CHAPTER 3

LAND USE AND POPULATION

Panorama Heights

INTRODUCTION

The City of Bonney Lake (City) *Comprehensive Plan* (Phase 1) was adopted January 27, 2004. The plan was developed to meet the requirements of the State of Washington *Growth Management Act* (GMA). The GMA requires, among other things, consistency between land use and utility plans and their implementation.

This chapter demonstrates the compatibility of the *Comprehensive Water System Plan* with other plans, identifies the designated land uses within the City's water service area, and identifies population projections within the Bonney Lake planning area.

COMPATIBILITY WITH OTHER PLANS

Introduction

Currently, Bonney Lake's water service area includes areas that fall under the land use planning efforts of other jurisdictions such as the Cities of Sumner and Auburn, as well as Pierce County. To ensure that the *Comprehensive Water System Plan* is consistent with the land use policies of all agencies involved the following planning documents were examined.

- *Growth Management Act*
- City of Bonney Lake *Comprehensive Plan*
- City of Auburn *Comprehensive Plan*
- City of Sumner *Comprehensive Plan*
- Pierce County *Comprehensive Plan*
- Pierce County *Coordinated Water System Plan (PC-CWSP)*

Growth Management Act

The State of Washington *Growth Management Act* of 1990 and its 1991 and 1993 amendments defined four goals relevant to this water plan.

1. Growth and services should be in urban areas;
2. There should be consistency between land use and utility plans and their implementation;
3. There should be concurrency of growth with public facilities and services; and
4. Critical areas should be designated and protected.

Urban Growth Area

The GMA requires that Pierce County (County) and the City cooperate in designating an Urban Growth Area (UGA). As part of the development of its Comprehensive Plan, the County designated an UGA that would accommodate the City's projected population growth and provide resource conservation. The City only has the ability to annex areas within its UGA. However, the City can and does provide water service outside of UGAs. Currently, Bonney Lake's Water Service Area includes UGAs for Sumner and Auburn, as well as for the County's Comprehensive Urban Growth Area (CUGA).

Consistency

The GMA requires planning consistency from two perspectives. First, it requires consistency of plans among jurisdictions. This means that plans and policies of Bonney Lake and Pierce County must be consistent (*RCW 36.70A.100*). Second, the Act requires the implementation of the plan be consistent with the comprehensive plan (*RCW 36.70A.120*).

Concurrency

Concurrency means that adequate public facilities and services must be provided at the time growth occurs, which is defined as being within a 6-year time frame. For example, growth should not occur where schools, roads, and other public facilities are overloaded. Concurrency ensures that public dollars are used efficiently and that quality of life is preserved. To achieve this objective, the GMA directs growth to areas already served or readily served by public facilities and services (*RCW 36.70A.110*). It also requires that when public facilities and services cannot be maintained at an acceptable level of service, the new development should be prohibited (*RCW 36.70A.100*).

Critical Areas

The GMA requires that critical areas be designated and protected. Critical areas include fish and wildlife habitat, flood zones, aquifer recharge areas, streams, creeks, rivers, lakes, wetlands, and other surface water, and geologic hazard areas such as steep slopes and liquefaction zones. **Appendix A** contains a SEPA checklist that addresses other environmental concerns.

Pierce County Coordinated Water System Plan (PC-CWSP)

The purpose of the PC-CWSP is to assist the area's water utilities in establishing an effective process for planning and development of public water systems and restricting the proliferation of small public water systems. The plan accomplishes this by establishing future service area boundaries, minimum design standards, service review procedures, appeals procedures, long-term regional water supply strategy, water conservation program and goals, and the satellite system management program. As can be seen in the following sections of this plan, the City has established policies, design criteria, and goals that meet or exceed the requirements and goals of the PC-CWSP.

LAND USE

The city limits currently encompass an area of approximately 4,627 acres. The City's existing UGA encompasses an additional 157 acres outside of the current city limits. The water service area is significantly larger than the City's UGA with 16,868 total acres. Historically, only Bonney Lake's and Pierce County's zoning and land use designations have governed land uses within the water service area. However, annexations and new UGA designations have extended

the City of Auburn's and the City of Sumner's land use interests into Bonney Lake's water service area. Currently, 7 percent and 6 percent of the water service area is now under the land use planning of Auburn and Sumner, respectively.

The Existing Land Use Map, **Figure 4**, shows the existing land uses for the water service area. Future land use designations from Bonney Lake, Auburn, Sumner, and Pierce County were used in evaluation growth projections for this plan. Land Use maps for each of these agencies are included in **Appendix T**. Land Use Maps were used to identify current land uses and potential land, vacant and underdeveloped land. Zoning maps and classifications were used to evaluate growth projections based in potential developments of developable land. Also included in **Appendix T** is a composite City of Bonney Lake Sewer and Water Service Area figure.

City of Bonney Lake

The *Land Use Element* of the City of Bonney Lake's *Comprehensive Plan* is the City's vision of how growth and development should occur over a 20-year horizon. While the *Land Use Element* goals and policies set forth general standards for locating land uses, the *Comprehensive Plan's* Land Use map indicates geographically where certain types of uses may be appropriate. The Land Use map is a blueprint for development of an area, whereas the zoning code is the regulatory means for implementing it.

The *Land Use Element* articulates many of the same goals and concerns of the GMA. Like the GMA, the *Land Use Element* seeks to accommodate growth while preserving the City's character and protecting the environmentally sensitive areas. It seeks to promote a strong local economy and vital commercial, industrial and airport industrial districts by focusing economic development within them and establishing development guidelines. The *Utilities Element* ensures that new development will be adequately serviced without compromising existing levels of service, similar to the principal of concurrency as defined in the GMA.

The City adopted its *Comprehensive Plan* in November 2004. The 2022 population projection for Bonney Lake at the time of this Plan is 27,284 people.

City of Auburn

As of 2007, the City of Auburn has annexed approximately 756 acres of the Bonney Lake water service area. The City of Auburn has a land area of 14,956 acres; therefore Bonney Lake serves approximately five percent of Auburn's land area. Most of the land use within this annexation is governed by a Planned Unit Development known as Lakeland Hills South. In addition, Auburn has approximately 138 acres of future annexation areas within the water service area. Most of this potential annexation area is designated for single family residential.

City of Sumner

As of 2007, the City of Sumner has annexed approximately 142 acres of the water service area in three distinct areas. The City of Sumner has a land area of 4,608 acres; therefore Bonney Lake

serves approximately three percent of Sumner's land area. While none of these annexation areas currently have any developments requiring water from Bonney Lake they have the potential to develop into low density residential and urban village uses. In addition, Sumner has approximately 664 acres of designated UGA within the water service area. Most of this UGA is designated for single family residential.

Pierce County

The Pierce County Comprehensive Plan designates land use for unincorporated Pierce County, including many portions of the Bonney Lake water service area. The Pierce County *Comprehensive Plan* was developed in response to the requirements of the Washington State *Growth Management Act*. The Plan integrates citizen's ideas, concerns and preferences into statements of how the County should be developed, what development regulations should accomplish, what facilities and services levels are needed, and how publicly funded improvements should support these objectives. The *Comprehensive Plan* is codified as Title 19A of the Pierce County Code

The areas nearest the Bonney Lake city limits have the following designations.

- *Moderate Density Single-Family - Four dwelling units per acre without sewer or 6 dwelling units per acre with sewer*
- *Reserve 5 - One dwelling unit per five acres*
- *Rural 10 - One dwelling unit per ten acres*
- *Agricultural Resource Land - One dwelling unit per ten acres*
- *Master Planned Community – Planned Unit Development known as Lakeland Hills South currently under City of Auburn planning efforts.*

The areas to the west and to the north of the Bonney Lake city limits are primarily zoned as Rural 10 with Agricultural Resource Land. East of the city limits are areas zoned with Reserve 5, Rural 10, and Agricultural Resource Land. The area south of the city limits is Reserve 5 and Moderate Density Single-Family.

POPULATION

Household Trends

According to the U.S. Census Bureau, the average household size in Bonney Lake was 2.9645 persons per household in 2000, which has increased from 2.94 in 1990. The average household size in unincorporated Pierce County was 2.8118 persons per household in 2000.

Bonney Lake's residential community is comprised largely of single-family residences. According to the City's *Comprehensive Plan - Land Use Element*, there were approximately 4,169 housing units within the City in 2002. This number was calculated based on April 2002 OFM population data (12,360 people / 2.9645 people per household = 4,169 households). Because April is closer to the end of 2001 than the end of 2002 all OFM population data referenced in the City's *Comprehensive Plan - Land Use Element* has been shifted back one year (i.e. 2002 data in the *Land Use Element* is shown as 2001 data in this *Comprehensive Water System Plan*). Using this approach, the OFM city population listed for April 2004 is 13,740, so in this Plan it is shown as year end 2003 population. This number is slightly lower than the population served number of 13,855 (see **Table 4-1 – *Historical Water Connections***) calculated in this *Comprehensive Water System Plan*. It is assumed that this discrepancy is due to the fact that the Water Department calculates the number of accounts based on meters installed and therefore, there is a slight lag between meter installation and the occupancy of a new home, vacation home, etc.

Existing and Future Population

The City of Bonney Lake and Pierce County has experienced rapid population growth and extensive physical developments since 1990. The population of the City has more than doubled from 1990 to 2006 from both annexations and growth. In 2006, it is estimated that the City's population is approximately 16,090 and that the water system serves an additional 16,547 people outside of the City.

Build-out of the water service area is not expected to occur in the 20-year planning period. The City's population is expected to grow from 16,090 people in 2006 to approximately 27,284 people in 2026 within the city limits, UGA and proposed UGA, which is an average growth rate of 3.5 percent per year. This is considered saturation for the Bonney Lake incorporated area. However, additional growth is expected to continue to occur in unincorporated Pierce County after 2026.

Table 3-1 – ***Population Trends and Projection*** illustrates the historical population growth since 1990 and the projected future growth for the City and WSA. The historical population data shown in the table represents the population within the established city limits for each year, whereas the projected population data is based on growth estimates both inside the current city limits and within the existing UGA. These population forecasts are based on recently updated Puget Sound Regional Council (PSRC) data for the portions of the Forecast Analysis Zones (FAZ No. 805 and No. 806) that are within the Bonney Lake water service area.

