.005	0.005	0.007	0.008	0.006	0.009
	Total		0.058	0.089	0.085	0.075	0.075	0.095	0.118	0.114	0.122	0.166	0.138	0.136
Makawao - Pukalani - Kula														
		Lower Kula	1.289	1.555	1.243	1.207	1.643	1.564	1.556	1.652	1.178	1.475	1.319	1.505
		Ulupalakua-Kanaio	0.112	0.111	0.109	0.112	0.150	0.155	0.167	0.167	0.140	0.140	0.124	0.146
		Upper Kula	0.400	0.465	0.387	0.344	0.412	0.485	0.529	0.526	0.375	0.445	0.415	0.482
		Haliimaile	0.003	0.004	0.004	0.004	0.003	0.003	0.004	0.004	0.004	0.004	0.003	0.000
		Makawao	0.069	0.076	0.094	0.087	0.097	0.173	0.126	0.096	0.086	0.089	0.135	0.106
		Pukalani	0.006	0.008	0.008	0.007	0.009	0.009	0.008	0.009	0.008	0.008	0.010	0.012
	Total		1.879	2.220	1.846	1.762	2.314	2.388	2.391	2.454	1.792	2.162	2.007	2.251
Lahaina		Alaeloa-Kahana		0.000	0.001	0.002	0.003	0.004	0.004	0.006	0.009	0.010	0.008	0.009
		Honokowai	0.001	0.007	0.009	0.009	0.011	0.017	0.020	0.014	0.018	0.017	0.013	0.015
		Lahaina	0.002											
	Total		0.003	0.007	0.010	0.011	0.014	0.021	0.024	0.021	0.026	0.027	0.022	0.024
Hana - East Maui		Hana	0.003	0.004	0.007	0.009	0.010	0.010	0.015	0.007	0.009	0.005	0.004	0.005
	Total		0.003	0.004	0.007	0.009	0.010	0.010	0.015	0.007	0.009	0.005	0.004	0.005
Molokai		Kawela-Kaunakakai	0.001	0.001	0.004	0.006	0.007	0.006	0.008	0.007	0.007	0.008	0.004	0.004
		Ualapue-Kamalo	0.009	0.011	0.011	0.010	0.012	0.014	0.017	0.015	0.014	0.021	0.012	0.015
	Total		0.010	0.012	0.015	0.016	0.019	0.020	0.025	0.022	0.020	0.029	0.016	0.019
AG Potable	Total		2.374	2.845	2.556	2.475	3.036	3.133	3.232	3.289	2.379	2.809	2.639	2.875

Figure 7 Historical Metered DWS Consumption - Agricultural Uses by Community Plan District and DWS Subdistrict

Historical Metered Consumption (Millions of Gallons per Day)

General Consumption			Calendar Year											
CPD NAME		**SUBDIST NAME**	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Wailuku - Kahului		Kahului	3.914	4.360	4.316	4.098	4.301	4.501	4.295	4.485	4.493	4.448	4.427	4.868
		Puunene	0.024	0.032	0.031	0.028	0.041	0.042	0.034	0.030	0.017	0.032	0.017	0.018
		Waihee	0.067	0.070	0.079	0.080	0.072	0.076	0.084	0.080	0.074	0.074	0.067	0.077
		Waikapu	0.136	0.145	0.143	0.136	0.144	0.159	0.146	0.146	0.137	0.141	0.150	0.146
		Wailuku	3.149	3.186	3.238	3.209	3.295	3.528	3.487	3.559	3.537	3.460	3.402	3.530
		Wailuku Hts	0.211	0.238	0.234	0.217	0.242	0.268	0.246	0.242	0.245	0.243	0.217	0.225
		Spreckelsville	0.161	0.180	0.187	0.204	0.189	0.222	0.231	0.234	0.234	0.223	0.206	0.212
	Total		7.663	8.213	8.228	7.972	8.285	8.796	8.522	8.775	8.738	8.622	8.486	9.075
Kihei - Makena		Kihei	9.285	9.623	9.382	9.423	10.004	10.419	10.554	10.826	10.303	10.815	10.605	11.222
		Maalaea	0.228	0.212	0.212	0.232	0.214	0.227	0.249	0.249	0.233	0.230	0.212	0.219
		Makena	0.388	0.404	0.410	0.436	0.479	0.457	0.476	0.528	0.594	0.613	0.634	0.606
		Wailea												
	Total		9.901	10.239	10.004	10.091	10.697	11.104	11.279	11.603	11.130	11.658	11.451	12.047
Paia - Haiku		Haiku-Pauwela	0.227	0.254	0.266	0.250	0.243	0.281	0.313	0.326	0.326	0.363	0.359	0.354
		Kokomo-Kaupakalua	0.307	0.343	0.384	0.361	0.341	0.364	0.397	0.432	0.439	0.457	0.435	0.434
		Kuiaha	0.079	0.093	0.100	0.094	0.096	0.100	0.112	0.104	0.103	0.115	0.109	0.114
		Paia-Kuau	0.328	0.371	0.389	0.371	0.391	0.412	0.417	0.444	0.435	0.465	0.444	0.426
	Total		0.941	1.061	1.139	1.077	1.071	1.157	1.239	1.307	1.303	1.400	1.348	1.328
Makawao - Pukalani - Kula		Kula Ag Park	0.037	0.037	0.032	0.009	0.010	0.009	0.006				0.015	0.028
		Lower Kula	0.707	0.874	0.719	0.672	0.733	0.750	0.753	0.868	0.734	0.831	0.676	0.679
		Ulupalakua-Kanaio	0.027	0.024	0.019	0.019	0.021	0.021	0.024	0.029	0.038	0.033	0.022	0.028
		Upper Kula	0.805	0.884	0.740	0.666	0.803	0.813	0.913	1.015	0.842	0.942	0.837	0.877
		Haliimaile	0.085	0.089	0.091	0.085	0.089	0.097	0.096	0.092	0.093	0.100	0.107	0.110
		Makawao	0.752	0.843	0.883	0.778	0.806	0.831	0.861	0.903	0.884	0.894	0.869	0.853
		Pukalani	0.845	0.940	0.850	0.757	0.861	0.880	0.895	1.054	1.000	1.044	0.958	0.964
	Total		3.258	3.691	3.334	2.987	3.322	3.402	3.548	3.960	3.592	3.843	3.484	3.539
Lahaina		Alaeloa-Kahana	0.844	0.934	0.981	0.998	0.984	1.041	1.101	1.140	1.129	1.256	1.260	1.341
		Honokohau	0.003	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.003	0.004
		Honokowai	1.601	1.744	1.705	1.576	1.650	1.753	1.648	1.607	1.569	1.607	1.809	1.548
		Lahaina	2.192	2.294	2.245	2.091	2.339	2.462	2.611	2.594	2.327	2.341	2.247	2.273
	Total		4.641	4.975	4.933	4.668	4.975	5.258	5.363	5.344	5.028	5.208	5.320	5.166
Hana - East Maui		Hana	0.139	0.145	0.136	0.125	0.140	0.146	0.158	0.163	0.146	0.151	0.133	0.128
		Kaupo	0.004	0.004	0.004	0.005	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.004
		Keanae	0.026	0.025	0.027	0.025	0.026	0.025	0.024	0.021	0.022	0.034	0.024	0.020
		Nahiku	0.010	0.008	0.008	0.011	0.011	0.011	0.011	0.011	0.010	0.012	0.012	0.012
	Total		0.179	0.181	0.174	0.165	0.181	0.186	0.197	0.199	0.180	0.200	0.173	0.164
Molokai	Molokai	Halawa	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000
		Kalae	0.026	0.028	0.030	0.028	0.027	0.028	0.027	0.028	0.028	0.042	0.035	0.031
		Kawela-Kaunakakai	0.750	0.719	0.669	0.675	0.707	0.720	0.686	0.701	0.682	0.676	0.630	0.626
		Ualapue-Kamalo	0.154	0.178	0.191	0.174	0.183	0.180	0.178	0.194	0.194	0.218	0.160	0.165
	Total		0.931	0.927	0.891	0.878	0.918	0.928	0.891	0.923	0.905	0.938	0.826	0.823
All DWS General	Total		27.512	29.287	28.703	27.838	29.449	30.830	31.040	32.111	30.875	31.868	31.088	32.142

Figure 8 Historical Metered DWS Consumption - General Potable Services by Community Plan District and DWS Subdistrict

Maui DWS Historical Metered Consumption by Class Code (Thousands of Gallons)

			Calendar Year												
CPD NAME	**CLASS CODE**		**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Wailuku-Kahului	10	Single Family	3.721	3.967	3.951	3.748	3.954	4.240	4.187	4.376	4.321	4.493	4.315	4.545	4.648
	20	Multi-Family	0.570	0.646	0.660	0.710	0.706	0.770	0.795	0.794	0.745	0.721	0.701	0.772	0.830
	30	Commercial	1.171	1.267	1.332	1.313	1.412	1.385	1.298	1.442	1.486	1.392	1.417	1.450	1.441
	40	Hotel	0.102	0.119	0.114	0.099	0.107	0.094	0.072	0.037	0.079	0.047	0.044	0.049	0.055
	50	Industrial	0.541	0.620	0.649	0.612	0.556	0.631	0.569	0.591	0.626	0.615	0.630	0.681	0.669
	60	Government	1.468	1.438	1.409	1.394	1.445	1.560	1.460	1.405	1.364	1.234	1.266	1.457	1.515
	70	Agriculture	0.138	0.172	0.165	0.151	0.120	0.137	0.141	0.152	0.130	0.108	0.081	0.104	0.135
	80	Religious Inst.	0.062	0.096	0.070	0.058	0.062	0.067	0.089	0.081	0.084	0.087	0.085	0.096	0.084
Wailuku-KahuluiTotal	Total		7.774	8.326	8.349	8.084	8.362	8.885	8.611	8.878	8.836	8.698	8.539	9.156	9.376
Wailuku-Kahului	10	Single Family	47.9%	47.7%	47.3%	46.4%	47.3%	47.7%	48.6%	49.3%	48.9%	51.7%	50.5%	49.6%	49.6%
	20	Multi-Family	7.3%	7.8%	7.9%	8.8%	8.4%	8.7%	9.2%	8.9%	8.4%	8.3%	8.2%	8.4%	8.8%
	30	Commercial	15.1%	15.2%	16.0%	16.2%	16.9%	15.6%	15.1%	16.2%	16.8%	16.0%	16.6%	15.8%	15.4%
	40	Hotel	1.3%	1.4%	1.4%	1.2%	1.3%	1.1%	0.8%	0.4%	0.9%	0.5%	0.5%	0.5%	0.6%
	50	Industrial	7.0%	7.4%	7.8%	7.6%	6.6%	7.1%	6.6%	6.7%	7.1%	7.1%	7.4%	7.4%	7.1%
	60	Government	18.9%	17.3%	16.9%	17.2%	17.3%	17.6%	17.0%	15.8%	15.4%	14.2%	14.8%	15.9%	16.2%
	70	Agriculture	1.8%	2.1%	2.0%	1.9%	1.4%	1.5%	1.6%	1.7%	1.5%	1.2%	0.9%	1.1%	1.4%
	80	Religious Inst.	0.8%	1.1%	0.8%	0.7%	0.7%	0.8%	1.0%	0.9%	1.0%	1.0%	1.0%	1.1%	0.9%
Wailuku-KahuluiTotal	Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

			Calendar Year												
CPDIST NAME	**CLASS18**		**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Kihei-Makena	10	Single Family	3.296	3.470	3.363	3.382	3.679	3.807	3.932	4.097	3.994	4.390	4.236	4.532	4.530
	20	Multi-Family	3.362	3.486	3.367	3.360	3.433	3.599	3.733	3.725	3.452	3.442	3.298	3.448	3.384
	30	Commercial	0.606	0.648	0.643	0.636	0.741	0.673	0.724	0.833	0.964	0.887	0.899	0.892	0.910
	40	Hotel	1.811	1.839	1.850	1.859	1.929	2.118	2.103	2.179	1.945	2.151	2.220	2.208	2.185
	50	Industrial	0.252	0.244	0.226	0.230	0.233	0.250	0.285	0.307	0.296	0.310	0.325	0.341	0.355
	60	Government	0.506	0.492	0.501	0.569	0.622	0.598	0.439	0.397	0.417	0.412	0.418	0.564	0.495
	70	Agriculture	0.334	0.417	0.485	0.504	0.548	0.532	0.595	0.596	0.334	0.370	0.420	0.382	0.285
	80	Religious Inst.	0.044	0.044	0.041	0.042	0.045	0.044	0.047	0.046	0.045	0.047	0.041	0.045	0.059
Kihei-MakenaTotal	Total		10.212	10.640	10.475	10.582	11.229	11.620	11.858	12.180	11.448	12.009	11.857	12.412	12.203
Kihei-Makena	10	Single Family	32.3%	32.6%	32.1%	32.0%	32.8%	32.8%	33.2%	33.6%	34.9%	36.6%	35.7%	36.5%	37.1%
	20	Multi-Family	32.9%	32.8%	32.1%	31.8%	30.6%	31.0%	31.5%	30.6%	30.2%	28.7%	27.8%	27.8%	27.7%
	30	Commercial	5.9%	6.1%	6.1%	6.0%	6.6%	5.8%	6.1%	6.8%	8.4%	7.4%	7.6%	7.2%	7.5%
	40	Hotel	17.7%	17.3%	17.7%	17.6%	17.2%	18.2%	17.7%	17.9%	17.0%	17.9%	18.7%	17.8%	17.9%
	50	Industrial	2.5%	2.3%	2.2%	2.2%	2.1%	2.2%	2.4%	2.5%	2.6%	2.6%	2.7%	2.7%	2.9%
	60	Government	5.0%	4.6%	4.8%	5.4%	5.5%	5.1%	3.7%	3.3%	3.6%	3.4%	3.5%	4.5%	4.1%
	70	Agriculture	3.3%	3.9%	4.6%	4.8%	4.9%	4.6%	5.0%	4.9%	2.9%	3.1%	3.5%	3.1%	2.3%
	80	Religious Inst.	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.3%	0.4%	0.5%
Kihei-MakenaTotal	Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Figure 9 Historical Metered DWS Consumption by Use Class Code and Community Plan District

Maui DWS Historical Metered Consumption by Class Code (Thousands of Gallons)

			Calendar Year												
CPD NAME	**CLASS CODE**		**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Makawao-Kula	10	Single Family	2.446	2.756	2.496	2.221	2.443	2.526	2.716	3.066	2.828	3.122	2.890	2.970	3.118
	20	Multi-Family	0.041	0.051	0.045	0.041	0.036	0.060	0.065	0.070	0.065	0.059	0.050	0.049	0.048
	30	Commercial	0.183	0.190	0.207	0.136	0.185	0.208	0.160	0.187	0.208	0.219	0.205	0.177	0.171
	40	Hotel	0.006	0.007	0.006	0.006	0.007	0.008	0.011	0.011	0.009	0.007	0.006	0.010	0.006
	50	Industrial	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	60	Government	0.168	0.166	0.172	0.175	0.219	0.198	0.215	0.237	0.182	0.188	0.191	0.186	0.199
	70	Agriculture	2.781	3.357	2.719	2.530	3.241	3.327	3.260	3.513	2.510	2.973	2.708	2.952	2.732
	80	Religious Inst.	0.016	0.020	0.016	0.015	0.017	0.018	0.018	0.021	0.015	0.019	0.017	0.016	0.017
Makawao-KulaTotal	Total		5.642	6.546	5.662	5.123	6.149	6.345	6.445	7.106	5.817	6.588	6.066	6.361	6.291
Makawao-Kula	10	Single Family	43.4%	42.1%	44.1%	43.3%	39.7%	39.8%	42.1%	43.2%	48.6%	47.4%	47.6%	46.7%	49.6%
	20	Multi-Family	0.7%	0.8%	0.8%	0.8%	0.6%	0.9%	1.0%	1.0%	1.1%	0.9%	0.8%	0.8%	0.8%
	30	Commercial	3.2%	2.9%	3.7%	2.6%	3.0%	3.3%	2.5%	2.6%	3.6%	3.3%	3.4%	2.8%	2.7%
	40	Hotel	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.1%	0.1%	0.2%	0.1%
	50	Industrial	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	60	Government	3.0%	2.5%	3.0%	3.4%	3.6%	3.1%	3.3%	3.3%	3.1%	2.9%	3.1%	2.9%	3.2%
	70	Agriculture	49.3%	51.3%	48.0%	49.4%	52.7%	52.4%	50.6%	49.4%	43.1%	45.1%	44.6%	46.4%	43.4%
	80	Religious Inst.	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Makawao-KulaTotal	Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

			Calendar Year												
CPDIST NAME	**CLASS18**		**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Paia-Haiku	10	Single Family	0.790	0.864	0.914	0.857	0.868	0.950	1.019	1.070	1.077	1.185	1.176	1.157	1.166
	20	Multi-Family	0.016	0.044	0.047	0.043	0.037	0.040	0.041	0.047	0.043	0.040	0.014	0.016	0.014
	30	Commercial	0.051	0.065	0.076	0.079	0.060	0.066	0.070	0.064	0.062	0.065	0.064	0.065	0.065
	50	Industrial	0.012	0.013	0.018	0.016	0.021	0.019	0.018	0.016	0.012	0.015	0.014	0.012	0.014
	60	Government	0.026	0.026	0.031	0.028	0.034	0.026	0.025	0.039	0.036	0.045	0.048	0.058	0.059
	70	Agriculture	0.095	0.130	0.129	0.121	0.120	0.143	0.178	0.178	0.186	0.207	0.159	0.144	0.165
	80	Religious Inst.	0.007	0.008	0.007	0.006	0.006	0.007	0.005	0.005	0.007	0.007	0.009	0.012	0.006
Paia-HaikuTotal	Total		0.998	1.149	1.223	1.150	1.145	1.251	1.356	1.420	1.425	1.565	1.485	1.464	1.490
Paia-Haiku	10	Single Family	79.2%	75.2%	74.7%	74.5%	75.8%	75.9%	75.1%	75.4%	75.6%	75.7%	79.2%	79.0%	78.3%
	20	Multi-Family	1.6%	3.8%	3.9%	3.8%	3.3%	3.2%	3.0%	3.3%	3.0%	2.6%	1.0%	1.1%	0.9%
	30	Commercial	5.2%	5.7%	6.2%	6.9%	5.2%	5.2%	5.1%	4.5%	4.4%	4.1%	4.3%	4.4%	4.4%
	50	Industrial	1.2%	1.1%	1.5%	1.4%	1.8%	1.5%	1.3%	1.2%	0.8%	0.9%	0.9%	0.9%	1.0%
	60	Government	2.6%	2.3%	2.6%	2.4%	3.0%	2.1%	1.9%	2.8%	2.6%	2.9%	3.2%	4.0%	4.0%
	70	Agriculture	9.6%	11.3%	10.5%	10.5%	10.5%	11.5%	13.1%	12.6%	13.1%	13.2%	10.7%	9.8%	11.1%
	80	Religious Inst.	0.7%	0.7%	0.6%	0.5%	0.5%	0.5%	0.4%	0.4%	0.5%	0.5%	0.6%	0.8%	0.4%
Paia-HaikuTotal	Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Figure 10 Historical Metered DWS Consumption by Use Class Code and Community Plan District

Maui DWS Historical Metered Consumption by Class Code (Thousands of Gallons)

			Calendar Year												
CPD NAME	**CLASS CODE**		**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
West Maui	10	Single Family	1.403	1.510	1.476	1.400	1.543	1.617	1.649	1.669	1.612	1.704	1.629	1.629	1.651
	20	Multi-Family	1.520	1.711	1.716	1.626	1.638	1.705	1.695	1.765	1.719	1.780	1.672	1.666	1.638
	30	Commercial	0.352	0.360	0.352	0.319	0.335	0.361	0.407	0.420	0.409	0.396	0.399	0.446	0.512
	40	Hotel	0.540	0.552	0.561	0.519	0.550	0.576	0.516	0.439	0.416	0.440	0.822	0.620	0.689
	50	Industrial	0.408	0.414	0.427	0.395	0.395	0.385	0.381	0.391	0.389	0.371	0.362	0.378	0.367
	60	Government	0.371	0.375	0.353	0.359	0.463	0.566	0.663	0.602	0.428	0.455	0.382	0.367	0.402
	70	Agriculture	0.008	0.016	0.018	0.019	0.019	0.027	0.033	0.035	0.038	0.035	0.027	0.034	0.044
	80	Religious Inst.	0.040	0.043	0.040	0.042	0.044	0.042	0.044	0.043	0.044	0.053	0.049	0.050	0.053
West MauiTotal	Total		4.644	4.983	4.943	4.679	4.989	5.279	5.388	5.365	5.054	5.235	5.342	5.190	5.356
West Maui	10	Single Family	30.2%	30.3%	29.9%	29.9%	30.9%	30.6%	30.6%	31.1%	31.9%	32.6%	30.5%	31.4%	30.8%
	20	Multi-Family	32.7%	34.3%	34.7%	34.8%	32.8%	32.3%	31.5%	32.9%	34.0%	34.0%	31.3%	32.1%	30.6%
	30	Commercial	7.6%	7.2%	7.1%	6.8%	6.7%	6.8%	7.5%	7.8%	8.1%	7.6%	7.5%	8.6%	9.6%
	40	Hotel	11.6%	11.1%	11.4%	11.1%	11.0%	10.9%	9.6%	8.2%	8.2%	8.4%	15.4%	11.9%	12.9%
	50	Industrial	8.8%	8.3%	8.6%	8.4%	7.9%	7.3%	7.1%	7.3%	7.7%	7.1%	6.8%	7.3%	6.9%
	60	Government	8.0%	7.5%	7.1%	7.7%	9.3%	10.7%	12.3%	11.2%	8.5%	8.7%	7.1%	7.1%	7.5%
	70	Agriculture	0.2%	0.3%	0.4%	0.4%	0.4%	0.5%	0.6%	0.7%	0.7%	0.7%	0.5%	0.7%	0.8%
	80	Religious Inst.	0.9%	0.9%	0.8%	0.9%	0.9%	0.8%	0.8%	0.8%	0.9%	1.0%	0.9%	1.0%	1.0%
West MauiTotal	Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

			Calendar Year												
CPDIST NAME	**CLASS18**		**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Hana	10	Single Family	0.123	0.131	0.129	0.124	0.130	0.135	0.144	0.143	0.129	0.137	0.122	0.123	0.129
	20	Multi-Family	0.000	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.000	0.000
	30	Commercial	0.014	0.015	0.016	0.013	0.015	0.011	0.010	0.010	0.010	0.021	0.014	0.010	0.013
	40	Hotel	0.008	0.006	0.004	0.004	0.005	0.005	0.006	0.005	0.004	0.005	0.005	0.005	0.006
	60	Government	0.027	0.025	0.021	0.021	0.027	0.030	0.033	0.036	0.032	0.033	0.028	0.023	0.028
	70	Agriculture	0.004	0.004	0.008	0.009	0.011	0.011	0.016	0.007	0.010	0.006	0.004	0.005	0.006
	80	Religious Inst.	0.004	0.004	0.003	0.002	0.003	0.003	0.003	0.002	0.003	0.003	0.003	0.003	0.004
HanaTotal	Total		0.181	0.185	0.182	0.174	0.191	0.196	0.213	0.205	0.190	0.205	0.177	0.169	0.186
Hana	10	Single Family	68.0%	70.5%	71.2%	71.2%	68.4%	68.9%	68.0%	69.8%	68.2%	66.9%	68.8%	73.0%	69.5%
	20	Multi-Family	0.3%	0.3%	0.6%	0.4%	0.4%	1.0%	0.4%	0.3%	0.3%	0.3%	0.4%	0.3%	0.2%
	30	Commercial	7.8%	7.9%	8.6%	7.7%	7.8%	5.6%	4.7%	5.0%	5.3%	10.2%	8.2%	5.7%	7.1%
	40	Hotel	4.5%	3.1%	2.3%	2.5%	2.5%	2.4%	2.6%	2.6%	2.3%	2.2%	2.7%	3.1%	3.2%
	60	Government	15.0%	13.7%	11.4%	11.9%	13.9%	15.2%	15.3%	17.8%	17.1%	16.1%	15.7%	13.4%	14.8%
	70	Agriculture	2.1%	2.4%	4.2%	5.1%	5.6%	5.6%	7.6%	3.4%	5.1%	2.7%	2.4%	3.0%	3.1%
	80	Religious Inst.	2.3%	2.1%	1.7%	1.3%	1.3%	1.4%	1.5%	1.1%	1.6%	1.4%	1.8%	1.5%	2.0%
HanaTotal	Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Figure 11 Historical Metered DWS Consumption by Use Class Code by Community Plan District

Maui DWS Historical Metered Consumption by Class Code (Thousands of Gallons)

			Calendar Year												
CPD NAME	**CLASS CODE**		**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Molokai	10	Single Family	0.648	0.655	0.635	0.607	0.628	0.634	0.612	0.638	0.591	0.638	0.552	0.560	0.537
	20	Multi-Family	0.062	0.058	0.049	0.051	0.042	0.049	0.041	0.043	0.049	0.053	0.050	0.052	0.053
	30	Commercial	0.066	0.065	0.067	0.067	0.066	0.070	0.065	0.061	0.057	0.068	0.072	0.052	0.044
	40	Hotel	0.046	0.043	0.053	0.051	0.051	0.054	0.043	0.043	0.087	0.053	0.048	0.049	0.053
	50	Industrial	0.009	0.009	0.009	0.009	0.011	0.009	0.011	0.009	0.008	0.009	0.007	0.008	0.009
	60	Government	0.089	0.083	0.062	0.079	0.093	0.094	0.096	0.110	0.098	0.100	0.083	0.087	0.079
	70	Agriculture	0.010	0.013	0.018	0.021	0.034	0.024	0.035	0.027	0.023	0.032	0.019	0.023	0.019
	80	Religious Inst.	0.012	0.013	0.013	0.009	0.012	0.014	0.013	0.014	0.012	0.013	0.010	0.011	0.011
MolokaiTotal	Total		0.941	0.939	0.906	0.894	0.937	0.949	0.916	0.946	0.925	0.967	0.842	0.842	0.805
Wailuku-Kahului	10	Single Family	68.9%	69.7%	70.1%	67.9%	67.0%	66.8%	66.8%	67.5%	63.9%	66.0%	65.6%	66.5%	66.7%
	20	Multi-Family	6.6%	6.2%	5.5%	5.7%	4.5%	5.2%	4.4%	4.5%	5.3%	5.4%	5.9%	6.2%	6.6%
	30	Commercial	7.0%	6.9%	7.4%	7.5%	7.1%	7.4%	7.1%	6.5%	6.2%	7.1%	8.5%	6.1%	5.5%
	40	Hotel	4.9%	4.6%	5.9%	5.7%	5.4%	5.7%	4.7%	4.5%	9.4%	5.5%	5.7%	5.8%	6.6%
	50	Industrial	0.9%	0.9%	1.0%	1.0%	1.2%	1.0%	1.2%	0.9%	0.9%	0.9%	0.9%	0.9%	1.1%
	60	Government	9.5%	8.8%	6.8%	8.8%	10.0%	9.9%	10.5%	11.6%	10.6%	10.4%	9.9%	10.3%	9.8%
	70	Agriculture	1.0%	1.4%	1.9%	2.3%	3.6%	2.5%	3.8%	2.9%	2.5%	3.3%	2.3%	2.7%	2.4%
	80	Religious Inst.	1.2%	1.4%	1.4%	1.0%	1.3%	1.5%	1.4%	1.5%	1.3%	1.4%	1.2%	1.4%	1.3%
Wailuku-KahuluiTotal	Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Figure 12 Historical Metered DWS Consumption by Use Class Code by Community Plan District

Wailuku - Kahului CPD DWS Historical Water Use

The table below depicts monthly water demand for each use class for several recent years. Single family dwellings are the largest users of water in this district. The cyclical demand pattern for single family use class indicates a substantial component of outdoor water uses. The next largest use classes are the commercial and government classes showing a discernable but less pronounced annual cyclical use pattern.

