SECTION 2
POPULATION AND WATER DEMAND

This section summarizes the methodologies developed to project future water system demands using existing City of Battle Ground (City) water supply and consumption data. Projected water demands are used in Section 3 to analyze existing supply, transmission, and storage facilities and to form the basis for recommending future water system improvements that address deficiencies in Section 8.

Current Population, Service Connections, and Water Use

This section presents current and historical data for the City's water service area between 2005 and 2011. The data is used to establish existing baseline population, number of service connections, water production and consumption volumes.

Current Service Area Population

The current City water service area comprises a distinctly different boundary than the city limits and urban growth area, as illustrated in Figure 1-2. Due to this difference, water service area population is not available, as it is for city limits, through tracked census data from the Washington State Office of Financial Management (OFM). For the purposes of this plan, a 2011 water service area population is established by projecting actual City population data obtained through OFM and the most recent water service area population projections in Table 2-1.

Table 2-1
Water Service Area Population Summary

Year	BG City Limits Population[1]	Water Service Area Population[2]
2005	14,730	11,048
2006	15,588	11,691
2007	16,048	12,036
2008	16,682	12,512
2009	17,201	12,900
2010	17,571	13,178
2011	17,780	13,335

Notes:
1. Data obtained from State OFM population database, year 2011 estimated.
2. Estimated water service area population based on City staff estimate of water service to approximately 75% of the City population.

Current Service Connections

The City implemented a new billing system software for 2011; in the process, service connection information pertaining to customer class prior to 2011 has become unavailable. Table 2-2 presents 2011 service connection data by customer class, as provided and calculated by the City. These numbers have some inconsistencies with those submitted in the 2011 Water Facilities Inventory form, but are believed to represent the most accurate tabulation of customer service data.

Table 2-2
2011 Water Service Connections and Consumption by Customer Class

Customer Class	Number of Connections	2011 Consumption (million gallons)	Percent of Total Consumption
Commercial Irrigation	20	4.85	1.1%
Commercial	24	75.60	17.5%
Churches	302	13.77	3.2%
Institutional	1	-	-
Multi-Family	14	9.18	2.1%
Residential	4,962	329.38	76.1%
Total	**5,323**	**432.79**	

Current Water Use

The City uses its own groundwater wells as the primarily source of supply for the system, supplementing with water from interties with Clark Public Utilities (CPU) as necessary during peak usage periods. Monthly and yearly water production data by individual source of supply was obtained from City operational records. Monthly data for 2011 and annual totals for 2005 to 2010 are presented in Table 2-3.

The annual totals in Table 2-3 represent system supply. Daily supply to the system should not only consider source production, but also fluctuations in storage volume during the course of the day. Consumption is typically derived from billing records for individual service meters and is typically lower than the supply volume for the same time period. Differences between production and consumption are referred to as unaccounted for water use, which includes unmetered authorized and unauthorized uses. For a fully metered system like the City's, with limited authorized, unmetered usage unaccounted for water is primarily distribution system leakage (DSL) as discussed in Section 4.

Table 2-3
Historical Monthly and Annual Water Production

Month	Water Production (MG)							
	Wells 1&2	Wells 4&5	Well 6	Well 7	Well 8	Well 9	CPU Intertie	Total
January	7.13	5.17	2.35	5.44	8.82	4.08	-	32.98
February	7.16	4.67	5.50	0.74	12.21	-	-	30.28
March	8.76	5.11	6.83	-	14.11	-	-	34.81
April	8.80	2.89	6.33	-	13.46	1.17	-	32.65
May	7.21	4.58	-	-	13.29	8.71	-	33.79
June	8.95	5.19	-	6.42	2.33	8.97	0.08	41.94
July	11.09	5.23	-	12.12	12.64	10.32	0.46	51.86
August	11.48	5.20	-	11.43	11.41	17.86	0.39	57.77
September	10.43	4.98	-	10.83	10.91	10.41	0.10	47.66
October	6.83	5.19	-	4.08	10.37	8.41	-	34.88
November	6.01	5.19	-	-	8.50	12.40	-	32.09
December	7.79	5.46	-	-	8.38	10.82	-	32.45
2011 Total	**101.63**	**58.83**	**21.01**	**51.07**	**136.42**	**93.15**	**1.04**	**463.15**
2010	84.02	67.31	47.11	37.30	162.30	66.27	1.12	465.43
2009	81.14	76.17	47.01	50.89	179.00	79.14	5.79	519.14
2008	100.37	80.01	68.35	124.34	70.89	51.27	10.04	505.28
2007	85.37	83.07	70.95	62.32	145.32	79.66	6.20	532.88
2006	102.40	49.88	85.02	44.14	175.09	73.66	7.92	538.11
2005	89.87	20.87	59.64	83.83	90.90	144.72	0.57	490.40