Table 3-1
Population Trends and Projections

Year	Inside Bonney Lake	Outside Bonney Lake	Total WSA
Historical			
1990	7,860	7,754	15,614
1991	8,110	8,155	16,265
1992	8,504	8,319	16,823
1993	8,805	8,733	17,538
1994	9,045	9,066	18,111
1995	9,346	9,146	18,492
1996	9,590	9,413	19,003
1997	9,825	9,913	19,738
1998	10,060	10,461	20,521
1999	9,687	11,714	21,401
2000	9,980	12,387	22,367
2001	12,360	11,910	24,270
2002	12,950	13,135	26,085
2003	13,740	13,843	27,583
2004	14,370	15,013	29,383
2005	15,230	16,044	31,274
2006	16,090	16,547	32,637
Projected			
2012 (+ 6 years)	17,041	22,470	39,511
2026 (+ 20 years)	27,284	25,817	53,101
Buildout	27,284	27,376	54,660

NOTE: The historical populations shown under "Inside Bonney Lake" include only the population within the city limits and does not include any population within the current UGA. However, the projected populations shown under "Inside Bonney Lake" includes population within the current city limits, existing UGA, and proposed UGA.
Also note that the City popluation data is from Land Use Element and has been shifted back one year since it is from April data as opposed to end of year data.

Saturation Projections

Saturation population projections were estimated for saturation development within the proposed water service area. However, no attempt was made to identify the year in which saturation development will occur. Saturation estimates were based on information provided in the City's *Comprehensive Plan* and on land use information from Auburn, Sumner, and Pierce County. Population projections were based on three sources. (1) Build-out projections from the City's *Comprehensive Plan - Land Use Element* were used for all areas within the existing city limits,

existing Urban Growth Area, and proposed Urban Growth Area. (2) there are already plans for over 3,350 housing units within the water service area have been submitted to the City. These developments were allocated into the forecasted projects based on their location inside or outside the city. (3) Estimates were made based on current zoning densities and estimated amounts of available land that could be developed to calculate saturation in the remaining unincorporated Pierce County portions of the water service area, as well as, areas within Auburn and Sumner's city limits and UGAs. Allocations were made for both currently vacant land and land that is currently underutilized. **Table 3-2** – ***Build-out Population*** shows that the estimated saturation population for the City of Bonney Lake's water service area is approximately 54,660, based on this projection, the service area's population in the year 2026 will be approximately 97 percent of the potential saturation population.

Table 3-2
Build-out Population

	Housing Units	Population
Bonney Lake		
Currently In Existing City Limits	5,428	16,090
Additional in Existing City Limits	3,368	9,984
Currently In Existing UGA	170	504
Additional in Existing UGA	50	148
Currently in Existing Proposed UGA	38	113
Additional in Proposed UGA	150	445
Subtotal (Bonney Lake City & UGA)	*9,204*	*27,284*
Auburn[1]		
Currently In Existing City Limits	*1,051*	3,116
Additional in Existing City Limits	*1,775*	5,261
Currently In Existing UGA	*40*	119
Additional in Existing UGA	*260*	771
Subtotal (Auburn City & UGA)	*3,126*	*9,267*
Sumner[1]		
Currently In Existing City Limits	*0*	*0*
Additional in Existing City Limits	*416*	1,233
Currently In Existing UGA	*156*	462
Additional in Existing UGA	*374*	1,109
Subtotal (Sumner City & UGA)	*946*	*2,804*
Pierce County[2]		
Currently In Existing Unicorporated	4,335	12,850
Additional in Unincorporated (under planning)	277	821
Additional in Unincorporated (vacant land)	273	810
Additional in Unincorporated (underutilized land)	278	824
Subtotal (Unincorporated)	*5,163*	*15,305*
Saturation Total at Current Zoning	**18,438**	**54,660**
Vacant Land (acres)		1,366
Average Density (DU/acre)		0.20
Total Housing/Dwelling Units		273

[1]Within Bonney Lake's Water Service Area
[2]Within Bonney Lake's Water Service Area and not within other city limits or UGAs

CHAPTER 4

WATER DEMANDS

Lakeridge Booster Pump Station

INTRODUCTION

A detailed analysis of system demands is crucial to the planning efforts of a water supplier. A demand analysis first identifies current demands to determine if the existing system can effectively provide an adequate quantity of water to its customers under the most crucial conditions, in accordance with federal and state laws. A future demand analysis identifies projected demands to determine how much water will be needed to satisfy future growth of the water system and continue to meet federal and state laws.

Demands on the water system determine the size of storage reservoirs, supply facilities, water mains, and treatment facilities. Several different types of demands were analyzed and are addressed in this chapter, including average day demand; peak day demand; peak hour demand; fire flow demand; future demands; and a conservation demand reduction forecast.

The magnitude of water demands is typically based on three main factors: (1) population, (2) weather, and (3) water use classification. Population and weather have the two largest impacts

on water system demands. Population growth has a tendency to increase the annual demand, whereas high temperature has a tendency to increase the demand over a short period of time. Population does not solely determine demand, because different populations use varying amounts of water. The use varies based on the number of users in each type of customer class, land use density, and irrigation practices. Water conservation efforts will also impact demands and can be used to accommodate a portion of system growth without increasing a system's supply capacity.

Certificate of Water Availability

In accordance with the requirements of the *Growth Management Act* (GMA), Bonney Lake must identify that water is available prior to issuing a building permit. A "Certificate of Water Availability" (CWA) is issued if there is sufficient water supply to meet the domestic water service and fire flow requirements of the proposed building. The requirement for providing evidence of an adequate water supply was codified in 1990 under Title 19.27.097 of the Revised Code of Washington (RCW) in the Building Code Section. To assist governments with implementing these requirements, the Department of Health has developed a handbook titled *Guidelines for Determining Water Availability for New Buildings*.

CURRENT POPULATION AND SERVICE CONNECTIONS

Residential Population Served

As discussed in **Chapter 3,** it is estimated that in 2006 the Bonney Lake water system provided service to approximately 32,637 people. According to metered water account records, it is estimated that approximately 16,090 of these people are located within the city limits and approximately 16,547 people are located outside the city limits. Therefore, approximately 49 percent of the total population served is inside the city. The computation of this number is discussed later in this chapter and a more detailed discussion of the city's population and household trends is in **Chapter 3**.

By the end of 2006, the City provided water service to 11,373 customer accounts, of which 10,729 or approximately 94 percent of these accounts were single-family residential customers, 371 accounts or approximately 3 percent were multi-family residential customers, and 273 accounts or less than 3 percent were non-residential customers.

Water Use Classifications

Bonney Lake has divided all water customers into seven different classes for billing purposes. For planning purposes, the water customers have been combined into three different groups – single-family residential, multi-family residential, and non-residential. The non-residential user group includes the following billing classes: "commercial and public," "schools," and "irrigation and parks." Note that the single-family residential classification includes duplexes and that multi-family is considered three or more residential units. The demand analysis that follows will report on the water use patterns of these three user groups. **Table 4-1 – *Historical Water Connections*** shows historic connection data by customer class for 1996 through 2006.

EXISTING WATER DEMANDS

Water Consumption

Water consumption is the amount of water used by all customers of the system, as measured by the customer's meters.

As shown in **Chart 4-1 – *2006 Water Connections by Customer Class***, the single-family residential class represents approximately 94 percent of all connections but only 81 percent of total system consumption, as shown in **Chart 4-2 – *Consumption by Customers Class***. This is due to the lower consumption per connection of the single-family residential customers as compared to the other customers. **Table 4-2 – *Average Annual Metered Consumption and Service Connections*** shows the historical average number of connections, average annual consumption, and average daily consumption per connection of each customer class for the City from 1994 through 2006. As shown in **Table 4-2 – *Average Annual Metered Consumption and Service Connections***, the single-family residential customers use an average of approximately 244 gallons per day per connection, compared to the multi-family customers that use an average of approximately 676 gallons per day per connection, and the non-residential customers that use an average of approximately 1,392 gallons per day per connection. The higher consumption of customers other than single-family is expected, since these customers include multi-family residential customers where one connection typically serves several units, and commercial customers that include the system's highest individual water users.

