

## 2. Planning Data and Demand

This chapter discusses planning data and the City of Tumwater's demand forecast. The information is presented in three main sections: the first section summarizes historical and projected demographic data for Tumwater; the second section summarizes Tumwater's water use characteristics including production, consumption, water balance, and water use factors; and the third section combines the demographics and the water supply characteristics to develop Tumwater's demand forecast for the next 20 years.

### 2.1. Demographics – Historical and Projected

Several demographic units were analyzed for this water system plan. The demographic units are listed below and information is provided regarding how the demographic units relate to the demand forecast.

- **Population:** Population growth is presented to provide the growth context, and is used as the basis for growth projections where other variables are not forecasted directly.
- **Single Family Households:** The number of single family households is one of two demographic units used for the residential component of the demand forecast.
- **Multifamily Households:** The number of multifamily households is the other of two demographic units used for the residential component of the demand forecast. Note this is the number of multifamily households (e.g., apartments) and not the number of multifamily connections (e.g., apartment buildings).
- **Employment:** The number of employees is the demographic unit used for the non-residential component of the demand forecast.

Table 2-1 presents recent demographic data as well as projections for the forecasting period. The demographics are for Tumwater's retail service area and reflect the timing of providing service within that area, as described in Chapter 1. The population, single family households, multifamily households, and employment demographics are based on data from the Thurston Regional Planning Council (TRPC), which develops demographic projections for all of Thurston County. The most recent data set from TRPC is their October 2007 data set. The TRPC data provides projections for key milestone years. Those milestone years are 2006, 2010, 2015, 2020, 2025, and 2030 for population and housing; and 2005 and 2030 for employment. For the Tumwater Water System Plan (WSP) analysis, the intervening years were interpolated.

The TRPC data is allocated to small geographic areas called Traffic Analysis Zones (TAZs). The TAZ boundaries are independent of Tumwater's service area. Therefore, GIS analysis was used to determine which TAZs, or portions thereof, are in each of Tumwater's pressure zones. The boundaries of the TAZs were overlaid on the pressure zones. Where TAZs cross pressure zone or service area boundaries, the area of the TAZ was used to allocate a percentage of demographics to the appropriate pressure zone. Additionally, each TAZ (or portion of a TAZ) was assigned a service status indicating whether it: 1) is currently served, 2) will be added within the six-year WSP planning period, or 3) will be added by the year 20 of the WSP planning period.

**Table 2-1 Demographics for Tumwater Retail Service Area**

Calendar Year	Plan Year	Population					Single Family (SF) Households					
		Pressure Zone 350	Pressure Zone 454	Pressure Zone 549	Total		Pressure Zone 350	Pressure Zone 454	Pressure Zone 549	Total		
					Qty	Annual Increase				Qty	Annual Increase	
2001	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
2002	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
2004	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
2005	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
2006	n/a	15,782	3,119	365	19,266	n/a	5,035	786	30	5,852	n/a	
2007	n/a	16,250	3,201	388	19,839	3.0%	5,127	808	38	5,973	2.1%	
2008	n/a	16,719	3,283	411	20,413	2.9%	5,219	829	46	6,094	2.0%	
2009	n/a	17,188	3,698	433	21,319	4.4%	5,311	850	54	6,216	2.0%	
2010	1	17,905	3,495	456	21,856	2.5%	5,496	897	62	6,454	3.8%	
2011	2	18,563	3,603	463	22,629	3.5%	5,688	941	64	6,693	3.7%	
2012	3	19,245	3,709	471	23,425	3.5%	5,901	987	66	6,954	3.9%	
2013	4	19,951	3,823	478	24,252	3.5%	6,113	1,033	68	7,215	3.8%	
2014	5	20,682	3,935	486	25,103	3.5%	6,333	1,080	70	7,484	3.7%	
2015	6	21,436	4,050	494	25,979	3.5%	6,560	1,128	72	7,760	3.7%	
2029	20	33,543	6,232	658	40,433	n/a	10,234	1,979	138	12,351	n/a	
Calendar Year	Plan Year	Multifamily (MF) Households					Employment					
		Pressure Zone 350	Pressure Zone 454	Pressure Zone 549	Total		Pressure Zone 350	Pressure Zone 454	Pressure Zone 549	Total		
					Qty	Annual Increase				Qty	Annual Increase	
2001	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
2002	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
2004	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
2005	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
2006	n/a	2,122	761	172	3,055	n/a	17,372	3,034	135	20,541	n/a	
2007	n/a	2,231	767	172	3,170	3.8%	17,753	3,065	137	20,955	2.0%	
2008	n/a	2,340	773	172	3,285	3.6%	18,133	3,096	139	21,368	2.0%	
2009	n/a	2,448	779	172	3,400	3.5%	18,514	3,127	141	21,781	1.9%	
2010	1	2,564	785	172	3,521	3.6%	19,065	3,167	143	22,375	2.7%	
2011	2	2,653	794	174	3,621	2.8%	19,635	3,207	145	22,987	2.7%	
2012	3	2,745	803	176	3,724	2.8%	20,223	3,248	146	23,617	2.7%	
2013	4	2,841	812	177	3,830	2.9%	20,830	3,289	148	24,267	2.7%	
2014	5	2,940	821	179	3,939	2.9%	21,455	3,330	150	24,935	2.8%	
2015	6	3,042	830	181	4,052	2.9%	22,099	3,371	152	25,622	2.8%	
2029	20	4,746	947	195	5,887	n/a	28,461	4,066	178	32,704	n/a	

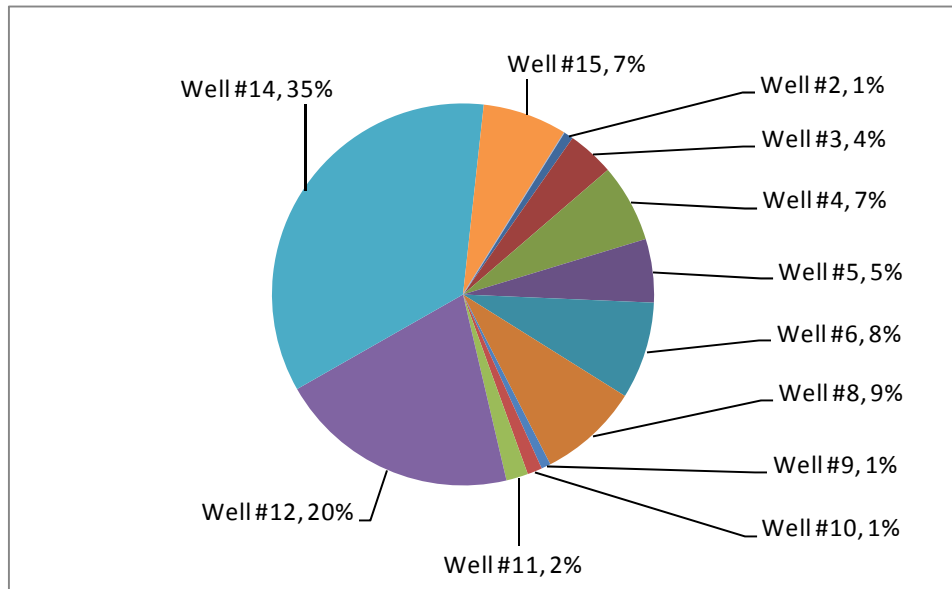
1. The demographics are based on data from the Thurston Regional Planning Council or TRPC (October 2007 data set). The TRPC data uses six demographic categories: 1) population, 2) single family households, 3) multifamily households, 4) manufactured homes, 5) population in group quarters, and 6) employment. The population in group quarters category (jails, institutions, military facilities, dorms, etc) is a subset of the population category, however it is not included in any of the housing categories. For Tumwater's WSP, the population in group quarters was not allocated to housing types since the associated water use is analyzed as part of the Non Residential customer category. For Tumwater's WSP, manufactured homes were included in with single family homes.