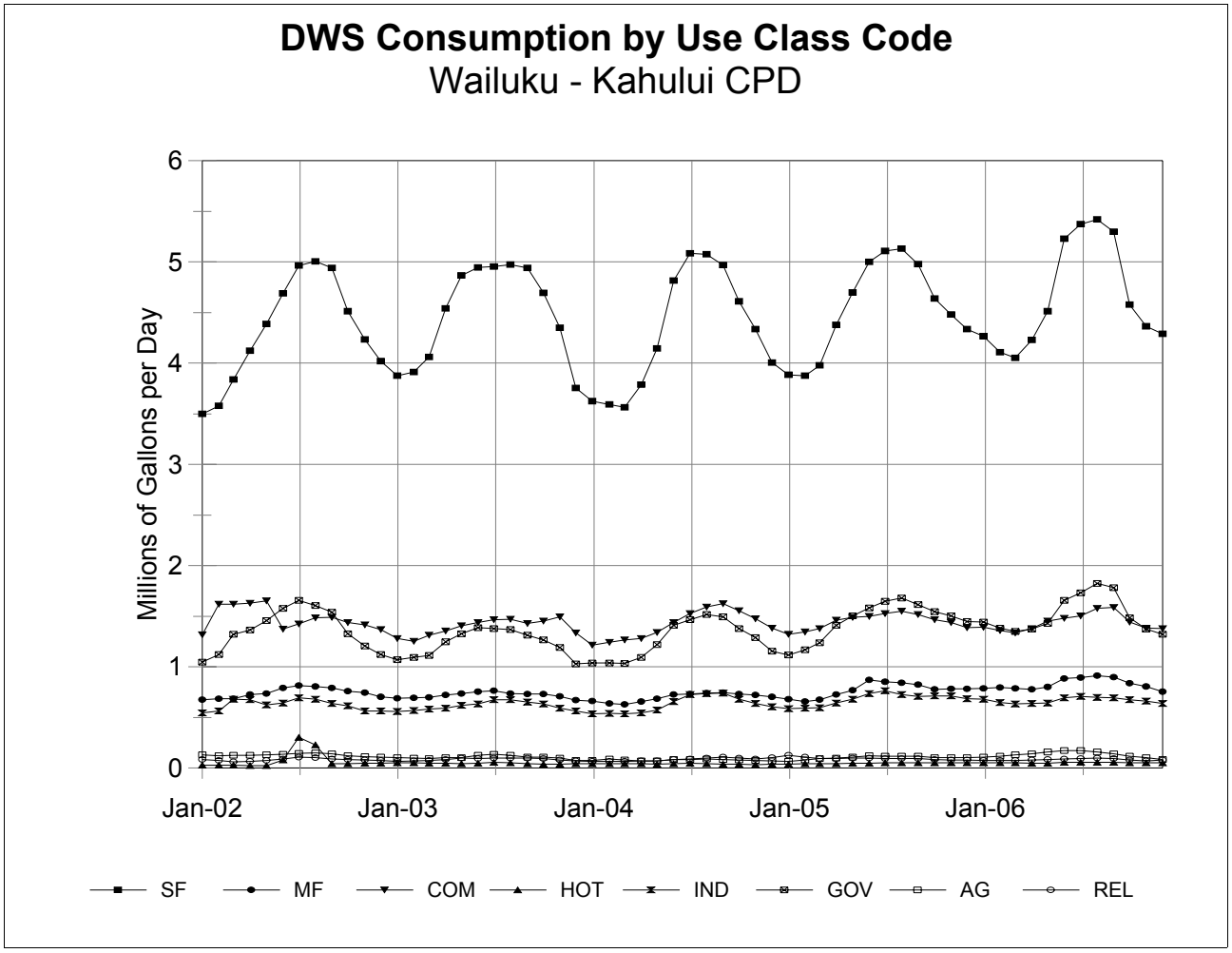

Figure 13 Historical Monthly DWS Consumption by Use Class Code: Wailuku-Kahului CPD

Kihei - Makena CPD DWS Historical Water Use

The table below depicts monthly water demand for each use class for several recent years. A mix of use classes contributes to water demand in this district. The largest use classes are single family, multi-family and hotel classes. The multi-family use class includes both resident and visitor components including apartments, condominiums, time-share units and hotel units. There is a strong annual cyclical use pattern for these use classes indicating a substantial component of outdoor water use.

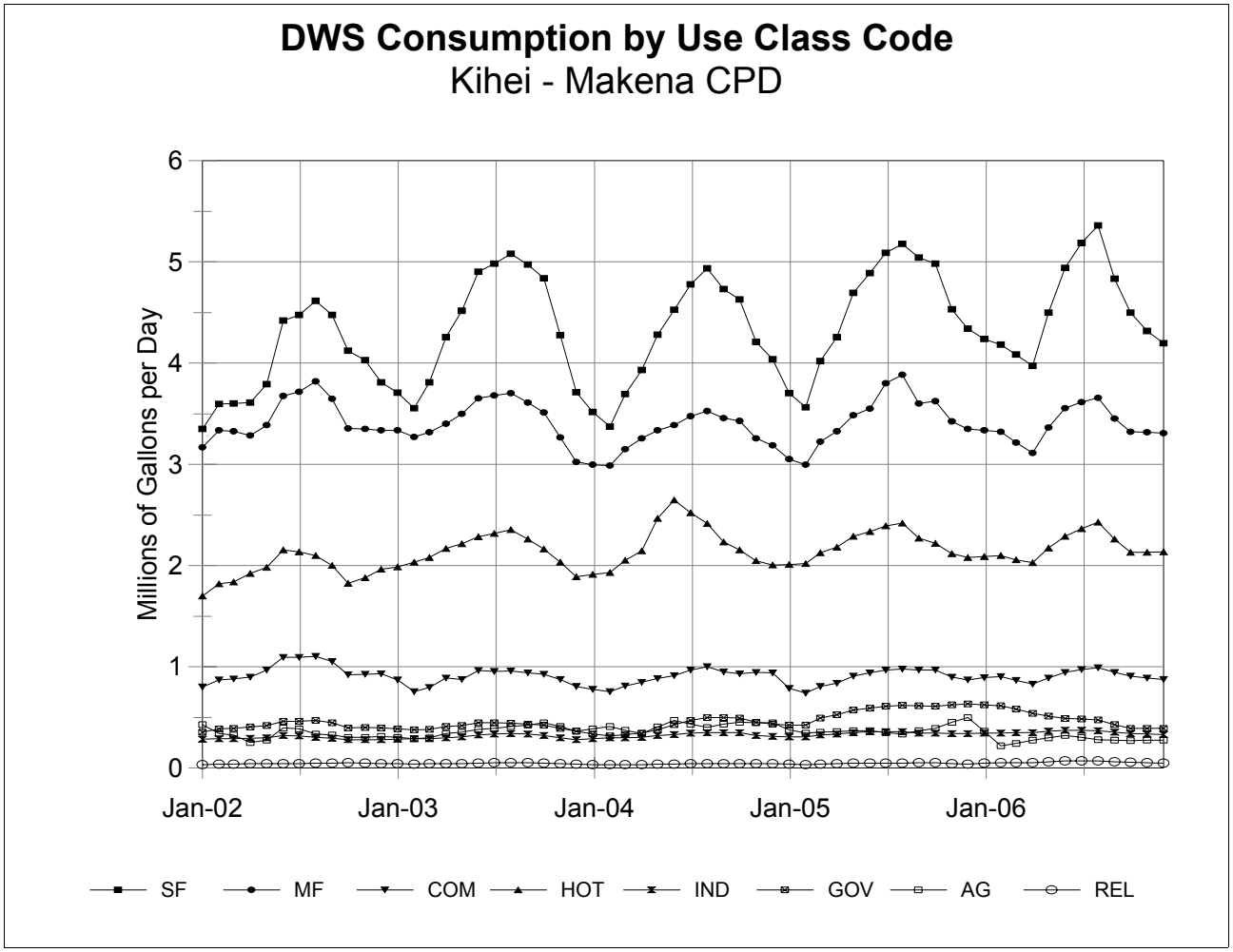

Figure 14 Historical Monthly DWS Consumption by Use Class Code: Kihei - Makena CPD

Makawao - Pukalani - Kula CPD DWS Historical Water Use

The table below depicts monthly water demand for each use class for several recent years. This community plan district shows the largest component of agricultural water use, matching single family use. These two use classes comprise almost all of the water use in the district. There is a strong annual cyclical pattern, especially for the agricultural uses which are exclusively outdoor uses.

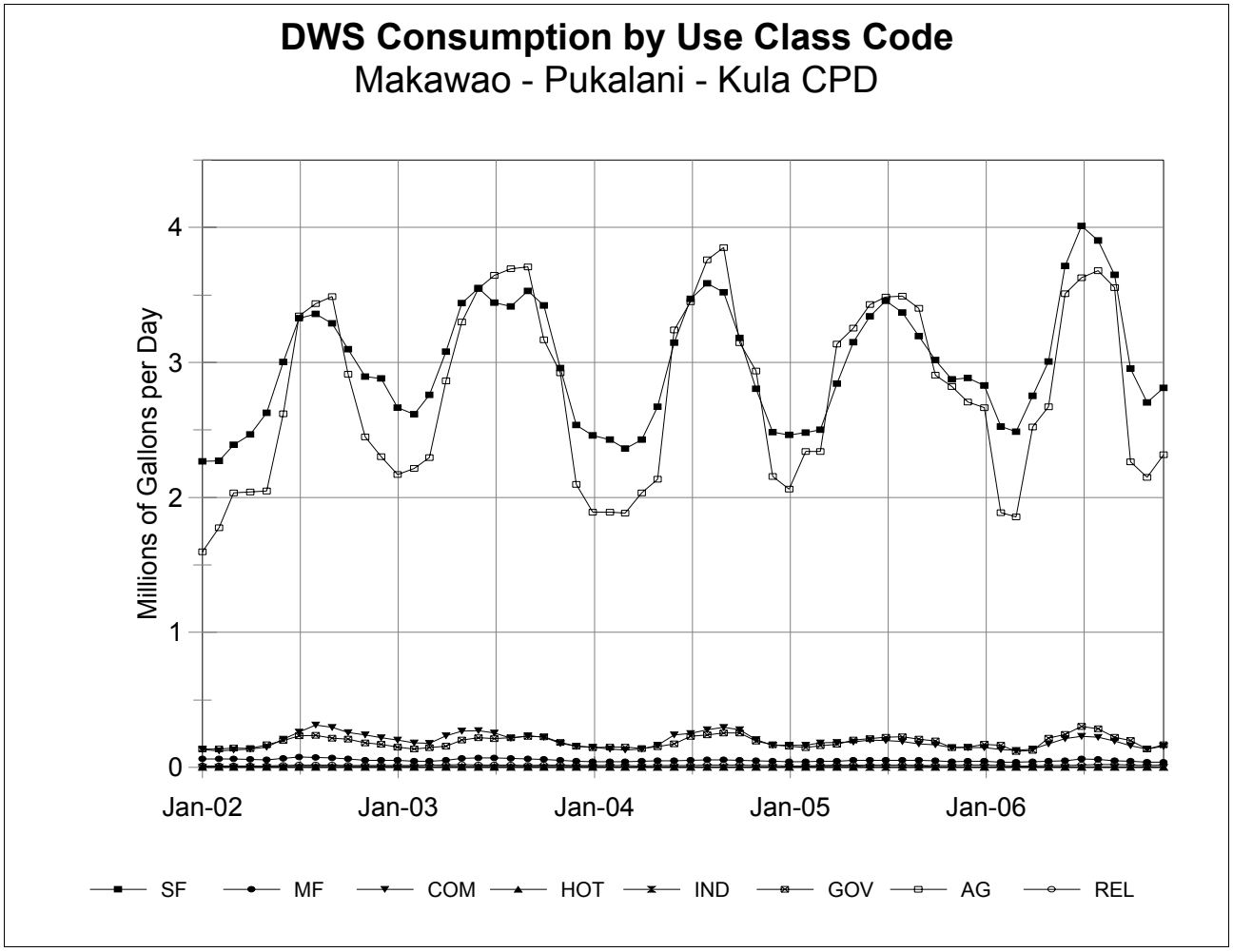

Figure 15 Historical Monthly DWS Consumption by Use Class Code: Makawao - Pukalani - Kula Community Plan District

Paia - Haiku CPD DWS Historical Water Use

The table below depicts monthly water demand for each use class for several recent years. Water use in the Paia-Haiku CPD is predominantly by the single family use class with some agricultural water use. These two use classes comprise almost all of the water use in this district.

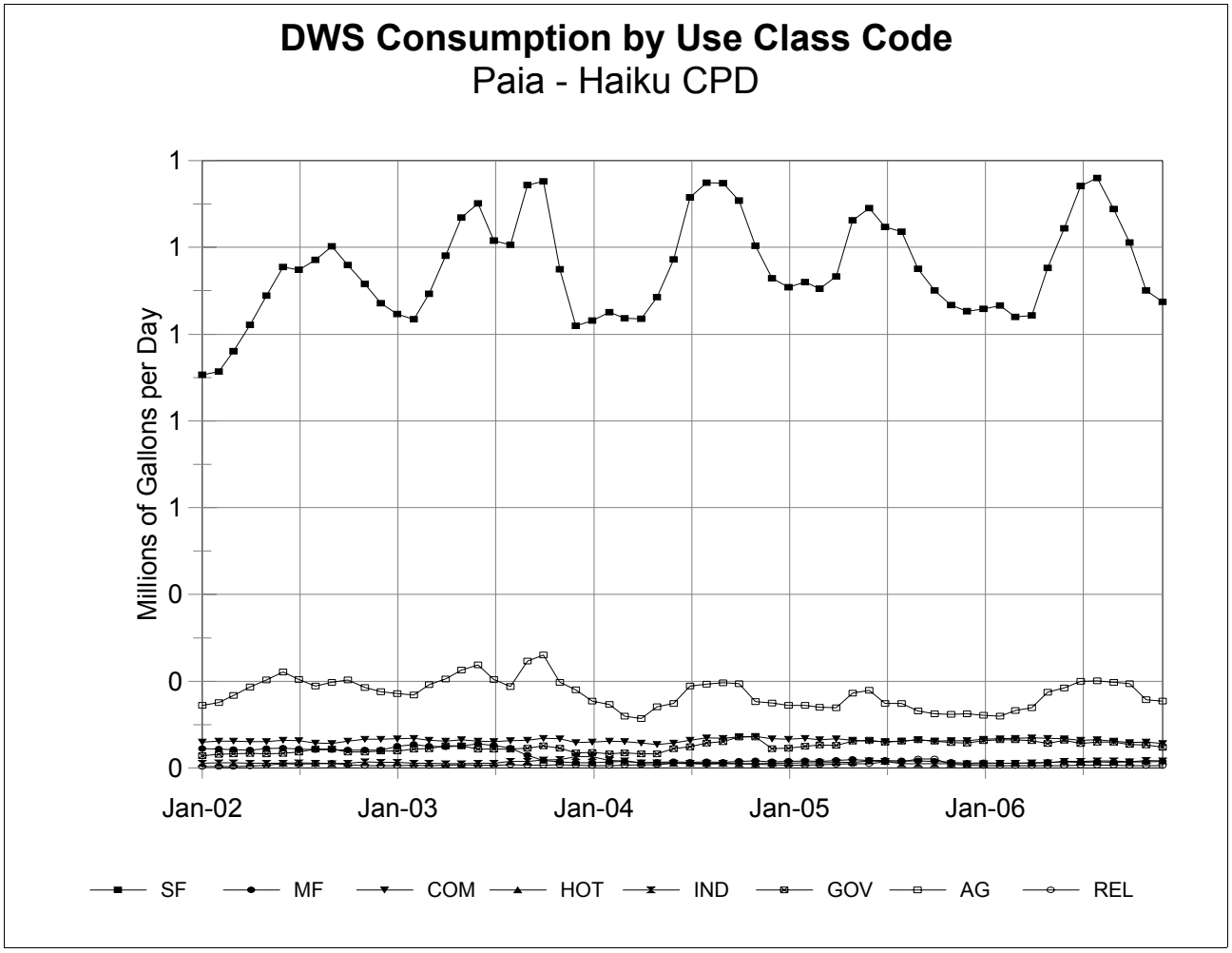

Figure 16 Historical Monthly DWS Consumption by Use Class: Paia - Haiku CPD

Lahaina CPD DWS Historical Water Use

The table below depicts monthly water demand for each use class for several recent years. The single family and multi-family use classes contribute the largest water demands in this district. These use classes show a strong annual cyclical use pattern indicating a substantial component of outdoor water uses. A mix of diverse uses including commercial, hotel, industrial and government uses comprise the remainder of demand. Substantial portions of hotel and visitor accommodation uses are included in the multi-family use class or are served by several large non-DWS water purveyors.

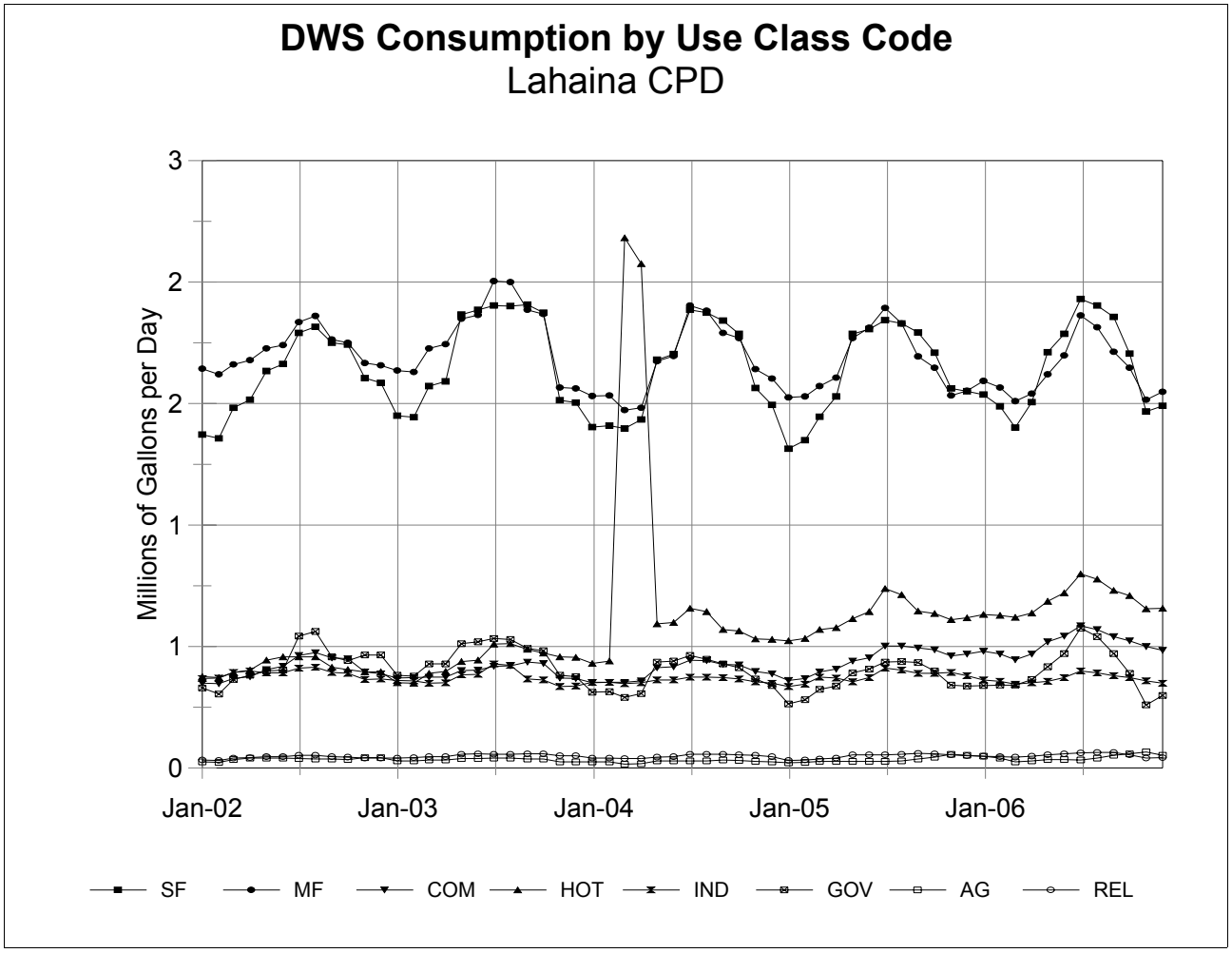

Figure 17 Historical Monthly DWS Consumption by Use Class Code: Lahaina CPD

Hana CPD DWS Historical Water Use

The table below depicts monthly water demand for each use class for several recent years. The single family use class contributes the predominant water demands for the Hana CPD. Government uses and a mix of smaller uses comprise the remainder. The relatively flat annual use pattern suggests that outdoor uses are a minor component of water uses.

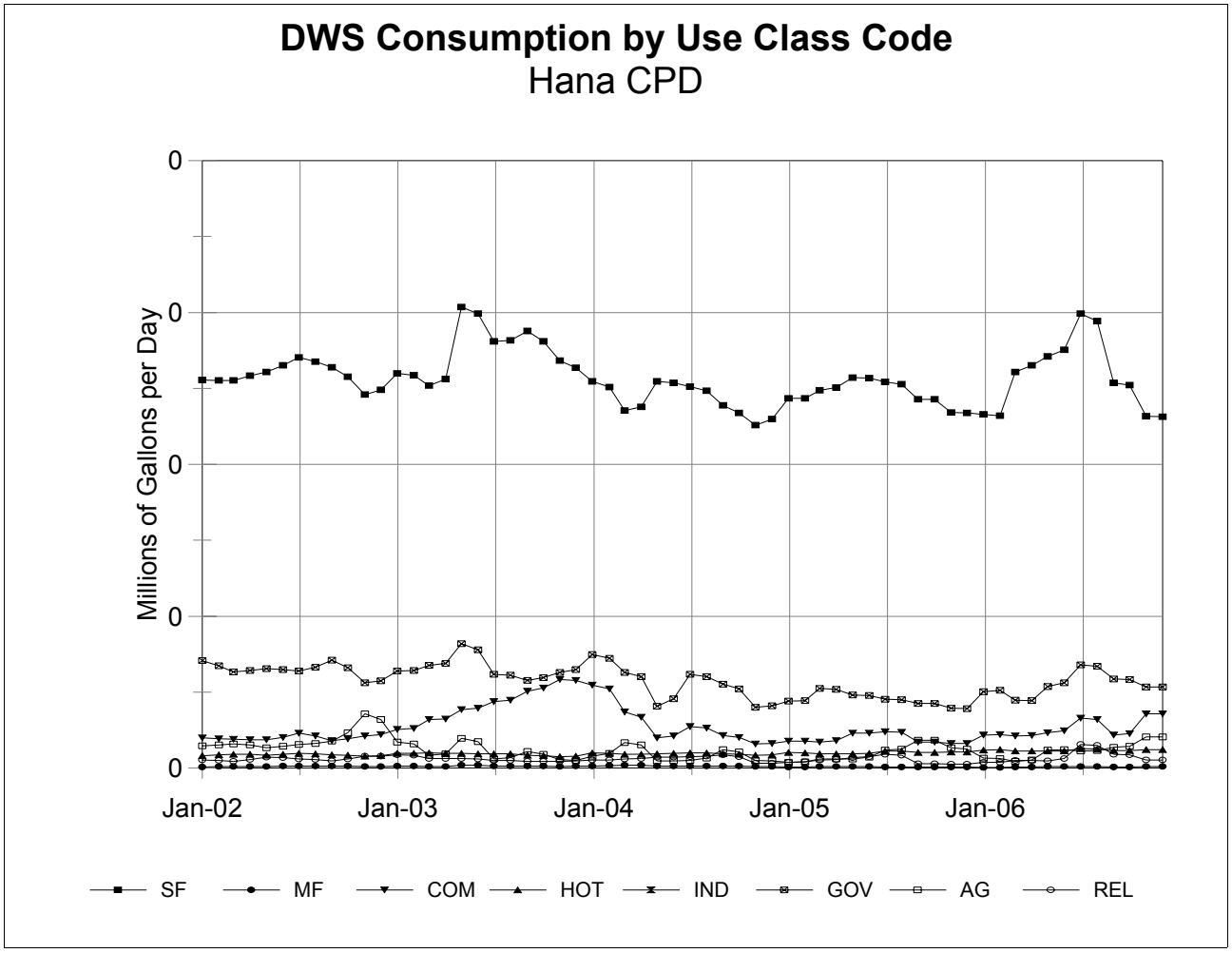

Figure 18 Historical Monthly DWS Consumption by Use Class Code: Hana CPD

Molokai CPD DWS Historical Water Use

The table below depicts monthly water demand for each use class for several recent years. Single family water use is the predominant use class. The pronounced annual cyclical use pattern suggests a substantial component of outdoor water use.