Table 4-1
Historical Water Connections

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Number of Utility Connections (Accounts)											
Customer Class											
Commercial / Public	103	111	118	118	128	135	146	148	139	141	148
Inside Single-Family	3,017	3079	3155	3235	3326	3,626	4,276	4,593	4,708	5,002	5,232
Outside Single-Family	3,438	3631	3823	4042	4280	4,554	4,407	4,615	5,022	5,314	5,497
Inside Multi-Family	28	29	33	38	41	41	51	53	80	92	99
Outside Multi-Family	59	60	60	61	64	118	175	167	210	242	272
Irrigation / Parks	17	28	28	35	47	66	74	81	89	97	109
Schools	11	12	12	12	13	14	14	14	15	16	16
Total Connections	**6,673**	**6,950**	**7,229**	**7,541**	**7,899**	**8,554**	**9,143**	**9,671**	**10,263**	**10,904**	**11,373**
Total Residential Connections Inside	3,045	3,108	3,188	3,273	3,367	3,667	4,327	4,646	4,788	5,094	5,331
Total Residential Connections Outside	3,497	3,691	3,883	4,103	4,344	4,672	4,582	4,782	5,232	5,556	5,769
Total Residential Connections	6,542	6,799	7,071	7,376	7,711	8,339	8,909	9,428	10,020	10,650	11,100
Percent Residential Connections	*89%*	*88%*	*88%*	*88%*	*87%*	*87%*	*87%*	*87%*	*87%*	*88%*	*87%*
Population (Capita)											
Total Population Served	**19,003**	**19,738**	**20,521**	**21,401**	**22,367**	**24,270**	**26,085**	**27,583**	**29,383**	**31,274**	**32,637**
Total Population Growth Rate	*2.8%*	*3.9%*	*4.0%*	*4.3%*	*4.5%*	*8.5%*	*7.5%*	*5.7%*	*6.5%*	*6.4%*	*4.4%*
Population Served Inside City	9,070	9,258	9,502	9,761	10,044	10,934	12,906	13,855	14,317	15,243	15,956
Population Served Outside City	10,458	11,034	11,603	12,257	12,976	14,032	13,852	14,433	15,833	16,843	17,520
Average Single-Family Connections	6,368	6,583	6,844	7,128	7,442	7,893	8,432	8,946	9,469	10,023	10,523
Average Multi-Family Connections	86	88	91	96	102	132	193	223	255	312	353
Average Non-Residential Connections	126	141	155	162	177	202	225	239	243	249	264
Average Total Connections	***6,580***	***6,812***	***7,090***	***7,385***	***7,720***	***8,227***	***8,849***	***9,407***	***9,967***	***10,584***	***11,139***
Residential Connections Growth Rate	2.8%	3.9%	4.0%	4.3%	4.5%	8.1%	6.8%	5.8%	20.2%	6.3%	4.2%
Total Annual Growth	2.9%	4.2%	4.0%	4.3%	4.7%	8.3%	6.9%	5.8%	20.0%	6.2%	4.3%
Total SF Connections	6,455	6,710	6,978	7,277	7,606	8,180	8,683	9,208	9,730	10,316	10,729
Number of Equivalent Residential Units (ERU)											
Total Single-Family ERU	6,455	6,710	6,978	7,277	7,606	8,180	8,683	9,208	9,730	10,316	10,729
New Units	174	255	268	299	329	574	503	525	522	586	413
Growth in SF ERU	2.8%	4.0%	4.0%	4.3%	4.5%	7.5%	6.1%	6.0%	5.7%	6.0%	4.0%
Total MF Connections	87	89	93	99	105	159	226	220	290	334	371
New Units	3	2	4	6	6	54	67	(6)	70	44	37
Total Multi-Family ERU	188	193	201	214	227	344	489	476	628	723	803
Growth in MF ERU	3.6%	2.3%	4.5%	6.5%	6.1%	51.4%	42.1%	-2.7%	31.8%	15.2%	11.1%
Total Non-ResConnections	131	151	158	165	188	215	234	243	243	254	273
New Units	10	20	7	7	23	27	19	9	0	11	19
Total Non-Residential ERU	800	922	965	1,007	1,148	1,313	1,429	1,484	1,484	1,552	1,667
Growth in Non-Res ERU	8.3%	15.3%	4.6%	4.4%	13.9%	14.4%	8.8%	3.8%	0.0%	4.6%	7.4%
Total ERU Served	**7,443**	**7,825**	**8,144**	**8,499**	**8,981**	**9,837**	**10,601**	**11,168**	**11,842**	**12,591**	**13,199**
Percent Residential ERU	*2.8%*	*3.9%*	*4.0%*	*4.3%*	*4.6%*	*8.8%*	*7.6%*	*5.6%*	*7.0%*	*6.6%*	*4.5%*
Total New ERU	242	381	319	355	482	856	764	567	674	749	608
Annual Total Growth in ERU	*3.4%*	*5.1%*	*4.1%*	*4.4%*	*5.7%*	*9.5%*	*7.8%*	*5.3%*	*6.0%*	*6.3%*	*4.8%*
Mid Year Number (ERU)	**7,322**	**7,634**	**7,984**	**8,321**	**8,740**	**9,409**	**10,219**	**10,884**	**11,505**	**12,216**	**12,895**
Residential Growth Rate (ERU)	*2.8%*	*3.9%*	*4.0%*	*4.3%*	*4.6%*	*8.8%*	*7.6%*	*5.6%*	*7.0%*	*6.6%*	*4.5%*
Non-Residential Growth Rate (ERU)	*8.3%*	*15.3%*	*4.6%*	*4.4%*	*13.9%*	*14.4%*	*8.8%*	*3.8%*	*0.0%*	*4.6%*	*7.4%*