In addition to the demographics from TRPC, the demand forecast uses the number of irrigation connections to forecast separately-metered irrigation use. This was projected into future years based on annual population growth rates from the TRPC data.

## 2.2. Water Use Characteristics

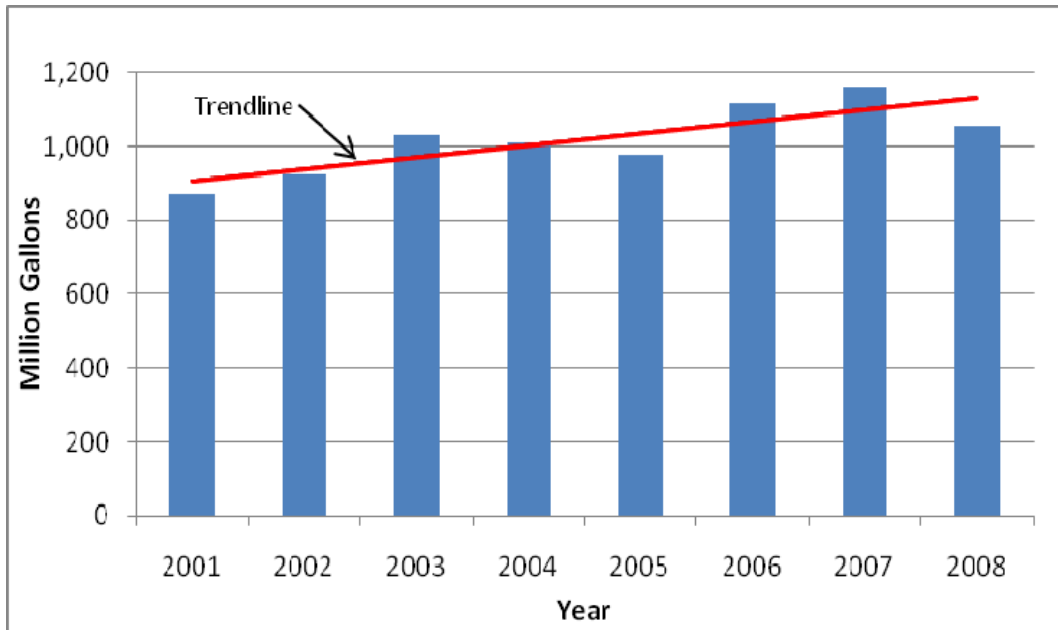
### 2.2.1. Production, Purchases, and Peaking Factor

Tumwater’s water source is groundwater from its 13 production wells. Some of the wells are used consistently throughout the year, others are used primarily for the summer peak season, and one well (Well #20) has not been used since 2003. Figure 2-1 shows the percent of supply from each well, for the most recent three years. Wells #12 and #14 provide over half of Tumwater’s supply.

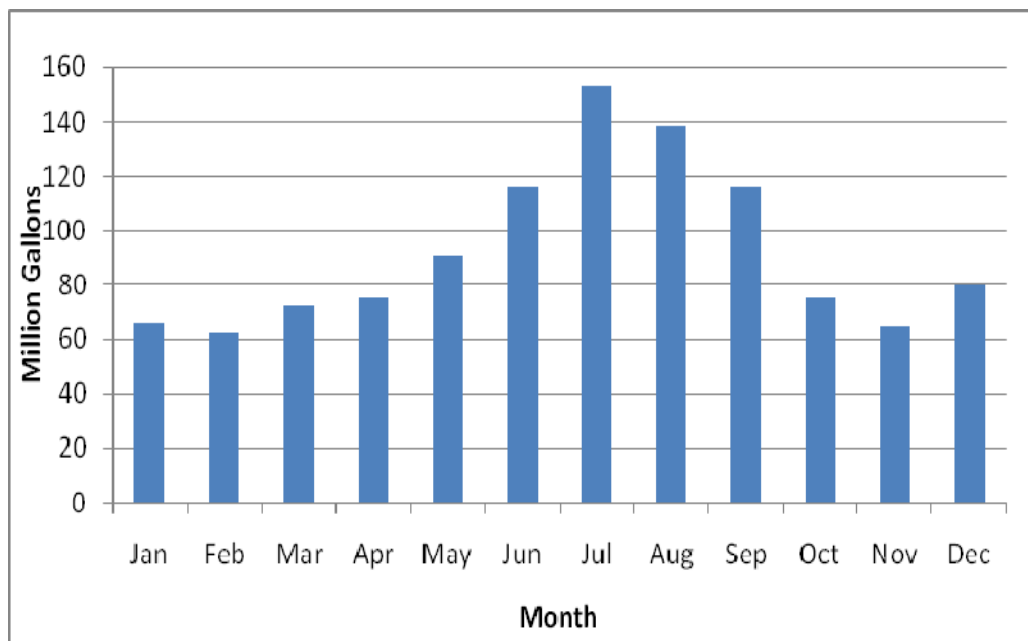


**Figure 2-1 Production by Source (2006–2008)**

Figure 2-2 shows an eight year history of Tumwater’s water production. Water production has ranged from a low of 872 million gallons (mg) in 2001 to a high of 1,164 mg in 2007. Table 2-2 shows the 2006-2008 average production from each Tumwater well. The total 2006–2008 average production was 1,113 mg. The most recent 3-year average production by month is shown in Figure 2-3. As with most water utilities, Tumwater’s production increases in the summer months due to irrigation use.