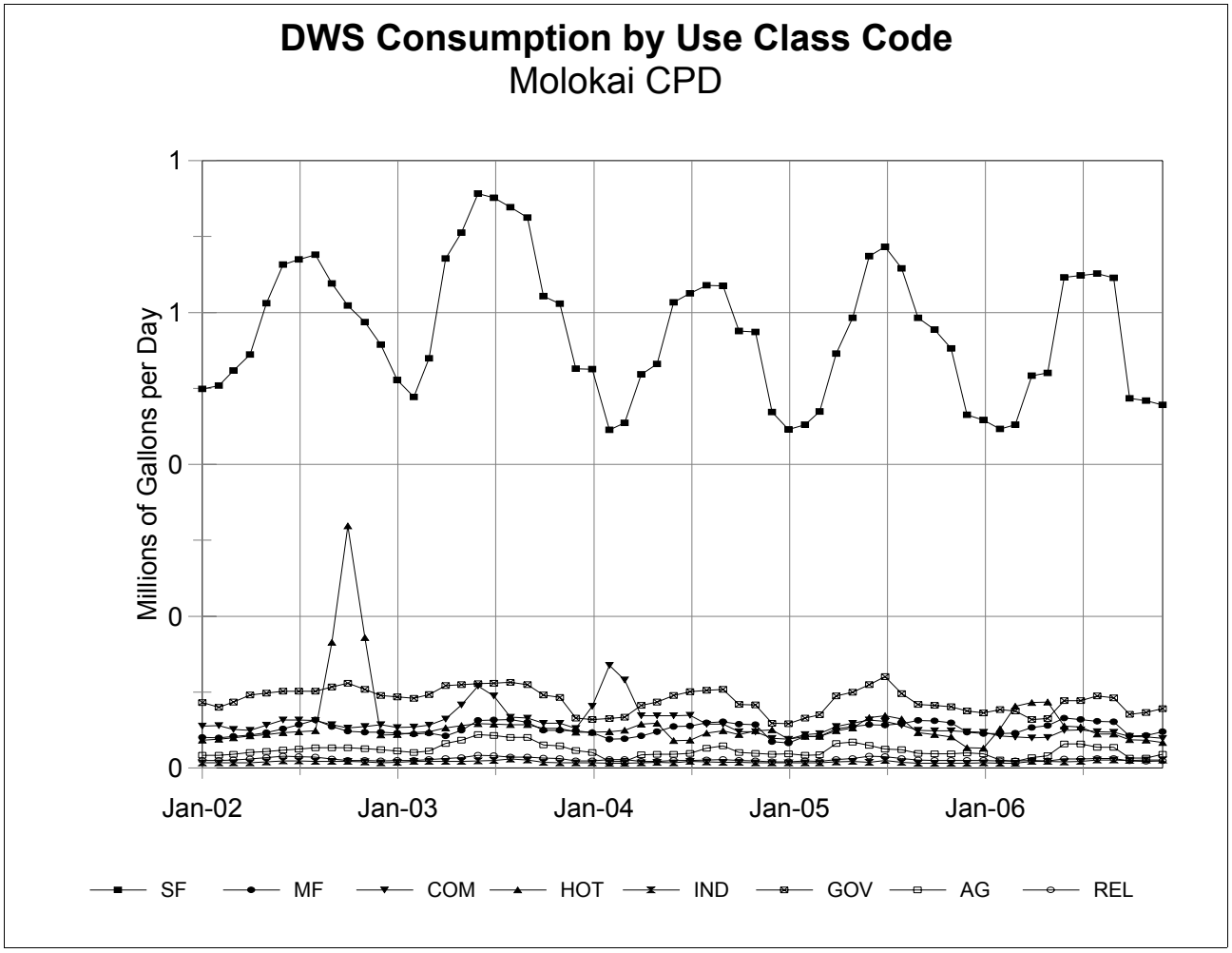

Figure 19 Historical Monthly DWS Consumption by Use Class Code: Molokai CPD

Consumption Per Day Per DWS Single Family Coded Account

Average Gallons per Day per Account (Excluding Accounts with Zero Consumption)

			Calendar Year					Five Year
DISTRICT	**AREA**	**SUBDISTRICT**	**2002**	**2003**	**2004**	**2005**	**2006**	**Average**
Central		Paia-Kuau	458.5	465.4	442.8	427.3	433.7	445.4
		Spreckelsville	1163.7	1109.2	1017.2	1060.6	1088.7	1087.0
	East CentralTotal		561.3	558.5	527.1	520.8	530.4	539.4
		Kahului	528.6	549.3	519.5	540.3	537.6	535.1
		Puunene	1674.0	1689.7	976.9	1186.8	1499.1	1405.3
		Waihee	340.2	307.2	293.4	289.0	325.6	311.0
		Waikapu	399.7	411.3	374.8	396.8	328.4	378.5
		Wailuku	411.9	426.4	399.9	387.9	391.1	402.8
		Wailuku Hts	490.8	500.8	453.4	464.2	473.6	476.4
	North CentralTotal		464.4	480.6	452.0	454.4	452.4	460.5
		Kihei	862.2	887.6	838.7	881.3	864.3	866.8
		Maalaea	1708.8	1755.7	1424.4	1317.1	1276.7	1496.6
		Makena	1563.5	1872.6	1715.1	2109.0	2216.0	1914.6
		Wailea	1897.0	1980.8	1793.0	1779.8	1705.4	1831.2
	South CentralTotal		893.0	925.4	871.0	919.2	904.2	902.7
CentralTotal			602.4	627.5	590.6	604.0	597.8	604.3
Hana - East Maui		Hana	349.5	368.8	315.1	328.6	352.6	342.9
		Kaupo	198.3	276.1	237.7	269.4	310.9	257.5
		Keanae	239.0	253.4	251.2	232.7	232.1	241.8
		Nahiku	305.6	384.2	400.8	380.7	284.6	350.1
	East MauiTotal		321.4	346.8	308.2	314.4	325.2	323.2
Hana - East MauiTotal			321.4	346.8	308.2	314.4	325.2	323.2
Molokai		Halawa	57.5	64.3	159.4	94.1	16.8	84.1
		Kalae	296.5	366.7	342.2	311.6	288.0	320.9
		Kawela-Kaunakakai	487.3	505.2	442.4	442.8	413.5	457.8
		Ualapue-Kamalo	462.4	525.1	410.7	414.8	429.3	448.2
	MolokaiTotal		467.5	498.4	427.7	426.3	406.9	444.9
MolokaiTotal			467.5	498.4	427.7	426.3	406.9	444.9
Upcountry		Haiku-Pauwela	395.1	444.0	428.0	430.4	432.4	426.1
		Kokomo-Kaupakalua	407.3	407.1	421.2	403.0	399.6	407.6
		Kuiaha	368.9	425.8	405.6	412.3	436.0	410.2
	HaikuTotal		397.8	422.8	421.8	414.2	416.2	414.7
		Lower Kula	694.3	828.9	730.2	922.8	967.4	830.2
		Ulupalakua-Kanaio	1239.6	1094.6	715.6	972.9	1066.4	1017.4
		Upper Kula	442.4	481.8	432.2	430.8	461.8	449.7
	KulaTotal		533.5	597.0	526.7	582.6	616.0	572.3
		Haliimaile	422.7	424.7	425.3	390.3	395.1	411.6
		Makawao	385.5	387.5	371.2	359.0	361.8	372.9
		Pukalani	446.4	465.3	433.1	432.3	451.1	445.6
	MakawaoTotal		416.8	427.3	404.1	396.6	407.4	410.4
UpcountryTotal			443.2	471.6	441.6	452.7	468.5	455.7
West Maui		Alaeloa-Kahana	572.3	655.7	611.7	578.4	613.8	606.6
		Honokohau	314.7	311.1	290.5	333.4	257.1	302.5
		Honokowai	799.0	746.7	688.6	714.9	717.6	731.0
		Lahaina	669.7	682.3	648.1	646.1	636.7	656.5
	West MauiTotal		662.0	682.3	643.7	638.8	639.9	653.1
West MauiTotal			662.0	682.3	643.7	638.8	639.9	653.1
Grand Total			550.1	576.1	539.7	550.3	551.2	553.4

Figure 20 Daily Consumption per Single Family Account by Location

IV. DWS Water Demand Projections

This section presents projections of water demand for the Maui Department of Water Supply systems. Water demand for private purveyors, non-DWS users, aquiculture, hydro power, reuse and reclamation will be presented in a separate section of the WUDP.

This section outlines the selection of methods for projecting DWS water demand, the consideration, selection and development of demographic and economic data and projections, the econometric regression and projection procedures and finally a presentation of the DWS water demand projections.

Consideration and Selection of Water Demand Projection Methods

Various methods of projecting future water demands were examined and considered. These are briefly described below.

- **Time series trends**. A simple way to forecast future water use is to project trends of historical water use. This approach inherently presumes simply that changes in water demand will continue in the future at the same rate as in the past. The only data necessary for this method are historical consumption (or production) data. Trending can be performed on the basis of average annual growth or by regression methods. Trends can be performed on either a linear or exponential basis.

- **Constant use per capita**. Future water use can be forecasted on the basis of projections of future population growth. Unless other specific assumptions are made, this method presumes that water demand will grow in direct proportion to population growth (constant use per capita). The data necessary for this method are projections of future population growth and base year water demand. Although factors other than population are not explicitly considered, basing projections on defacto population (which includes visitor count) is a way to incorporate some consideration of Maui County's future economic activity into water demand projections.

- **Econometric regression and projection**. Econometric methods include several phases of analysis. First, the relationships of various demographic and economic parameters are examined and quantified based on historical data. This process is usually performed using statistical regression analysis methods. Second, an equation (model) is specified that expresses water demand as a function of explanatory parameters. The specification of the model equation is based on consideration of the regression analyses, basic economic principles and an assessment of appropriate available projections of future demographic and economic parameters. Third, future water demand is projected using the specified demand equation, the historically derived regression relationships and future projections of the selected demographic and economic parameters. The data necessary to perform econometric projections includes a substantial amount of historical data and projections of appropriate demographic and/or economic parameters. Econometric methods explicitly incorporate several factors to project water demand.

- **Land use build-out calculations** One direct method to correlate water consumption and land use is to estimate the amount of water that would be necessary to serve full "buildout" of land identified by zoning classification. A common method is to apply estimates of water use per acre or per "unit" for each land use category. The data required

for this method are (1) an itemization of land area by zoning category and (2) estimates of water use per land area for each zone. This method provides a means to associate the magnitude of potential water demand with specific land use decisions. It does not, however, identify future water consumption associated by year. In practical application, this method can be used to make short term projections of water use for specific new developments using estimates of water use per acre or per unit.

- **End-use analysis** Water demand can be categorized in accordance with its end-uses. End uses are identified by the specific purposes for which water is used (dishwashing, laundry, hand washing, irrigation, etc.) and or by the type of fixtures or appliances that use water (toilets, sink faucets, washing machines, dishwashers). This approach is not often used as a primary method to make long range projections of water demand. End use analysis is often performed in conjunction with other methods of projecting water demand for the specific purpose of evaluating and targeting conservation and efficiency measures.

Several criteria were used to determine the most appropriate methods to project future water demand. These are listed below:

- **Geographic breakdown** It is necessary to provide water demand projections for each DWS water system, district (and in some cases subdistrict) as well as for community plan districts.

- **Time frame** It is necessary to project water demand for a twenty to thirty year period for purposes of meaningful economic analysis in the WUDP process. Projections are required on an annual basis for the initial years of the planning time frame.

- **Availability of necessary data and projections** Data must be available to support water demand projections. Different forecast methods have different data requirements. A significant consideration is the unavailability of extensive economic data for geographic subdivisions of the county.

- **Consideration of fundamental parameters** The ability of a forecast method to explicitly consider fundamental parameters that affect water demand is preferred. These include population growth, economic activity, precipitation and water price.

- **Scenarios and uncertainty** Regardless of the rigor of water demand forecasting efforts there is a significant amount of inevitable uncertainty in future projections. It is necessary to generate a range of projections to encompass future contingencies. It is preferred if a range of scenarios can be generated based on explicit alternate assumptions regarding future uncertainties.

- **Explicit correlation to land use assumptions and decisions** A fundamental objective of the WUDP is to correlate water use and land use. A forecast method that bases water demand projections most directly on specific assumptions that can be correlated with land use assumptions and decisions is preferred.

- **Consideration of specific known development projects** The CWRM Framework suggests that WUDP forecasts should explicitly account for known project developments in the initial years of the planning period.

In consideration of all of the criteria identified above an econometric regression and projection method is the preferred method. This method can provide projections broken down by geographic area, can produce meaningful projections for the necessary time frames, account for the widest

range of fundamental parameters and generate scenarios based on explicit assumptions related to demographic, economic or land use assumptions.

Explicit correlation to land use assumptions and the identification of specific known developments is addressed in the projections of demographic and economic parameters using the 2006 Socio-Economic Forecast prepared by the Maui County Planning Department. This is explained in more detail in a later section below.

A significant challenge with econometric methods is the extensive data requirements and the fact that most economic data are available only for the county as a whole and not on a disaggregated geographic basis. In order to address this issue a procedure has been designed to provide geographic breakdowns by DWS water system, district and subdistrict based on historical and projected data that is available by community plan district. This procedure is explained in more detail in a later section below.

Description of the DWS Water Demand Forecast Process

The projections of DWS water demand presented in this chapter are based primarily upon econometric methods with some reliance on time series trending methods. Econometric methods are used to project aggregate DWS water demand for each CPD and each DWS district, system and subdistrict. The share of water demand for each class of use within each of these geographic units is then disaggregated and projected using time series trend methods.

Land use buildout projections and end-use analysis methods are used for specific purposes in developing the WUDP but are not used as primary methods to project expected levels of future DWS water demand.

The process for developing DWS water demand projections includes several steps outlined below. These steps progress somewhat sequentially but include some iteration and repetition as information and projections are refined:

- Collecting and developing historical data
    - Developing historical DWS metered consumption data
    - Gathering historical demographic and economic data
    - Identifying and selecting appropriate demographic and economic projections
- Econometric regression analysis
    - Statistical regression analysis
    - Economic analysis and development of demand models
- Development of econometric projections for each geographic unit
- Disaggregation of demand by use class

Each of these steps is explained the sections below.

Development of DWS Historical Metered Consumption Data

Historical metered consumption data is available for several periods of record at several levels of detail. The availability of historical consumption data in conjunction with the availability of historical demographic and economic data determined several periods for which statistical regressions were feasible:

- **32-year period from 1970 - 2001**. Consumption data are available by DWS district, system and subdistrict by annual fiscal year from 1957 until present. Comprehensive and continuous useful demographic and economic data are not available prior to 1970 or, at the time regressions were performed, after 2001. Breakdown of consumption by use class or billing class is not available for this full period of record. Consumption data for this period were derived from DWS Planning Division records. This period of record was used in the primary regressions used in the econometric projections of DWS water demand presented in this chapter.

- **17-year period from 1985 - 2001**. Consumption data from annual reports were developed for calendar years for this period of record for each DWS district. Calendar year data for 1985 through 1988 were interpolated from fiscal year data. Calendar year data for 1999 through 2001 were derived from monthly reported data in the DWS annual reports. This period of record was used in several preliminary econometric analyses and projections including several previous projections for the West Maui district.

- **8-year period from 1994-2001**. For this limited period of record detailed data are available for each premises (meter) on the DWS systems. Consumption data for this period are available on an averaged monthly basis disaggregated by district, area, system subdistrict, use class, bill class, meter size, and by individual premises or sets of premises. The derivation of this consumption data is described in some detail below.

Development of Historical Metered Consumption Data by Individual Premises

As a part of the WUDP process substantial improvements were made in the DWS record of historical metered consumption. Efforts are proceeding to improve the quality of historical metered consumption data.

Prior to this WUDP effort the DWS maintained records of metered consumption by district, system and subdistrict on an annual basis. Consumption by district as a whole was also reported on a monthly basis. All of these tabulations, however, were posted to historical records at the date of billing which lags the date of water consumption by several months. There were no records that identified historical consumption for each individual premises (meter).[2]

Billing services for the Maui DWS are provided by the Honolulu Board of Water Supply (HBWS). Historical metered consumption data were obtained from the HBWS by retrieval from archived electronic storage media. Unfortunately all historical consumption and billing records maintained by HBWS prior to the Spring of 1993 were not retrievable and are considered destroyed. Paper hand written records of historical meter readings are archived by the Maui DWS but retrieval of this information is a substantial task that has, as of this date, not been undertaken.

Several raw data files with records of historical metered consumption were obtained from HBWS. Using several computer programs written for this specific purpose these historical data were parsed and compiled into a consumption database that includes continuous consumption data for each DWS premises from June 1993 until present. This record includes the periods of transition between a CIS and CAS accounting system and transition between manual-read to radio-read

[2] The only consumption data available for each individual premises were “rolling” tabulations of consumption for the twelve previous bimonthly bills used to create the charts of historical consumption provided on customer bills. These consumption statistics were not correlated with specific consumption dates and, upon examination, proved to be prohibitively inaccurate.

metering system.

In order to be useful for planning purposes the historical data were converted from a two-month rolling billing date format to a calendar month consumption period format. Billing data are based on meter readings taken every two months. These meter reading periods are staggered continuously throughout each two month period as meters in each district are read sequentially. Metering data is posted to the HBWS billing database at the time each bill is mailed.

In the new format the metered consumption from each two month billing period is tabulated and posted to the consumption database by calendar month based upon the number of days between meter reading dates that fall in each month. This method allocates metered consumption to the dates that water was consumed. It represents a monthly tabulation of a symmetrically weighted two month moving average of water consumption.

For purposes of the water demand projections a one calendar month summary reporting basis was selected. A monthly format is approximately consistent with the optimum use of the information contained in staggered two-month metering period data. Monthly calendar reporting is consistent with the monthly basis used in reporting many other data including DWS production data, weather data and provides sufficient resolution to provide both calendar year and fiscal year tabulations.

In the process of converting the raw data from the HBWS to a useable database format several significant discrepancies were noted. These include discrepancies in (1) the classification of premises geographically to district, system and subdistrict, (2) the classification of premises to use class (customer class) and (3) several large outlying apparent errors in reported consumption. Many errors in reported consumption were traced to the period of conversion from manual-read to radio-read metering systems. As part of the forecasting process substantial effort was made to reclassify premises to geographic unit and use class based on subjective judgement and available data. GIS layers were developed to verify geographic location for those premises with valid Tax May Key numbers. A substantial effort was also made to adjust outlier consumption readings where available billing and metering data were sufficient to determine that consumption readings were likely in error.

After the publication of the Preliminary Draft version of this WUDP Water Demand Chapter the DWS commissioned the Honolulu Board of Water Supply to revise the compilation method and formats used to report water consumption data for the DWS. The new compilation method incorporates changes to consumption estimates made to correct for ongoing metering/billing errors and adjustments into the record of historical consumption. The new reporting format conforms to the monthly consumption reporting format described above with consumption for each account allocated to each month based on number of days the billing period falls into each month. In conjunction with these revisions the historical record of consumption data was also recompiled, corrected and reported. This version of the WUDP Water Demand Chapter incorporates the newer records of historical metered water consumption in the tables, charts and water demand forecast projections.

Adjustment of Consumption Data for Recycled Water and Conservation Programs

One purpose for developing records of historical water consumption is to perform regression analyses to determine fundamental relationships between demographic and economic parameters and historical water demand. For this purpose it is useful to explicitly determine the impacts of

known water recycling or conservation programs[3] that reduce water demand to account for these impacts separate from underlying demographic and economic trends. The approach used in the projections presented in this chapter is as follows:

- Quantify the impacts of known recycling and conservation programs
- Reconstruct a record of historical consumption that would have occurred without the implementation of the programs
- Perform regression analyses on the reconstructed record of consumption to determine relationships of underlying demographic and economic parameters
- Project future water demand using the derived regression statistics applied to base year consumption that includes impacts of previous accounted programs
- Consider the impacts of future additional recycling or conservation programs separate from the demand projections as resources applied to meet water demand projections.

In order to implement this approach the impacts of known recycling and conservation programs was estimated and disaggregated (based on best available data) to each DWS district and area. Only the portion of impacts likely to have displaced potable water needs was considered. A reconstructed record of water consumption was developed by adding the impacts of the programs to the metered consumption records by district and/or area. The reconstructed record was used in the statistical regression analyses.

The programs considered included recycled water provided by the Maui County Department of Public Works (DPW), fixture replacement programs by the DPW, DWS and Maui Electric Company (MECO), and fixture giveaway programs by the DWS. The impacts of information programs, xeriscaping programs and ordinances were not included.

Demographic and Economic Data and Projections

Use of Data and Projections in Econometric Water Demand Forecasts

Demographic and economic data are used in several ways in forecasting future water demand using econometric methods. **Historical** data are used to examine the relationships that underlie water use patterns. **Projections** of demographic and economic data are used as the basis for water demand projections and to correlate water future water demand to specific assumptions regarding land use and planning decisions.

The econometric forecasts of water demand presented in this chapter use both historical data and projections of future demographic and economic parameters. Historical data were examined by multiple regression analyses to determine and quantify the relationships of water demand with respect to various demographic and economic parameters. All known relevant parameters for which sufficient data were available were examined, including resident population, visitor population, defacto population, income, employment (by sector), number of jobs (by sector), water price, hotel occupancy, number of hotel rooms, precipitation, temperature, etc. The relationships of each of these parameters individually and in combination with other parameters were examined

[3] The term conservation programs is used loosely here to include specific identifiable programmatic efforts to reduce DWS potable water consumption. As applied here this does not include the impacts of ordinances or statutes mandating the use of low flow fixtures. The term “demand-side management” is a term consistent with this definition used commonly in the context of utility resource planning.

using descriptive statistics derived by multiple regression analyses. Regression statistics in conjunction with fundamental principles of accepted economic theory were considered to determine which parameters and equations best serve as predictors of future water demand for each geographic area. Econometric water demand projections were derived using projections of relevant demographic and economic parameters.

Sources of Historical Demographic and Economic Data

Several sources of demographic and economic data and projections were examined and used in forecasting water demand. These include:

- U.S. Bureau of Census: Decennial Census Databases
- Annual State of Hawaii Data Books
- Hawaii DBEDT Research & Economic Analysis Division (statistics, reports, forecasts)
- Hawaii Visitors Bureau annual Research Reports
- Annual Hawaii Visitor Plant Inventory reports
- Hawaii Housing Policy Study 1997 Update
- Maui County annual Data Books
- Maui Electric Company 1998 - 2018 Sales and Peak Forecast
- Maui County Community Plan Update Program: 1992 and 2002 studies
    - Socio-Economic Forecast Report
    - Land Use Forecast Technical Study
    - Infrastructure Assessments
- Maui County General Plan Socio-Economic Forecast: June 2006 update
- Maui County Real Property Tax Division database extracts

Criteria for the Selection of Data Projection Sources

Several criteria were used to select projections of demographic and economic parameters to serve as the basis for water demand projections.

- **Geographic breakdown**. Information is necessary that is specific to Maui County that, to the extent possible, is broken down by geographic subdivisions of the islands.

- **Data series time frame**. Data projections are necessary for the twenty to thirty year planning time frame. Data must support the development of water demand projections on an annual basis for the initial years of the forecast time frame.

- **Scope of mutually consistent data series**. Several data series projections are required that need to be mutually consistent, including population (resident, visitor, defacto) and indicators of economic activity (income and/or employment, preferably by sector, jobs, hotel rooms and occupancy).

- **Vintage of data**. Projections need to be recent enough to be relevant.

- **Integrity and documentation of data**. Data projections need to be based on sound assumptions and methods of analysis. Projections need to be documented sufficiently to

ensure integrity and properly characterize underlying assumptions and define the applicability and proper context for application.

- **Consistency with the Maui County planning process**. It is required that the WUDP be updated on an ongoing basis to be consistent with the Maui County general plan. This is most easily facilitated if the data used in the WUDP are consistent with the county planning projections and if the impacts of specific land use planning assumptions can be incorporated into the WUDP.

Selection and Development of Demographic and Economic Projections

Based on the criteria above the primary source of economic and demographic projections used as the basis for econometric water demand projections is the *Socio-Economic Forecast, The Economic Projections for the Maui County General Plan 2030,* prepared by the Maui County Planning Department, dated June 2006 (2006 Socio-Economic Forecast). The selection of these projections was done in conjunction with the econometric analyses described further below.

The projections in the 2006 Socio-Economic Forecast were completed recently specifically for Maui County's land use planning process. The projections are broken down by island and CPD and encompass an extended time frame. The scope of data series projections is robust and the assumptions and methods are documented.[4] Specific assumptions regarding both short term known projects and long term economic assumptions and methods are incorporated by the Planning Department in preparing the 2006 Socio-Economic Forecast. Using the SMS Report as the primary source of economic and demographic projections supports the objective that the WUDP should be consistent with the Maui County General and Community Plans and allows specific land use assumptions and decisions identified in the county planning process to be most directly correlated to the WUDP.

The Preliminary Draft of the Water Demand Chapter used the earlier 2003 Socio-Economic Forecast as the basis for demographic and economic projections. Several modifications to the projections were made by HDA to the 2003 projections for purposes of the water demand projections in the Preliminary Draft. The range of growth scenarios was expanded substantially, the time frame of the projections was extended to 2030 from 2020 and an alternate method of allocating projected growth between CPD's was utilized. The updated 2006 Socio-Economic Forecast addresses and mitigates the primary concerns underlying these previous adjustments. As a result, in this update of the Water Demand Chapter several adjustments are no longer necessary. The assumptions in the Preliminary draft and this updated draft of the Water Demand Chapter are identified for each of the adjustments identified below:

- Development of a broad range of five growth rate scenarios
- Extension of projections to a thirty year time frame
- Development and projection of data on an annual basis
- Allocation of projected growth between CPD districts
- Derivation of defacto population data and projections
- Accounting for specific known projects

[4] In addition to the text of the forecast report, the specific assumptions, methods and calculations are documented in the spreadsheets used in preparing the Socio-Economic Forecast.

Each of these extensions and adjustments to the Socio-Economic Forecast projections is discussed below.

Development of a Broad Range of Growth Rate Scenarios

The Socio-Economic Forecasts (both the 2003 and 2006 updates) utilized analyses performed for Maui County by the Hawaii DBEDT Research & Economic Analysis Division using a state regional forecast model. The DBEDT model provided high, base and low case projections of fundamental economic and demographic parameters for the County of Maui as a whole. The Socio-Economic Forecast reports document the methods by which these projections were allocated first to Maui County's three principal islands and then to the CPD's on the Island of Maui.

The 2003 Socio-Economic Forecast that was used in the Preliminary Draft of the Water Demand Chapter did not project much difference between the base, low and high scenarios. For purposes of the Preliminary Draft, HDA developed a wider range of five growth rate scenarios in order to consider a wider range of possibilities for purposes of water planning analyses.

The 2006 Socio-Economic Forecast projects a robust set of base, high and low case projections. In this update of the Water Demand Chapter the base, high and low case projections developed in the 2006 Socio-Economic Forecast are used without alteration in the development of base, high and low case water demand projection scenarios. In addition to these three scenarios a medium-high and a medium-low case were developed by interpolation between the base and high case and the base and low case scenarios respectively.

Development and Projection of Data on an Annual Basis

The Socio-Economic Forecast provides historical and projected parameters by five or ten year increments. For purposes of the WUDP it is necessary to project water demand on an annual basis for the initial years of the planning period.

Annual projections for a thirty year study period were produced by interpolating between the five and ten year increments provided by the Socio-Economic Forecast. Historical data were interpolated, when required, using available annual statistics as indices where possible and on a simple linear basis where necessary. Forecast projections were interpolated on a simple linear basis.

Allocation of Projected Growth Between CPD Districts

The Socio-Economic Forecasts rely on projections of demographic and economic parameters provided by an analysis performed for Maui County for this purpose using the DBEDT regional forecast model. This model provided parameters for the County as a whole. The Planning Department allocated the demographic and economic projections first to the Islands of Maui, Lanai and Molokai and then allocated the Maui island projections to each community plan district. Resident population and visitor census are the fundamental drivers of the projections of demographic and economic parameters in the DBEDT projections and the SMS Report.

In the Preliminary Draft of the Water Demand Chapter the allocation of the Maui Island demographic projections to the individual CPD's was modified by HDA. The reasons for the modifications and the methods used are documented in the Preliminary Draft. The 2006 Socio-Economic Forecast addresses the previous concerns underlying the need to make these modifications. In this updated Water Demand Chapter the allocations of the Maui Island demographic and economic projections to the individual CPD's are used without modification.

In addition to the allocation of the demographic and economic projections to each CPD a further refinement was incorporated in this update of the Water Demand Chapter. For the DWS Upcountry district, projections of resident population and average visitor count were developed for each of the four interconnected water systems.

Derivation of Defacto Population Data and Projections

Defacto population is the average total number of people present, including both residents and visitors. The Socio-Economic Forecasts provide projections of defacto population for each island but do not provide projections for each CPD.

Projections of defacto population were derived for each CPD using the formula identified in the Socio-Economic Forecast report text using projections of resident population and average visitor count by CPD in conjunction with an estimate of average number of residents traveling off-island:

Defacto Population = "Res. Pop. * 2000 in transit ratio + AVC"

Accounting for Specific Known Projects

The Socio-Economic Forecasts incorporate consideration of specific known development projects for each CPD. These projects are taken into consideration in the estimates of new housing units for each CPD. The estimates of new housing units in turn are used to determine the proportional allocation of new housing units to each CPD which in turn determines the distribution of population growth in each CPD.