Chart 4-1
2006 Water Connections by Customer Class

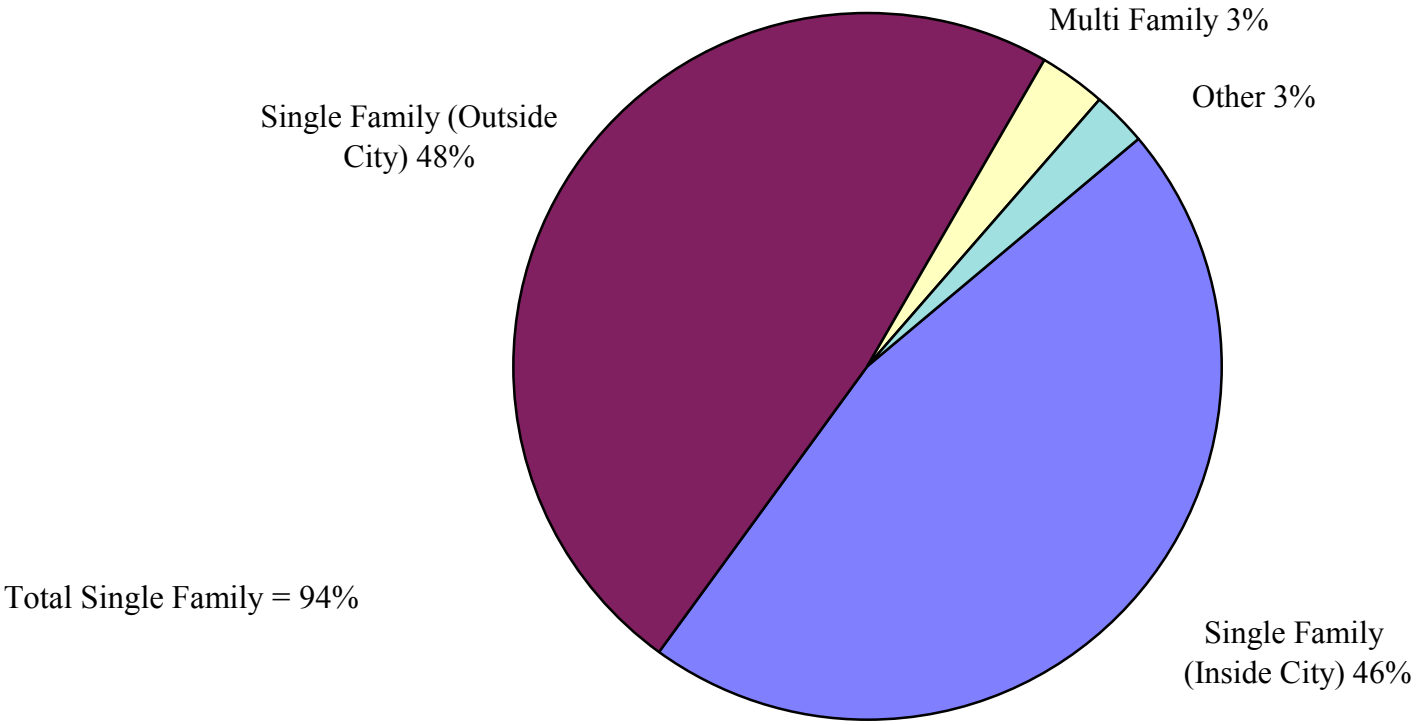


Chart 4-2
2006 Consumption by Customer Class

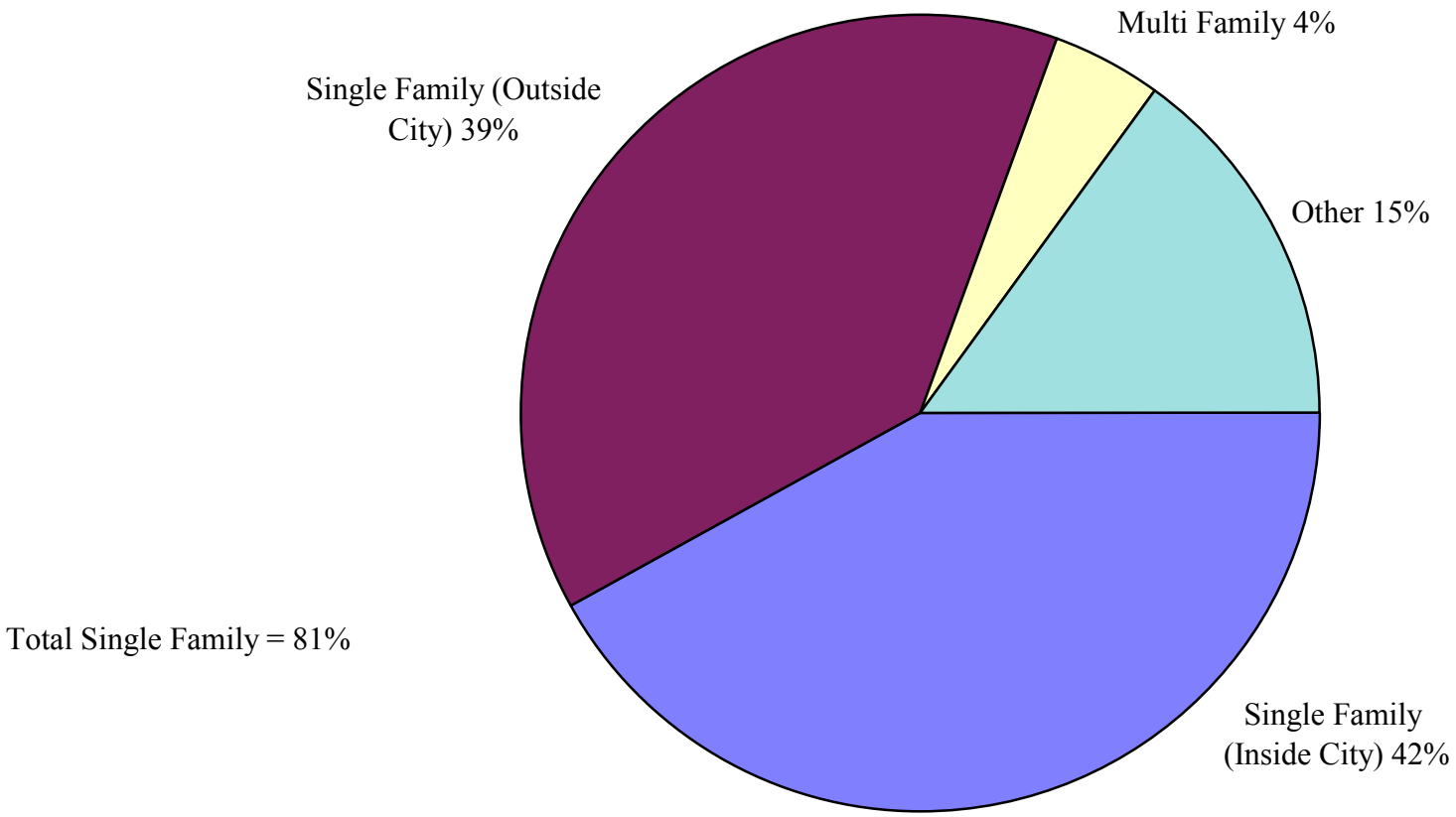


Table 4-2
Average Annual Metered Consumption and Service Connections

Year	Customer Class			
	Single-Family	Multi-Family	Non-Residential	Totals
Average Number of Connections				
1994	6,067	72	110	6,249
1995	6,223	79	120	6,421
1996	6,368	86	126	6,580
1997	6,583	88	141	6,812
1998	6,844	91	155	7,090
1999	7,128	96	162	7,385
2000	7,442	102	177	7,720
2001	7,893	132	202	8,227
2002	8,432	193	225	8,849
2003	8,946	223	239	9,407
2004	9,469	255	243	9,967
2005	10,023	312	249	10,584
2006	10,523	353	264	11,139
Average Annual Consumption (1000 gallons)				
1994	596,492	25,209	54,773	676,474
1995	577,097	25,658	55,057	657,811
1996	546,149	24,922	54,493	625,564
1997	574,138	24,648	63,199	661,985
1998	652,968	27,042	80,738	760,748
1999	633,100	28,407	73,583	735,090
2000	650,212	30,270	80,043	760,525
2001	656,579	30,916	95,483	782,978
2002	752,990	35,517	107,690	896,198
2003	848,368	42,505	124,497	1,015,370
2004	759,827	42,094	137,712	939,633
2005	796,001	44,938	148,325	989,263
2006	990,322	54,129	183,757	1,228,208
Average Daily Consumption per Connection (gal/day/conn)				
1994	269	959	1,370	*
1995	254	895	1,262	*
1996	234	796	1,182	(Leap Year)
1997	239	767	1,228	*
1998	261	814	1,432	*
1999	243	811	1,248	*
2000	239	811	1,239	(Leap Year)
2001	228	642	1,298	*
2002	245	505	1,314	*
2003	260	522	1,430	*
2004	220	452	1,552	(Leap Year)
2005	218	395	1,634	*
2006	258	421	1,910	*
94-06 Avg	**244**	**676**	**1,392**	

Table 4-3 - *2006 Largest Water Uses* shows the largest water users of the system in 2006 and their total amount of metered consumption for the year. The total water consumption of these 15 water accounts represented approximately four percent of the system's total consumption in 2006. The list of accounts in the table consists of commercial facilities, schools; and multi-family residences.

Table 4-3
2006 Largest Water Users

Name	Address	Annual Consumption (gals)
Fred Meyer	20901 SR 410	4,316,708
Home Depot -Irrigation	9602 214th Ave E	3,987,588
Sunset Park Irrigation (City of Auburn)	Lakeland Hills Way & 69th St SE	3,829,012
Emerald Hills Elementary	19515 S Tapps Dr	3,749,724
Bonney Lake High School Irrigation	10920 199th Ave Ct E	3,665,200
Sunset Park Irrigation (City of Auburn)	Lakeland Hills Way & 69th St SE	3,425,092
Top Foods	1406 Lake Tapps Parkway	3,325,608
Heatherwood at Lakeland Irrigation	1108 59th St SE	3,213,408
City of Auburn Foxwood Irrigation	Lakeland Hills Way & 63rd St SE	3,169,276
Lakeland Towncenter Irrigation	1402 Lake Tapps Parkway	3,008,456
Dieringer School District	20029 12th St E	3,007,708
Foxwood at Lakeland Irrigation	1117 62nd St SE	2,561,152
Safeway	21301 SR 410	2,544,696
Crestwood Elementary	3914 W Tapps Dr	2,539,460
Lake Bowman Mobile Home Park	19707 6th St Ct E	2,277,660
Largest Water Users Total		48,620,748
Water System Total		1,228,208,153
Percent of Total		4.0%

Water Supply

Water supply, or production, is the total amount of water supplied to the system, as measured by the meters at each supply source. Water supply is different than water consumption in that water supply is essentially the recorded amount of water put into the system and water consumption is the recorded amount of water taken out of the system. The measured amount of water supply of any system is typically larger than the measured amount of water consumption, due to non-metered water use and water loss (i.e. unaccounted-for water). **Table 4-4** – ***Historical Water Supply and System Demand*** summarizes the total amount of water supplied to the Bonney Lake system from 1994 through 2006 and the calculated average day demand for each year.

Table 4-4
Historical Water Supply and System Demand

Year	Annual Supply (gallons)	Average Daily Demand (gpm)	(MGD)
1994	825,250,000	1,570	2.26
1995	857,043,000	1,631	2.35
1996	785,600,000	1,491	2.15
1997	778,156,000	1,481	2.13
1998	916,015,000	1,743	2.51
1999	844,395,000	1,607	2.31
2000	867,042,330	1,645	2.37
2001	903,167,000	1,718	2.47
2002	1,061,302,000	2,019	2.91
2003	1,115,590,404	2,123	3.06
2004	1,150,827,056	2,184	3.14
2005	1,155,872,000	2,199	3.17
2006	1,309,914,734	2,485	3.58

In general, the City has experienced a trend of increasing water supply, or system-wide water demand since 1994, as shown in the table, due to system-wide growth and the associated increase in water usage.

Table 4-5 – ***Existing Per Capita Demand*** presents the computation of the existing system per capita demand, based on 2006 data. As shown in the upper portion of the table, the residential population served by the City's water system is approximately 30,368 and is based on the recorded number of residential units served and the average residential household size. This population number and the City's residential consumption records for 2006 were used to arrive at the existing per capita demand of 95 gallons per day.

Table 4-6 – *Multi-Family Demand* presents a computation of multi-family demand and a comparison to single-family demand. In 2004 and 2006, the City conducted an inventory of all multi-family units. The results of this inventory and the billing records for multi-family consumption were used to calculate the average day demand for a multi-family unit. This number was compared to the average day demand for a single-family household. The multi-family average day demand ranged between 65 percent and 92 percent of single-family average day demand.

Table 4-5
Existing Per Capita Demand

2006 Single-Family Population Served Computation	
2006 Single-Family Units Inside City (mid-year)	5,117
Average Owner Occupied Household Size (People Per Unit)	2.96
Calculated 2006 Single-Family Single-Family Population Served Inside City	15,169
2006 Single-Family Units Outside City (mid-year)	5,406
Average Owner Occupied Household Size (People Per Unit)	2.81
Calculated 2006 Single-Family Population Served Outside City	15,199
Calculated 2006 Total Single-Family Population Served	30,368
2006 Total Annual Supply	
2006 Total Annual Single-Family Consumption (gallons)	990,321,713
Unaccounted-for Water Factor	6%
2006 Total Annual Single-Family Demand (gallons)	1,052,093,521
Existing Per Capita Demand (gal/day/capita)	**95**

Table 4-6
Multi-Family Demand

Multi-Family Units	**2004**	**2006**
Multi-Family Units (mid-year)	573	884
Total Annual Multi-Family Consumption (gallons)	42,093,700	54,129,020
Unaccounted-for Water Factor	18%	6%
Total Annual Multi-Family Demand (gallons)	49,818,522	57,505,344
Multi-Family Average Day Demand per Unit (gal/day/unit)	**238**	**178**
Single-Family Units (mid-year)	9469	10,523
Total Annual Single-Family Consumption (gallons)	759,827,376	990,321,713
Unaccounted-for Water Factor	18%	6%
Total Annual Single-Family Demand (gallons)	899,267,042	1,052,093,521
Single-Family Average Day Demand per Unit (gal/day/unit)	**260**	**274**
Multi-Family to Single-Family Ratio	**92%**	**65%**

Table 4-7 – *2006 Demands by Pressure Zone* shows the average demand in the City's main 748 Pressure Zone and four boosted pressure zones, based on 2006 water demand data.

Table 4-7
2006 Demands by Pressure Zone

Pressure Zone	2006 Annual Supply (gallons per year)	Average Daily Demand (gpm)	Average Daily Demand (MGD)	Percent of Total Demand (%)
Lakeridge 810[1]	128,194,000	244	0.35	10%
Ponderosa 800	262,097,000	499	0.72	21%
Summit 790	7,009,052	13	0.02	1%
Pinnacle Estates 795	56,579	0.11	0.00	0%
Bonney Lake 748[2]	830,851,523	1,581	2.28	68%
Total	1,228,208,153	2,337	3.36	100%

[1]Includes unmetered flows to the 47th Street and 166th Ave Zones

[2]Includes unmetered flows to the Rhodes, Angeline Valley, and lower zones

Unaccounted-for Water

The difference between the amount of water supply and water consumption is the amount of unaccounted-for water. Unaccounted-for water is simply water that is supplied to the system but not metered (accounted-for) as it is taken out of the system. There are many sources of unaccounted-for water in a typical water system, including water system leaks; inaccurate supply metering; inaccurate customer metering; fire hydrant usage; water main flushing; illegal water system connections or water use; and malfunctioning telemetry and control equipment resulting in overflowing of reservoirs.

The City has experienced a decrease in unaccounted-for water since 23 percent unaccounted-for water was experienced in 1995. The decrease is primarily due to several factors: (1) The City's replacement of old and likely inaccurate customer meters on a 20-year life cycle basis, (2) the replacement and calibration of the City's source of supply meters, (3) replacement of leaking water mains, and (4) the promotion of conservation within the system. The amount of unaccounted-for water in the Bonney Lake system dropped to six percent in 2006, as shown in **Table 4-8 – *Unaccounted-for Water***. The level of unaccounted-for water is likely from unauthorized use of fire hydrants, water services during construction, flushing activities and leaking water mains. Due to the high growth rates the City has experienced, they have been unable to accurately monitor and record water used on construction sites. The City does have a leak detection program and is actively repairing leaks and replacing leaking water mains.

The City intends to further minimize the amount of unaccounted-for water in the system by continuing with its customer meter replacement program, recording the amount of water used for flushing the distribution system and construction purposes, and continuing its leak detection and leaking water main replacement efforts.

Table 4-8
Unaccounted-for Water

Year	Total Supply (CCF)	Total Consumption (CCF)	Un-accounted For Water	
1994	1,103,275	904,377	283 gpm	18%
1995	1,139,096	879,427	370 gpm	23%
1996	1,050,267	898,968	215 gpm	14%
1997	1,040,316	885,007	221 gpm	15%
1998	1,224,619	1,017,043	295 gpm	17%
1999	1,128,870	982,741	208 gpm	13%
2000	1,159,147	1,016,745	203 gpm	12%
2001	1,207,443	1,046,762	229 gpm	13%
2002	1,418,853	1,198,125	314 gpm	16%
2003	1,491,431	1,357,447	191 gpm	9%
2004	1,538,539	1,256,194	401 gpm	18%
2005	1,545,283	1,322,544	317 gpm	14%
2006	1,751,223	1,641,990	155 gpm	6%
10-Year Maximum			401 gpm	18%
10-year Average			253 gpm	13%

Table 4-9 - ***Unaccounted-for Water by Type*** shows an estimated summary of unaccounted-for water in 2006 by type. The table lists several types of unaccounted-for water including leaking water mains; unauthorized hydrant and water service use, permitted hydrant use (for construction purposes); vactor truck water use; fire fighting; and water main flushing. The City is currently experiencing a period of large growth with approximately 500 to 700 new homes and numerous commercial structures constructed each year. During the construction process, contractors connect to fire hydrants and meter setters without proper authorization and use unaccounted-for water.