**Figure 2-2 Annual Production (2001–2008)**



**Figure 2-3 Monthly Production (2006–2008 Average)**

**Table 2-2 2006-2008 Average Production (million gallons)**

Month	Well #2	Well #3	Well #4	Well #5	Well #6	Well #8	Well #9	Well #10	Well #11	Well #12	Well #14	Well #15	Well #20	Total	Percent
Jan	0.7	6.7	6.0	4.6	6.3	7.2	0.0	0.0	0.3	13.6	21.1	0.1	0.0	67	6%
Feb	0.6	6.6	6.5	5.0	6.9	8.0	0.0	0.0	0.0	11.8	17.3	0.0	0.0	63	6%
Mar	0.8	7.6	6.1	5.2	7.3	8.5	0.0	0.0	0.0	18.1	19.0	0.0	0.0	73	7%
Apr	0.9	6.1	4.7	5.2	7.4	8.4	0.0	0.0	0.0	21.3	21.8	0.0	0.0	76	7%
May	1.1	7.2	5.7	4.6	7.2	8.2	0.0	0.0	0.1	22.2	32.0	2.5	0.0	91	8%
Jun	1.2	5.4	7.1	5.9	8.8	7.3	0.0	1.0	0.6	21.6	49.7	7.8	0.0	116	10%
Jul	1.0	2.6	8.1	6.7	10.0	10.2	3.0	3.9	5.9	26.6	56.8	18.3	0.0	153	14%
Aug	1.0	0.0	7.8	4.3	9.5	9.7	4.9	6.3	8.3	22.9	43.1	20.9	0.0	139	12%
Sep	0.7	0.1	7.0	5.5	8.8	8.9	0.9	2.7	4.5	22.3	41.3	13.6	0.0	116	10%
Oct	0.4	0.1	4.9	4.3	6.5	6.3	0.0	0.0	0.3	16.1	30.1	6.7	0.0	76	7%
Nov	0.5	0.1	4.5	3.9	5.7	5.4	0.0	0.0	0.0	15.2	22.5	6.8	0.0	65	6%
Dec	0.4	1.7	5.6	4.7	7.2	7.0	0.0	0.0	0.5	15.3	34.7	2.9	0.0	80	7%
<b>Total</b>	<b>9.3</b>	<b>44.2</b>	<b>73.7</b>	<b>59.8</b>	<b>91.5</b>	<b>94.9</b>	<b>8.9</b>	<b>13.9</b>	<b>20.7</b>	<b>227.1</b>	<b>389.4</b>	<b>79.6</b>	<b>0.0</b>	<b>1,113</b>	<b>100%</b>
<b>Percent</b>	<b>1%</b>	<b>4%</b>	<b>7%</b>	<b>5%</b>	<b>8%</b>	<b>9%</b>	<b>1%</b>	<b>1%</b>	<b>2%</b>	<b>20%</b>	<b>35%</b>	<b>7%</b>	<b>0%</b>	<b>100%</b>	

Data Source: "Well Production Totals" spreadsheet provided by City staff.

Eight years of production data was analyzed, however the average uses the most recent three years in order to focus on current trends.

Table 2-3 shows the maximum month versus average month peaking factors for the most recent three years. The maximum month peaking factor has ranged from 1.5 to 1.9, and has averaged 1.7 for the most recent 3 years. Maximum day numbers were not available, and therefore it was not feasible to calculate a maximum day to average day peaking factor.

**Table 2-3 Peaking Factor – Average Month to Maximum Month**

Year	Average Month (mg)	Peak Month		Peaking Factor
		(mg)	Month	
2006	93	152	July	1.6
2007	97	143	July	1.5
2008	88	164	July	1.9
<b>2006-2008 Avg</b>	<b>93</b>	<b>153</b>	<b>n/a</b>	<b>1.7</b>

Data Source: "Well Production Totals" spreadsheet provided by City staff.

### 2.2.2. Customer Categories, Connections, and Consumption

Tumwater has the following eight customer categories:

- **Residential – In City:** Single family and multifamily residential buildings (excluding mobile homes) that are within Tumwater’s municipal boundary.
- **Residential – County:** Same as above, except that the buildings are outside of Tumwater’s municipal boundary.
- **Mobile Home Park:** Residential customers that are mobile home parks.
- **Commercial – In City:** All non-residential customers (excluding government) that are within Tumwater’s municipal boundary.
- **Commercial – County:** Same as above, except that buildings are outside of Tumwater’s municipal boundary.
- **Political -** All government customers (excluding the City of Tumwater) including all of the State campuses, school districts, army facility, and the Bonneville Power Administration.
- **City of Tumwater –** The City of Tumwater.
- **Irrigation:** Irrigation water provided through a dedicated irrigation line. These customers represent the full range of customer types including single family homeowner associations, multifamily buildings, and non-residential accounts. Note that irrigation water is also provided through the other customer categories where there is no dedicated irrigation line, particularly single family residential.

Table 2-4 provides the number of connections from 2001 to 2008. At the end of 2008, Tumwater had 6,567 connections, the vast majority of which (87%) were residential.

**Table 2-4 Number of Connections**

Customer Category	2001	2002	2003	2004	2005	2006	2007	2008	2006-2008 Average	
									#	%
Residential - In City	3,906	3,945	3,984	4,073	4,170	4,280	4,419	5,007	4,569	72%
Residential - County	530	558	732	927	1,083	1,103	1,124	685	971	15%
Mobile Home Park	3	3	3	3	3	3	3	3	3	0.05%
Commercial - In City	391	400	408	421	431	460	496	511	489	8%
Commercial - County	36	38	39	40	41	42	42	41	42	1%
Political	47	51	54	52	53	58	59	59	59	1%
City of Tumwater	54	54	54	58	59	60	60	60	60	1%
Irrigation	126	136	159	165	180	192	197	201	197	3%
<b>Total</b>	<b>5,093</b>	<b>5,185</b>	<b>5,433</b>	<b>5,739</b>	<b>6,020</b>	<b>6,198</b>	<b>6,400</b>	<b>6,567</b>	<b>6,388</b>	<b>100%</b>

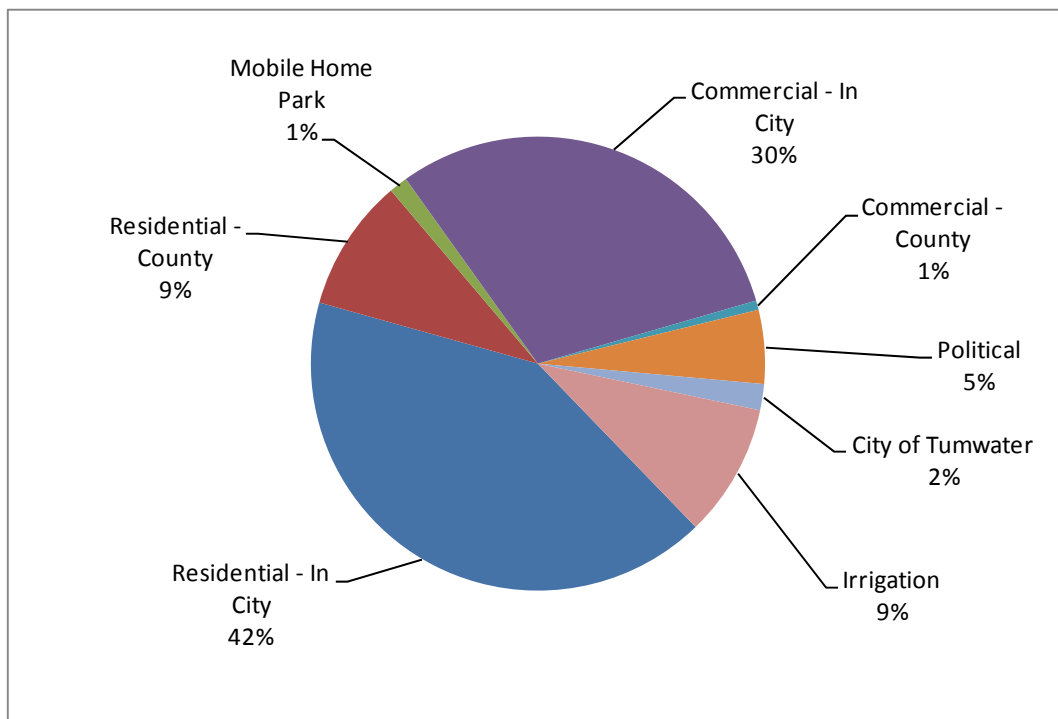
Data Source: "Utility Data - Water" spreadsheet provided by City staff.  
 Data is presented for eight years to show a lengthy history; however the average uses the most recent three years to focus on current trends.