In the Preliminary Draft of the Water Demand Chapter several adjustments were made to the tallies and assumptions regarding specific known projects. These are documented in the Preliminary Draft.

The assumptions used and reported in the 2006 Socio-Economic Forecast were not changed in deriving the projections used in this updated Water Demand Chapter.

Econometric Analysis

The purpose of the econometric analysis described below is to formulate a “model” that can be used to develop meaningful projections of future water demand. The first step is to determine and quantify the relationship that various demographic and economic factors have on the level of water demand. Then, using historical records, statistical analysis methods and fundamental economic principals, various possible explanatory factors are examined to determine a combination to serve as predictors of future water demand. A forecast equation (model) is formulated that can be used to derive projections of future water demand based on projections of the explanatory factors. The implementation of this procedure is described below.

Statistical Regression Analysis

A spectrum of relevant explanatory parameters for which sufficient data were available were examined to determine and quantify correlations with water demand. The factors that were examined included:

- resident population
- average visitor census
- visitor arrivals and departures
- defacto population

- number of services
- income (nominal, real; total, household, per capita; average, median)
- employment (by sector)
- number of jobs (by sector)
- hotel occupancy
- number of hotel rooms
- number of bedrooms, bathrooms, structures (tax division records)
- improved acreage and assessed building value (tax division records)
- precipitation (various stations, nominal, transforms)
- temperature
- water price (nominal, real, average, marginal)

The relationships of historical water demand to each of these parameters, both individually and in combination with other parameters, were examined using multi variate regression analysis. Regressions were performed for several periods of historical record at several levels of aggregation as dictated by the scope and quality of available information.

- **8 - year period of record: monthly data 1994 - 2001**.
  - An extensive bivariate regression matrix[5] was developed indicating correlation regression statistics and elasticities for a list of demographic and economic parameters for each customer class in each DWS district and area. This matrix was used to examine the basic relationships of explanatory parameters with water demand by customer class and geographic area.
  - A series of monthly regression analyses was performed for this period of record to examine annual cyclic relationships including precipitation, temperature and visitor census. The monthly analyses also examined relationships between metered consumption and production.
- **17 - year period of record: calendar year annual data 1985 - 2001**
  - Several regression studies were performed that rely on calendar year data including studies of precipitation and temperature and various transforms of weather data.
  - Regression studies were performed to examine various combinations of explanatory variables
  - Econometric projections were developed for the previous West Maui district WUDP effort.
  - Econometric projections were developed for a preliminary Central district water

[5] The matrix is a spreadsheet table of "cells" with one set of rows for each demographic and economic parameter (including resident population, non-zero services, visitor census, defacto population, jobs, hotel jobs, precipitation, temperature, hotel occupancy, etc.). There is one column for each customer class in each area in each district. Each cell includes the correlation coefficient, R-squared, elasticity, standard error and t-statistic for the explanatory parameter (row) and the water consumption for the district/area/class (column).

This is referred to as a bivariate regression because only one explanatory parameter is considered with respect to one consumption statistic. The short eight year period of record is not sufficient to support multi variate regression analyses.

demand forecast.

- Regression studies were performed examining and verifying the applicability of regressions based on fiscal year consumption and fiscal year precipitation data in conjunction calendar year demographic and economic data.

- **32 - year period of record: fiscal year annual data 1970 - 2001**
  - Regression analyses were performed for each CPD. These regressions were used in the econometric DWS water demand projections presented in this chapter.

Specification of Econometric Model

An econometric forecast model is essentially an equation that expresses the relationship between a dependent parameter (in this case water demand) with one or more independent parameters (explanatory variables). There are several common forms of forecast equations that are well documented in literature. Two general forms commonly used in forecasting water demand are additive (linear) forms and multiplicative (log-log) forms. The econometric models used to derive the projections of water demand presented in this chapter are in multiplicative form. Each form is described briefly below.

Additive forecast equations are appropriate for expressing water demand in terms of several factors that sum together to create water demand. An example would be a model that expresses water demand in terms of indoor uses and outdoor uses. Water demand would be projected as the sum of these two terms. The form of an additive forecast equation is provided below for a case with three explanatory terms:

$$Q = a + (b_1 * X_1) + (b_2 * X_2) + (b_3 * X_3)$$

where:

Q represents the predicted quantity of water demand,

X represents the value of an explanatory parameter,

b represents a coefficient derived by regression, and

a represents a constant derived by regression.

Multiplicative forecast equations are used to express water demand in terms of several explanatory factors all of which affect composite water demand. An example would be a model that expresses water demand as a function of population, precipitation and water price. Each of the explanatory factors affects water demand but the effects are not additive. The form of a multiplicative forecast equation is provided below for a case with three explanatory parameters:

$$Q = e^{a} * X_1^{b_1} * X_2^{b_2} * X_3^{b_3}$$

or equivalently in the logarithmic form used for linear statistical regression analysis:

$$\ln Q = a + (b_1 * \ln X_1) + (b_2 * \ln X_2) + (b_3 * \ln X_3)$$

A multiplicative equation form is used in the econometric analysis and projections presented in this chapter. This form best utilizes the available data.

The multiplicative equation form has an important characteristic that is useful conceptually. Using this form the "b" coefficients derived by regression analysis represent "elasticities". There is one elasticity derived for each explanatory parameter. Each elasticity expresses the percentage change in water demand that is predicted by a percentage change in the explanatory parameter. For example, if regression analysis determines that b = 1.1 for the population parameter, this would mean that a one percent change in population would be expected to result in a 1.1 percent change in water demand. This characteristic of the multiplicative form is convenient in the meaningful conceptualization of regression results.

Using the multiplicative form requires careful consideration of the relationship and compatibility between explanatory parameters. It is important in selecting parameters for multi variate regression analysis to respect several foundational statistical principles. One important principal is that all of the explanatory parameters should be statistically independent. If two or more explanatory parameters are substantially statistically correlated with one another the mathematics of the statistical regression analysis will be confounded leading to spurious results. For an extreme example, it would not be meaningful to analyze water demand using both residential population and defacto population as explanatory parameters. These parameters include the expression of redundant information and are highly statistically correlated. Using both of these parameters as explanatory parameters in multi variate regression analysis would produce indeterminate and useless results.

The requirement that explanatory parameters be statistically independent is an important and sometimes dominating factor in selecting explanatory parameters to serve in an econometric model. This is discussed in more detail below

Criteria for Selection of Econometric Model Explanatory Parameters

A broad spectrum of potential explanatory parameters was considered. These are listed above. The relationship of each of these parameters to water demand was evaluated individually and in combination with other parameters. The objective of the analysis was to select a combination of explanatory parameters to serve as meaningful predictors of future water demand. Several criteria were considered in selecting explanatory parameters.

- Statistical correlation to water demand. In order for a parameter to be useful in predicting water demand its relationship to water demand should be demonstrable and quantifiable, individually and in combination with other parameters.
- Availability of appropriate projections of explanatory parameters. In order for an explanatory parameter to be useful in deriving an econometric projection of water demand it is necessary to use projections of the parameter through the future forecast period.
- Consistency with accepted economic principles.
- Usefulness in later WUDP analyses. Specification of some parameters in the forecast equation is useful for analyses used in later stages of the WUDP process. Water price and precipitation, for example, are useful in characterizing various possible future scenarios to be analyzed in the WUDP process even though these are not exogenous parameters that are projected through the forecast period.
- Statistical independence with other parameters. In order to maintain the mathematical

integrity of the statistical regression analyses, parameters need to be capable of expression in a form that is statistically independent of other selected parameters.

Selection of a Primary "Counting" Parameter

The basic approach in selecting candidate explanatory parameters was to start with selection of candidate primary "driving" or "counting" parameters representing basic demographic or economic growth. Accompanying parameters were then expressed in a statistically independent form.[6]

Several parameters were analyzed as primary driving parameters for individual sectors and for geographic units as a whole:

Resident Population interpolated by Maui County R. Pop estimates (DBEDT)[7]
Resident Population interpolated by Tax Div. Assessed Bathroom Count
Defacto Population (CPD R.Pop plus CPD % of Visitor Count)
Tax Div. CPD Assessed Bathroom Count
Tax Div. CPD Assessed Structure Count
Employment
Wage and Salary Jobs
Income

Each of the candidate primary parameters was analyzed by multi variate regression with other accompanying explanatory parameters, both individually and in appropriate combinations. For example:

resident population with combinations of
- visitor census
- per capita income
- water price
- precipitation
- temperature
- wage and salary jobs per capita
- hotel jobs

defacto population with combinations of
- wage and salary jobs per capita
- hotel jobs
- per capita income
- water price
- precipitation

[6] For example, with population considered as a parameter, income would be expressed in the form of per capita income to maintain statistical independence. This is necessary because population and income are highly statistically correlated and cannot be used simultaneously as explanatory parameters. Using per capita income uses the same information in a form that is more statistically independent.

[7] Resident population and other historical statistics are measured with most accuracy each ten years by census. Statistics for years between the decennial census benchmarks are estimated by interpolation using any of several alternate methods.

temperature

wage and salary jobs, employment and income with
visitor census
water price
precipitation
temperature

Analysis was performed for the following CPD's:

Wailuku - Kahului
Kihei - Makena
Lahaina
Paia - Haiku
Makawao-Pukalani-Kula
Lahaina
Hana

Defacto population was selected as the best primary "counting" parameter for each of the CPD's. There are several reasons for selecting this statistic as a primary regressor.

First, the regression statistics are favorable. The correlation with water demand for all CPD's is excellent. The elasticity is close to one, indicating that water demand is closely proportional to defacto population. Defacto population was a better regressor than resident population when examined in conjunction with other regressors, including precipitation and price effects.

Second, defacto population projections can be constructed for each CPD using the Planning Department Socio-Economic Forecast. It is important in selecting regressors to make sure that reasonable projections are available so that the regressor can be used effectively in making projections of water demand. It is especially appropriate to use statistics that can be derived from the county long-range planning studies so that water demand can be estimated corresponding to decisions or scenarios that are to be considered in the General and Community planning process.

Third, from a theoretical standpoint, defacto population is a good statistic to use in projections that incorporate both domestic and commercial water consumption. Defacto population is an aggregate of resident population and visitor count. For Maui's significantly tourist-driven economy, visitor count is a reasonable indicator of economic activity. In the context of land-use planning defacto population is sensitive to decisions and scenarios that contemplate different intensities of hotel and commercial growth as well as growth in resident domestic consumption.

For regressions that disaggregate consumption into different customer classes (resident vs visitor, single family vs multi-family, domestic vs commercial/industrial, etc.) it may be appropriate to use residential population for some customer classes and one or another statistic representing commercial activity for other classes. As discussed in more detail below, however, geographic units were not disaggregated by use classes for purposes of developing econometric projections. For use in projections of aggregate water consumption by CPD, defacto population is a good single-statistic "counting" variable. This is consistent with theory, appropriate for the intended application of the forecasts and is verified by the empirical regression analyses.

Level of Geographic Aggregation

Water demand could be projected for any of several levels of geographic aggregation. For example, projections could be performed for the county as a whole, by island, by CPD's, by DWS district, by demographic area or by DWS subdistrict.

Ultimately, for the purposes of the WUDP and DWS planning, water demand projections are necessary by CPD, DWS district, system and, in some cases, by subdistrict. Careful consideration was given to determine a level of geographic aggregation that is appropriate considering the availability of data and the ultimate purposes of the water demand projections.

The most appropriate available projections of economic and demographic parameters were projected initially by a state regional model adapted for Maui County (by DBEDT) and then were broken down by island and by CPD (by the SMS Report). Useful economic and demographic projections are not available for each DWS water system or subdistrict.

To meet the ultimate needs for geographic aggregation with available data, DWS water demand is projected by

- determining regression statistics for each CPD,
- developing econometric projections of unit water demand growth factors for each CPD
- projecting water demand for each subdistrict according to unit growth factors corresponding to CPD location and
- aggregating subdistrict projections to systems, areas, districts or CPD's as necessary.

Level of Sector Aggregation

Water demand can be projected for each geographic unit as a whole or it can be projected for individual sectors within each geographic unit. Sectors could include:

- bill classes (general, agricultural, non-potable),
- "customer classes" (single family residential, multifamily, commercial, hotel, industrial, agricultural, government, religious institutions), or
- some aggregates of these classes.

Various combinations of class aggregations were considered and analyzed including

- Residential / Non-residential / Agricultural
- Residential / Non-residential
- General / Agricultural
- Domestic / Commercial / Agricultural
- Residential / Hotel / Commercial / Agricultural
- No use class disaggregation

Regression analyses were performed for several combinations of regressors for several types of class aggregations. For example, the following sets of explanatory parameters were examined in for several geographic areas for two sectors: residential (single family and multifamily) and non-residential (all other excluding agricultural)

RESIDENTIAL NON RESIDENTIAL

(1)	defacto population	defacto population
(2)	defacto population water price income (real, per capita)	defacto population water price income (real, per capita)
(3)	resident population income (real, per capita) water price	wage and salary jobs water price
(4)	resident population income (real, per capita) water price precipitation	wage and salary jobs water price precipitation
(5)	defacto population water price precipitation	defacto population water price precipitation
(6)	defacto population water price precipitation income (real, per capita)	defacto population water price precipitation income (real, per capita)

The decided approach was to project water demand for each geographic unit as a whole without disaggregating the residential and non-residential sectors. The share of use by each sector (and by use class within sectors) within each geographic unit was projected by means of a subsequent analysis based on a time series trend of the historical sector share. Agricultural uses were given individual consideration and treatment as appropriate for each individual geographic unit. This approach provides the most detailed and flexible approach to sector disaggregation and acknowledges the limitations in available useful data upon which to base sector disaggregated regressions.

One issue that is closely related to the determination of sector aggregation is the determination of the primary “counting variable”. Determining a meaningful primary counting variable for non-residential sectors presents several challenges. Although several projected parameters indicating levels of economic activity would seem to be appropriate candidates (income, employment, jobs, visitor census) none are corroborated by regression statistics. Statistically, the best primary regressors for water demand, whether residential or non-residential, are consistently resident population and defacto population. Disaggregation of water demand by sector did not yield better regression statistics than considering each geographic unit as a whole.

A significant factor in the analyses is the quality of data regarding use classification. Although each DWS customer is assigned a basic use class (single family, multi-family, commercial, hotel, industrial, government, agricultural, religious institution, other) the accuracy of these classifications is poor. Furthermore, the composition of the large multi-family category is a composite of residents, time-share and hotel visitor units. It is not feasible with available data to differentiate

between resident and visitor components of the multi-family class. Analysis by use class is problematic with the current quality of use classification data.

The determination to project consumption by geographic unit without disaggregating the residential and non-residential sectors was made in conjunction and is co-determinant with the selection of defacto population as the primary counting parameter in the econometric analyses. Defacto population is the sum of resident population and average visitor census and thus includes components of both demographic growth and economic activity reflecting growth in both the residential and non-residential sectors.

Precipitation

Precipitation is a major factor in water demand and deserves careful consideration. A substantial component of water use is for outdoor uses. The primarily outdoor use is for irrigation of plants but other uses include washing cars, sidewalks and driveways and recreational uses.

The effects of precipitation on water demand can be seen both in cross-sectional and in time-series analyses. From a cross-sectional perspective, it is clear that parts of the island with higher rainfall use less water on a per capita basis than drier parts of the island. From a time-series perspective it is clear that in times of lower precipitation water consumption is higher than during wet periods.

The cause and effect relationship between precipitation and water demand is obvious. From the standpoint of regression analysis, however, quantifying this relationship is problematic for several reasons.

First, changes in water demand resulting from precipitation occur more instantly and often last for a much shorter period of time than the two-month meter-reading cycle. Consumption statistics are two-month averages. Water demand responds to changes in precipitation on a weekly or daily basis. Unless precipitation patterns are long-lived or persistent enough to affect the two-month averaged meter readings, the effects of water demand are not fully reflected in the available data. The annual cycles of precipitation include drier summer months and wetter winter months. The response to this cycle in terms of water demand is obvious and significant. The full effects of the response in water demand, however, are not completely measured in the available statistics. The effects of precipitation in regressions of *annual* water demand are substantially masked by temporal averaging but nevertheless are still obvious and significant.

Second, the response of water demand to precipitation is not a linear relationship. This is true for several reasons. The indoor component of water use is not likely to change significantly in response to precipitation. The outdoor component is sensitive to the amount of precipitation but not in a linear relationship. It may be just as important how many days there is precipitation in any particular time period as how much rain falls during the time period. Excess precipitation beyond the amount that is useful in displacing irrigation is not likely to have an effect in proportion to the amount of excess. For these reasons, various forms of transforms on the precipitation data yield better correlations with water demand than simple linear regressions against periodic average precipitation.

Third, precipitation data is extremely variable. Whereas water consumption and demographic statistics may vary from year to year as a small proportion of the mean, precipitation varies from month to month and from year to year as a large factor of the mean. This presents difficulties in both the regression process and in application of the derived elasticities in preparing forecasts. Econometric forecast models are particularly sensitive to the variance of statistics from the mean

and can produce spurious results for adjustments to base year precipitation if base year precipitation is much different than the mean.

Fourth, average annual precipitation statistics are dominated by the large volumes of winter rains. Water demand peaks in summer months and is sensitive to the relatively smaller fluctuations of summer precipitation.

Several transforms were analyzed for precipitation data from the Kahului Airport and the Kihei Kulanihakoi Gulch stations. Continuous rainfall statistics for the Lahaina Airport were considered but are not continuous through the regression periods. Improved regression statistics were obtained by implementing several types of precipitation data transforms. After examination of the regressions and consideration of the application of the regression statistics in forecasting applications, however, it was decided to use precipitation measured at the Kahului Airport for all CPD's without transform.

The Kahului Airport precipitation data has a lower variance than the Kihei data and correlates better to water demand, even for the Kihei-Makena CPD. Analysis of East Maui precipitation data determined that it was highly correlated with the Kahului Airport data and would not produce different results.

It was decided not to use transforms on the data because these did not yield sufficiently better results in conjunction with regressors in multi-variate analysis to justify the complexity and less straightforward presentation in application to the forecasting process. Development of a meaningful and straightforward water demand precipitation index (transform) merits some further study but is beyond the scope of the instant forecasting effort.

Selection of Regressors and Forecast Variables

Regression analyses were performed with the primary objective of selecting meaningful and effective parameters for projecting future water demand. As explained above defacto population was selected as the primary "counting" variable. Other explanatory parameters were analyzed against water demand in conjunction with defacto population.

The elasticity of water demand with respect to defacto population is close to unity. This means that water demand is close to being proportional to defacto population. Other explanatory parameters were examined as indicators of per capita consumption (using defacto population as the denominator for determining per capita consumption). Where necessary to avoid excessive colinearity with defacto population, demographic statistics were stated in per capita terms (jobs per capita, income per capita, etc.)

Explanatory parameters were analyzed and selected independently for each CPD. The preferred explanatory parameters selected for all CPD's were one or more of the following:

Defacto population

Precipitation measured at Kahului Airport

Real water price

Real income per capita

A table is provided below that identifies basic regression statistics for each of several combinations of these explanatory parameters. The term "b" is the elasticity for each parameter. The elasticities

are derived by regression and represent the expected change in water demand that is predicted by a percentage change in the explanatory parameter. The term “t” is the “t - ratio” which indicates the degree of statistical significance for each parameter.[8] The term “R^2" (r-squared) indicates the proportion of variance in water demand that is explained by each combination of explanatory

[8] The t-ratio expresses the ratio of the magnitude of “b” to the “standard error” associated with the parameter. This ratio provides a means to determine the probability or “confidence” that the parameter is a meaningful predictor of the dependent variable (in this case water demand). For the sample size in these analyses a t-ratio of greater than 2.7 in absolute value, for example, would indicate a confidence level of greater than 99%. A t-ratio greater than 2.0 would indicate a confidence level of greater than 95%. A t-ratio greater than 1.7 would indicate a confidence level of greater than 90%.

Selected Regression Statistics Water Consumption - Maui County CPD's									
CPD	Defacto Population		Precipitation		Water Price		Income Real Per Capita		Correlation Statistic
	b	t	b	t	b	t	b	t	R^2
Lahaina	0.822	24.019							0.951
	0.822	24.454	-0.062	-1.452					0.954
	0.859	**22.391**	**-0.057**	**-1.637**	**-0.227**	**-1.809**			**0.959**
	0.814	11.583	-0.061	-1.721	-0.218	-1.720	2.910	0.762	0.960
Kihei	1.220	39.063							0.981
Makena	1.220	41.312	-0.093	-2.139					0.983
	1.277	**44.802**	**-0.103**	**-2.862**	**-0.492**	**-3.831**			**0.989**
	1.317	25.218	-0.098	-2.670	-0.499	-3.868	-0.372	-0.934	0.989
Wailuku	0.970	23.951							0.950
Kahului	0.962	24.937	-0.037	-2.083					0.957
	1.030	**26.120**	**-0.037**	**-2.454**	**-0.178**	**-3.255**			**0.969**
	0.942	15.343	-0.045	-2.952	-0.176	-3.342	0.261	1.830	0.972
Makawao	0.969	23.210							0.947
Pukalani	0.968	34.295	-0.130	-6.055					0.977
Kula	**1.003**	**31.936**	**-0.133**	**-6.545**	**-0.155**	**-2.123**			**0.980**
	0.986	11.983	-0.134	-6.265	-0.153	-2.053	0.073	0.222	0.980
Paia	0.985	24.650							0.953
Haiku	**1.047**	**24.685**			**-0.265**	**-2.776**			**0.963**
	0.902	16.996			-0.268	-3.353	0.735	3.673	0.975
	0.881	16.241	-0.005	-1.412	-0.267	-3.400	0.806	3.970	0.977
Hana	1.021	24.499							0.952
	1.024	**25.500**	**-0.040**	**-1.835**					**0.957**
	1.040	21.381	-0.042	-1.864	-0.047	-0.583			0.958
	0.954	10.745	-0.043	-1.955	-0.036	-0.446	0.280	1.148	0.960
Molokai	0.876	6.261							0.723
	0.815	**5.088**	**-0.016**	**-0.815**					**0.736**
	0.600	4.189	-0.051	-2.694	-0.249	-3.118			0.849
	0.613	3.893	-0.050	-2.350	-0.243	-2.807	-0.060	-0.243	0.850

parameters. The preferred combination of explanatory parameters used in the econometric projections of water demand presented in this chapter are indicated in bold type.

DEFACTO POPULATION

In each CPD defacto population is statistically very significant and is the primary forecast variable. In most CPD's the elasticity is close to one indicating that changes in the magnitude of water demand are closely proportional to changes in defacto population.

For the Lahaina CPD the elasticity is substantially less than one (.859). This is expected due to

the proportion of recent population and visitor accommodation growth in this area that is served increasingly by non-DWS water purveyors. As population has been increasing in this CPD only a portion of new water demand has been served by the DWS.

For the Kihei-Makena CPD the elasticity of demand with respect to defacto population is substantially higher than one (1.28). This indicates that water demand is growing faster than in straight proportion with reported defacto population. This increase is not fully explained by any increase in the average water use of existing DWS premises. Water does appear to be growing more closely in direct proportion to the number of structures (b = 1.02 with consideration of precipitation and water price).

For the Molokai CPD regression statistics for all combinations of parameters including defacto population are less than compelling. The econometric projections for Molokai will be reconsidered in detail in conjunction with the WUDP process when it focuses there.

PRECIPITATION

Precipitation is an obvious and important determinant of water demand. The quantification and significance of the effects of precipitation, however, tend to be underestimated by the elasticities and correlations derived by statistical regression analyses. As discussed at some length above, the effects of precipitation on water demand statistics are masked by substantial temporal averaging. Nevertheless, precipitation is an important parameter in the specification of the econometric projections.

Precipitation is not, strictly speaking, a predictive parameter. Future precipitation is not forecasted or predicted in any way except as a continuation of historical averages. Including precipitation as a regressor in the multi variate regression analysis provides “correction” for weather effects. Including precipitation as a parameter in the projection of future water demand provides a straightforward and meaningful method to create precipitation scenarios for purposes of economic and resource planning analyses.

All of the regression analyses were performed with respect to precipitation measured at the Kahului Airport. This was done for several reasons. First, there are not continuous precipitation statistics for the entire period of record for most CPD’s. Second, precipitation statistics from some stations have extreme variances that are problematic in analysis. Third, the various stations in Maui County were examined and determined to be highly correlated. The Kahului Airport station statistics are a good proxy for local station statistics. Fourth, the derived elasticities are directly dependent upon the variance of the precipitation statistics of each weather station which are very different from one another. Using precipitation statistics from one station for the regressions for all CPD’s allows direct comparisons of elasticities which would not be possible using different stations.

Elasticities for the effects of changes in precipitation are negative, indicating, as expected, that increased precipitation results in decreased water consumption. The affects of precipitation are greatest in the Kihei-Makena CPD and the Makawao-Pukalani-Kula CPD where the average use of water per service and the proportion of outdoor water uses for irrigation are highest.

Precipitation was not included as an explanatory parameter for the Paia-Haiku CPD because regression analyses determined no significant impact of precipitation on water demand in this area.

REAL WATER PRICE

Real water price elasticities were derived by regression analysis for each CPD and were determined to be statistically significant for most CPD's. Water price was included as an explanatory parameter in the projections of water demand for all CPD's with the exception of Hana (not statistically significant) and Molokai (not sufficiently analyzed).

Including water price as an explanatory parameter in projecting water demand provides a means to analyze the price effects of future rates, policies and resource mixes on future water demand. In the projections of water demand the real price of water is assumed to remain constant. This presumes that water price will increase at the rate of general inflation.

It is difficult to resolve conclusive and accurate price elasticity effects using only the DWS and Maui available information. Responses to water prices are a mix of both short term behavioral responses and long term changes to appliance, fixture and water use saturations. These effects are difficult to determine conclusively based on available data. The derived elasticities were examined for consistency with estimates based on meta-analyses using studies conducted on other water utility systems.

The price of water for the DWS systems increased in some recent years including an approved 18% increase to take effect in July 2007 and a further anticipated increase of 12% scheduled to take effect in July 2008. These substantial increases in water price occur in the very early stage of the water demand projections and are exceptional. In the long term, water prices are assumed to increase at the rate of general inflation. Since the demand response to these exceptional water price increases is uncertain and could be substantial, a range of assumptions was incorporated in the range of water projections presented in this chapter. For the base case, medium-low and low cases the elasticities derived by regression analysis were used. For the high case it was assumed that the response to the increase in water price would be one half of what was derived from the regression analyses. The medium high case assumes an elasticity between these estimates equal to three quarters the derived estimate.

REAL INCOME PER CAPITA

Real income per capita was a significant and favorable regressor in conjunction with some combinations of other explanatory parameters. This statistic, however, was not selected for use in the projections of water demand. A primary reason is that the projections of the rate of growth of income in the Socio-economic Forecast Report are exactly identical for each CPD and are derived from population and visitor census information. Including income as an explanatory parameter provides little independent predictive information and dilutes the extent to which allocation of resident population and visitor census to the individual CPD's provides differentiation between CPD's. As a predictor of overall county water demand, income per capita could be a meaningful explanatory parameter. Unless independent projections of income are developed for each CPD, however, income does not provide sufficient information additional to the specification of defacto population (resident population plus visitor census) for each individual CPD.