Average, Maximum Day and Peak Hour Demand with Calculated Peaking Factors

Average Day Demand

Average Day Demand (ADD) is the total amount of water consumed and used in a year divided by the number of days in the year. The ADD is determined from historical water use patterns of the system and can be used to project future demand within the system. ADD data is typically used to determine standby storage and other requirements for water systems.

From the water production data presented in Table 2-3, an ADD for the years between 2005 and 2011 ranged between 1.27 and 1.47 million gallons per day (mgd).

Maximum Day Demand

Maximum day demand (MDD) is the maximum amount of water consumed and used throughout the system during any 24-hour period. MDD typically occurs on a hot summer day when a large volume of outdoor water use, such as lawn watering, is occurring.

Water supply records and reservoir telemetry reports are typically used to determine a system's MDD. Review of City water production, water purchase and reservoir data for the years between 2005 and 2011 determined that the MDD of 3.09 mgd (2,147 gallons per minute) occurred on July 31, 2007. A historical MDD:ADD peaking factor of 2.24 is established for demand forecasting.

Peak Hour Demand

Peak Hour Demand (PHD) is the maximum amount of water consumed and used throughout the system, excluding fire flow, during any one-hour time period.

The City does not have continuous system records that allow the calculation of PHD directly from operational data. Considering the residential land use and water demands that represent the vast majority of the City's service area, the *December 2009 DOH Water System Design Manual* is used to estimate the PHD for the purposes of this plan.

The calculated PHD, using current City MDD and equivalent residential units (ERUs) presented later in this section, is 3,298 gallons per minute (gpm). The calculated PHD:MDD peaking factor is 1.26.

Largest Water Users

Table 2-4 presents the City's top 10 water users in 2011. The water consumption of these 10 customers represents approximately 0.6 percent of the total consumption in 2011. The majority of large water users in the City are multi-family housing complexes, public facilities and commercial properties. While these users consume the largest amount per connection, single family residential customers account for vast majority of City consumption.

Table 2-4
2011 Largest 10 Water Users

Name	Address	Annual Consumption (1,000 gallons)
BG Mobile Estates	300 SW 7th Avenue	855
Old Castle Glass	1611 SE Commerce Ave	254
Mill Creek Apartments	518-520 NW 12th Ave	237
First Place Apartments	407 SW Eaton Blvd	192
Fred Meyer	401 NW 12th Ave	187
Victory Health & Rehab	510 N Parkway Ave	187
Devonwood Apartments	101 NE 1st Ave	167
Rivergrove Apartments	617 SE 4th Street	147
Mallard Landing	813 SE Clark Ave	137
BG Plaza Laundry	713 W Main St # 103	114
	Total	**2,478**

Equivalent Residential Units (ERUs)

As required by Washington State Department of Health (DOH) for planning purposes, the demand of each customer class can be expressed in terms of ERUs for demand forecasting and establishing system capacities. One (1) ERU is equivalent to the average amount of water used by a single family residence. The number of ERUs represented by the demand of the other customer groups is determined from the total demand of the customer group and the demand per ERU calculated from the single family residential demand data.

Table 2-5 presents the computed ERU value and the number of ERUs for each customer class within the City's water service area, the total number of ERUs for all customers served by the City in 2011. The demands shown in the table are based on groundwater well production and CPU water purchasing data, which includes non-billed authorized consumption and DSL.

Table 2-5
2011 Equivalent Residential Unit Summary

Description	Customer Class			Totals
	Residential	Multi-Family	Commercial/ Industrial	
Number of Service Connections	4,962	14	347	5,323
Annual Demand (MG)[1]	352.50	9.82	100.83	463.15
Demand per ERU (gal/day/ERU)[2]	195	195	195	195
Total ERUs	**4,962**	**138**	**1,419**	**6,520**

Notes:

1. The Annual Demand is calculated by adding a proportional DSL component to the billed consumption data for each customer class. Total reflects overall system supply.
2. Demand per ERU is the amount of water used, including DSL, by one (1) residential unit.