Table 2-5 provides the average consumption, by customer category and by month, over the last 3 years. Figure 2-4 shows the allocation between the customer categories. The majority (52%) of Tumwater's water is used by the three residential categories. The two commercial categories represent 31% of the consumption. The two governmental categories represent 7% of the consumption. Dedicated irrigation represents 9% of the consumption.

**Table 2-5 2006-2008 Average Water Consumption (million gallons)**

Customer Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Percent
Residential - In City	27.4	25.6	25.0	26.9	28.5	40.8	48.2	48.9	50.3	29.7	30.2	24.7	406	42%
Residential - County	6.2	4.9	4.5	5.2	6.5	9.0	14.6	12.7	12.1	6.6	5.3	4.9	93	9%
Mobile Home Park	0.9	1.0	0.8	0.9	0.8	1.0	1.1	1.5	1.6	1.2	1.1	1.0	13	1%
Commercial - In City	19.3	24.0	22.5	23.3	29.2	27.5	31.3	28.5	28.6	20.5	23.8	18.6	297	30%
Commercial - County	0.5	0.5	0.4	0.5	0.5	0.7	1.4	0.1	0.6	0.4	0.5	0.4	6	1%
Political	1.4	1.6	1.7	1.8	2.0	4.4	7.6	11.0	10.4	5.8	2.1	1.5	51	5%
City of Tumwater	0.0	0.2	0.2	0.5	0.2	2.5	4.9	3.8	3.9	1.3	0.3	0.4	18	2%
Irrigation	0.6	0.5	0.8	1.9	2.4	9.9	20.6	19.4	21.1	11.4	4.1	0.0	93	9%
<b>Total</b>	<b>56</b>	<b>58</b>	<b>56</b>	<b>61</b>	<b>70</b>	<b>96</b>	<b>130</b>	<b>126</b>	<b>129</b>	<b>77</b>	<b>67</b>	<b>52</b>	<b>978</b>	<b>100%</b>
% of Total	6%	6%	6%	6%	7%	10%	13%	13%	13%	8%	7%	5%	100%	

Data Source: "Utility Data - Water" spreadsheet provided by City staff.  
 Eight years of sales data was analyzed, however the average uses the most recent three years in order to focus on current trends.  
 The monthly distribution of actual water use may differ somewhat from this representation since consumption numbers are based on meter read dates.



**Figure 2-4 Consumption by Customer Category (2006–2008)**

The peaking aspect of Tumwater’s production was discussed in Section 2.2.1. Each customer category was examined to evaluate its contribution to system-wide peaking. Four customer categories drive most of the system’s peak profile. These are:

- Residential – In City
- Residential – County
- Political
- City of Tumwater
- Irrigation

The remaining three customer categories exhibit relatively stable uses throughout the year, so they do not contribute significantly to peaking.

Customers with large water demands are of interest because their demand could have significant impact on the overall demand for Tumwater. This is particularly the case for non residential customers due to the demand forecast methodology, which entails multiplying the number of employees by the water use per employee. Non residential customers with very large demands, but relatively few employees, artificially inflate the demand per employee and the resulting demand forecast. Therefore, Tumwater’s 20 largest customers from 2003 to 2008 were reviewed to determine whether they require special treatment for the demand forecast. Special treatment was deemed appropriate for one customer, Pepsi NW Beverage LLC, which is Tumwater’s largest customer. Water use at the Pepsi bottling plant constitutes approximately 10% of Tumwater’s production and approximately 33% of the non residential consumption.

### 2.2.3. Water Balance, Non-Revenue, and Leakage

A water balance is an accounting for all water that is produced. Table 2-6 shows Tumwater’s 2008 water balance. The table is a slightly modified version of the format recommended for use by the American Water Works Association’s Water Loss Committee.

The water balance allocates the Water Produced to different categories at three different levels.

Level 1 simply allocates the water to either Revenue Water or Non-Revenue Water. Revenue Water generates income while Non-Revenue Water does not. Tumwater’s 2008 water production is divided into 91% Revenue Water and 9% Non-Revenue Water.

**Table 2-6 Water Balance (2008)**

	Level 1	Level 2	Level 3	Volume (mg)	% of Water Production
Water Production	Revenue Water	Billed Authorized Consumption	1. Billed Water Exported	0	0%
			2. Billed Metered Consumption	958 <sup>1</sup>	91%
			3. Billed Unmetered Consumption	0	0%
	Non-Revenue Water	Unbilled Authorized Consumption	4. Unbilled Metered Consumption	0	0%
			5. Unbilled Unmetered Consumption	2 <sup>2</sup>	0.2%
		Apparent Losses	6. Unauthorized Consumption	0	0%
			7. Customer Metering Inaccuracies	0	0%
		Real Losses	8. Known Leakage	0	0%
			9. Assumed Leakage	97 <sup>3</sup>	9%
<b>TOTAL</b>				<b>1,057 <sup>4</sup></b>	<b>100%</b>

1. Data Source: "Utility Data - Water" spreadsheet provided by City staff.

2. Provided by City staff as follows: 586,460 gallons for flushing, 96,000 gallons for water quality testing, and 1,040,000 gallons for firefighting.

3. Water Production minus all other categories.

4. Data Source: "Well Production Totals" spreadsheet provided by City staff.

Level 2 splits Non-Revenue Water into the following three sub-categories, which are useful in identifying potential additional revenue sources and identifying the magnitude of leaks or other losses that could be addressed:

- **Unbilled Authorized Consumption:** Includes uses such as water system flushing, firefighting, and unbilled contractor use. Tumwater’s 2008 unbilled authorized consumption is estimated at less than 1%.
- **Apparent Losses:** Includes unauthorized uses and customer meter inaccuracies, both of which are lost revenue opportunities. Tumwater had no quantitative information to estimate these quantities and therefore zero was used as a default.
- **Real Losses:** Includes various types of system leaks. A certain level of leakage is unavoidable; however, leakage beyond that level should be repaired to avoid unduly burdening both the natural resource and the physical infrastructure. Any amount that cannot be assigned to another category is considered a real loss under the American Water Works Association’s protocol, as well as per the formula for calculating distribution system leakage under Washington State’s Water Use Efficiency Rule. Tumwater’s 2008 real losses are estimated at 9%.