The amount of water for each classification, except for leaking water mains, was estimated based on City data and estimates. The amount of unaccounted-for water attributed to leaking water mains was then assumed to be the remaining portion of unaccounted-for water. Some of the classifications in **Table 4-9** - ***Unaccounted-for Water by Type***, such as fire fighting activities, un-permitted hydrant use, and water main flushing, can be considered non-revenue accounted-for

water when it is accurately recorded. However, the amount of unaccounted-for water for each of these activities is estimated and was not actually accounted-for. These estimates were based on leak detection efforts, readings from hydrant meters, and estimates of other uses based on both discussions with maintenance staff and data from similar systems. In the future, the City will require improved recordkeeping for these activities.

Table 4-9
Unaccounted-for Water by Type

2006 Unaccounted-for Water Classification	Total Amount (CCF)	Unaccounted-for Water (%)
Leaking Water Mains	75,110	68.8%
Unauthorized Hydrant and Service Use	1,090	1.0%
Permitted Hydrant Use	13,362	12.2%
Fire Fighting Activities	3,280	3.0%
Water Main Flushing	16,380	15.0%
Total	109,230	100%

Equivalent Residential Units

The demand of each customer class can be expressed in terms of equivalent residential units (ERUs) for demand forecasting and planning purposes. One ERU is equivalent to the amount of water used by a single-family residence. The number of ERUs represented by the demand of the other customer classes is determined from the total demand of the customer class and the unit demand per ERU from the single-family residential demand data.

Table 4-10 – ***Equivalent Residential Units (ERU)*** presents the computed number of ERUs for each customer class from 1994 through 2006 for Bonney Lake's service area. The demands shown are based on supply data that was computed from the consumption of each customer class and the average amount of unaccounted-for water from each year. The average day demand per ERU from 1997 through 2006 was 278 gallons per day. This is within the typical range of between 250 and 300 gallons per day for single family demand in the Puget Sound area. The maximum value for an average day demand factor for the last ten years of data was 314 gallons per day and occurred in 1998.

Production data was also used to determine demand values for the system. Unlike consumption data, source production data is available from the City's telemetry system on an hourly basis. Therefore, production data can be used to determine, not just average day demand values, but also maximum day demand and peak hour demand values for each year. Demand values based on production data is presented in **Table 4-11 – *Historic Demand Values***.

Table 4-10
Equivalent Residential Units (ERU)

Year	Average Number of Connections	Average Annual Demand (gallons)	Demand per ERU (gal/day/ERU)	Total ERU's
Single Family Residential (ERU Basis)				
1994	6,067	727,677,492	329	6,067
1995	6,223	747,496,935	329	6,223
1996	6,368	638,068,337	274	6,385
1997	6,583	674,892,438	281	6,583
1998	6,844	786,237,284	315	6,844
1999	7,128	727,239,759	280	7,128
2000	7,442	741,279,428	272	7,462
2001	7,893	757,365,118	263	7,893
2002	8,432	891,711,587	290	8,432
2003	8,946	932,104,572	285	8,946
2004	9,469	930,607,799	269	9,469
2005	10,023	930,061,017	254	10,023
2006	10,523	1,056,202,892	275	10,523
10-year Maximum			315	
10-year Average			278	
Multi-Family Residential				
1994	72	30,753,298	329	256
1995	79	33,233,928	329	277
1996	86	29,116,315	274	291
1997	88	28,973,552	281	283
1998	91	32,560,840	315	283
1999	96	32,630,763	280	320
2000	102	34,509,606	272	346
2001	132	35,662,069	263	372
2002	193	42,060,555	290	398
2003	223	46,700,479	285	448
2004	255	51,554,770	269	525
2005	312	52,505,869	254	566
2006	353	57,729,955	275	575
Non-Residential				
1994	110	66,819,210	329	557
1995	120	71,313,138	329	594
1996	126	63,664,739	274	635
1997	141	74,290,010	281	725
1998	155	97,216,876	315	846
1999	162	84,524,477	280	828
2000	177	91,253,296	272	916
2001	202	110,139,813	263	1,148
2002	225	127,529,857	290	1,206
2003	239	136,785,353	285	1,313
2004	243	168,664,487	269	1,716
2005	249	173,305,114	254	1,868
2006	264	195,981,887	275	1,952
System-Wide Totals				
1994	6,249	825,250,000	329	6,881
1995	6,421	852,044,000	329	7,093
1996	6,580	730,849,391	274	7,311
1997	6,812	778,156,000	281	7,590
1998	7,090	916,015,000	315	7,974
1999	7,385	844,395,000	280	8,276
2000	7,720	867,042,330	272	8,724
2001	8,227	903,167,000	263	9,412
2002	8,849	1,061,302,000	290	10,035
2003	9,407	1,115,590,404	285	10,706
2004	9,967	1,150,827,056	269	11,710
2005	10,584	1,155,872,000	254	12,456
2006	10,985	1,309,914,734	275	13,050

Average Day Demand

Average Day Demand (ADD) is the total amount of water delivered to the system in a year divided by the number of days in the year. The average day demand is determined from historical water use patterns of the system and can be used to project future demand within the system. Average day demand data is typically used to determine standby storage requirements for water systems. Standby storage is the volume of a water tank used to provide water supply under emergency conditions when supply facilities are out of service. Water production records from the City's wells and wholesale sources were reviewed to determine the system's average day demand. The system's average day demands for 1994 through 2006 are shown in **Table 4-11 – *Historic Demand Values***.

An average day demand per ERU of 314 gallons per day, or 0.218 gpm/ERU, will be used forecast ERU in future years, based on estimated future demands. This demand per ERU value will also be used to determine the capacity (in terms of ERU) of the existing system in **Chapter 7**.

Table 4-11
Historic Demand Values

Year	ADD[1] gpd/ERU	PDD[2] gpd/ERU	PHD[2] gpm/ERU	Max Month[1] gpd/ERU	4DMD[2] gpd/ERU
1995	330	626	no data	478	no data
1996	296	no data	no data	no data	no data
1997	279	no data	no data	no data	no data
1998	314	700	0.97	543	665
1999	278	539	0.57	423	475
2000	274	619	0.76	456	575
2001	263	553	0.71	406	509
2002	285	607	0.81	480	567
2003	281	no data	no data	no data	no data
2004	273	645	0.80	474	620
2005	259	602	0.68	496	475
2006	278	670	0.81	481	621
10-yr Avg	278	617	0.76	470	564
10-yr Max	314	700	0.97	543	665

[1]From source meter records
[2]From water system telemetry data
no data = no reliable data exists

Peak Day Demand

Peak Day Demand (PDD) is the maximum amount of water used throughout the system during a 24-hour time period of a given year. Peak day demand typically occurs on a hot summer day when lawn watering is occurring throughout much of the system. In accordance with WAC 246-290-230 - Distribution Systems, the distribution system shall provide fire flow at a minimum pressure of 20 psi during maximum day demand (i.e. peak day demand) conditions. At the time of Bonney Lake's last *Comprehensive Water System Plan*, the system was required to provide fire flow during peak hour demand rather than peak day demand. Supply facilities (wells, springs, pump stations, interties) are typically designed to supply water at a rate that is equal to or greater than the system's peak day demand.

The peak day demand is typically determined from the combined flow of water into the system from all supply sources and water tanks on the peak day. **Table 4-12 – *Historical Peak Hours and Peak Days*** lists the dates on which peak hour and peak day demands occurred over the last ten years for which reliable water system telemetry data existed. It should be noted that an extended period of hot and dry weather occurred in 2003; however, the peaks experienced by the system were not as high as in 1995 and 1998 due to the water voluntary curtailment effort

implemented by the City that year to reduce the amount of water consumed by customers. The system's peak day demands for 1995 through 2006 are shown in **Table 4-11 – *Historic Demand Values***.

Peak Hour Demand

Peak Hour Demand (PHD) is the maximum amount of water used throughout the system, excluding fire flow, during a one-hour time period of a given year. In accordance with WAC 246-290-230 - Distribution Systems, new public water systems or additions to existing systems shall be designed to provide domestic water at a minimum pressure of 30 psi during peak hour demand conditions. Equalizing storage requirements are typically based on peak hour demand data.

The peak hour demand, like the peak day demand, is typically determined from the combined flow of water into the system from all supply sources and water tanks. The system's peak hour demands for 1995 through 2006 are shown in **Table 4-12 – *Historical Peak Hours and Peak Days***.

Table 4-12
Historical Peak Hours and Peak Days

Year	Peak Hour Demands			Peak Day Demand	
	Flow	Date	Time	Flow	Date
1998	7,737 gpm	Monday, July 27, 1998	9:00 PM	3,884 gpm	Monday, July 27, 1998
1999	4,746 gpm	Monday, July 26, 1999	8:00 PM	3,713 gpm	Sunday, July 25, 1999
2000	6,630 gpm	Wednesday, August 02, 2000	8:20 PM	3,758 gpm	Thursday, August 03, 2000
2001	6,638 gpm	Sunday, August 12, 2001	9:00 PM	3,615 gpm	Monday, August 13, 2001
2002	8,276 gpm	Monday, July 22, 2002	9:00 PM	4,308 gpm	Tuesday, July 23, 2002
2003	no data	no data	no data	no data	no data
2004	9,259 gpm	Tuesday, June 29, 2004	9:00 PM	5,191 gpm	Sunday, July 25, 2004
2005	8,247 gpm	Wednesday, August 03, 2005	8:00 PM	5,106 gpm	Monday, August 15, 2005
2006	9,941 gpm	Monday, July 24, 2006	9:00 PM	6,179 gpm	Saturday, July 22, 2006

Table 4-13 – *Demands Peaking Factors* shows the peaking factors of the water system based on the average day, peak day, and peak hour demand data presented above. The peak day demand/average day demand ratio of 2.23 is within the typical range of 1.2 to 2.5 for most systems. The estimated peak hour demand/peak day demand ratio (PHD/PDD = 1395gpd/700spd) of 1.99 is within the typical range of 1.3 to 2.0 for most systems. These peaking factors will be used later in this chapter in conjunction with projected average day demands to project future peak day and peak hour demands of the system.