Econometric Projection Procedure

Econometric projections of water demand were developed for each DWS subdistrict. The projections for each subdistrict were summed, as appropriate, to determine projections for each DWS water system, district and each CPD. The procedure included the following steps.

- A unit water demand projection was determined for each CPD using the regression statistics derived for each CPD and the projections of the selected explanatory parameters

for each CPD. The unit projections express the amount of water demand in each future year as a factor of base year water demand.

- For the DWS Upcountry District unit water demand projections were made individually for each of the four interconnected water systems (Upper Kula, Lower Kula, Makawao and Haiku systems) based on demographic projections for the areas served by these systems.[9]

- Using the base year water consumption for each subdistrict and the unit projections for the CPD (or Upcountry District water system) in which each subdistrict is located a projection of future water demand was derived for each subdistrict.

Development of a Range of Water Demand Projections

A range of five water demand projections was developed: a base case and high, low, medium-high and medium-low cases.

Three projections, the base, high and low cases, were developed based directly on the corresponding base, high and low case demographic projections in the 2006 Socio-Economic Forecast prepared by the Planning Department. These three water demand scenarios correspond directly to the to assumptions and projections used in the *2006 Socio-Economic Forecast* that is being used in the concurrent Maui County General Plan update process.

The high case water demand projection includes a specific assumption that the incremental reductions in water consumption that are expected as a result of the near-term DWS water price increases (18% in July 2007 and expected additional 12% in July 2008) will be only one third what is predicted by regression analysis and what is assumed in the base and low cases. Other than this specific assumption the only difference between the base, high and low case projections is the use of the base, high and low case demographic projections developed from the *2006 Socio-Economic Forecast*.

Two additional intermediate projections, a medium-high case and a medium-low case, were developed by linear interpolation as an average of the base and high cases and base and low cases respectively.

Disaggregation of Demand by Use Class

Projections of water demand by Use Class Code were developed for each DWS subdistrict. For each subdistrict the share of consumption for each use class was determined by a linear least squares time series trend of recent historical use class share. Water demand by use class for each DWS district and area were derived by summing subdistrict usage.

Land Use Inventory Water Demand Estimates

Estimates of the amount of water demand that would result from build out of the existing land use inventory were developed by CPD and by land use category. Land Use Inventory by CPD is documented in the *Maui Land Use Forecast, April 2003, County of Maui Department of Planning Long Range Planning Division* (Land Use Forecast).

---

[9] The Haliimaile subdistrict growth area falls across the border between the Paia-Haiku CPD and the Makawao-Pukalani-Kula CPD. This subdistrict was projected as part of the Makawao water system and is included in the CPD summaries as part of the Makawao-Pukalani-Kula CPD.

Table 2 from the Land Use Forecast identifies the gross number of acres for currently zoned in several land use categories for each CPD. This table is reproduced in the table on page 74 below. Water use was projected for each use category using standards for water use for each category. The water use standards and estimated water use for each category in each CPD are presented in the table on page 75 below.

DWS Water Demand Projections: Tables

Several charts and tables that present the projections of DWS water demand are provided below.

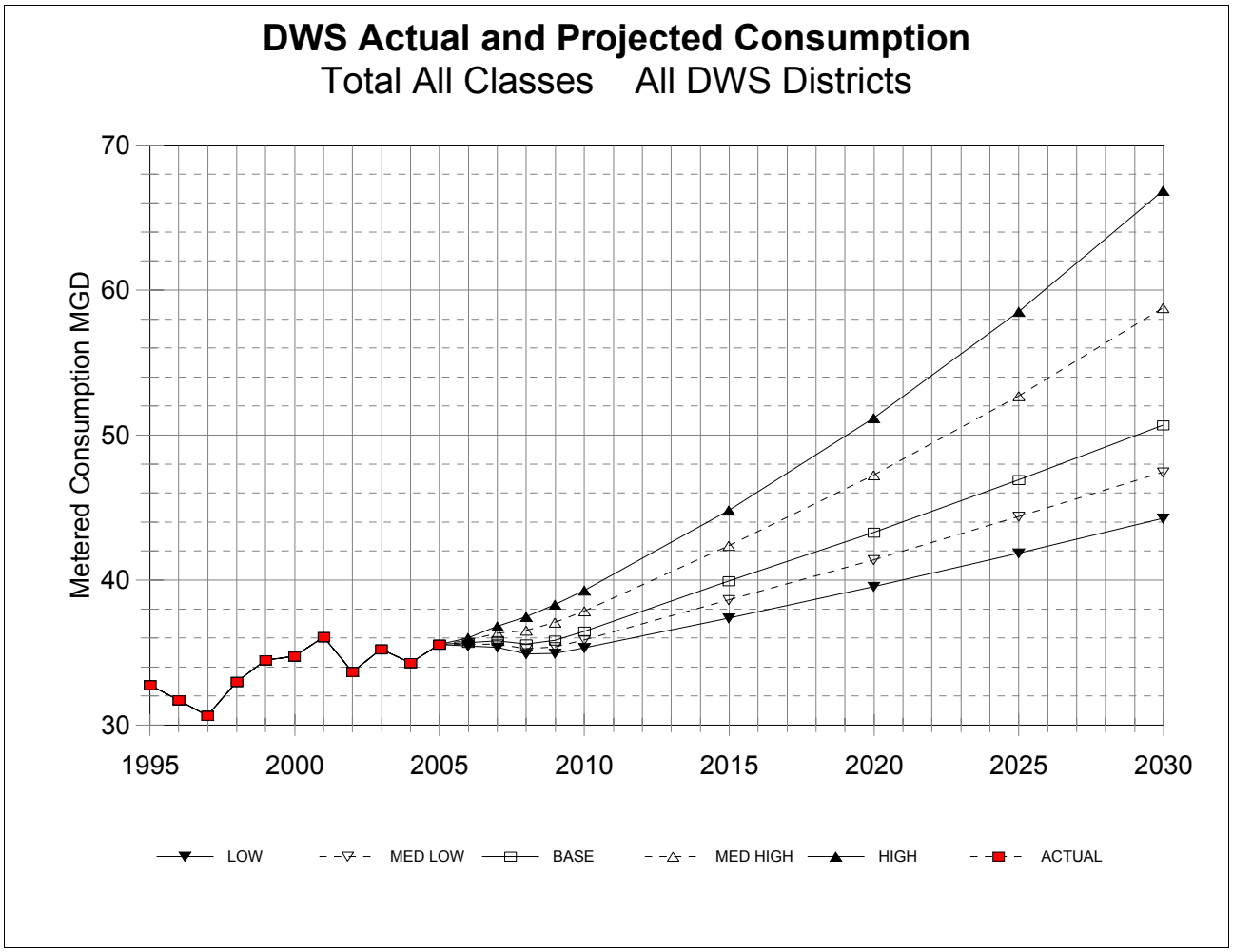

Figure 22 Actual and Projected Water Demand, Total All DWS Districts, All Metered Uses

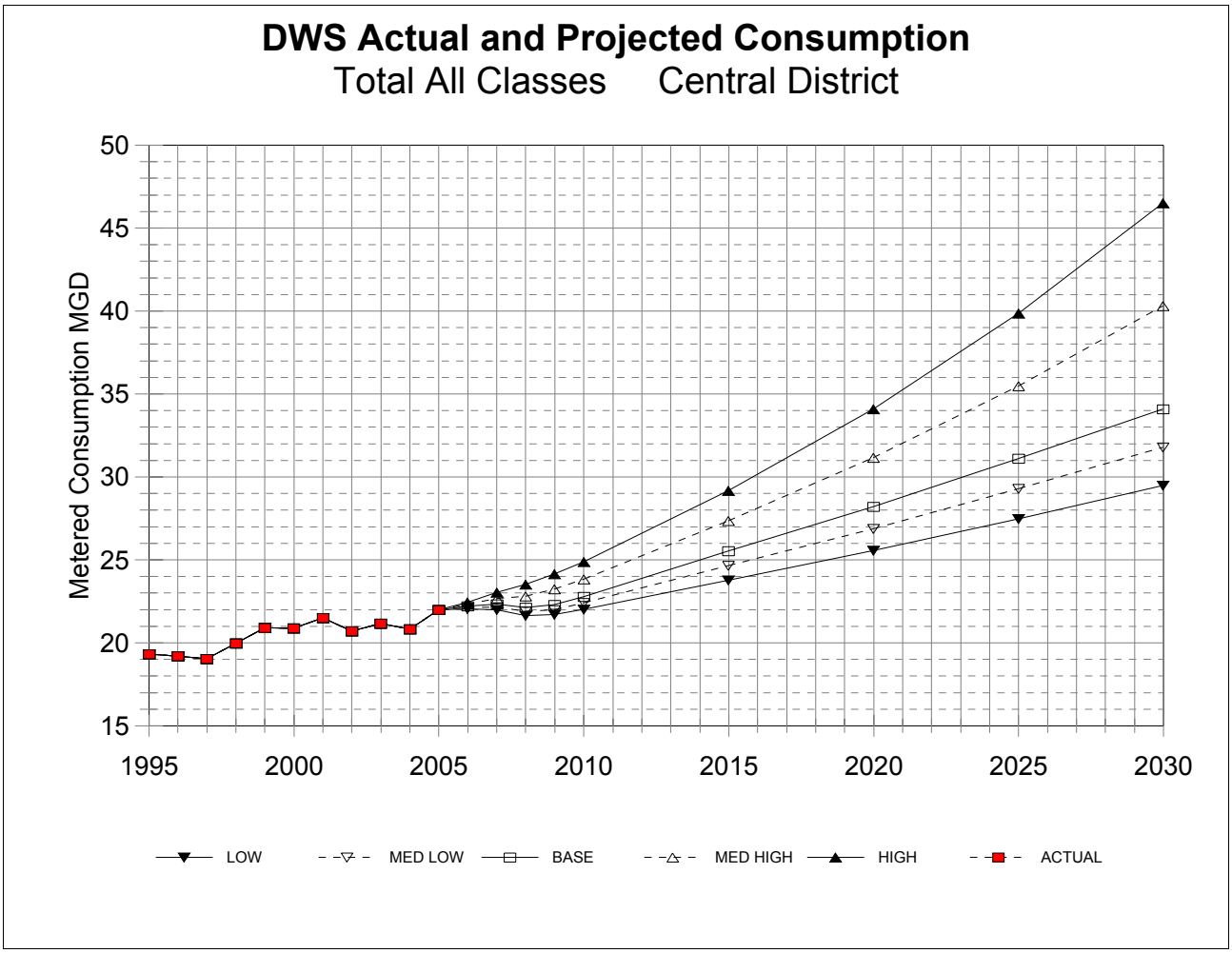

Figure 23 Actual and Projected Water Demand, DWS Central District, All Metered Uses

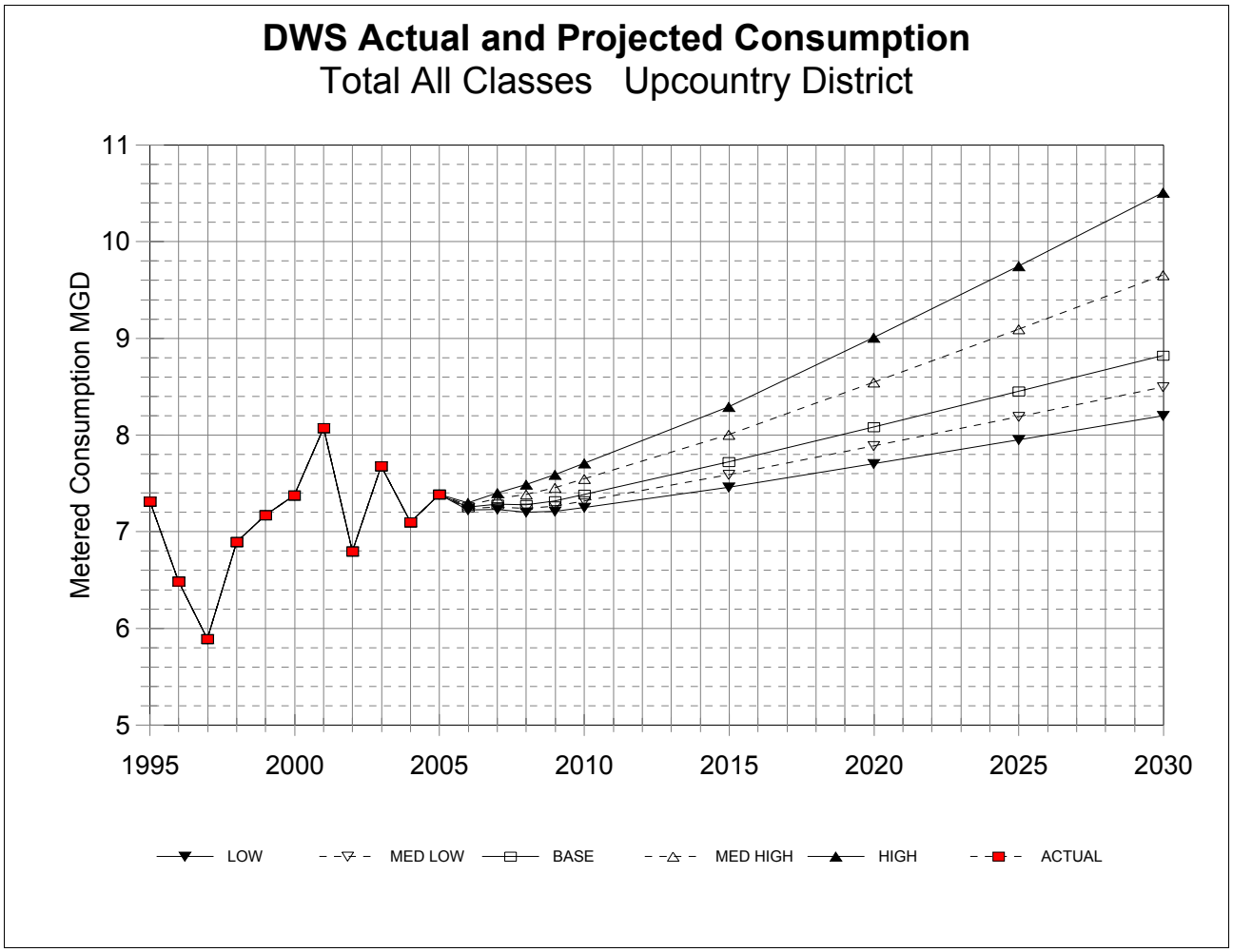

Figure 24 Actual and Projected Water Demand, DWS Upcountry District, All Metered Uses

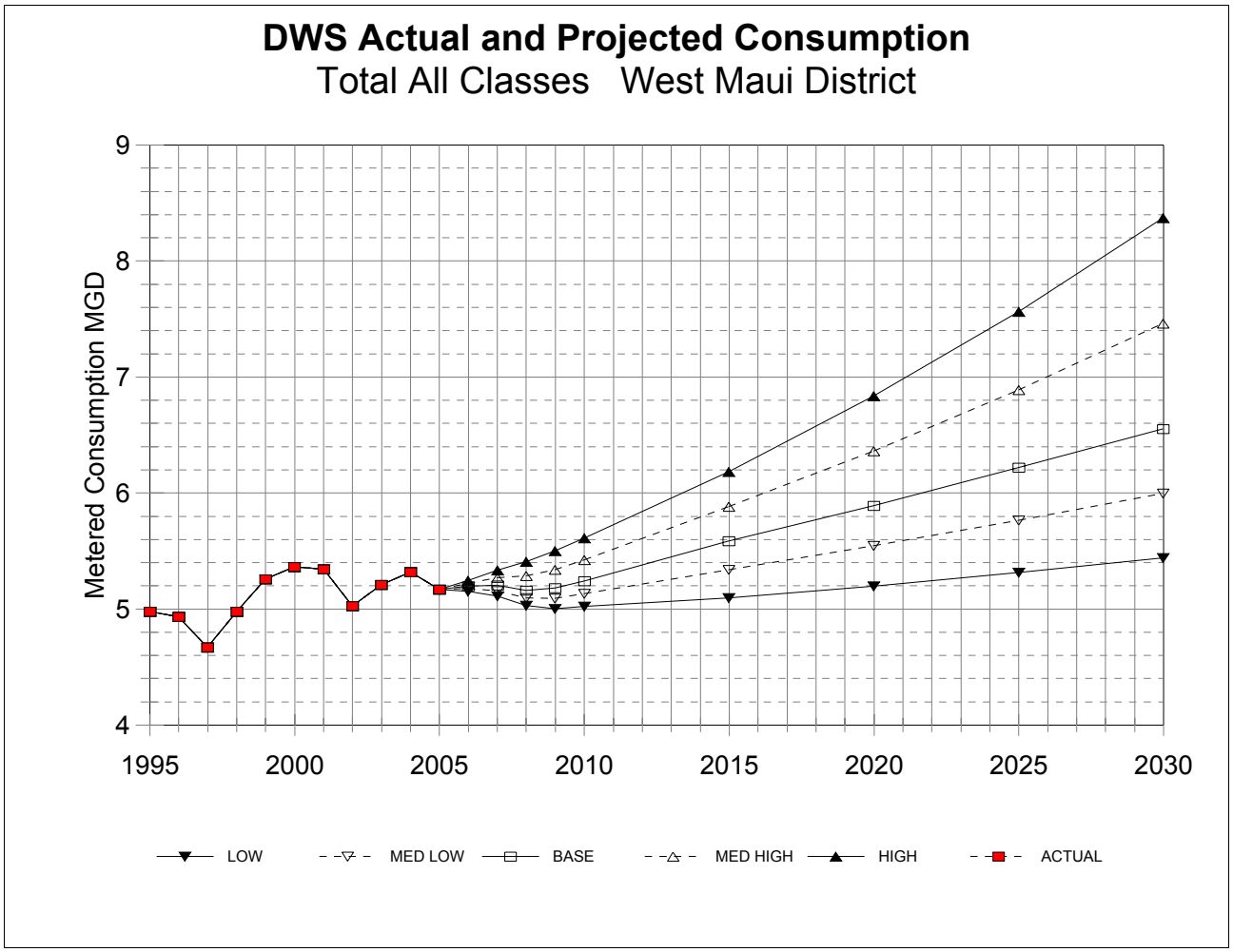

Figure 25 Actual and Projected Water Demand, DWS West Maui District, All Metered Uses

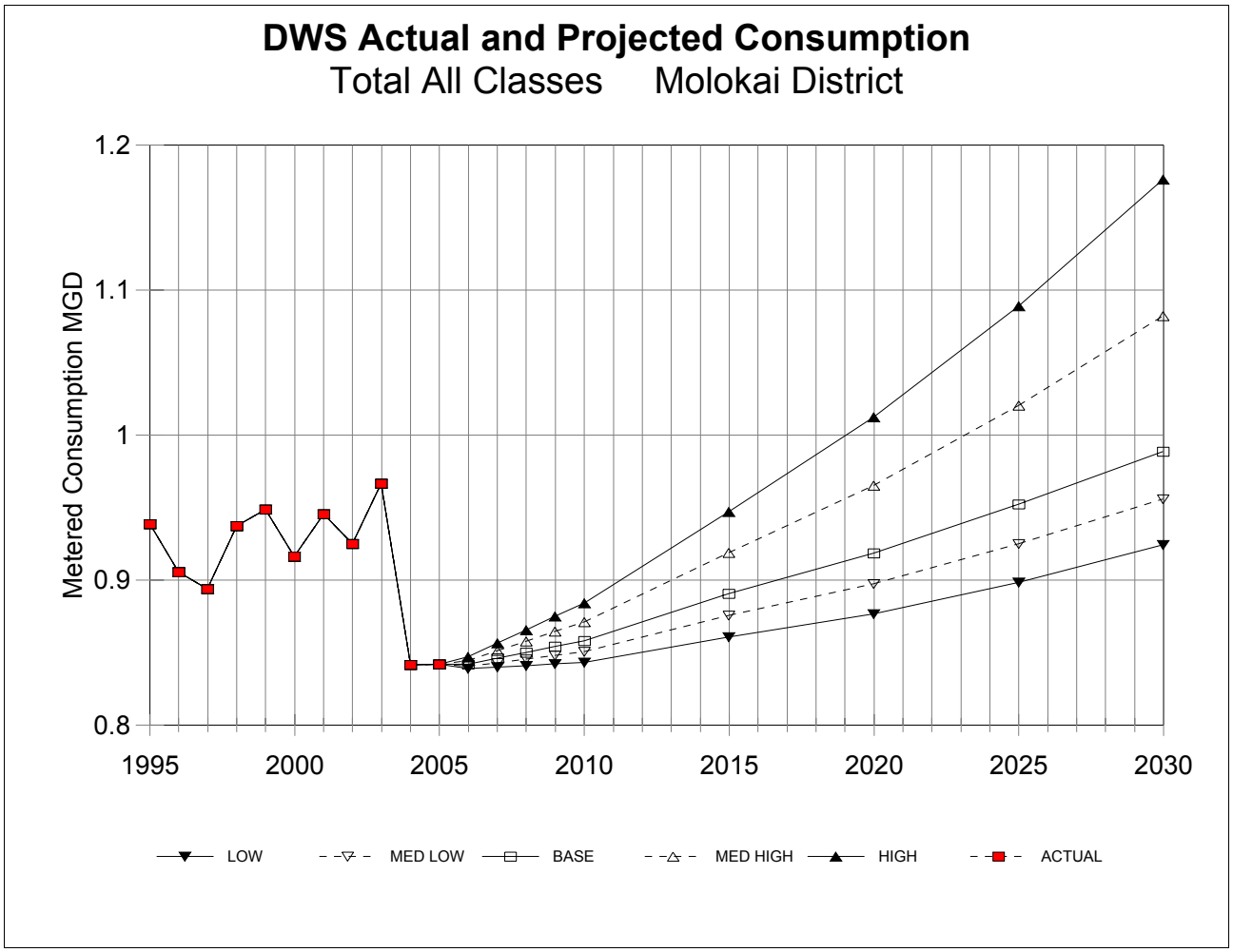

Figure 26 Actual and Projected Water Demand, DWS Molokai District, All Metered Uses

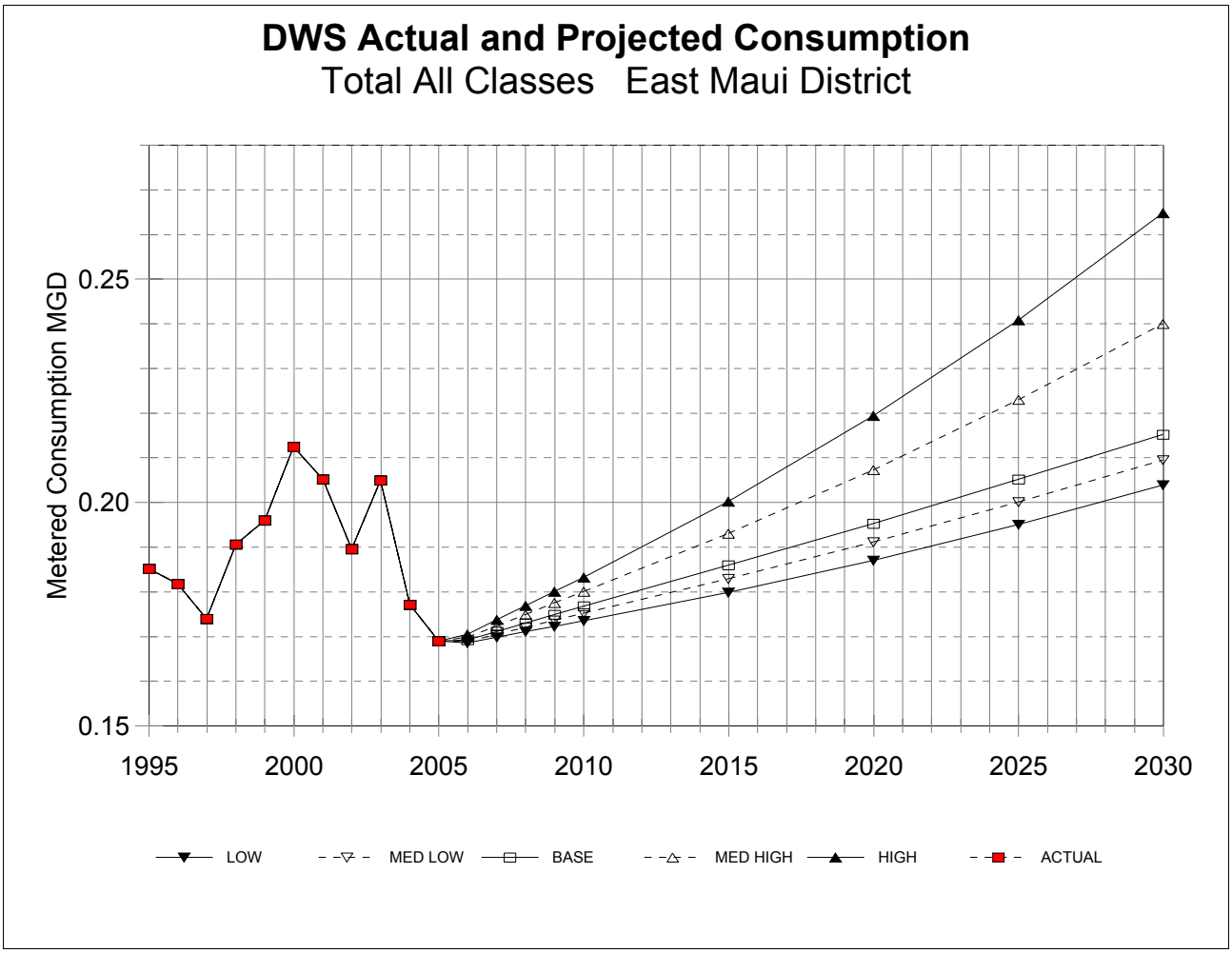

Figure 27 Actual and Projected Water Demand, DWS East Maui District, All Metered Uses

BASE CASE ECONOMETRIC WATER CONSUMPTION PROJECTIONS (Millions of Gallons per Day)