Future Population and Water Demand Forecasting

Projected Population

Although the water service area population differs from the City's population, it is anticipated that city-wide growth will reflect growth within the service area. Based on recent population growth within the City, projected water service area population at the 6-year planning horizon in 2018 is estimated based on an annual average growth rate of 1.5 percent. Beyond 2018, through the 20-year planning horizon population growth is projected based on an annual average growth rate of 3.93 percent as presented in the City's *2004 Comprehensive Plan*. The smaller growth rate for the 6-year planning horizon is considered appropriate for the current development climate in the City. Table 2-6 presents the projected service area population for current 2012, 6-year and 20-year planning horizons.

Table 2-6
Water Service Area Population Projection

Projection Year	Projected Service Area Population
Current 2012[1]	13,535
6-Year 2018[1]	14,800
20-Year 2032[2]	25,390

Notes:

1. Population data for 2011-2018 is based on a 1.5 percent annual growth rate, representing a composite average of recent OFM, County and City data sources and near-term predicted growth trends.
2. Population data for 2018-2032 is based on a 3.93 percent annual growth rate, reflecting long-term predicted growth trends that are in concurrence with the currently adopted *2004 City of Battle Ground Comprehensive Plan.*

Projected Water Demands

Population and demand projections for the current, 6-year and 20-year planning horizons are summarized in Table 2-7. ERUs are projected using the annual average growth rates used to project population growth in Table 2-6. Future ADD was estimated based on an average water demand of 195 gallons per day (gpd) per ERU. Future MDD is estimated by multiplying projected ADD by the peaking factor 2.24. The *December 2009 DOH Water System Design Manual* calculation method is used to estimate future PHD. Table 2-7 also shows estimated future demands for the City's two (2) pressure zones, Main and Tukes Mountain. Projected demand in the Tukes Mountain Pressure Zone is based on the estimated number of existing ERUs in this zone in 2011, approximately 104 ERUs which is approximately 1.6 percent of total system demand.

The City, through its Water Use Efficiency (WUE) program, has implemented conservation measures that have resulted in a significant DSL reduction in recent years as discussed in Section 4. Through these measures, the City's goal of attaining annual system leakage below 10 percent was first achieved in 2009 and continues to be maintained. Average customer demand per ERU has also decreased considerably from 235 gpd/ERU in 2010, when the City's current WUE goals were established, to 195 gpd/ERU as shown in Table 2-5. Although some customer water use efficiency may be due to variations in weather, this approximately 20 percent per ERU demand decrease far exceeds the City's WUE program goal of a 1 percent reduction over 6 years. With the program's success, no additional measures are currently planned for implementation. The methodologies employed in developing current planning data incorporate the results of the WUE program, thus future system demand projections based on this planning data implicitly include sufficient

conservation measures. Consistent with the goals of the ongoing WUE program, demand projections for the required planning period are presented in Table 2-7 with no demand reduction to reflect additional conservation potential.

Table 2-7
Population and Demand Projections Summary

Projection Year	Estimated Service Area Population	ERUs	Pressure Zone	Water Demands		
				ADD (mgd)	MDD (mgd)	PHD (gpm)
Current 2012	13,535	6,618	Main	1.27	2.84	3,245
			Tukes Mt.	0.02	0.05	53
			Total	1.29	2.89	3,298
6-Year 2018	14,800	7,236	Main	1.39	3.11	3,540
			Tukes Mt.	0.02	0.05	58
			Total	1.41	3.16	3,598
20-Year 2032	25,390	12,412	Main	2.38	5.33	6,012
			Tukes Mt.	0.04	0.09	98
			Total	2.42	5.42	6,110

Notes:

1. ERU projections are based on ERU growth rates equivalent to the population growth rates presented in Table 2-6.
2. 195 gpd/ERU was used to forecast future average daily demand based on historical demand per ERU.
3. MDD projections are calculated by multiplying the ADD by the peaking factor 2.24.
4. PHD is projected from MDD using the estimating method described in the *December 2009 DOH Water System Design Manual.*
5. Tukes Mountain Pressure Zone demand is estimated as 1.6 percent of total system demand.