Table 4-13
Demands Peaking Factors

Demand Data		
Demand Type	**Demand (gpm/ERU)**	**Demand (gpd/ERU)**
Average Day Demand (ADD)	0.218	314
Peak Day Demand (PDD)	0.486	700
Peak Hour Demand (PHD)	0.969	1,395
Peaking Factors		
Peak Day Demand/Average Day Demand (PDD/ADD)		2.23
Peak Hour Demand/Peak Day Demand (PHD/PDD)		1.99
Peak Hour Demand/Average Day Demand (PHD/ADD)		4.44

Fire Flow Demand

Fire Flow Demand is the amount of water required during fire fighting as defined by applicable codes. Fire flow requirements are established for individual buildings and expressed in terms of flow rate (gpm) and flow duration (hours). Fighting fires imposes the greatest demand on the water system because a high rate of water must be supplied over a short period of time, requiring each component of the system to be properly sized and configured to operate at its optimal condition. Adequate storage and supply is useless if the transmission or distribution system can not deliver water at the required rate and pressure necessary to extinguish a fire.

Each of the four land use agencies (Bonney Lake, Auburn, Sumner, and Pierce County) with interests within the City's water service area set their own minimum fire flow requirements. These minimum, or general, fire flow requirements were established for the different land use categories to provide a target level of service for planning and sizing future water facilities in areas that are not fully developed. The general fire flow requirement for each agency is shown in **Table 4-14 – *General Fire Flow Requirements***. The water system analyses presented in **Chapter 7** are based on an evaluation of the water system for providing sufficient fire flow in accordance with these general fire flow requirements and the fire flow requirements of existing buildings. At a minimum, Bonney Lake's general requirements are used, except for areas where the other land use agency's requirements are more stringent. Note: the general requirements do not necessarily equate to actual existing or future fire flow needs for a specific site. Also note that the values shown in **Table 4-14 – *General Fire Flow Requirements*** are the minimum set by codes for each of the jurisdiction listed.

Table 4-14
General Fire Flow Requirements

Land Use Category	Fire Flow Requirement (gpm)	Flow Duration (minutes)
Bonney Lake		
Single-Family Residential	1,000	45
Multi-Family Residential	2,500	120
Commercial	2,500	120
Commercial - Permitted Exceptions[1]	4,000	120
Industrial	3,500	180
Auburn		
Single-Family Residential	1,500	120
Multi-Family Residential	2,500	180
Commercial	2,500	180
Industrial	3,500	240
Sumner		
Medium Density Residential	1,000	120
High Density Residential	1,500	120
Commercial	1,500	120
Industrial	3,500	180
Pierce County		
Rural Areas	750	45

[1]The City's Building Department and Fire Marshall have permitted two facilities with fire flow requirements greater than the standard minimum. They are Home Depot at 3,625 gpm and Lowe's at 4,000 gpm.

FUTURE WATER DEMANDS

Basis for Projecting Demands

Future demands were calculated using historic 10-year maximum "Average Day Demand" value as shown in **Table 4-11 – *Historic Demand Values*** and the projected population data from **Chapter 3**. Future demand projections were computed with and without a further reduction in water use from conservation measures included in the City's conservation plan as well as cost-effective conservation methods not chosen in the City's conservation plan. The calculated demand of 314 gallons per day per ERU was used for all average day demand projections without water conservation. This value was reduced to reflect the water use reduction enhancement goals contained in the City's Water Conservation Plan and used as the basis for future water demand projections with the conservation component. The City's Water Conservation Plan, contained in **Appendix C**, presents a goal of 5 percent additional water use reduction by the year 2012 and 10 percent water use reduction by the year 2026, with 2006 as the base year. Applying these water use reduction goals to the per customer demand of 314 gallons per day results in projected per customer demand with conservation of 298 gallons per day in the year 2012 (6-year forecast) and 283 gallons per day in the year 2026 (20-year forecast), as shown in **Table 4-15 – *Future Total Water Demand Summary***.

Demand Forecasts and Conservation

Table 4-14 - ***Future Total Water Demand Summary*** presents the 6-year and 20-year water demand forecast for the Bonney Lake water system. The actual demand data from 2006 is also shown in the table for comparison purposes. The future average day demands were projected based on population estimates for the given years, estimated number of customers in terms of ERU, and the estimated demand per ERU values. The future peak day and peak hour demands shown were computed from the projected average day demands and the existing system peaking factors shown in **Table 4-13 – *Future Total Water Demand Summary***. The future demand projections are also shown with and without estimated additional reductions in water use from achieving the conservation enhancement goals described earlier.

The analysis and evaluation of the existing water system with proposed improvements, as presented in **Chapters 7** and **9**, is based on the 20-year projected demand data without conservation reductions. This ensures that the future system will be sized properly to meet all requirements, whether or not additional water use reductions from conservation are achieved. However, the City will pursue reductions in per capita water use by implementing the Water Conservation Plan contained in **Appendix C** of this plan.

Table 4-16 – ***Future Demand Projections (ERU)*** presents the existing and projected ERUs of the system. The 6-year and 20-year ERU forecast is based on the projected water demand data. The historical and projected water demand and ERU data from **4-16** - ***Future Demand Projections (ERU)*** are also shown graphically in **Chart 4-3 – *Historical Future Water Demand and Number of Customers Projections*.**

Table 4-15
Future Total Water Demand Summary

Description	2006 Actual [1,2]	2012 Projected[2] (+ 6 yrs)	2026 Projected[2] (+ 20 yrs)
Customer Data			
Customers (ERU at mid year)	12,895	15,611	20,980
Increase from Base Year 2006		2,716	8,085
Demand Basis Data (gal/day/ERU)			
Avg Day Demand without Conservation	314	314	314
Avg Day Demand with Conservation		298	283
Average Day Demand (gpm)			
Demand without Conservation	2,812	3,404	4,575
Demand with Conservation		3,234	4,117
Peak Day Demand (gpm)			
Demand without Conservation	6,268	7,589	10,199
Demand with Extra Conservation Measures		7,209	9,179
Peak Hour Demand (gpm)			
Demand without Conservation	12,495	15,127	20,330
Demand with Conservation		14,371	18,297

[1]2006 Peak Day Demand and Peak Hour Demand values are based on actual Average Day Demand amounts for the given year and historical peaking factors, and do not necessarily represent actual peak demands for these years.

[2]Demands are based on yearly average data since demand peaks near the middle of the year.

Table 4-16
Future Demand Projections (ERU)

Year	Customers (ERU at mid-year)	ADD (gpm) Without Conservation	ADD (gpm) With Conservation	PDD (gpm) Without Conservation	PDD (gpm) With Conservation	PHD (gpm) Without Conservation	PHD (gpm) With Conservation
Customer Data							
2007	13,354	2,912	2,912	6,491	6,491	12,940	12,940
2008	13,829	3,016	2,990	6,723	6,667	13,401	13,289
2009	14,321	3,123	3,071	6,962	6,846	13,878	13,646
2010	14,831	3,234	3,153	7,210	7,029	14,372	14,012
2011	15,216	3,318	3,140	7,397	7,000	14,744	13,955
2012	15,611	3,404	3,234	7,589	7,209	15,127	14,371
2013	16,016	3,492	3,280	7,786	7,313	15,520	14,577
2014	16,431	3,583	3,353	7,988	7,474	15,922	14,899
2015	16,858	3,676	3,427	8,195	7,639	16,335	15,227
2016	17,295	3,771	3,502	8,407	7,807	16,759	15,562
2017	17,744	3,869	3,579	8,626	7,979	17,194	15,905
2018	18,204	3,970	3,658	8,849	8,154	17,640	16,254
2019	18,677	4,073	3,738	9,079	8,333	18,098	16,611
2020	19,161	4,178	3,820	9,315	8,516	18,568	16,976
2021	19,453	4,242	3,863	9,456	8,612	18,850	17,167
2022	19,749	4,306	3,907	9,600	8,709	19,137	17,360
2023	20,050	4,372	3,950	9,747	8,807	19,429	17,555
2024	20,356	4,439	3,995	9,895	8,906	19,725	17,752
2025	20,666	4,506	4,040	10,046	9,005	20,025	17,951
2026	20,980	4,575	4,117	10,199	9,179	20,330	18,297