Level 3 simply further splits water into additional sub-categories to support further estimation and water management.

Table 2-7 shows a longer history of some of the water balance elements, namely distribution system leakage and non-revenue water. The table shows numbers from 2001 to 2008.

Washington State’s Water Use Efficiency Rule defines distribution system leakage as water production (and purchases, if applicable) minus authorized consumption. Under the Rule, distribution system leakage cannot exceed 10%, based on a 3-year rolling average. Tumwater began reporting its annual distribution system leakage in 2008 (for the 2007 calendar year), and compliance will be determined in 2010, when the 2007 to 2009 leakage numbers are known. The average from the most recent 3 years shows that the 2006–2008 average distribution system leakage has been 12% of water production. In 2007, Tumwater experienced a problem with their SCADA system that resulted in significant inadvertent overflows at their largest (4MG) reservoir. Therefore, the 2007 leakage number was very high (18% of production). The SCADA problem has been rectified and the 2008 leakage number was much lower (9% of production). Tumwater’s ability to meet the leakage standard for the 2007-2009 compliance period will be impacted by the high 2007 number. However, the longer range data suggests that leakage typically will be below the DOH standard of 10%.

Non-revenue water as a percent of billed consumption is used to develop the non-revenue component of the demand forecast. Since 2007 was an anomalous year in terms of non-revenue water, the average of 2006 and 2008 was used to develop the demand forecast. This average is 10% (note this is a different value than leakage, which averaged 9% in these two years).

**Table 2-7 Distribution System Leakage and Non-Revenue Water (million gallons)**

Year	Water Produced <sup>1</sup>	Authorized Consumption		Distribution System Leakage <sup>4</sup>		Non-Revenue Water <sup>5</sup>	
		Billed Consumption <sup>2</sup>	Unbilled Consumption <sup>3</sup>	Qty	Percent of Production	Qty	Percent of Billed Consumption
2001	872	764	1.4	107	12%	108	14%
2002	924	863	1.5	60	7%	62	7%
2003	1,030	958	1.7	71	7%	72	8%
2004	1,009	918	1.6	90	9%	91	10%
2005	978	915	1.6	61	6%	62	7%
2006	1,118	1,019	1.8	97	9%	99	10%
2007	1,164	956	1.9	206	18%	208	22%
2008	1,057	958	1.7	97	9%	99	10%
<b>2006-2008 Average<sup>6</sup></b>	<b>1,113</b>	<b>978</b>	<b>1.8</b>	<b>133</b>	<b>12%</b>	<b>135</b>	<b>14%</b>

1. Data Source: "Well Production Totals" spreadsheet provided by City staff.
2. Data Source: "Utility Data - Water" spreadsheet provided by City staff.
3. For 2008, this number was estimated by City staff. For the other years, the 2008 percent of unbilled consumption as a percent of water produced (0.2%) was applied to the water production.
4. Distribution system leakage is defined in the 2007 Water Use Efficiency Rule as water production minus authorized consumption.
5. This calculation is water production and purchases minus billed consumption. These numbers are used to develop the non-revenue portion of the demand forecast.
6. Data is presented for eight years to show a lengthy history; however the average uses the most recent three years to focus on current trends.

### 2.2.4. Water Use Factors and Equivalent Residential Units

Water use factors were calculated for three aggregated customer categories: residential, non residential, and irrigation. Table 2-8 shows the inputs and the results of the calculations. For the residential category, the water use factor is 153 gallons per day (gpd) per household. For

the non residential category, the water use factor is 33 gpd per employee. For the irrigation category, the water use factor is 1,291 gpd per irrigation connection.

As discussed in Section 2.2.2, the Pepsi bottling plant requires separate treatment to avoid skewing the demand forecast and therefore a special category (Large Industrial) was created for Pepsi. This category is included in Table 2-8, although a water use factor is not calculated for it.

**Table 2-8 Water Use Factors and ERUs (2006-2008 Average)**

Customer Category	Sales (gpd) <sup>4</sup>	Households or Employees or Connections	Consumption Per Household or Employee or Connection (gpd)	Number of ERUs <sup>9</sup>
Residential <sup>1</sup>	1,402,181	9,143	153	9,143
Non Residential <sup>2</sup>	688,794	20,955	33	6,685
Large Industrial <sup>3</sup>	333,988	n/a	n/a	2,183
Irrigation	253,840	197	1,291	1,659
Total	2,678,803	n/a	n/a	17,487

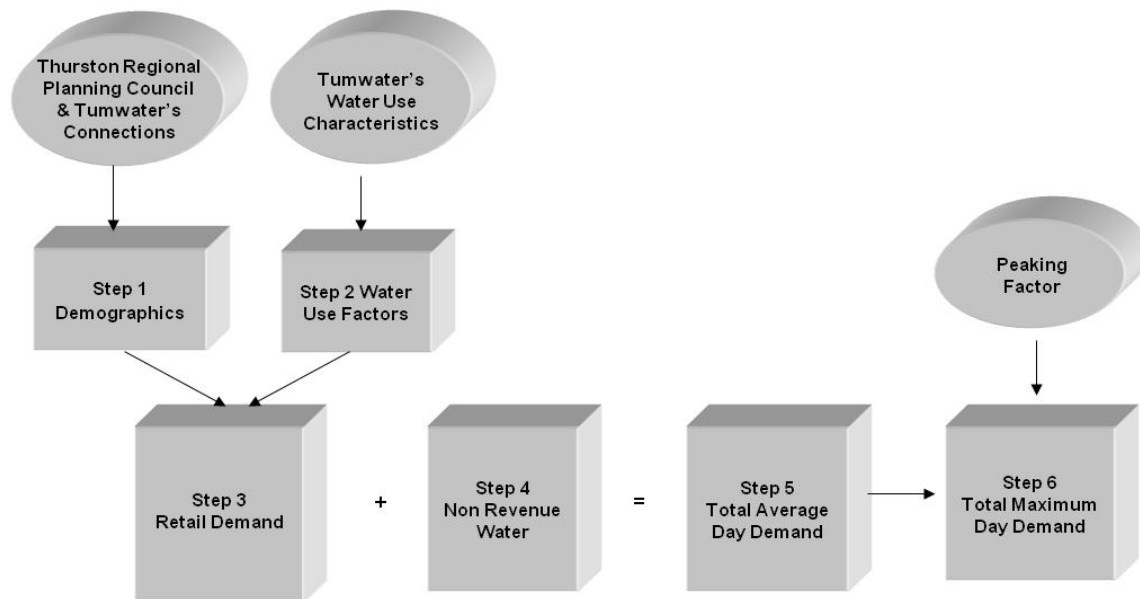
1. This includes the following three customer categories: residential in city, residential county, and mobile home park.
2. This includes the following four customer categories: commercial in city, commercial county, political sub, and City of Tumwater. However, consumption for Tumwater's largest non-residential customer (Pepsi NW Beverage LLC) has been subtracted from this category and put into its own category (Large Industrial).
3. This category is water use by the Pepsi bottling plant and is treated separately for demand forecasting purposes.
4. Data Source: "Utility Data - Water" spreadsheet provided by City staff.
5. This is the number of single family and multifamily households and is based on data in Table 2-1.
6. This is the number of employees and is based on data in Table 2-1.
7. This is the number of connections and is based on data in Table 2-4.
8. This number, 153 gallons per day, is the City of Tumwater's ERU value. Since Tumwater does not track single family consumption separately, the ERU value reflects "residential" consumption, which is both single family and multifamily.
9. The number of ERUs in any customer category is calculated by dividing that customer category's water sales by the ERU value.