Base Case	Land-Use Based Demographic Forecast - Base Case	Calendar Year												Avg. Ann.
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Growth
Central															
	General	21.772	21.881	21.685	21.869	22.348	22.892	23.438	23.986	24.537	25.090	27.759	30.651	33.648	1.83%
	Ag Potable	0.454	0.454	0.454	0.454	0.454	0.455	0.455	0.455	0.455	0.455	0.456	0.457	0.458	0.04%
	Total Potable	22.226	22.335	22.139	22.323	22.803	23.347	23.893	24.441	24.992	25.545	28.215	31.108	34.106	1.80%
	Ag Non Potable	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	Total	22.226	22.335	22.139	22.323	22.803	23.347	23.893	24.441	24.992	25.545	28.215	31.108	34.106	1.80%
Upcountry															
	General	4.408	4.419	4.400	4.419	4.469	4.519	4.568	4.618	4.667	4.717	4.982	5.249	5.516	0.94%
	Ag Potable	2.272	2.285	2.298	2.312	2.326	2.340	2.354	2.368	2.382	2.397	2.472	2.551	2.634	0.62%
	Total Potable	6.680	6.704	6.698	6.731	6.795	6.858	6.922	6.986	7.050	7.114	7.454	7.800	8.150	0.83%
	Ag Non Potable	0.577	0.581	0.584	0.588	0.592	0.596	0.600	0.604	0.608	0.612	0.633	0.654	0.676	0.66%
	Total	7.257	7.285	7.283	7.320	7.387	7.455	7.522	7.590	7.658	7.726	8.086	8.454	8.826	0.82%
West Maui															
	General	5.178	5.182	5.140	5.156	5.217	5.286	5.354	5.423	5.491	5.559	5.861	6.185	6.513	0.96%
	Ag Potable	0.024	0.024	0.025	0.025	0.026	0.027	0.027	0.028	0.029	0.029	0.033	0.038	0.043	2.49%
	Total Potable	5.201	5.206	5.165	5.181	5.243	5.313	5.382	5.451	5.520	5.588	5.894	6.223	6.556	0.97%
	Ag Non Potable	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	Total	5.201	5.206	5.165	5.181	5.243	5.313	5.382	5.451	5.520	5.588	5.894	6.223	6.556	0.97%
Molokai															
	General	0.824	0.828	0.832	0.835	0.839	0.845	0.851	0.857	0.864	0.870	0.896	0.927	0.961	0.64%
	Ag Potable	0.018	0.018	0.019	0.019	0.019	0.020	0.020	0.020	0.021	0.021	0.023	0.025	0.028	1.79%
	Total Potable	0.842	0.846	0.850	0.854	0.858	0.865	0.871	0.878	0.884	0.891	0.919	0.952	0.989	0.67%
	Ag Non Potable	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	Total	0.842	0.846	0.850	0.854	0.858	0.865	0.871	0.878	0.884	0.891	0.919	0.952	0.989	0.67%
Hana - East Maui															
	General	0.165	0.167	0.169	0.171	0.173	0.174	0.176	0.178	0.180	0.182	0.191	0.201	0.211	1.03%
	Ag Potable	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.08%
	Total Potable	0.169	0.171	0.173	0.175	0.177	0.179	0.181	0.182	0.184	0.186	0.195	0.205	0.215	1.01%
	Ag Non Potable	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	Total	0.169	0.171	0.173	0.175	0.177	0.179	0.181	0.182	0.184	0.186	0.195	0.205	0.215	1.01%
DWS All Districts															
	General	32.347	32.477	32.225	32.450	33.046	33.716	34.388	35.062	35.739	36.417	39.688	43.213	46.849	1.56%
	Ag Potable	2.771	2.786	2.800	2.815	2.830	2.845	2.860	2.876	2.891	2.907	2.989	3.075	3.167	0.56%
	Total Potable	35.119	35.263	35.026	35.265	35.876	36.561	37.248	37.938	38.630	39.324	42.677	46.288	50.016	1.48%
	Ag Non Potable	0.577	0.581	0.584	0.588	0.592	0.596	0.600	0.604	0.608	0.612	0.633	0.654	0.676	0.66%
	Total	35.695	35.843	35.610	35.853	36.468	37.157	37.848	38.542	39.238	39.936	43.310	46.942	50.692	1.47%

Figure 28 Base Case Econometric DWS Water Demand Projections by DWS District by Use Classification

ECONOMETRIC COMPOSITE WATER CONSUMPTION PROJECTIONS (Millions of Gallons per Day)

DWS Projections Indexed to Maui County General Plan Update: Socio-Economic Forecast Report 2006

		Calendar Year													Avg. Ann.
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Growth
DWS All Districts															
	Low Case	32.125	32.040	31.591	31.614	31.999	32.408	32.819	33.230	33.642	34.055	36.221	38.521	40.939	1.02%
	Medium Low Case	32.236	32.259	31.908	32.032	32.522	33.062	33.604	34.146	34.690	35.236	37.955	40.867	43.894	1.29%
General	Base Case	32.347	32.477	32.225	32.450	33.046	33.716	34.388	35.062	35.739	36.417	39.688	43.213	46.849	1.56%
	Medium High Case	32.504	32.957	33.150	33.664	34.431	35.299	36.170	37.045	37.923	38.805	43.549	48.878	54.773	2.20%
	High Case	32.661	33.438	34.076	34.879	35.817	36.884	37.955	39.030	40.110	41.195	47.414	54.549	62.706	2.76%
	Low Case	2.757	2.757	2.757	2.757	2.757	2.757	2.757	2.757	2.757	2.757	2.757	2.757	2.757	0.00%
	Medium Low Case	2.764	2.771	2.778	2.786	2.793	2.800	2.808	2.815	2.822	2.830	2.868	2.907	2.948	0.27%
Ag Potable	Base Case	2.771	2.786	2.800	2.815	2.830	2.845	2.860	2.876	2.891	2.907	2.989	3.075	3.167	0.56%
	Medium High Case	2.775	2.793	2.811	2.830	2.849	2.868	2.887	2.907	2.927	2.947	3.052	3.166	3.289	0.71%
	High Case	2.778	2.800	2.822	2.845	2.868	2.891	2.914	2.938	2.963	2.988	3.119	3.262	3.420	0.87%
	Low Case	34.882	34.797	34.347	34.371	34.755	35.165	35.576	35.987	36.399	36.812	38.978	41.278	43.695	0.94%
	Medium Low Case	35.000	35.030	34.686	34.818	35.315	35.862	36.411	36.961	37.513	38.066	40.823	43.775	46.842	1.22%
Total Potable	Base Case	35.119	35.263	35.026	35.265	35.876	36.561	37.248	37.938	38.630	39.324	42.677	46.288	50.016	1.48%
	Medium High Case	35.279	35.750	35.961	36.493	37.279	38.166	39.057	39.952	40.850	41.751	46.601	52.044	58.062	2.10%
	High Case	35.440	36.238	36.898	37.723	38.685	39.774	40.869	41.969	43.073	44.183	50.533	57.811	66.126	2.63%
	Low Case	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.00%
	Medium Low Case	0.575	0.577	0.579	0.581	0.583	0.585	0.586	0.588	0.590	0.592	0.602	0.612	0.622	0.33%
Ag Non Potable	Base Case	0.577	0.581	0.584	0.588	0.592	0.596	0.600	0.604	0.608	0.612	0.633	0.654	0.676	0.66%
	Medium High Case	0.578	0.583	0.587	0.592	0.597	0.602	0.607	0.612	0.617	0.622	0.649	0.676	0.704	0.83%
	High Case	0.579	0.584	0.590	0.596	0.602	0.608	0.614	0.620	0.626	0.633	0.665	0.699	0.734	1.00%
	Low Case	35.455	35.370	34.920	34.944	35.328	35.738	36.149	36.560	36.972	37.385	39.551	41.851	44.268	0.93%
	Medium Low Case	35.575	35.607	35.265	35.398	35.898	36.447	36.998	37.550	38.103	38.658	41.425	44.387	47.464	1.21%
Total	Base Case	35.695	35.843	35.610	35.853	36.468	37.157	37.848	38.542	39.238	39.936	43.310	46.942	50.692	1.47%
	Medium High Case	35.856	36.332	36.549	37.086	37.877	38.769	39.664	40.564	41.467	42.374	47.250	52.720	58.767	2.08%
	High Case	36.018	36.822	37.488	38.319	39.287	40.382	41.483	42.589	43.700	44.815	51.198	58.510	66.860	2.61%

Figure 29 Range of Water Demand Projections: Total of All DWS Districts by Use Classification

ECONOMETRIC COMPOSITE WATER CONSUMPTION PROJECTIONS (Millions of Gallons per Day)

DWS Projections Indexed to Maui County General Plan Update: Socio-Economic Forecast Report 2006

		Calendar Year													Avg. Ann.
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Growth
Central															
	Low Case	21.609	21.560	21.220	21.256	21.580	21.929	22.278	22.628	22.979	23.331	25.128	27.036	29.038	1.24%
	Medium Low Case	21.690	21.721	21.453	21.563	21.964	22.410	22.858	23.307	23.758	24.210	26.444	28.843	31.343	1.55%
General	Base Case	21.772	21.881	21.685	21.869	22.348	22.892	23.438	23.986	24.537	25.090	27.759	30.651	33.648	1.83%
	Medium High Case	21.885	22.239	22.386	22.789	23.395	24.091	24.790	25.494	26.201	26.911	30.709	35.029	39.860	2.53%
	High Case	21.997	22.597	23.087	23.709	24.441	25.289	26.143	27.001	27.864	28.732	33.659	39.406	46.073	3.13%
	Low Case	0.454	0.454	0.454	0.454	0.454	0.454	0.454	0.454	0.454	0.454	0.454	0.454	0.454	0.00%
	Medium Low Case	0.454	0.454	0.454	0.454	0.454	0.454	0.454	0.454	0.454	0.454	0.455	0.455	0.456	0.02%
Ag Potable	Base Case	0.454	0.454	0.454	0.454	0.454	0.455	0.455	0.455	0.455	0.455	0.456	0.457	0.458	0.04%
	Medium High Case	0.454	0.454	0.454	0.454	0.455	0.455	0.455	0.455	0.456	0.456	0.457	0.458	0.460	0.06%
	High Case	0.454	0.454	0.454	0.455	0.455	0.455	0.455	0.456	0.456	0.456	0.458	0.460	0.461	0.07%
	Low Case	22.062	22.013	21.673	21.710	22.034	22.382	22.732	23.082	23.433	23.784	25.582	27.489	29.491	1.22%
	Medium Low Case	22.144	22.174	21.906	22.016	22.418	22.864	23.312	23.762	24.213	24.665	26.899	29.299	31.799	1.52%
Total Potable	Base Case	22.226	22.335	22.139	22.323	22.803	23.347	23.893	24.441	24.992	25.545	28.215	31.108	34.106	1.80%
	Medium High Case	22.338	22.693	22.840	23.243	23.849	24.545	25.245	25.949	26.656	27.367	31.166	35.487	40.320	2.49%
	High Case	22.451	23.051	23.541	24.164	24.896	25.744	26.598	27.457	28.320	29.188	34.116	39.866	46.534	3.08%
	Low Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Medium Low Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ag Non Potable	Base Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Medium High Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	High Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Low Case	22.062	22.013	21.673	21.710	22.034	22.382	22.732	23.082	23.433	23.784	25.582	27.489	29.491	1.22%
	Medium Low Case	22.144	22.174	21.906	22.016	22.418	22.864	23.312	23.762	24.213	24.665	26.899	29.299	31.799	1.52%
Total	Base Case	22.226	22.335	22.139	22.323	22.803	23.347	23.893	24.441	24.992	25.545	28.215	31.108	34.106	1.80%
	Medium High Case	22.338	22.693	22.840	23.243	23.849	24.545	25.245	25.949	26.656	27.367	31.166	35.487	40.320	2.49%
	High Case	22.451	23.051	23.541	24.164	24.896	25.744	26.598	27.457	28.320	29.188	34.116	39.866	46.534	3.08%

Figure 30 Range of Water Demand Projections: DWS Central District by Use Classification

ECONOMETRIC COMPOSITE WATER CONSUMPTION PROJECTIONS (Millions of Gallons per Day)

DWS Projections Indexed to Maui County General Plan Update: Socio-Economic Forecast Report 2006

		Calendar Year													Avg. Ann.
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Growth
Upcountry															
	Low Case	4.399	4.401	4.372	4.383	4.423	4.465	4.506	4.547	4.588	4.630	4.874	5.122	5.373	0.84%
	Medium Low Case	4.404	4.410	4.386	4.401	4.446	4.492	4.537	4.582	4.628	4.673	4.928	5.185	5.444	0.89%
General	Base Case	4.408	4.419	4.400	4.419	4.469	4.519	4.568	4.618	4.667	4.717	4.982	5.249	5.516	0.94%
	Medium High Case	4.426	4.469	4.491	4.539	4.607	4.676	4.745	4.814	4.883	4.952	5.367	5.787	6.212	1.42%
	High Case	4.445	4.520	4.583	4.660	4.747	4.836	4.924	5.013	5.102	5.191	5.756	6.331	6.915	1.86%
	Low Case	2.258	2.258	2.258	2.258	2.258	2.258	2.258	2.258	2.258	2.258	2.258	2.258	2.258	0.00%
	Medium Low Case	2.265	2.272	2.278	2.285	2.292	2.299	2.305	2.312	2.319	2.326	2.361	2.397	2.434	0.30%
Ag Potable	Base Case	2.272	2.285	2.298	2.312	2.326	2.340	2.354	2.368	2.382	2.397	2.472	2.551	2.634	0.62%
	Medium High Case	2.275	2.292	2.309	2.326	2.343	2.361	2.379	2.397	2.415	2.433	2.530	2.633	2.744	0.78%
	High Case	2.278	2.298	2.319	2.339	2.361	2.382	2.404	2.426	2.448	2.471	2.591	2.721	2.862	0.96%
	Low Case	6.657	6.659	6.631	6.641	6.682	6.723	6.764	6.805	6.847	6.888	7.132	7.380	7.631	0.57%
	Medium Low Case	6.668	6.682	6.664	6.686	6.738	6.790	6.842	6.895	6.947	6.999	7.289	7.583	7.879	0.70%
Total Potable	Base Case	6.680	6.704	6.698	6.731	6.795	6.858	6.922	6.986	7.050	7.114	7.454	7.800	8.150	0.83%
	Medium High Case	6.701	6.761	6.799	6.865	6.950	7.037	7.124	7.211	7.298	7.386	7.897	8.420	8.956	1.22%
	High Case	6.723	6.818	6.902	6.999	7.107	7.218	7.328	7.439	7.550	7.662	8.347	9.051	9.778	1.57%
	Low Case	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.573	0.00%
	Medium Low Case	0.575	0.577	0.579	0.581	0.583	0.585	0.586	0.588	0.590	0.592	0.602	0.612	0.622	0.33%
Ag Non Potable	Base Case	0.577	0.581	0.584	0.588	0.592	0.596	0.600	0.604	0.608	0.612	0.633	0.654	0.676	0.66%
	Medium High Case	0.578	0.583	0.587	0.592	0.597	0.602	0.607	0.612	0.617	0.622	0.649	0.676	0.704	0.83%
	High Case	0.579	0.584	0.590	0.596	0.602	0.608	0.614	0.620	0.626	0.633	0.665	0.699	0.734	1.00%
	Low Case	7.230	7.232	7.204	7.214	7.255	7.296	7.337	7.378	7.420	7.461	7.705	7.953	8.204	0.53%
	Medium Low Case	7.243	7.258	7.243	7.267	7.320	7.375	7.429	7.483	7.537	7.592	7.891	8.195	8.501	0.67%
Total	Base Case	7.257	7.285	7.283	7.320	7.387	7.455	7.522	7.590	7.658	7.726	8.086	8.454	8.826	0.82%
	Medium High Case	7.279	7.343	7.387	7.457	7.547	7.639	7.731	7.823	7.915	8.008	8.546	9.096	9.660	1.19%
	High Case	7.302	7.402	7.492	7.595	7.710	7.826	7.942	8.059	8.177	8.294	9.012	9.750	10.512	1.53%

Figure 31 Range of Water Demand Projections: DWS Upcountry District by Use Classification

ECONOMETRIC COMPOSITE WATER CONSUMPTION PROJECTIONS (Millions of Gallons per Day)

DWS Projections Indexed to Maui County General Plan Update: Socio-Economic Forecast Report 2006

		Calendar Year													Avg. Ann.
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Growth
West Maui															
	Low Case	5.132	5.092	5.008	4.982	5.000	5.015	5.030	5.045	5.060	5.075	5.177	5.292	5.422	0.23%
	Medium Low Case	5.155	5.137	5.074	5.069	5.109	5.151	5.192	5.234	5.276	5.317	5.519	5.739	5.967	0.61%
General	Base Case	5.178	5.182	5.140	5.156	5.217	5.286	5.354	5.423	5.491	5.559	5.861	6.185	6.513	0.96%
	Medium High Case	5.201	5.247	5.263	5.317	5.402	5.493	5.584	5.675	5.765	5.856	6.329	6.851	7.414	1.49%
	High Case	5.224	5.313	5.386	5.478	5.586	5.700	5.814	5.927	6.040	6.152	6.798	7.516	8.315	1.96%
	Low Case	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.00%
	Medium Low Case	0.023	0.024	0.024	0.024	0.024	0.025	0.025	0.025	0.026	0.026	0.028	0.029	0.031	1.24%
Ag Potable	Base Case	0.024	0.024	0.025	0.025	0.026	0.027	0.027	0.028	0.029	0.029	0.033	0.038	0.043	2.49%
	Medium High Case	0.024	0.024	0.025	0.026	0.027	0.028	0.028	0.029	0.030	0.031	0.036	0.042	0.049	3.10%
	High Case	0.024	0.025	0.026	0.027	0.028	0.029	0.030	0.031	0.032	0.033	0.040	0.048	0.057	3.73%
	Low Case	5.155	5.115	5.031	5.005	5.023	5.038	5.053	5.068	5.083	5.098	5.200	5.315	5.445	0.23%
	Medium Low Case	5.178	5.160	5.098	5.093	5.133	5.175	5.217	5.259	5.301	5.343	5.546	5.768	5.999	0.61%
Total Potable	Base Case	5.201	5.206	5.165	5.181	5.243	5.313	5.382	5.451	5.520	5.588	5.894	6.223	6.556	0.97%
	Medium High Case	5.224	5.272	5.288	5.343	5.428	5.521	5.612	5.704	5.796	5.887	6.366	6.893	7.464	1.50%
	High Case	5.247	5.338	5.412	5.505	5.614	5.729	5.843	5.958	6.072	6.185	6.838	7.564	8.373	1.97%
	Low Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Medium Low Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ag Non Potable	Base Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Medium High Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	High Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Low Case	5.155	5.115	5.031	5.005	5.023	5.038	5.053	5.068	5.083	5.098	5.200	5.315	5.445	0.23%
	Medium Low Case	5.178	5.160	5.098	5.093	5.133	5.175	5.217	5.259	5.301	5.343	5.546	5.768	5.999	0.61%
Total	Base Case	5.201	5.206	5.165	5.181	5.243	5.313	5.382	5.451	5.520	5.588	5.894	6.223	6.556	0.97%
	Medium High Case	5.224	5.272	5.288	5.343	5.428	5.521	5.612	5.704	5.796	5.887	6.366	6.893	7.464	1.50%
	High Case	5.247	5.338	5.412	5.505	5.614	5.729	5.843	5.958	6.072	6.185	6.838	7.564	8.373	1.97%

Figure 32 Range of Water Demand Projections: DWS West Maui District by Use Classification

ECONOMETRIC COMPOSITE WATER CONSUMPTION PROJECTIONS (Millions of Gallons per Day)

DWS Projections Indexed to Maui County General Plan Update: Socio-Economic Forecast Report 2006

		Calendar Year													Avg. Ann.
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Growth
Hana - East Maui															
	Low Case	0.164	0.166	0.167	0.168	0.169	0.171	0.172	0.173	0.174	0.176	0.183	0.191	0.200	0.81%
	Medium Low Case	0.165	0.166	0.168	0.169	0.171	0.172	0.174	0.176	0.177	0.179	0.187	0.196	0.205	0.92%
General	Base Case	0.165	0.167	0.169	0.171	0.173	0.174	0.176	0.178	0.180	0.182	0.191	0.201	0.211	1.03%
	Medium High Case	0.166	0.168	0.171	0.173	0.176	0.178	0.181	0.184	0.186	0.189	0.203	0.219	0.236	1.48%
	High Case	0.166	0.169	0.173	0.176	0.179	0.182	0.186	0.189	0.193	0.196	0.215	0.237	0.260	1.89%
	Low Case	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.00%
	Medium Low Case	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.04%
Ag Potable	Base Case	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.08%
	Medium High Case	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.10%
	High Case	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.12%
	Low Case	0.169	0.170	0.171	0.172	0.174	0.175	0.176	0.177	0.179	0.180	0.187	0.195	0.204	0.79%
	Medium Low Case	0.169	0.171	0.172	0.174	0.175	0.177	0.178	0.180	0.181	0.183	0.191	0.200	0.210	0.90%
Total Potable	Base Case	0.169	0.171	0.173	0.175	0.177	0.179	0.181	0.182	0.184	0.186	0.195	0.205	0.215	1.01%
	Medium High Case	0.170	0.172	0.175	0.178	0.180	0.183	0.185	0.188	0.191	0.193	0.207	0.223	0.240	1.45%
	High Case	0.171	0.174	0.177	0.180	0.183	0.187	0.190	0.193	0.197	0.200	0.219	0.241	0.265	1.85%
	Low Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Medium Low Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ag Non Potable	Base Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Medium High Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	High Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Low Case	0.169	0.170	0.171	0.172	0.174	0.175	0.176	0.177	0.179	0.180	0.187	0.195	0.204	0.79%
	Medium Low Case	0.169	0.171	0.172	0.174	0.175	0.177	0.178	0.180	0.181	0.183	0.191	0.200	0.210	0.90%
Total	Base Case	0.169	0.171	0.173	0.175	0.177	0.179	0.181	0.182	0.184	0.186	0.195	0.205	0.215	1.01%
	Medium High Case	0.170	0.172	0.175	0.178	0.180	0.183	0.185	0.188	0.191	0.193	0.207	0.223	0.240	1.45%
	High Case	0.171	0.174	0.177	0.180	0.183	0.187	0.190	0.193	0.197	0.200	0.219	0.241	0.265	1.85%

Figure 33 Range of Water Demand Projections: DWS East Maui District by Use Classification

ECONOMETRIC COMPOSITE WATER CONSUMPTION PROJECTIONS (Millions of Gallons per Day)

DWS Projections Indexed to Maui County General Plan Update: Socio-Economic Forecast Report 2006

		Calendar Year													Avg. Ann.
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Growth
Molokai															
	Low Case	0.821	0.822	0.824	0.825	0.826	0.829	0.833	0.836	0.840	0.843	0.859	0.881	0.907	0.41%
	Medium Low Case	0.823	0.825	0.828	0.830	0.832	0.837	0.842	0.847	0.852	0.856	0.877	0.904	0.934	0.53%
General	Base Case	0.824	0.828	0.832	0.835	0.839	0.845	0.851	0.857	0.864	0.870	0.896	0.927	0.961	0.64%
	Medium High Case	0.827	0.833	0.839	0.845	0.852	0.861	0.870	0.879	0.888	0.897	0.941	0.993	1.052	1.01%
	High Case	0.829	0.838	0.847	0.855	0.864	0.876	0.888	0.900	0.912	0.924	0.986	1.059	1.142	1.34%
	Low Case	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.00%
	Medium Low Case	0.018	0.018	0.018	0.018	0.018	0.019	0.019	0.019	0.019	0.019	0.020	0.021	0.022	0.90%
Ag Potable	Base Case	0.018	0.018	0.019	0.019	0.019	0.020	0.020	0.020	0.021	0.021	0.023	0.025	0.028	1.79%
	Medium High Case	0.018	0.018	0.019	0.019	0.020	0.020	0.021	0.021	0.022	0.022	0.025	0.028	0.031	2.24%
	High Case	0.018	0.019	0.019	0.020	0.020	0.021	0.021	0.022	0.022	0.023	0.026	0.030	0.034	2.69%
	Low Case	0.839	0.840	0.841	0.842	0.843	0.847	0.850	0.854	0.857	0.861	0.877	0.899	0.924	0.40%
	Medium Low Case	0.841	0.843	0.846	0.848	0.851	0.856	0.861	0.866	0.871	0.876	0.898	0.925	0.956	0.54%
Total Potable	Base Case	0.842	0.846	0.850	0.854	0.858	0.865	0.871	0.878	0.884	0.891	0.919	0.952	0.989	0.67%
	Medium High Case	0.845	0.851	0.858	0.865	0.871	0.881	0.890	0.900	0.909	0.919	0.966	1.021	1.082	1.04%
	High Case	0.847	0.857	0.866	0.875	0.884	0.897	0.910	0.922	0.935	0.947	1.013	1.089	1.177	1.38%
	Low Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Medium Low Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ag Non Potable	Base Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Medium High Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	High Case	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Low Case	0.839	0.840	0.841	0.842	0.843	0.847	0.850	0.854	0.857	0.861	0.877	0.899	0.924	0.40%
	Medium Low Case	0.841	0.843	0.846	0.848	0.851	0.856	0.861	0.866	0.871	0.876	0.898	0.925	0.956	0.54%
Total	Base Case	0.842	0.846	0.850	0.854	0.858	0.865	0.871	0.878	0.884	0.891	0.919	0.952	0.989	0.67%
	Medium High Case	0.845	0.851	0.858	0.865	0.871	0.881	0.890	0.900	0.909	0.919	0.966	1.021	1.082	1.04%
	High Case	0.847	0.857	0.866	0.875	0.884	0.897	0.910	0.922	0.935	0.947	1.013	1.089	1.177	1.38%

Figure 34 Range of Water Demand Projections: DWS Molokai District by Use Classification

COMPOSITE ECONOMETRIC WATER CONSUMPTION PROJECTION **Millions of Gallons per Day (MGD)**

Base Case **Total All Classes** **Land-Use Based Demographic Forecast - Base Case**