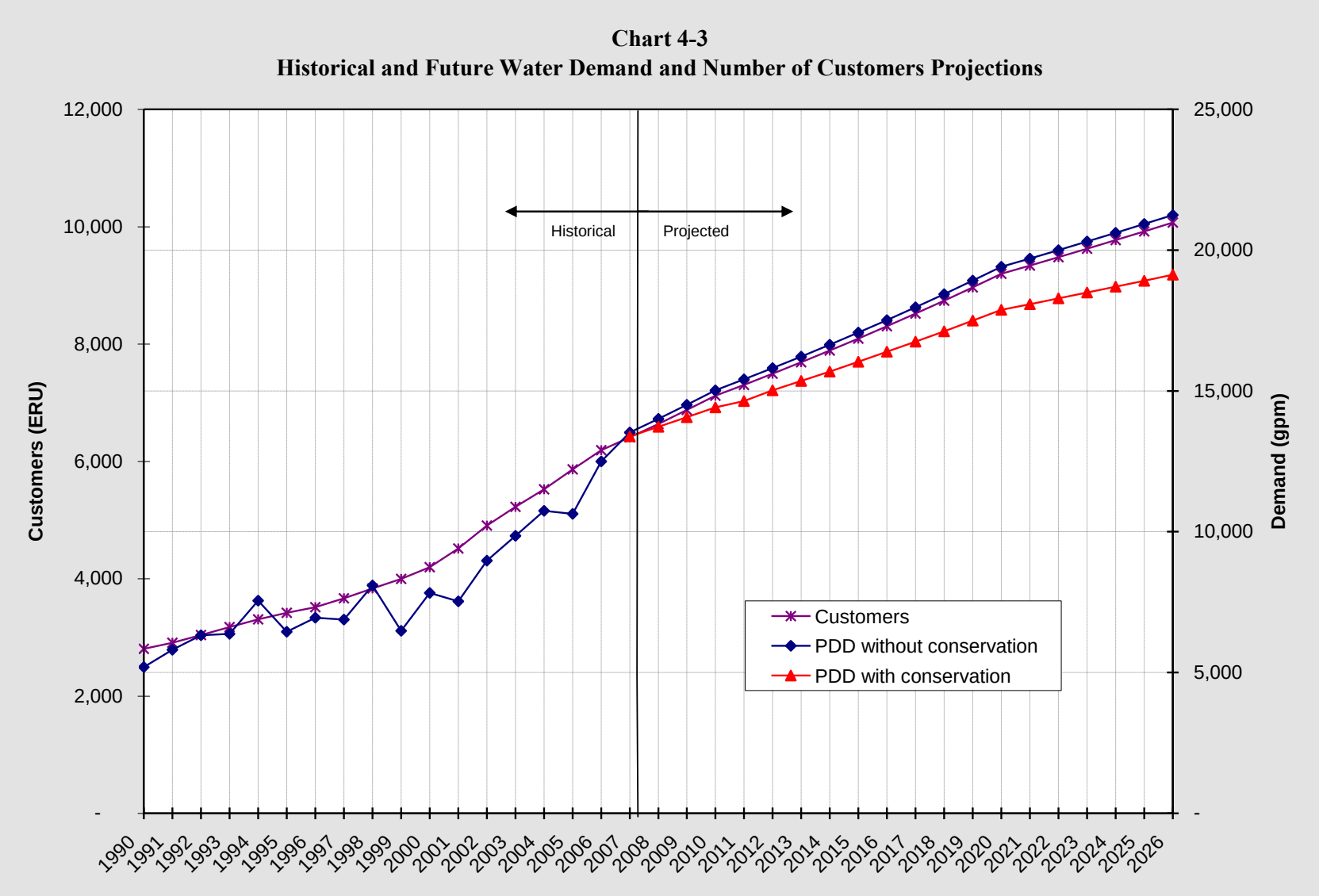


Chart 4-3
Historical and Future Water Demand and Number of Customers Projections
Customers (ERU)
Demand (gpm)
12,000
10,000
8,000
6,000
4,000
2,000
-
25,000
20,000
15,000
10,000
5,000
-
Historical
Projected
Customers
PDD without conservation
PDD with conservation
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026

WATER USE DATA COLLECTION

Requirements and Compliance Status

In an effort to promote water use efficiency, a document titled Conservation Planning Requirements was prepared by the Department of Ecology, Department of Health, and the Washington Water Utilities Council in 1994. A part of this document addresses water use data collection requirements for public water systems. It identifies the minimum data required to project water demand and to provide a basis for evaluating the effectiveness of conservation programs. At least five years of continuous water use data is required. The City has collected and kept on file more than five years of consumption and supply data, which is presented earlier in this chapter.

The water use data collection requirements vary, depending on the size of the water system. The water use data for the City is presented in the tables of this chapter and discussed throughout. The following identifies the data requirements for the City of Bonney Lake and the City's status for meeting these requirements.

Source of Supply Meter Readings

Requirement: Read meters daily and record monthly and annual totals.

Compliance Status: Each of the sources has a meter that is read and recorded on a daily basis. The City also tabulates monthly and yearly totals from this data for each source.

Emergency Interties

Requirement: Collect monthly emergency intertie imported and exported amounts.

Compliance Status: The City collects intertie flow data when the intertie is activated.

Peak Day/Peak Month

Requirement: Record each year's peak day and peak month totals.

Compliance Status: The City has been recording peak day and peak month demand data from the daily and monthly water supply reports and telemetry system data.

Non-Revenue Unaccounted-for Water

Requirement: Record annual totals.

Compliance Status: Non-revenue unaccounted-for water is determined from the annual supply, consumption, and non-revenue accounted-for water data. The annual unaccounted-for water is recorded in this chapter.

Non-Revenue Accounted-for Water

Requirement: Record annual totals.

Compliance Status: Non-revenue accounted-for water is metered water that is used for construction projects, water main flushing and various other purposes. In the last several years, the City has improved the recording of non-revenue accounted-for water. The East Pierce Fire and Rescue District is asked to record water used for training and the Public Works Department is asked to record water used for street sweeping. The Public Works Department records water for construction and water flushing when possible.

Customer Service Meters

Requirement: a) Record monthly totals. Monthly totals may be estimated if water usage is billed less frequently; b) record usage for the following classes: single-family, multi-family, commercial, industrial, government and agricultural. If different classes of users are used, include in water system plan a timetable for when data will be collected for customer classes that is consistent with the above requirements.

Compliance Status: All residential customer meters are currently read every other month and non-residential customer meters are read monthly. In addition, the City has grouped all customers into several classes that meet the requirements stated above.

Population Served

Requirement: Record annually the estimated number of customers and connections served in the residential classes and the number of connections served in each of the other classes.

Compliance Status: The City has been recording the total number of connections in each customer class on an annual basis. The City's Planning and Community Development Department records the City's population on an annual basis. County data is used to estimate the population served outside of the city limits, as illustrated earlier in this chapter and in **Chapter 3**.

Economic Data

Requirement: Record existing water rates for each customer class.

Compliance Status: The City has established water rates for each of the customer classes. The existing water rates information is contained in **Chapter 10** of this plan.

Conservation Data

Requirement: Record annually the type of measure, the level of implementation, the duration of the measure, and the date at which they began.

Compliance Status: A Water Conservation Plan has been prepared as part of this plan and is included as **Appendix C**.

Recommendations

The City's current data collection program meets the requirements of several, but not all of the data collection items listed above. To attain full compliance status, it is recommended that the City plan for the following data collection improvements.

- Improve metering of all non-revenue water usage for construction projects, water main flushing, street cleaning, etc.
- Implement the Water Conservation Plan in **Appendix C** and maintain records of the conservation measures, as required above.
- Add meters at all interties with adjacent water systems.

CHAPTER 5

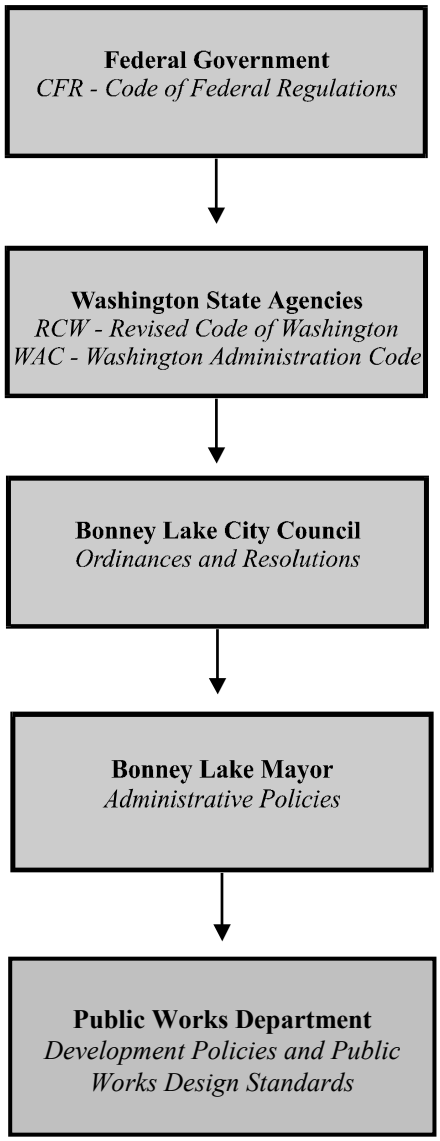
POLICIES AND DESIGN CRITERIA

Previous Lakeridge Tank Booster Pump Station

Current Lakeridge Tank Booster Pump Station

INTRODUCTION

The City of Bonney Lake (City) operates and plans water service for Bonney Lake water service area's residents and businesses according to the design criteria, laws, and policies that originate from the following five sources, listed in descending order from those with the broadest authority to the most narrow:



These laws, design criteria, and policies guide the City's operation and maintenance of the water system on a daily basis, and it's planning for growth and improvements. Their overall objective is to ensure that the City provides high quality water service at a fair and reasonable cost to its customers. They also set the standards that the City must meet to ensure that the water supply is adequate to meet existing and future water demands. The system's ability to meet these demands is detailed in **Chapter 7**, and the recommended improvements are identified in **Chapter 9**.

The highest three entities establishing policies - U.S. Government, Washington State Agencies, and Bonney Lake City Council - dictate requirements that are set by law. The last two entities - Bonney Lake Mayor's Office and the Public Works Department - adopt policies that are not less stringent or in conflict with those established by an entity higher on the list. Law is set by the Federal government through Federal regulations, by the State of Washington in the form of Statutes, and by

City Council in the form of Ordinances. The City's administrative policies are established in the form of memorandums, resolutions, standards, design criteria, and operational procedures, and are based on standard engineering practices and American Water Works Association (AWWA) standards. The City's policies are summarized in this chapter.

It is important to understand that if standards are set too low, customers will not be satisfied, and if standards are set too high, the cost of installing and operating facilities at this level will be unacceptable.

The policies associated with the following categories are presented in this chapter.

- Supply
- Customer Service
- Facilities
- Finance
- Organization

Policies listed below that are italicized are set by Federal or State Law or by City Code; all others are Public Works Guidelines.

SUPPLY POLICIES

Quality Protection

- *The City will require special control measures to protect aquifer recharge zones (16.20.540 and 639 § 6 1991).*
- *Bonney Lake will pursue aquifer protection by developing a wellhead protection program and watershed control program (WAC 246-290-135).*
- *The quality goal of the City is to maintain water quality at a level that equals or is better than water quality in its natural state and that meets or exceeds all water quality laws and standards (WAC 246-290-250 and WAC 246-290-300).*
- *The City will pursue and maintain an active role in protecting the regional environment (16.20.030 and 639 § 6 1991).*
- The City will pursue steps to meet or exceed all water quality laws and standards.
- The City will take all reasonable measures to protect its system and customers.

Cross-Connection Control

- The City has a responsibility to protect the public water system from contamination due to cross-connections. Cross-connections that can be eliminated will be eliminated.
- The City has a cross-connection control program for eliminating cross-connections. A copy of the City of Bonney Lake Cross-Connection Control Plan is contained in **Appendix E**.
- The City has staff that is certified for backflow prevention and testing.

- The City will comply with the backflow prevention assembly installation and testing requirements as indicated in WAC 246-290-490, and as published in the manual entitled Cross Connection Control Manual Accepted Procedure and Practice – Pacific Northwest Section – American Water Works Association (AWWA).