Table 2-8 also shows the number of Equivalent Residential Units, or ERUs, in each customer category. ERUs are a method of representing water use by non-residential customers as an equivalent number of residential customers. Tumwater's ERU value is 153 gallons per day, which is the average amount of water used by a household. Tumwater's ERU value is calculated by dividing residential consumption by the number of households. Note that the calculation for the ERU value typical only incorporates single family. However, since Tumwater does not track single family consumption separately, the ERU value reflects "residential" consumption, which is both single family and multifamily. The number of ERUs for each customer category is obtained by dividing the consumption for a customer category by 153. The 2006-2008 average number of ERUs was 17,487.

## 2.3. Demand Forecast

### 2.3.1. Demand Forecast Methodology

The methodology used to develop the demand forecast is shown graphically in Figure 2-5. The basic process is to combine demographic data with water use factors to develop the retail demands. Demands are also developed for non-revenue water. The retail and the non-revenue demands are summed to create the total average day demand. To generate the total maximum day demand, a peaking factor is applied to the average day demand. More details on each step are provided below.



**Figure 2-5 Demand Forecast Methodology**

**Step 1 Demographics**

Demographics were developed per the methodology described in Section 2.1.

**Step 2 Water Use Factors**

Water use factors were developed per the methodology described in Section 2.2.4.

**Step 3 Retail Demand**

The demographic projections (from Step 1) were multiplied by the water use factors (from Step 2) to generate the demand for the residential, non residential, and irrigation customer categories.

Demands were developed for the large industrial regular category, which is the Pepsi bottling plant. For the first six years of the planning period (2010-2015), the demand was estimated at a 10% increase over the highest demand for the Pepsi plant for the most recent six years (i.e., 10% increase over 0.37 mgd in 2006). For the remaining years (2016-2029) a 2% annual increase was used per input from Pepsi. A block of water for large industrial users was included in case Tumwater adds new large industrial users in the future. The 20-year (2029) demand for this category was estimated at 60% of the projected Pepsi demand plus an additional 1.01 mgd, per the recommendation of Tumwater staff. Recognizing that this additional demand may be associated with multiple users that come on-line at different times, it was assumed that half of the 20-year demand estimate (i.e., 0.66 mgd) will be realized within the 6-year planning period, with the remaining 0.67 mgd realized by 2029.

**Step 4 Non-Revenue Demand**

The sum of all demands was multiplied by the average of the 2006 and 2008 "non-revenue water as % of billed consumption" from the water balance table, which is 10%. (The non-

revenue water from 2007 was not included in this calculation since 2007 was an anomalous year for non-revenue water.)

### **Step 5 Total Average Day Demand (ADD)**

The average day demand was calculated by adding the demands from all preceding steps.

### **Step 6 Total Maximum Day Demand (MDD)**

To generate the total maximum day demand, a peaking factor was applied to the average day demand. A peaking factor of 2.4 was used, which is the peaking factor from Tumwater's 2003 Water System Plan. The peaking factor from the previous plan was used since more recent maximum day production data was not available.

### **Step 7 Conservation Adjustment**

The methodology outlined in Steps 1 through 6 creates a baseline demand forecast. This baseline forecast was then adjusted for conservation.

The conservation adjustment was accomplished by reducing the water use factors in 2010-2015 to reflect the estimated conservation savings from the conservation program included in Chapter 3. The residential water use factor shifts from 153 gpd per household in 2009 to 149 gpd by 2015. The non-residential water use factor shifts from 33 gpd per employee in 2009 to 32 gpd by 2015. The irrigation water use factor shifts from 1,291 gpd per irrigation connection in 2009 to 1,254 gpd by 2015.

Tumwater plans to continue conservation efforts beyond 2015. However, since the conservation goals beyond 2015 are not defined at this time, the water use factors are then held constant for all years beyond 2015.

## **2.3.2. Demand Forecast Results**

The projected demands are provided in Table 2-9 and Table 2-10. Table 2-9 shows the demand without additional conservation while Table 2-10 incorporates conservation. The tables show the demand forecast for years 1 through 6, as well year 20, of the planning period from 2010 to 2029. The tables also include historical demands for 2001 to 2008. The demands for 2009 were projected, although 2009 is not within the 20-year planning period for this water system plan.

Table 2-9 shows the total average day demand increasing from 4.0 mgd in 2010 which is the Year 1 of the water system planning period to 6.9 mgd in 2029 which is Year 20 of the water system planning period. The maximum day demand is expected to increase from 9.5 mgd in 2010 to 16.5 mgd in 2029.

Figure 2-6 shows a graph of the average day and maximum day demands. Figure 2-7 shows the various components of the average day demand in order to provide information about the relative impact of each component. Both of these figures use the demand without additional conservation, in order to be conservative.

**Table 2-9 Demand Forecast (Without Additional Conservation)**

Calendar Year	Plan Year	Demographics					Water Use Factors (gpd) <sup>3</sup>					Demand						
		Population <sup>1</sup>	Single Family Households (SFHH) <sup>1</sup>	Multifamily Households (MP-HH) <sup>1</sup>	Employees <sup>1</sup>	Irrigation Connections <sup>2</sup>	Per Household	Per Employee	Per Irrigation Connection	Residential <sup>4</sup>	Non Residential <sup>5</sup>	Large Industrial - Regular <sup>6</sup>	Irrigation <sup>7</sup>	Large Industrial - Future Block <sup>8</sup>	Subtotal <sup>9</sup>	Non-Revenue <sup>10</sup>	Total <sup>11</sup>	Maximum Day Demand (MDD) (mgd) <sup>12</sup>
2001	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00	2.09	0.30	2.39	5.74
2002	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00	2.36	0.17	2.53	6.08
2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00	2.63	0.20	2.82	6.78	
2004	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00	2.51	0.25	2.76	6.63	
2005	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00	2.51	0.17	2.68	6.43	
2006	n/a	19,266	5,852	3,055	20,541	192	n/a	n/a	1.44	0.73	0.57	0.26	0.00	2.79	0.27	3.06	7.35	
2007	n/a	19,839	5,973	3,170	20,955	197	n/a	n/a	1.38	0.69	0.32	0.23	0.00	2.62	0.57	3.19	7.66	
2008	n/a	20,413	6,094	3,285	21,368	201	n/a	n/a	1.39	0.65	0.32	0.27	0.00	2.62	0.27	2.90	6.95	
2009	n/a	21,319	6,216	3,400	21,781	210	153	33	1.47	0.72	0.41	0.27	0.00	2.87	0.29	3.15	7.57	
2010	1	21,856	6,454	3,521	22,375	215	153	33	1.53	0.74	0.41	0.28	0.66	3.61	0.36	3.97	9.53	
2011	2	22,629	6,693	3,621	22,987	223	153	33	1.58	0.76	0.41	0.29	0.66	3.69	0.37	4.06	9.74	
2012	3	23,425	6,954	3,724	23,617	231	153	33	1.63	0.78	0.41	0.30	0.66	3.78	0.38	4.16	9.97	
2013	4	24,252	7,215	3,830	24,267	239	153	33	1.69	0.80	0.41	0.31	0.66	3.87	0.39	4.25	10.21	
2014	5	25,103	7,484	3,939	24,935	247	153	33	1.75	0.82	0.41	0.32	0.66	3.96	0.40	4.35	10.45	
2015	6	25,979	7,760	4,052	25,622	256	153	33	1.81	0.85	0.41	0.33	0.66	4.05	0.41	4.45	10.69	
2019	20	40,433	12,351	5,887	32,704	398	153	33	1.291	1.08	0.54	0.51	1.33	6.25	0.63	6.88	16.50	