DISTRICT NAME	AREA NAME	SUBDIST NAME	CPD Coeff.	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Avg. Ann. Growth
Central	East Central	Paia-Kuau	P-H	0.436	0.432	0.425	0.423	0.425	0.427	0.429	0.431	0.434	0.436	0.447	0.459	0.471	
		Spreckelsville	W-K	0.215	0.217	0.218	0.220	0.225	0.229	0.233	0.237	0.241	0.246	0.268	0.291	0.314	
	East CentralTotal			0.650	0.649	0.642	0.643	0.650	0.656	0.662	0.669	0.675	0.682	0.715	0.750	0.785	0.79%
	North Central	Kahului	W-K	4.937	4.992	5.011	5.073	5.170	5.267	5.363	5.460	5.556	5.653	6.156	6.686	7.226	
		Puunene	W-K	0.071	0.072	0.072	0.072	0.072	0.073	0.073	0.073	0.074	0.074	0.076	0.078	0.080	
		Waihee	W-K	0.078	0.079	0.079	0.080	0.082	0.083	0.085	0.087	0.088	0.090	0.098	0.106	0.115	
		Waikapu	W-K	0.149	0.150	0.151	0.153	0.156	0.158	0.161	0.164	0.167	0.170	0.185	0.201	0.217	
		Wailuku	W-K	3.594	3.634	3.648	3.693	3.764	3.834	3.904	3.974	4.044	4.114	4.480	4.865	5.257	
		Wailuku Hts	W-K	0.228	0.231	0.232	0.234	0.239	0.243	0.248	0.252	0.257	0.261	0.285	0.309	0.334	
	North CentralTotal			9.057	9.157	9.192	9.306	9.483	9.658	9.834	10.010	10.186	10.362	11.279	12.244	13.229	1.59%
	South Central	Kihei	K-M	11.684	11.693	11.485	11.549	11.825	12.162	12.502	12.843	13.186	13.532	15.133	16.895	18.737	
		Maalaea	K-M	0.221	0.221	0.217	0.218	0.223	0.230	0.237	0.243	0.250	0.257	0.288	0.322	0.358	
		Makena	K-M	0.614	0.615	0.603	0.607	0.622	0.640	0.658	0.677	0.696	0.714	0.801	0.896	0.996	
		Wailea	K-M														
	South CentralTotal			12.518	12.529	12.305	12.374	12.670	13.032	13.397	13.763	14.132	14.502	16.221	18.114	20.091	1.99%
CentralTotal				22.226	22.335	22.139	22.323	22.803	23.347	23.893	24.441	24.992	25.545	28.215	31.108	34.106	1.80%
Hana - East Maui	East Maui	Hana	HANA	0.133	0.135	0.136	0.137	0.139	0.140	0.142	0.143	0.145	0.146	0.153	0.161	0.169	
		Kaupo	HANA	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	
		Keanae	HANA	0.020	0.021	0.021	0.021	0.021	0.021	0.022	0.022	0.022	0.022	0.024	0.025	0.026	
		Nahiku	HANA	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.013	0.013	0.013	0.014	0.015	0.015	
	East MauiTotal			0.169	0.171	0.173	0.175	0.177	0.179	0.181	0.182	0.184	0.186	0.195	0.205	0.215	1.01%
Hana - East MauiTotal				0.169	0.171	0.173	0.175	0.177	0.179	0.181	0.182	0.184	0.186	0.195	0.205	0.215	1.01%
Molokai	Molokai	Halawa	MOL	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
		Kalae	MOL	0.031	0.031	0.031	0.031	0.031	0.031	0.032	0.032	0.032	0.032	0.033	0.034	0.036	
		Kawela-Kaunakakai	MOL	0.632	0.634	0.637	0.640	0.643	0.648	0.653	0.657	0.662	0.667	0.687	0.712	0.738	
		Ualapue-Kamalo	MOL	0.180	0.181	0.182	0.183	0.184	0.185	0.187	0.188	0.190	0.191	0.198	0.206	0.214	
	MolokaiTotal			0.842	0.846	0.850	0.854	0.858	0.865	0.871	0.878	0.884	0.891	0.919	0.952	0.989	0.67%
MolokaiTotal				0.842	0.846	0.850	0.854	0.858	0.865	0.871	0.878	0.884	0.891	0.919	0.952	0.989	0.67%
Upcountry	Haiku	Haiku-Pauwela	P-H	0.391	0.389	0.383	0.382	0.385	0.388	0.390	0.393	0.396	0.399	0.413	0.429	0.445	
		Kokomo-Kaupakalua	P-H	0.486	0.484	0.477	0.476	0.479	0.483	0.486	0.490	0.493	0.496	0.514	0.534	0.554	
		Kuiaha	P-H	0.163	0.163	0.162	0.163	0.165	0.166	0.168	0.170	0.172	0.174	0.183	0.194	0.206	
	Haiku System			1.040	1.036	1.022	1.021	1.029	1.037	1.045	1.053	1.061	1.069	1.111	1.156	1.205	0.61%
	Kula Ag Park	Kula Ag Park	M-P-K	0.605	0.609	0.612	0.616	0.621	0.625	0.629	0.634	0.638	0.642	0.665	0.688	0.712	0.68%
	Lower Kula Syster	Lower Kula	L.Kula Sys	2.095	2.110	2.120	2.135	2.155	2.175	2.195	2.214	2.234	2.254	2.358	2.464	2.569	0.85%
		Ulupalakua-Kanaio	U.Kula Sys	0.164	0.166	0.167	0.169	0.171	0.173	0.175	0.178	0.180	0.182	0.193	0.205	0.217	
		Upper Kula	U.Kula Sys	1.321	1.330	1.334	1.345	1.361	1.377	1.393	1.409	1.425	1.441	1.527	1.614	1.701	
	Upper Kula System			1.485	1.496	1.502	1.514	1.532	1.550	1.569	1.587	1.605	1.623	1.720	1.818	1.918	1.07%
	Makawao	Haliimaile	Mak Sys	0.110	0.111	0.110	0.110	0.111	0.112	0.113	0.114	0.115	0.116	0.120	0.125	0.130	
		Makawao	Mak Sys	0.962	0.964	0.961	0.964	0.973	0.981	0.990	0.999	1.007	1.016	1.063	1.110	1.157	
		Pukalani	Mak Sys	0.960	0.961	0.956	0.958	0.966	0.974	0.982	0.990	0.998	1.006	1.049	1.093	1.136	
	Makawao System			2.032	2.035	2.026	2.033	2.050	2.068	2.085	2.103	2.120	2.138	2.232	2.327	2.423	0.74%
UpcountryTotal				7.257	7.285	7.283	7.320	7.387	7.455	7.522	7.590	7.658	7.726	8.086	8.454	8.826	0.82%
West Maui	West Maui	Alaeloa-Kahana	LAH	1.353	1.354	1.344	1.348	1.364	1.382	1.400	1.419	1.437	1.455	1.535	1.621	1.708	
		Honokohau	LAH	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	
		Honokowai	LAH	1.566	1.568	1.556	1.561	1.580	1.600	1.621	1.642	1.663	1.684	1.776	1.876	1.977	
		Lahaina	LAH	2.278	2.280	2.262	2.269	2.296	2.326	2.356	2.386	2.416	2.446	2.579	2.722	2.866	
	West MauiTotal			5.201	5.206	5.165	5.181	5.243	5.313	5.382	5.451	5.520	5.588	5.894	6.223	6.556	0.97%
West MauiTotal				5.201	5.206	5.165	5.181	5.243	5.313	5.382	5.451	5.520	5.588	5.894	6.223	6.556	0.97%
Total All Classes				35.695	35.843	35.610	35.853	36.468	37.157	37.848	38.542	39.238	39.936	43.310	46.942	50.692	1.47%

Figure 35 Base Case Composite Water Demand Projections: Total All Services by DWS District, Area and Subdistrict

Water Demand Projections — **Land-Use Based Demographic Forecast - Base Case**

Agricultural Uses — **Base Case** — **Millions of Gallons per Day (MGD)**

DISTRICT NAME	AREA NAME	SUBDIST NAME		Calendar Year 2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Avg. Ann. Growth
AG Non-Potable																	
Upcountry	Kula	Kula Ag Park	L.S.Trend	0.577	0.581	0.584	0.588	0.592	0.596	0.600	0.604	0.608	0.612	0.633	0.654	0.676	
		Upper Kula	L.S.Trend														
	KulaTotal			0.577	0.581	0.584	0.588	0.592	0.596	0.600	0.604	0.608	0.612	0.633	0.654	0.676	0.66%
	Makawao	Makawao	L.S.Trend														
	MakawaoTotal																
UpcountryTotal			L.S.Trend	0.577	0.581	0.584	0.588	0.592	0.596	0.600	0.604	0.608	0.612	0.633	0.654	0.676	0.66%
AG Non-Potable Total				0.577	0.581	0.584	0.588	0.592	0.596	0.600	0.604	0.608	0.612	0.633	0.654	0.676	0.66%

DISTRICT NAME	AREA NAME	SUBDIST NAME		Calendar Year 2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Avg. Ann. Growth
AG Potable																	
Central	East Central	Paia-Kuau	L.S.Trend	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.008	
		Spreckelsville	L.S.Trend														
	East CentralTotal			0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.008	0.05%
	North Central	Kahului	L.S.Trend	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	
		Puunene	L.S.Trend	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	
		Wailuku	L.S.Trend	0.015	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.017	0.018	0.019	
	North CentralTotal			0.070	0.070	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.072	0.072	0.073	0.074	0.21%
	South Central	Kihei	L.S.Trend	0.373	0.373	0.373	0.373	0.373	0.373	0.373	0.373	0.373	0.373	0.373	0.373	0.373	
		Makena	L.S.Trend	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	
	South CentralTotal			0.376	0.376	0.376	0.376	0.376	0.376	0.376	0.376	0.376	0.376	0.377	0.377	0.377	0.01%
CentralTotal			L.S.Trend	0.454	0.454	0.454	0.454	0.454	0.455	0.455	0.455	0.455	0.455	0.456	0.457	0.458	0.04%
Hana - East Maui	East Maui	Hana	L.S.Trend	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	
	East MauiTotal			0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.08%
Hana - East MauiTotal			L.S.Trend	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.08%
		Kawela-Kaunakakai	L.S.Trend	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.005	0.006	0.006	
		Ualapue-Kamalo	L.S.Trend	0.014	0.014	0.014	0.015	0.015	0.015	0.015	0.016	0.016	0.016	0.018	0.019	0.021	
	MolokaiTotal			0.018	0.018	0.019	0.019	0.019	0.020	0.020	0.020	0.021	0.021	0.023	0.025	0.028	1.79%
MolokaiTotal			L.S.Trend	0.018	0.018	0.019	0.019	0.019	0.020	0.020	0.020	0.021	0.021	0.023	0.025	0.028	1.79%
Upcountry	Haiku	Haiku-Pauwela	L.S.Trend	0.034	0.035	0.036	0.037	0.038	0.038	0.039	0.040	0.041	0.042	0.047	0.053	0.059	
		Kokomo-Kaupakalua	L.S.Trend	0.050	0.051	0.052	0.053	0.054	0.055	0.056	0.057	0.059	0.060	0.066	0.073	0.081	
		Kuiaha	L.S.Trend	0.048	0.049	0.051	0.052	0.053	0.054	0.055	0.056	0.057	0.059	0.065	0.073	0.081	
	HaikuTotal			0.132	0.135	0.138	0.141	0.144	0.147	0.151	0.154	0.157	0.160	0.179	0.199	0.221	2.16%
		Lower Kula	L.S.Trend	1.416	1.420	1.424	1.428	1.433	1.437	1.441	1.445	1.449	1.453	1.475	1.496	1.518	
		Ulupalakua-Kanaio	L.S.Trend	0.137	0.138	0.140	0.141	0.143	0.145	0.146	0.148	0.150	0.151	0.160	0.170	0.180	
		Upper Kula	L.S.Trend	0.451	0.455	0.458	0.461	0.464	0.467	0.470	0.473	0.476	0.479	0.496	0.513	0.530	
	KulaTotal			2.004	2.013	2.022	2.030	2.039	2.048	2.057	2.066	2.075	2.084	2.131	2.179	2.228	0.44%
	Makawao	Haliimaile	L.S.Trend	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	
		Makawao	L.S.Trend	0.122	0.124	0.125	0.127	0.128	0.130	0.132	0.134	0.135	0.137	0.146	0.156	0.167	
		Pukalani	L.S.Trend	0.011	0.011	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.013	0.014	0.015	0.016	
	MakawaoTotal			0.135	0.137	0.139	0.140	0.142	0.144	0.146	0.148	0.150	0.152	0.162	0.173	0.185	1.32%
UpcountryTotal			L.S.Trend	2.272	2.285	2.298	2.312	2.326	2.340	2.354	2.368	2.382	2.397	2.472	2.551	2.634	0.62%
West Maui	West Maui	Alaeloa-Kahana	L.S.Trend	0.009	0.009	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.012	0.013	0.015	0.018	
		Honokowai	L.S.Trend	0.015	0.015	0.015	0.016	0.016	0.016	0.017	0.017	0.017	0.018	0.020	0.022	0.025	
		Lahaina	L.S.Trend														
	West MauiTotal																
West MauiTotal			L.S.Trend	0.024	0.024	0.025	0.025	0.026	0.027	0.027	0.028	0.029	0.029	0.033	0.038	0.043	2.49%
AG Potable Total				2.771	2.786	2.800	2.815	2.830	2.845	2.860	2.876	2.891	2.907	2.989	3.075	3.167	0.56%
AG Total				3.348	3.366	3.385	3.403	3.422	3.441	3.460	3.480	3.499	3.519	3.621	3.729	3.843	0.58%

Figure 36 Water Demand Projections: Agricultural Uses by DWS District, Area and Subdistrict

COMPOSITE ECONOMETRIC WATER CONSUMPTION PROJEC Land-Use Based Demographic Forecast - Base Case

General Potable **Base Case** Calendar Year **Millions of Gallons per Day (MGD)**

DISTRICT NAME	AREA NAME	SUBDIST NAME	CPD Coeff.	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Avg. Ann. Growth
Central	East Central	Paia-Kuau	P-H	0.428	0.425	0.417	0.415	0.417	0.420	0.422	0.424	0.426	0.428	0.440	0.452	0.464	
		Spreckelsville	W-K	0.215	0.217	0.218	0.220	0.225	0.229	0.233	0.237	0.241	0.246	0.268	0.291	0.314	
	East CentralTotal			0.643	0.642	0.635	0.636	0.642	0.648	0.655	0.661	0.668	0.674	0.707	0.742	0.778	0.80%
	North Central	Kahului	W-K	4.935	4.990	5.009	5.072	5.169	5.265	5.361	5.458	5.554	5.651	6.155	6.684	7.225	
		Puunene	W-K	0.018	0.018	0.018	0.018	0.019	0.019	0.019	0.020	0.020	0.021	0.022	0.024	0.026	
		Waihee	W-K	0.078	0.079	0.079	0.080	0.082	0.083	0.085	0.087	0.088	0.090	0.098	0.106	0.115	
		Waikapu	W-K	0.149	0.150	0.151	0.153	0.156	0.158	0.161	0.164	0.167	0.170	0.185	0.201	0.217	
		Wailuku	W-K	3.579	3.618	3.632	3.678	3.748	3.818	3.888	3.958	4.028	4.098	4.463	4.847	5.239	
		Wailuku Hts	W-K	0.228	0.231	0.232	0.234	0.239	0.243	0.248	0.252	0.257	0.261	0.285	0.309	0.334	
	North CentralTotal			8.987	9.087	9.121	9.235	9.412	9.587	9.763	9.938	10.114	10.290	11.207	12.171	13.156	1.60%
	South Central	Kihei	K-M	11.311	11.321	11.112	11.176	11.453	11.790	12.129	12.470	12.813	13.159	14.760	16.523	18.364	
		Maalaea	K-M	0.221	0.221	0.217	0.218	0.223	0.230	0.237	0.243	0.250	0.257	0.288	0.322	0.358	
		Makena	K-M	0.611	0.611	0.600	0.604	0.618	0.637	0.655	0.673	0.692	0.711	0.797	0.892	0.992	
		Wailea	K-M														
	South CentralTotal			12.143	12.153	11.929	11.998	12.294	12.656	13.020	13.387	13.755	14.126	15.845	17.737	19.714	2.04%
CentralTotal				21.772	21.881	21.685	21.869	22.348	22.892	23.438	23.986	24.537	25.090	27.759	30.651	33.648	1.83%
Hana - East Maui	East Maui	Hana	HANA	0.129	0.130	0.132	0.133	0.135	0.136	0.138	0.139	0.140	0.142	0.149	0.157	0.165	
		Kaupo	HANA	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	
		Keanae	HANA	0.020	0.021	0.021	0.021	0.021	0.021	0.022	0.022	0.022	0.022	0.024	0.025	0.026	
		Nahiku	HANA	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.013	0.013	0.013	0.014	0.015	0.015	
	East MauiTotal			0.165	0.167	0.169	0.171	0.173	0.174	0.176	0.178	0.180	0.182	0.191	0.201	0.211	1.03%
Hana - East MauiTotal				0.165	0.167	0.169	0.171	0.173	0.174	0.176	0.178	0.180	0.182	0.191	0.201	0.211	1.03%
Molokai	Molokai	Halawa	MOL	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
		Kalae	MOL	0.031	0.031	0.031	0.031	0.031	0.031	0.032	0.032	0.032	0.032	0.033	0.034	0.036	
		Kawela-Kaunakakai	MOL	0.627	0.630	0.633	0.636	0.639	0.643	0.648	0.653	0.657	0.662	0.682	0.706	0.732	
		Ualapue-Kamalo	MOL	0.166	0.166	0.167	0.168	0.169	0.170	0.171	0.172	0.174	0.175	0.180	0.186	0.193	
	MolokaiTotal			0.824	0.828	0.832	0.835	0.839	0.845	0.851	0.857	0.864	0.870	0.896	0.927	0.961	0.64%
MolokaiTotal				0.824	0.828	0.832	0.835	0.839	0.845	0.851	0.857	0.864	0.870	0.896	0.927	0.961	0.64%
Upcountry	Haiku	Haiku-Pauwela	P-H	0.356	0.354	0.347	0.345	0.347	0.349	0.351	0.353	0.355	0.357	0.366	0.376	0.386	
		Kokomo-Kaupakalua	P-H	0.436	0.433	0.425	0.423	0.425	0.428	0.430	0.432	0.434	0.437	0.448	0.460	0.473	
		Kuiaha	P-H	0.115	0.114	0.112	0.111	0.112	0.113	0.113	0.114	0.114	0.115	0.118	0.121	0.124	
	HaikuTotal			0.908	0.900	0.884	0.880	0.885	0.889	0.894	0.899	0.904	0.908	0.932	0.958	0.983	0.33%
	Kula	Kula Ag Park	M-P-K	0.028	0.028	0.028	0.028	0.028	0.029	0.029	0.029	0.030	0.030	0.032	0.034	0.036	
		Lower Kula	..Kula Sys	0.679	0.690	0.696	0.707	0.723	0.738	0.754	0.769	0.785	0.800	0.884	0.967	1.051	
		Ulupalakua-Kanaio	J.Kula Sys	0.027	0.028	0.028	0.028	0.028	0.029	0.029	0.030	0.030	0.030	0.033	0.035	0.037	
		Upper Kula	J.Kula Sys	0.869	0.876	0.877	0.884	0.897	0.910	0.923	0.936	0.949	0.962	1.032	1.101	1.171	
	KulaTotal			1.604	1.621	1.628	1.647	1.677	1.706	1.735	1.764	1.793	1.823	1.980	2.137	2.294	1.50%
	Makawao	Haliimaile	Mak Sys	0.109	0.109	0.108	0.108	0.109	0.110	0.111	0.112	0.113	0.114	0.119	0.123	0.128	
		Makawao	Mak Sys	0.840	0.840	0.835	0.837	0.844	0.851	0.858	0.865	0.872	0.879	0.916	0.953	0.991	
		Pukalani	Mak Sys	0.949	0.949	0.944	0.946	0.954	0.962	0.970	0.978	0.986	0.993	1.035	1.078	1.120	
	MakawaoTotal			1.897	1.898	1.888	1.892	1.908	1.923	1.939	1.955	1.970	1.986	2.070	2.154	2.238	0.69%
UpcountryTotal				4.408	4.419	4.400	4.419	4.469	4.519	4.568	4.618	4.667	4.717	4.982	5.249	5.516	0.94%
West Maui	West Maui	Alaeloa-Kahana	LAH	1.344	1.345	1.334	1.338	1.354	1.372	1.390	1.408	1.425	1.443	1.521	1.606	1.691	
		Honokohau	LAH	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	
		Honokowai	LAH	1.552	1.553	1.540	1.545	1.564	1.584	1.605	1.625	1.646	1.666	1.756	1.854	1.952	
		Lahaina	LAH	2.278	2.280	2.262	2.269	2.296	2.326	2.356	2.386	2.416	2.446	2.579	2.722	2.866	
	West MauiTotal			5.178	5.182	5.140	5.156	5.217	5.286	5.354	5.423	5.491	5.559	5.861	6.185	6.513	0.96%
West MauiTotal				5.178	5.182	5.140	5.156	5.217	5.286	5.354	5.423	5.491	5.559	5.861	6.185	6.513	0.96%
General Potable Total				32.347	32.477	32.225	32.450	33.046	33.716	34.388	35.062	35.739	36.417	39.688	43.213	46.849	1.56%

Figure 37 Base Case Econometric Water Demand Projections: General Potable Services by DWS District, Area and Subdistrict

COMPOSITE ECONOMETRIC WATER CONSUMPTION PROJECTION **Millions of Gallons per Day (MGD)**

Low Case **Total All Classes** **Land-Use Based Demographic Forecast - Low Case**

DISTRICT NAME	AREA NAME	SUBDIST NAME	CPD Coeff.	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Avg. Ann. Growth
Central	East Central	Paia-Kuau	P-H	0.435	0.430	0.421	0.418	0.420	0.421	0.423	0.425	0.426	0.428	0.437	0.447	0.459	
		Spreckelsville	W-K	0.214	0.216	0.216	0.218	0.222	0.225	0.229	0.233	0.237	0.240	0.260	0.281	0.304	
	East CentralTotal			0.648	0.646	0.637	0.637	0.641	0.647	0.652	0.657	0.663	0.668	0.697	0.728	0.763	0.68%
	North Central	Kahului	W-K	4.923	4.964	4.969	5.019	5.102	5.188	5.274	5.359	5.445	5.531	5.989	6.478	6.995	
		Puunene	W-K	0.071	0.071	0.071	0.072	0.072	0.072	0.073	0.073	0.073	0.074	0.075	0.077	0.079	
		Waihee	W-K	0.078	0.079	0.079	0.080	0.081	0.082	0.084	0.085	0.086	0.088	0.095	0.103	0.111	
		Waikapu	W-K	0.148	0.149	0.149	0.151	0.153	0.156	0.159	0.161	0.164	0.166	0.180	0.195	0.210	
		Wailuku	W-K	3.584	3.613	3.617	3.653	3.713	3.775	3.838	3.900	3.962	4.025	4.357	4.711	5.086	
		Wailuku Hts	W-K	0.228	0.229	0.230	0.232	0.236	0.240	0.244	0.248	0.252	0.256	0.277	0.299	0.323	
	North CentralTotal			9.032	9.106	9.116	9.205	9.357	9.513	9.670	9.826	9.983	10.139	10.973	11.863	12.805	1.47%
	South Central	Kihei	K-M	11.557	11.445	11.126	11.078	11.234	11.408	11.583	11.758	11.934	12.111	12.982	13.900	14.856	
		Maalaea	K-M	0.218	0.216	0.210	0.209	0.212	0.215	0.219	0.222	0.225	0.229	0.246	0.264	0.282	
		Makena	K-M	0.607	0.601	0.584	0.581	0.590	0.599	0.609	0.618	0.628	0.637	0.684	0.734	0.785	
		Wailea	K-M														
	South CentralTotal			12.382	12.262	11.920	11.868	12.035	12.222	12.410	12.598	12.787	12.977	13.912	14.897	15.924	1.05%
CentralTotal				22.062	22.013	21.673	21.710	22.034	22.382	22.732	23.082	23.433	23.784	25.582	27.489	29.491	1.22%
Hana - East Maui	East Maui	Hana	HANA	0.133	0.134	0.134	0.135	0.136	0.137	0.138	0.139	0.140	0.141	0.147	0.153	0.160	
		Kaupo	HANA	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	
		Keanae	HANA	0.020	0.020	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.022	0.023	0.023	0.025	
		Nahiku	HANA	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.013	0.013	0.014	0.014	
	East MauiTotal			0.169	0.170	0.171	0.172	0.174	0.175	0.176	0.177	0.179	0.180	0.187	0.195	0.204	0.79%
Hana - East MauiTotal				0.169	0.170	0.171	0.172	0.174	0.175	0.176	0.177	0.179	0.180	0.187	0.195	0.204	0.79%
Molokai	Molokai	Halawa	MOL	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
		Kalae	MOL	0.030	0.030	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.032	0.033	0.034	
		Kawela-Kaunakakai	MOL	0.629	0.630	0.631	0.632	0.633	0.635	0.638	0.641	0.643	0.646	0.658	0.675	0.694	
		Ualapue-Kamalo	MOL	0.179	0.179	0.179	0.179	0.180	0.180	0.181	0.182	0.182	0.183	0.186	0.191	0.196	
	MolokaiTotal			0.839	0.840	0.841	0.842	0.843	0.847	0.850	0.854	0.857	0.861	0.877	0.899	0.924	0.40%
MolokaiTotal				0.839	0.840	0.841	0.842	0.843	0.847	0.850	0.854	0.857	0.861	0.877	0.899	0.924	0.40%
Upcountry	Haiku	Haiku-Pauwela	P-H	0.389	0.385	0.378	0.376	0.377	0.378	0.379	0.381	0.382	0.383	0.391	0.399	0.409	
		Kokomo-Kaupakalua	P-H	0.484	0.480	0.471	0.468	0.469	0.471	0.472	0.474	0.476	0.477	0.486	0.497	0.509	
		Kuiaha	P-H	0.162	0.161	0.158	0.158	0.158	0.158	0.159	0.159	0.160	0.160	0.163	0.165	0.168	
	Haiku System			1.035	1.026	1.007	1.001	1.004	1.007	1.010	1.014	1.017	1.021	1.040	1.061	1.086	0.20%
	Kula Ag Park	Kula Ag Park	M-P-K	0.601	0.601	0.601	0.601	0.601	0.601	0.602	0.602	0.602	0.603	0.604	0.606	0.608	0.05%
	Lower Kula Syster	Lower Kula	L.Kula Sys	2.088	2.097	2.100	2.109	2.122	2.135	2.149	2.162	2.175	2.188	2.266	2.344	2.422	0.62%
		Ulupalakua-Kanaio	U.Kula Sys	0.162	0.163	0.163	0.163	0.163	0.163	0.164	0.164	0.164	0.165	0.167	0.169	0.171	
		Upper Kula	U.Kula Sys	1.316	1.320	1.319	1.325	1.336	1.346	1.357	1.368	1.379	1.390	1.455	1.521	1.586	
	Upper Kula System			1.478	1.482	1.481	1.487	1.499	1.510	1.521	1.532	1.544	1.555	1.622	1.689	1.757	0.72%
	Makawao	Haliimaile	Mak Sys	0.110	0.110	0.110	0.110	0.110	0.111	0.112	0.113	0.113	0.114	0.119	0.123	0.128	
		Makawao	Mak Sys	0.959	0.958	0.953	0.953	0.959	0.965	0.971	0.977	0.983	0.988	1.023	1.058	1.093	
		Pukalani	Mak Sys	0.959	0.958	0.952	0.953	0.959	0.966	0.972	0.979	0.986	0.992	1.032	1.071	1.110	
	Makawao System			2.028	2.026	2.014	2.016	2.029	2.042	2.055	2.068	2.082	2.095	2.174	2.252	2.331	0.58%
UpcountryTotal				7.230	7.232	7.204	7.214	7.255	7.296	7.337	7.378	7.420	7.461	7.705	7.953	8.204	0.53%
West Maui	West Maui	Alaeloa-Kahana	LAH	1.341	1.331	1.309	1.302	1.307	1.311	1.314	1.318	1.322	1.326	1.353	1.382	1.416	
		Honokohau	LAH	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	
		Honokowai	LAH	1.552	1.540	1.515	1.507	1.513	1.517	1.522	1.526	1.531	1.535	1.566	1.600	1.639	
		Lahaina	LAH	2.258	2.241	2.204	2.192	2.200	2.207	2.213	2.220	2.227	2.233	2.278	2.329	2.386	
	West MauiTotal			5.155	5.115	5.031	5.005	5.023	5.038	5.053	5.068	5.083	5.098	5.200	5.315	5.445	0.23%
West MauiTotal				5.155	5.115	5.031	5.005	5.023	5.038	5.053	5.068	5.083	5.098	5.200	5.315	5.445	0.23%
Total All Classes				35.455	35.370	34.920	34.944	35.328	35.738	36.149	36.560	36.972	37.385	39.551	41.851	44.268	0.93%

Figure 38 Low Case Composite Water Demand Projections: Total All Services by DWS District, Area and Subdistrict

COMPOSITE ECONOMETRIC WATER CONSUMPTION PROJECTION **Millions of Gallons per Day (MGD)**

Medium Low Case **Total All Classes** **Land-Use Based Demographic Forecast - Interpolated Medium Low Case**