1. From Table 4-1.

2. The number of connections are the actual connections through 2008. Then each year the number of connections is increased by the annual population growth rate.

3. From Table 4-9.

4. This category represents demand by the following customer categories: residential in city, residential county, and mobile home parks. The demand is calculated by multiplying the number of single family and multifamily households by the water use per household.

5. This category represents demand by the following customer categories: commercial in city, commercial county, political sub, and City of Tumwater. The demand is calculated by multiplying the number of employees by the water use per employee. Customers with very large demand, but relatively few employees, artificially inflate the demand per employee and the resulting demand forecast. Therefore, Tumwater's 20 largest customers from 2003 to 2008 were reviewed to determine whether they require special treatment for the demand forecast. This was determined to be the case for one customer, Pepsi NW Beverage LLC. Water use from the Pepsi bottling plant constitutes a large percentage of Tumwater's demand (approximately 10% of production and 33% of the non residential consumption). Therefore, a separate demand category (Non Residential - Industrial) was created for the Pepsi bottling plant.

6. Per the footnote above, this category represents demand for the Pepsi bottling plant. For the first six years of the planning period (2010-2015), the demand is estimated at a 10% increase over the highest demand for the Pepsi plant for the most recent six years (i.e., 10% increase over 0.37 mgd in 2006). For the remaining years (2016-2029) a 2% annual increase was used per input from Pepsi.

7. This category represents demands from dedicated irrigation meters. The demand is calculated by multiplying the number of irrigation connections by the water use per irrigation connection.

8. This block of water is included in case Tumwater adds new large industrial users. The demand was estimated at 60% of the Pepsi demand plus an additional 1.01 mgd. per the recommendation of Tumwater staff. It is assumed that half of the 2029 demand total for this category (0.66 mgd) would be realized within the 6-year planning horizon, with the remaining 0.67 mgd realized by 2029.

9. The sum of the previous demand components.

10. The sum of the previous demand components multiplied by the 2006 and 2008 average percent of non-revenue water as a percent of consumption. The non-revenue percent for 2007 was not used since that was an anomalous year.

11. The sum of the retail demands, plus the non-revenue water.

12. The total average day demand multiplied by a peaking factor of 2.4, which is the peaking factor used in Tumwater's 2003 Water System Plan. The peaking factor from the previous plan was used since more recent maximum day production data was not available.

**Table 2-10 Demand Forecast (With Additional Conservation)**

Calendar Year	Plan Year	Demographics					Water Use Factors (gpd) <sup>3</sup>				Demand						
		Population <sup>1</sup>	Single Family Households (SF HH) <sup>1</sup>	Multifamily Households (MF HH) <sup>1</sup>	Employees <sup>1</sup>	Irrigation Connections <sup>2</sup>	Per Household	Per Employee	Per Irrigation Connection	Residential <sup>4</sup>	Non Residential <sup>5</sup>	Large Industrial - Regular <sup>6</sup>	Average Day Demand (ADD mgd)	Subtotal <sup>9</sup>	Non-Revenue <sup>10</sup>	Total <sup>11</sup>	Maximum Day Demand (MDD mgd) <sup>12</sup>
2001	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.09	0.30	2.39	5.74
2002	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.36	0.17	2.53	6.08
2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.63	0.20	2.82	6.78
2004	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.51	0.25	2.76	6.63
2005	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.51	0.17	2.68	6.43
2006	n/a	19,266	5,852	3,055	20,541	192	3,055	192	1,444	0.73	0.37	0.26	0.26	2.79	0.27	3.06	7.35
2007	n/a	19,839	5,973	3,170	20,955	197	3,170	197	1,388	0.69	0.32	0.23	0.23	2.62	0.37	3.19	7.66
2008	n/a	20,413	6,094	3,285	21,368	201	3,285	201	1,399	0.65	0.32	0.27	0.27	2.62	0.27	2.90	6.95
2009	n/a	21,319	6,216	3,400	21,781	210	3,400	210	1,477	0.72	0.41	0.27	0.27	2.87	0.29	3.15	7.57
2010	1	21,856	6,454	3,521	22,375	215	3,521	215	1,528	0.73	0.41	0.28	0.28	3.60	0.36	3.95	9.49
2011	2	22,029	6,693	3,621	22,987	223	3,621	223	1,566	0.75	0.41	0.28	0.28	3.66	0.37	4.03	9.67
2012	3	23,425	6,954	3,724	23,617	231	3,724	231	1,611	0.77	0.41	0.29	0.29	3.74	0.37	4.11	9.86
2013	4	24,252	7,215	3,830	24,267	239	3,830	239	1,666	0.78	0.41	0.30	0.30	3.81	0.38	4.19	10.06
2014	5	25,103	7,484	3,939	24,935	247	3,939	247	1,711	0.80	0.41	0.31	0.31	3.89	0.39	4.27	10.26
2015	6	25,979	7,760	4,052	25,622	256	4,052	256	1,766	0.82	0.41	0.32	0.32	3.97	0.40	4.36	10.47
2029	20	40,433	12,351	5,887	32,704	398	5,887	398	2,711	1.05	0.54	0.50	0.50	6.13	0.61	6.74	16.17

1. From Table 4-1.

2. The number of connections are the actual connections through 2008. Then each year the number of connections is increased by the annual population growth rate.

3. For 2009, from the water use factor table. For 2010-2015, the water use factors are reduced to match the estimated savings from Tumwater's 2010-2015 conservation program. For 2016-2029, held constant since conservation savings beyond 2015 have not been identified.

4. This category represents demand by the following customer categories: residential in city, residential county, and mobile home parks. The demand is calculated by multiplying the number of single family and multifamily households by the water use per household.

5. This category represents demand by the following customer categories: commercial in city, commercial county, political sub, and City of Tumwater. The demand is calculated by multiplying the number of employees by the water use per employee. Customers with very large demand, but relatively few employees, artificially inflate the demand per employee and the resulting demand forecast. Therefore, Tumwater's 20 largest customers from 2003 to 2008 were reviewed to determine whether they require special treatment for the demand forecast. This was determined to be the case for one customer, Pepsi NW Beverage LLC. Water use from the Pepsi bottling plant constitutes a large percentage of Tumwater's demand (approximately 10% of production and 33% of the non residential consumption). Therefore, a separate demand category (Non Residential - Industrial) was created for the Pepsi bottling plant.

6. Per the footnote above, this category represents demand for the Pepsi bottling plant. For the first six years of the planning period (2010-2015), the demand is estimated at a 10% increase over the highest demand for the Pepsi plant for the most recent six years (i.e., 10% increase over 0.37 mgd in 2006). For the remaining years (2016-2029) a 2% annual increase was used per input from Pepsi.

7. This category represents demands from dedicated irrigation meters. The demand is calculated by multiplying the number of irrigation connections by the water use per irrigation connection.

8. This block of water is included in case Tumwater adds new large industrial users. The demand was estimated at 60% of the Pepsi demand plus an additional 1.01 mgd, per the recommendation of Tumwater staff. It is assumed that half of the 2029 demand total for this category (0.66 mgd) would be realized within the 6-year planning horizon, with the remaining 0.67 mgd realized by 2029.

9. The sum of the previous demand components.

10. The sum of the previous demand components multiplied by the 2006 and 2008 average percent of non-revenue water as a percent of consumption. The non-revenue percent for 2007 was not used since that was an anomalous year.

11. The sum of the retail demands, plus the non-revenue water.

12. The total average day demand multiplied by a peaking factor of 2.4, which is the peaking factor used in Tumwater's 2003 Water System Plan. The peaking factor from the previous plan was used since more recent maximum day production data was not available.

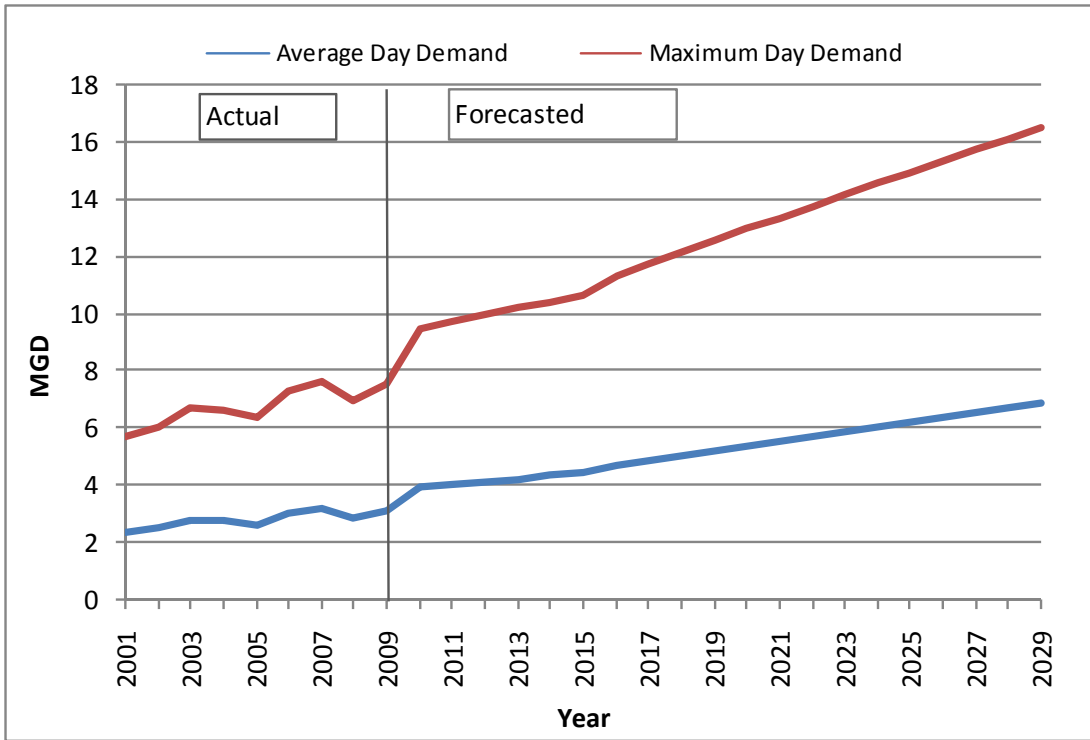


Figure 2-6 Demand Forecast Summary (Without Conservation)

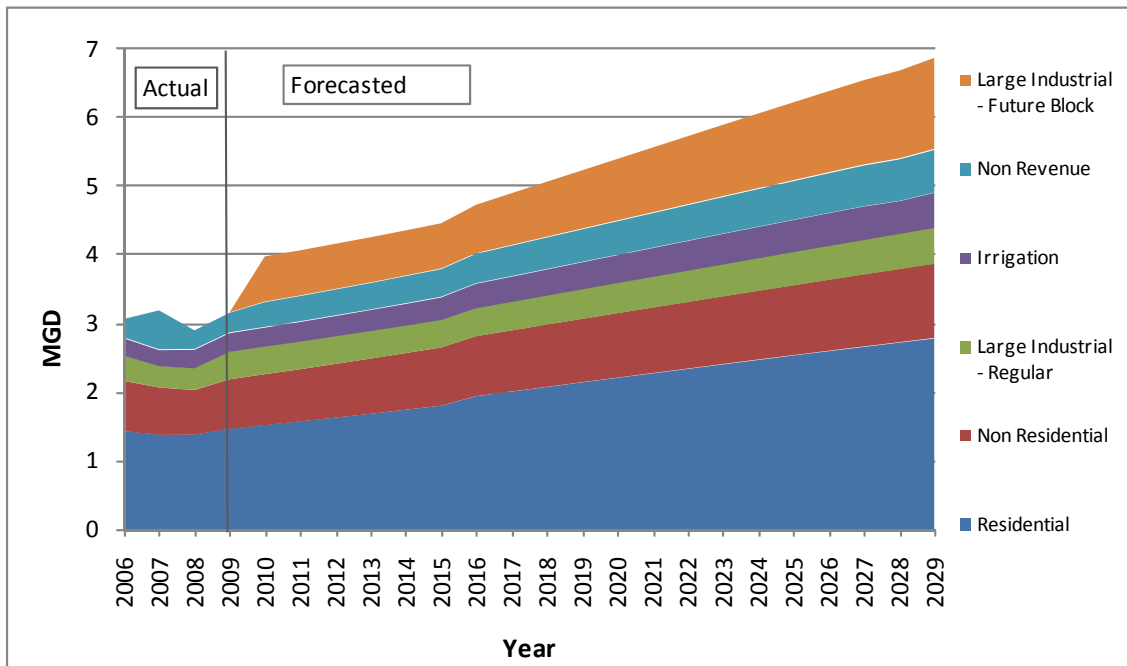


Figure 2-7 Demand Forecast by Sector (ADD Without Conservation)