DISTRICT NAME	AREA NAME	SUBDIST NAME	GPD Coeff.	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Avg. Ann. Growth
Central	East Central	Paia-Kuau	P-H	0.435	0.431	0.423	0.421	0.422	0.424	0.426	0.428	0.430	0.432	0.442	0.453	0.465	
		Spreckelsville	W-K	0.214	0.216	0.217	0.219	0.223	0.227	0.231	0.235	0.239	0.243	0.264	0.286	0.309	
	East CentralTotal			0.649	0.647	0.640	0.640	0.645	0.651	0.657	0.663	0.669	0.675	0.706	0.739	0.774	0.74%
	North Central	Kahului	W-K	4.930	4.978	4.990	5.046	5.136	5.227	5.318	5.410	5.501	5.592	6.073	6.582	7.111	
		Puunene	W-K	0.071	0.072	0.072	0.072	0.072	0.072	0.073	0.073	0.073	0.074	0.076	0.077	0.079	
		Waihee	W-K	0.078	0.079	0.079	0.080	0.081	0.083	0.084	0.086	0.087	0.089	0.096	0.104	0.113	
		Waikapu	W-K	0.148	0.150	0.150	0.152	0.154	0.157	0.160	0.163	0.165	0.168	0.183	0.198	0.214	
		Wailuku	W-K	3.589	3.623	3.632	3.673	3.738	3.804	3.871	3.937	4.003	4.069	4.418	4.788	5.172	
		Wailuku Hts	W-K	0.228	0.230	0.231	0.233	0.237	0.242	0.246	0.250	0.254	0.258	0.281	0.304	0.329	
	North CentralTotal			9.044	9.131	9.154	9.256	9.420	9.586	9.752	9.918	10.084	10.250	11.126	12.054	13.017	1.53%
	South Central	Kihei	K-M	11.620	11.569	11.306	11.314	11.529	11.785	12.042	12.301	12.560	12.821	14.057	15.398	16.796	
		Maalaea	K-M	0.219	0.218	0.213	0.213	0.218	0.223	0.228	0.233	0.238	0.243	0.267	0.293	0.320	
		Makena	K-M	0.611	0.608	0.594	0.594	0.606	0.620	0.634	0.648	0.662	0.676	0.743	0.815	0.891	
		Wailea	K-M														
	South CentralTotal			12.450	12.395	12.113	12.121	12.353	12.627	12.903	13.181	13.459	13.740	15.067	16.506	18.007	1.55%
CentralTotal				22.144	22.174	21.906	22.016	22.418	22.864	23.312	23.762	24.213	24.665	26.899	29.299	31.799	1.52%
Hana - East Maui	East Maui	Hana	HANA	0.133	0.134	0.135	0.136	0.138	0.139	0.140	0.141	0.143	0.144	0.150	0.157	0.165	
		Kaupo	HANA	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	
		Keanae	HANA	0.020	0.020	0.021	0.021	0.021	0.021	0.021	0.022	0.022	0.022	0.023	0.024	0.025	
		Nahiku	HANA	0.012	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.013	0.013	0.014	0.014	0.015	
	East MauiTotal			0.169	0.171	0.172	0.174	0.175	0.177	0.178	0.180	0.181	0.183	0.191	0.200	0.210	0.90%
Hana - East MauiTotal				0.169	0.171	0.172	0.174	0.175	0.177	0.178	0.180	0.181	0.183	0.191	0.200	0.210	0.90%
Molokai	Molokai	Halawa	MOL	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
		Kalae	MOL	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.032	0.032	0.033	0.034	0.035	
		Kawela-Kaunakakai	MOL	0.630	0.632	0.634	0.636	0.638	0.642	0.645	0.649	0.653	0.656	0.673	0.693	0.716	
		Ualapue-Kamalo	MOL	0.179	0.180	0.180	0.181	0.182	0.183	0.184	0.185	0.186	0.187	0.192	0.198	0.205	
	MolokaiTotal			0.841	0.843	0.846	0.848	0.851	0.856	0.861	0.866	0.871	0.876	0.898	0.925	0.956	0.54%
MolokaiTotal				0.841	0.843	0.846	0.848	0.851	0.856	0.861	0.866	0.871	0.876	0.898	0.925	0.956	0.54%
Upcountry	Haiku	Haiku-Pauwela	P-H	0.390	0.387	0.381	0.379	0.381	0.383	0.385	0.387	0.389	0.391	0.401	0.413	0.425	
		Kokomo-Kaupakalua	P-H	0.485	0.482	0.474	0.472	0.474	0.477	0.479	0.482	0.484	0.487	0.500	0.514	0.529	
		Kuiaha	P-H	0.163	0.162	0.160	0.160	0.161	0.162	0.163	0.164	0.166	0.167	0.172	0.178	0.185	
	Haiku System			1.038	1.031	1.015	1.011	1.016	1.022	1.027	1.033	1.038	1.044	1.073	1.105	1.140	0.39%
	Kula Ag Park	Kula Ag Park	M-P-K	0.603	0.605	0.607	0.609	0.611	0.613	0.615	0.618	0.620	0.622	0.634	0.646	0.658	0.36%
	Lower Kula Syster	Lower Kula	L.Kula Sys	2.092	2.103	2.110	2.122	2.139	2.155	2.171	2.188	2.204	2.221	2.312	2.403	2.495	0.74%
		Ulupalakua-Kanaio	U.Kula Sys	0.163	0.164	0.165	0.166	0.167	0.168	0.170	0.171	0.172	0.173	0.179	0.186	0.192	
		Upper Kula	U.Kula Sys	1.318	1.325	1.326	1.335	1.348	1.362	1.375	1.389	1.402	1.416	1.491	1.566	1.642	
	Upper Kula System			1.481	1.489	1.491	1.501	1.515	1.530	1.545	1.559	1.574	1.589	1.670	1.752	1.834	0.89%
	Makawao	Haliimaile	Mak Sys	0.110	0.110	0.110	0.110	0.111	0.112	0.112	0.113	0.114	0.115	0.120	0.124	0.129	
		Makawao	Mak Sys	0.960	0.961	0.957	0.959	0.966	0.973	0.980	0.988	0.995	1.002	1.042	1.083	1.123	
		Pukalani	Mak Sys	0.959	0.959	0.954	0.955	0.963	0.970	0.977	0.985	0.992	0.999	1.040	1.082	1.123	
	Makawao System			2.030	2.031	2.020	2.024	2.039	2.055	2.070	2.085	2.101	2.116	2.202	2.289	2.375	0.66%
UpcountryTotal				7.243	7.258	7.243	7.267	7.320	7.375	7.429	7.483	7.537	7.592	7.891	8.195	8.501	0.67%
West Maui	West Maui	Alaeloa-Kahana	LAH	1.347	1.342	1.326	1.325	1.335	1.346	1.357	1.368	1.379	1.390	1.443	1.501	1.561	
		Honokohau	LAH	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	
		Honokowai	LAH	1.559	1.554	1.535	1.534	1.546	1.559	1.572	1.584	1.597	1.610	1.671	1.738	1.807	
		Lahaina	LAH	2.268	2.260	2.233	2.230	2.248	2.266	2.285	2.303	2.321	2.340	2.428	2.525	2.626	
	West MauiTotal			5.178	5.160	5.098	5.093	5.133	5.175	5.217	5.259	5.301	5.343	5.546	5.768	5.999	0.61%
West MauiTotal				5.178	5.160	5.098	5.093	5.133	5.175	5.217	5.259	5.301	5.343	5.546	5.768	5.999	0.61%
Total All Classes				35.575	35.607	35.265	35.398	35.898	36.447	36.998	37.550	38.103	38.658	41.425	44.387	47.464	1.21%

Figure 39 Medium Low Case Composite Water Demand Projections: Total All Services by DWS District, Area and Subdistrict

COMPOSITE ECONOMETRIC WATER CONSUMPTION PROJECTION **Millions of Gallons per Day (MGD)**

Medium High Case **Total All Classes** **Land-Use Based Demographic Forecast - Interpolated Medium High Case**

DISTRICT NAME	AREA NAME	SUBDIST NAME	CPD Coeff.	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Avg. Ann. Growth
Central	East Central	Paia-Kuau	P-H	0.437	0.437	0.434	0.435	0.439	0.443	0.447	0.452	0.456	0.460	0.482	0.507	0.534	
		Spreckelsville	W-K	0.215	0.219	0.222	0.226	0.231	0.236	0.242	0.247	0.252	0.258	0.287	0.319	0.354	
	East CentralTotal			0.652	0.656	0.656	0.661	0.670	0.680	0.689	0.699	0.708	0.718	0.769	0.826	0.888	1.29%
	North Central	Kahului	W-K	4.956	5.044	5.108	5.202	5.319	5.441	5.565	5.688	5.811	5.934	6.607	7.344	8.142	
		Puunene	W-K	0.071	0.072	0.072	0.072	0.073	0.073	0.074	0.074	0.075	0.075	0.077	0.080	0.083	
		Waihee	W-K	0.079	0.080	0.081	0.082	0.084	0.086	0.088	0.090	0.092	0.094	0.105	0.116	0.129	
		Waikapu	W-K	0.149	0.152	0.154	0.156	0.160	0.164	0.167	0.171	0.175	0.179	0.199	0.221	0.245	
		Wailuku	W-K	3.607	3.672	3.718	3.786	3.871	3.960	4.050	4.139	4.229	4.318	4.807	5.343	5.923	
		Wailuku Hts	W-K	0.229	0.233	0.236	0.240	0.246	0.251	0.257	0.263	0.269	0.274	0.305	0.339	0.376	
	North CentralTotal			9.091	9.252	9.370	9.540	9.752	9.977	10.201	10.425	10.650	10.874	12.100	13.444	14.899	2.08%
	South Central	Kihei	K-M	11.755	11.931	11.960	12.172	12.530	12.960	13.395	13.832	14.273	14.716	17.066	19.786	22.875	
		Maalaea	K-M	0.222	0.225	0.226	0.230	0.237	0.245	0.254	0.262	0.271	0.280	0.326	0.379	0.439	
		Makena	K-M	0.618	0.628	0.629	0.641	0.660	0.683	0.707	0.730	0.754	0.778	0.906	1.053	1.220	
		Wailea	K-M														
	South CentralTotal			12.595	12.784	12.815	13.042	13.427	13.889	14.355	14.825	15.298	15.775	18.297	21.217	24.534	2.82%
CentralTotal				22.338	22.693	22.840	23.243	23.849	24.545	25.245	25.949	26.656	27.367	31.166	35.487	40.320	2.49%
Hana - East Maui	East Maui	Hana	HANA	0.134	0.136	0.138	0.140	0.141	0.144	0.146	0.148	0.150	0.152	0.163	0.175	0.188	
		Kaupo	HANA	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.006	
		Keanae	HANA	0.020	0.021	0.021	0.021	0.022	0.022	0.022	0.023	0.023	0.023	0.025	0.027	0.029	
		Nahiku	HANA	0.012	0.012	0.012	0.013	0.013	0.013	0.013	0.013	0.013	0.014	0.015	0.016	0.017	
	East MauiTotal			0.170	0.172	0.175	0.178	0.180	0.183	0.185	0.188	0.191	0.193	0.207	0.223	0.240	1.45%
Hana - East MauiTotal				0.170	0.172	0.175	0.178	0.180	0.183	0.185	0.188	0.191	0.193	0.207	0.223	0.240	1.45%
Molokai	Molokai	Halawa	MOL	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
		Kalae	MOL	0.031	0.031	0.031	0.031	0.032	0.032	0.032	0.033	0.033	0.033	0.035	0.037	0.039	
		Kawela-Kaunakakai	MOL	0.633	0.638	0.643	0.648	0.653	0.660	0.667	0.674	0.681	0.688	0.722	0.763	0.808	
		Ualapue-Kamalo	MOL	0.180	0.182	0.183	0.185	0.186	0.189	0.191	0.193	0.195	0.197	0.208	0.221	0.235	
	MolokaiTotal			0.845	0.851	0.858	0.865	0.871	0.881	0.890	0.900	0.909	0.919	0.966	1.021	1.082	1.04%
MolokaiTotal				0.845	0.851	0.858	0.865	0.871	0.881	0.890	0.900	0.909	0.919	0.966	1.021	1.082	1.04%
Upcountry	Haiku	Haiku-Pauwela	P-H	0.392	0.393	0.392	0.394	0.398	0.402	0.407	0.412	0.416	0.421	0.446	0.475	0.506	
		Kokomo-Kaupakalua	P-H	0.488	0.489	0.488	0.490	0.495	0.501	0.507	0.512	0.518	0.524	0.555	0.590	0.628	
		Kuiaha	P-H	0.164	0.165	0.166	0.167	0.170	0.173	0.175	0.178	0.181	0.183	0.198	0.215	0.234	
	Haiku System			1.044	1.048	1.045	1.051	1.063	1.076	1.089	1.102	1.115	1.128	1.200	1.279	1.368	1.13%
	Kula Ag Park	Kula Ag Park	M-P-K	0.606	0.611	0.616	0.621	0.626	0.632	0.637	0.643	0.648	0.654	0.683	0.713	0.744	0.86%
	Lower Kula Syster	Lower Kula	L.Kula Sys	2.101	2.124	2.144	2.167	2.193	2.219	2.245	2.271	2.297	2.323	2.477	2.632	2.787	1.18%
		Ulupalakua-Kanaio	U.Kula Sys	0.165	0.167	0.169	0.172	0.174	0.177	0.180	0.182	0.185	0.188	0.203	0.218	0.235	
		Upper Kula	U.Kula Sys	1.326	1.342	1.356	1.373	1.395	1.416	1.437	1.459	1.480	1.501	1.628	1.756	1.885	
	Upper Kula System			1.490	1.509	1.525	1.545	1.569	1.593	1.617	1.641	1.665	1.689	1.831	1.975	2.120	1.48%
	Makawao	Haliimaile	Mak Sys	0.111	0.111	0.112	0.112	0.114	0.115	0.116	0.117	0.118	0.120	0.127	0.134	0.142	
		Makawao	Mak Sys	0.964	0.971	0.975	0.983	0.994	1.006	1.017	1.029	1.040	1.052	1.121	1.190	1.261	
		Pukalani	Mak Sys	0.963	0.969	0.971	0.978	0.988	0.999	1.010	1.021	1.031	1.042	1.107	1.173	1.239	
	Makawao System			2.038	2.051	2.057	2.073	2.096	2.120	2.143	2.166	2.190	2.213	2.355	2.498	2.641	1.09%
UpcountryTotal				7.279	7.343	7.387	7.457	7.547	7.639	7.731	7.823	7.915	8.008	8.546	9.096	9.660	1.19%
West Maui	West Maui	Alaeloa-Kahana	LAH	1.359	1.371	1.376	1.390	1.413	1.437	1.461	1.485	1.508	1.532	1.658	1.796	1.945	
		Honokohau	LAH	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	
		Honokowai	LAH	1.573	1.588	1.593	1.610	1.635	1.663	1.691	1.719	1.746	1.774	1.919	2.078	2.251	
		Lahaina	LAH	2.288	2.309	2.316	2.340	2.377	2.417	2.457	2.497	2.537	2.577	2.785	3.014	3.262	
	West MauiTotal			5.224	5.272	5.288	5.343	5.428	5.521	5.612	5.704	5.796	5.887	6.366	6.893	7.464	1.50%
West MauiTotal				5.224	5.272	5.288	5.343	5.428	5.521	5.612	5.704	5.796	5.887	6.366	6.893	7.464	1.50%
Total All Classes				35.856	36.332	36.549	37.086	37.877	38.769	39.664	40.564	41.467	42.374	47.250	52.720	58.767	2.08%

Figure 40 Medium High Case Composite Water Demand Projecitons: Total All Services by DWS District, Area and Subdistrict

COMPOSITE ECONOMETRIC WATER CONSUMPTION PROJECTION **Millions of Gallons per Day (MGD)**

High Case **Total All Classes** **Land-Use Based Demographic Forecast - High Case**

DISTRICT NAME	AREA NAME	SUBDIST NAME	CPD Coeff.	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	Avg. Ann. Growth
Central	East Central	Paia-Kuau	P-H	0.439	0.442	0.444	0.448	0.453	0.459	0.466	0.472	0.478	0.484	0.517	0.555	0.596	
		Spreckelsville	W-K	0.216	0.221	0.226	0.232	0.238	0.244	0.251	0.257	0.264	0.270	0.307	0.348	0.394	
	East CentralTotal			0.655	0.664	0.670	0.680	0.691	0.703	0.716	0.729	0.741	0.754	0.824	0.902	0.990	1.74%
	North Central	Kahului	W-K	4.974	5.096	5.206	5.330	5.467	5.616	5.766	5.916	6.066	6.216	7.057	8.002	9.059	
		Puunene	W-K	0.072	0.072	0.072	0.073	0.073	0.074	0.074	0.075	0.075	0.076	0.079	0.083	0.086	
		Waihee	W-K	0.079	0.081	0.083	0.085	0.087	0.089	0.091	0.094	0.096	0.099	0.112	0.127	0.144	
		Waikapu	W-K	0.150	0.153	0.157	0.160	0.164	0.169	0.173	0.178	0.182	0.187	0.212	0.241	0.273	
		Wailuku	W-K	3.621	3.710	3.789	3.880	3.979	4.087	4.196	4.305	4.414	4.523	5.134	5.821	6.588	
		Wailuku Hts	W-K	0.230	0.236	0.241	0.246	0.253	0.260	0.266	0.273	0.280	0.287	0.326	0.370	0.419	
	North CentralTotal			9.125	9.348	9.547	9.774	10.022	10.295	10.568	10.841	11.114	11.387	12.920	14.643	16.568	2.52%
	South Central	Kihei	K-M	11.826	12.170	12.434	12.794	13.234	13.759	14.288	14.821	15.359	15.901	18.999	22.676	27.013	
		Maalaea	K-M	0.223	0.230	0.235	0.242	0.251	0.261	0.271	0.282	0.292	0.303	0.363	0.435	0.520	
		Makena	K-M	0.622	0.640	0.655	0.674	0.698	0.726	0.755	0.784	0.813	0.842	1.010	1.209	1.444	
		Wailea	K-M														
	South CentralTotal			12.671	13.040	13.324	13.710	14.183	14.746	15.314	15.887	16.465	17.047	20.372	24.320	28.976	3.51%
CentralTotal				22.451	23.051	23.541	24.164	24.896	25.744	26.598	27.457	28.320	29.188	34.116	39.866	46.534	3.08%
Hana - East Maui	East Maui	Hana	HANA	0.134	0.137	0.139	0.142	0.144	0.147	0.149	0.152	0.155	0.157	0.172	0.189	0.208	
		Kaupo	HANA	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.006	0.006	
		Keanae	HANA	0.020	0.021	0.021	0.022	0.022	0.022	0.023	0.023	0.024	0.024	0.026	0.029	0.032	
		Nahiku	HANA	0.012	0.012	0.012	0.013	0.013	0.013	0.013	0.014	0.014	0.014	0.016	0.017	0.019	
	East MauiTotal			0.171	0.174	0.177	0.180	0.183	0.187	0.190	0.193	0.197	0.200	0.219	0.241	0.265	1.85%
Hana - East MauiTotal				0.171	0.174	0.177	0.180	0.183	0.187	0.190	0.193	0.197	0.200	0.219	0.241	0.265	1.85%
Molokai	Molokai	Halawa	MOL	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
		Kalae	MOL	0.031	0.031	0.031	0.032	0.032	0.032	0.033	0.033	0.034	0.034	0.037	0.039	0.042	
		Kawela-Kaunakakai	MOL	0.635	0.642	0.649	0.656	0.663	0.672	0.681	0.690	0.700	0.709	0.757	0.814	0.878	
		Ualapue-Kamalo	MOL	0.181	0.183	0.185	0.187	0.189	0.192	0.195	0.198	0.201	0.203	0.218	0.236	0.256	
	MolokaiTotal			0.847	0.857	0.866	0.875	0.884	0.897	0.910	0.922	0.935	0.947	1.013	1.089	1.177	1.38%
MolokaiTotal				0.847	0.857	0.866	0.875	0.884	0.897	0.910	0.922	0.935	0.947	1.013	1.089	1.177	1.38%
Upcountry	Haiku	Haiku-Pauwela	P-H	0.394	0.398	0.401	0.405	0.411	0.417	0.424	0.430	0.437	0.443	0.480	0.521	0.568	
		Kokomo-Kaupakalua	P-H	0.490	0.495	0.499	0.504	0.511	0.519	0.527	0.535	0.543	0.552	0.596	0.647	0.704	
		Kuiaha	P-H	0.165	0.167	0.169	0.172	0.175	0.179	0.182	0.186	0.189	0.193	0.213	0.237	0.264	
	Haiku System			1.048	1.060	1.068	1.081	1.097	1.115	1.133	1.151	1.170	1.188	1.290	1.405	1.535	1.60%
	Kula Ag Park	Kula Ag Park	M-P-K	0.607	0.614	0.620	0.627	0.634	0.641	0.647	0.654	0.661	0.669	0.706	0.745	0.786	1.08%
	Lower Kula Syster	Lower Kula	L.Kula Sys	2.108	2.138	2.167	2.198	2.231	2.263	2.295	2.328	2.361	2.393	2.596	2.800	3.005	1.49%
		Ulupalakua-Kanaio	U.Kula Sys	0.165	0.168	0.171	0.174	0.177	0.181	0.184	0.187	0.191	0.194	0.213	0.233	0.254	
		Upper Kula	U.Kula Sys	1.331	1.355	1.377	1.402	1.428	1.455	1.482	1.508	1.535	1.562	1.730	1.899	2.070	
	Upper Kula System			1.496	1.523	1.548	1.576	1.606	1.636	1.665	1.695	1.725	1.756	1.942	2.132	2.324	1.85%
	Makawao	Haliimaile	Mak Sys	0.111	0.112	0.113	0.115	0.116	0.118	0.119	0.121	0.122	0.124	0.133	0.143	0.153	
		Makawao	Mak Sys	0.967	0.979	0.989	1.002	1.016	1.030	1.044	1.059	1.073	1.088	1.179	1.272	1.366	
		Pukalani	Mak Sys	0.965	0.976	0.985	0.997	1.010	1.024	1.037	1.051	1.064	1.078	1.166	1.254	1.342	
	Makawao System			2.043	2.068	2.088	2.113	2.142	2.172	2.201	2.230	2.260	2.289	2.478	2.668	2.861	1.41%
UpcountryTotal				7.302	7.402	7.492	7.595	7.710	7.826	7.942	8.059	8.177	8.294	9.012	9.750	10.512	1.53%
West Maui	West Maui	Alaeloa-Kahana	LAH	1.365	1.389	1.408	1.432	1.461	1.491	1.521	1.551	1.580	1.610	1.781	1.971	2.183	
		Honokohau	LAH	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.006	
		Honokowai	LAH	1.580	1.608	1.630	1.658	1.691	1.726	1.760	1.795	1.829	1.864	2.061	2.280	2.525	
		Lahaina	LAH	2.298	2.338	2.370	2.411	2.458	2.508	2.558	2.608	2.658	2.707	2.991	3.307	3.659	
	West MauiTotal			5.247	5.338	5.412	5.505	5.614	5.729	5.843	5.958	6.072	6.185	6.838	7.564	8.373	1.97%
West MauiTotal				5.247	5.338	5.412	5.505	5.614	5.729	5.843	5.958	6.072	6.185	6.838	7.564	8.373	1.97%
Total All Classes				36.018	36.822	37.488	38.319	39.287	40.382	41.483	42.589	43.700	44.815	51.198	58.510	66.860	2.61%

Figure 41 High Case Composite Water Demand Projections: Total All Services by DWS District, Area and Subdistrict

Table 2, Land Use Inventory by Community Plan Area

Gross Area in Acres

District	Single-family	Multi-family	Business	Industrial	Hotel	Rural
Hana	137	7	27	9	28	510
Kihei / Makena	1922	733	257	266	359	420
West Maui	917	341	166	145	336	35
UpCountry	1521	184	85	34	6	2106
Paia / Haiku	393	1	24	56	0	176
Wailuku / Kahului	2207	120	178	970	13	289
Molokai	662	106	60	199	189	1609
Lanai	477	19	36	116	3	173
Totals	8236	1511	833	1795	934	5318

Vacant Area in Acres

District	Single-family	Multi-family	Business	Industrial	Hotel	Rural
Hana	81	5	0	9	0	175
Kihei / Makena	573	291	129	76	196	57
West Maui	341	38	29	80	108	16
UpCountry	433	30	33	7	6	535
Paia / Haiku	55	0	2	0	0	32
Wailuku / Kahului	415	8	28	182	2	218
Molokai	239	69	31	31	138	1076
Lanai	155	7	0	0	0	0
Totals	2292	448	252	385	450	2109

Table from Maui Land Use Forecast, April 2003, County of Maui Department of Planning Long Range Planning Division

Figure 42 Maui Land Use Inventory Projections

Water Use Estimate Based on Land Use Inventory by Community Plan Area

Gross Area in Acres

District	Single-family		Multi-family		Business		Industrial		Hotel		Rural		Total	
	Acres	GPD	Acres	GPD	Acres	GPD	Acres	GPD	Acres	GPD	Acres	GPD	Acres	GPD
GPD per Acre =>		3000		5000		6000		6000		17000		3000		
Hana	137	411,000	7	35,000	27	162,000	9	54,000	28	476,000	510	1,530,000	718	2,668,000
Kihei / Makena	1,922	5,766,000	733	3,665,000	257	1,542,000	266	1,596,000	359	6,103,000	420	1,260,000	3,957	19,932,000
West Maui	917	2,751,000	341	1,705,000	166	996,000	145	870,000	336	5,712,000	35	105,000	1,940	12,139,000
UpCountry	1,521	4,563,000	184	920,000	85	510,000	34	204,000	6	102,000	2,106	6,318,000	3,936	12,617,000
Paia / Haiku	393	1,179,000	1	5,000	24	144,000	56	336,000	0	0	176	528,000	650	2,192,000
Wailuku / Kahului	2,207	6,621,000	120	600,000	178	1,068,000	970	5,820,000	13	221,000	289	867,000	3,777	15,197,000
Molokai	662	1,986,000	106	530,000	60	360,000	199	1,194,000	189	3,213,000	1,609	4,827,000	2,825	12,110,000
Lanai	477	1,431,000	19	95,000	36	216,000	116	696,000	3	51,000	173	519,000	824	3,008,000
Totals	8,236	24,708,000	1,511	7,555,000	833	4,998,000	1,795	10,770,000	934	15,878,000	5,318	15,954,000	18,627	79,863,000

Vacant Area in Acres

District	Single-family		Multi-family		Business		Industrial		Hotel		Rural		Total	
	Acres	GPD	Acres	GPD	Acres	GPD	Acres	GPD	Acres	GPD	Acres	GPD	Acres	GPD
GPD per Acre =>		3000		5000		6000		6000		17000		3000		
Hana	81	243,000	5	25,000	0	0	9	54,000	0	0	175	525,000	270	847,000
Kihei / Makena	573	1,719,000	291	1,455,000	129	774,000	76	456,000	196	3,332,000	57	171,000	1,322	7,907,000
West Maui	341	1,023,000	38	190,000	29	174,000	80	480,000	108	1,836,000	16	48,000	612	3,751,000
UpCountry	433	1,299,000	30	150,000	33	198,000	7	42,000	6	102,000	535	1,605,000	1,044	3,396,000
Paia / Haiku	55	165,000	0	0	2	12,000	0	0	0	0	32	96,000	89	273,000
Wailuku / Kahului	415	1,245,000	8	40,000	28	168,000	182	1,092,000	2	34,000	218	654,000	853	3,233,000
Molokai	239	717,000	69	345,000	31	186,000	31	186,000	138	2,346,000	1,076	3,228,000	1,584	7,008,000
Lanai	155	465,000	7	35,000	0	0	0	0	0	0	0	0	162	500,000
Totals	2,292	6,876,000	448	2,240,000	252	1,512,000	385	2,310,000	450	7,650,000	2,109	6,327,000	5,936	26,915,000

Water use estimates are based on estimates of average water use per acre.
Land areas are from Table 2 of the Maui Land Use Forecast prepared by the Department of Planning Long-Range Planning Division, April 2003

Figure 43 Water Use Estimate for Buildout of Land Use Inventory by CPD by Use Class