Quantity

- *The City of Bonney Lake will meet or exceed all laws and regulations regarding supply and storage quantities (WAC 246-290-200).*
- The City will observe water rights seniority.
- The City will pursue the acquisition of water rights to meet or exceed water demand at saturation development conditions.
- The City will pursue maximum supply rates as designated by relevant water rights without impacting the regional environment.
- The City is actively pursuing saturation planning for supply sources so that future water resource limitations can be handled effectively and the impacts of limitations can be minimized.
- The City will manage water resources to assure a continued, long-term, high quality supply for homes, commerce, industry and recreation.

Fire Flow Demand

Public agencies adopt fire flow standards for their specific jurisdiction. Since the City provides water service to several other jurisdictions (including Auburn, Sumner and Pierce County), there are different codes that govern minimal fire flow requirements. Therefore, the City will ensure that the minimum fire flow requirements for each jurisdiction are met for each jurisdiction's specific service area. The general fire flow requirements for each jurisdiction are listed in **Table 4-14**. In general, however, the City will plan to provide the following minimum fire flows for future development.

Single-Family Residential:	1,000 gpm for 1 hour duration
Multi-Family Residential:	2,500 gpm for 2 hours duration
Commercial/Schools:	2,500 gpm for 2 hours duration
Industrial:	3,500 gpm for 3 hours duration

The fire flows listed above are slightly more stringent than those required by the County and the City but will be for all areas within the City or that are within unincorporated Pierce County and that are not within another jurisdiction's corporate limits or UGA boundary.

These fire flows represent minimum standards. Specific fire flow design requirements for each development are determined by the Fire Marshal and the International Fire Code Appendix "B", and are based on the size and type of construction of each building.

For areas within the City of Auburn and its proposed expansion area, the City will plan to provide the following minimum fire flows.

Single-Family Residential:	1,500 gpm for 2 hours duration
Multi-Family Residential:	2,500 gpm for 3 hours duration
Commercial/Schools:	2,500 gpm for 3 hours duration
Industrial:	3,500 gpm for 4 hours duration

For areas within the City of Sumner and its UGA, the City will plan to provide the following minimum fire flows.

Medium Density Residential:	1,000 gpm for 2 hours duration
High Density Residential:	1,500 gpm for 2 hours duration
Commercial/Schools:	1,500 gpm for 2 hours duration
Industrial:	3,500 gpm for 3 hours duration

Note that single-family homes greater than 3,500 square feet are required by the building code to have a sprinkler system.

Fire Flow Analysis

Fighting fires test the limits and reliability of any given water system. During fires, an adequate combination of supply, storage, pipeline capacity, and reliability must be available to meet the fire fighting requirements.

According to Insurance Services Office (ISO) criteria, the primary goal of the water system is to provide water to a fire at a sufficient rate and duration to extinguish it. Adequate storage and supply is useless if the transmission or distribution system cannot deliver the water at the required rate necessary to extinguish the fire. To achieve this goal fire flow modeling and analysis should be conducted for all proposed developments during the plan review and permitting process. All fire flow modeling shall test at least the following two scenarios to confirm that adequate fire suppression protection will be available to new developments.

1. Assume that the fire flow demand will be required during a period of peak hour demand and that all major components of the water system are in service.
2. Assume that the fire flow demand will be required during a period of maximum day demand and that a major component of the water system will be out of service, either due to contamination, failure or maintenance. This includes a major water main, storage reservoir, or source of supply.

It is recommended that the following conditions be met for each scenario in conjunction with the recommended fire flow demand:

- Tank levels in the system have been drawn down to the bottom of both equalizing storage volume and the required fire suppression volume.
- System pressures do not fall below 20 psi.
- System pipeline velocities do not exceed eight feet per second.
- System demands and configurations shall be based on the year the development will reach build-out.

Conservation

- *The City may declare a water shortage emergency and take such steps as necessary to conserve water for basic household and domestic uses (13.04.06 588 § 4 1987).*
- *The City shall require the use of efficient water fixtures in all new construction (RCW 19.27.170).*
- The City will promote the efficient and responsible use of water and will conserve during a water shortage.
- The City will maintain their conservation plan based on the Department of Health's and Ecology's *Conservation Guidelines.*

Regional Participation

- *The City will update the Comprehensive Water System Plan and submit for approval from the State every six years (WAC 246-290-100).*
- The City will review the *Comprehensive Water System Plan* every two years and update as necessary.
- The City will stay up-to-date on regional supply activities that reduce the cost of service and that improve reliability, quantity and water quality.

CUSTOMER SERVICE POLICIES

Water Service and Connection

- The City will strive to provide potable water service to the people within the Bonney Lake water service area, provided all policies related to service can be met.
- All proposed developments within the Bonney Lake water service area shall connect directly to the City's water system, unless deemed unfeasible by the City at the time of the request.
- Water system extensions required to provide water service to proposed developments shall be approved by the Department of Public Works and must conform to the City's adopted design criteria, and construction standards and specifications, as shown in the City's Development Policies and Public Works Design Standards. All costs of the extension shall be borne by the developer or applicant.
- For water service applications the City will review the availability for water service at the time of land use permitting, site civil review, and building permit. During the land use permitting process, the City will determine if source of supply water is available for the site. During the site civil review, the City will address the sizing and looping of the water main and how water will be delivered to the site. The formal water service application begins at the time of building permit when fire flow and service sizing is evaluated. The complete process takes several months to be completed.
- Water system capacity will be evaluated at the time of water service application. The City will use the capacity analysis contained in **Chapter 7** of this Plan to evaluate source of supply, storage and water rights capacity available to the applicant.

- Water system source of supply capacity only will be considered when providing water availability to applicants.
- Water availability shall expire per Bonney Lake Resolution 730.

Annexations

- Areas annexed will be served by the City of Bonney Lake at the customer's expense unless accepted by City Council and must meet City of Bonney Lake water standards.
- The City will follow State guidelines in the assumption of facilities in annexation areas.
- The City's water will be mixed with water supplied by other systems only if the water supplied by others meets or exceeds Federal and State water quality requirements.

Temporary Services

- Compliance with quantity and construction standards but not quality standards may be deferred for temporary water service.

Emergency Service

- Compliance with standards may be temporarily deferred for emergency water service.
- Policy criteria may be waived for emergency service.

Planning Boundaries

- *The City of Bonney Lake's water system shall serve all users of water within the City and within the City's water service area subject to appropriate statutes and ordinances and subject to the limitations of the water department's supply and delivery system (13.04.010 588 § 1 1987).*
- *New developments will be required to pay for system extensions. Provisions for late-comer agreements will be allowed (13.04.150 588A § 1 1994 and RCW 35.91.020).*
- *The City may shut off water supply at any time without notice for repairs (13.04.05 588 § 8 1987).*
- With regards to public water service, the City is the lead agency within its service area boundary as designated by the *Pierce County Coordinated Water System Plan*. Therefore, the City accepts ultimate responsibility for providing water service within its service area.
- The City will supply all customers within its water service area limits via direct service only, unless approved otherwise by the City Council.
- The City will extend its system as needed to improve hydraulic conditions for its existing customers.

Satellite System Management

- The City will consider providing satellite system management or ownership services within the City's existing service area.

FACILITY POLICIES

This section describes the planning criteria and policies used to establish an acceptable hydraulic behavior level and a standard of quality for the water system. Additional criteria are contained in the City of Bonney Lake *Development Policies and Public Works Design Standards*, a copy of which is included in **Appendix D** of this Plan.

Minimum Standards

All proposed developments within the City's water service areas shall conform to the City's adopted design criteria, construction standards and specifications.

Pressure

- *A minimum pressure of 30 pounds per square inch (psi) at customer meters shall be provided during normal peak hourly demand conditions, not including fire flow or other emergency demand conditions (WAC 246-290-230 (4)).*
- *During fire flow and other emergency demand conditions, the minimum pressure at customer meters and in the remainder of the system shall not be less than 20 psi (WAC 246-290-420-230 (5)).*
- The City will endeavor to maintain a minimum pressure of 40 pounds per square inch (psi) at customer meters during normal demand conditions, excluding a fire or emergency.
- The City will endeavor to maintain a maximum pressure of 120 psi in the water mains during normal demand conditions, excluding pressure surges. Individual residences are responsible for reducing pressures over 80 psi.
- The City will endeavor to maintain a minimum pressure of 30 psi at customer meters during all demand conditions, excluding a fire or emergency.
- During fire conditions, the minimum pressure at customer meters and throughout the remainder of the system will be 20 psi.
- During a failure of any part of the system, the maximum pressure will not exceed 150 psi.

Velocities

- During normal demand conditions, the velocity of water in a water main should be less than 5 feet per second (fps).
- During emergency conditions such as a fire, and for design purposes, the velocity of water in a water main may exceed 5 fps, but may not exceed 8 fps.

Storage

- Storage within the distribution system must be of sufficient capacity to supplement supply when system demands are greater than the supply capacity (equalizing storage), and still maintain sufficient storage for proper pump operation (operational storage), fire suppression (fire flow storage), and other emergency conditions (standby storage).
- Equalizing storage must be stored above the elevation which yields a 30 psi service pressure to the highest service in the zone, and the City will strive to maintain adequate equalizing storage above an elevation which yields 40 psi.
- Standby storage must be located above the elevation that yields a 20 psi service pressure to the highest service in the zone under peak hour demand conditions.
- Fire flow storage must be located above the elevation that yields a 20 psi service pressure to all services in the zone under peak day demand conditions.
- The City will provide sufficient standby storage for an emergency condition in which a major supply source is out of service. The volume of storage will be sufficient to maintain uninterrupted supply to the system during the emergency condition.
- The City will provide sufficient storage for a fire condition equal to the system's maximum fire protection water demand and the required duration.
- The City will have high-water level and low-water level alarms at the Operations and Maintenance office.
- A water level indicator will be located at the Operations and Maintenance office.
- Storage facilities will be located in areas where they will satisfy the following requirements:
  1. Minimize fluctuations in system pressure during normal demands;
  2. Maximize use of the storage facilities during fires and peak demands; and
  3. Improve the reliability of supply to the system.

Transmission and Distribution

- *Cross connection control shall conform to WAC 246-290-490 and Accepted Procedures and Practices in Cross Connection Control Manual by Pacific Northwest Section AWWA (13.04.200 577 § 2 1986).*
- *All new construction shall be in accordance with the City of Bonney Lake standards for additions to the water system (589D § 1, 1995).*
- Dead-ends without domestic services will not be allowed unless otherwise approved by the City Engineer.
- Dead-end water main extensions that exceed the length of 650 feet or that serve more than 15 single-family homes or 15 multi-family units will not be permitted unless otherwise approved by the City Engineer.

- Unless deemed impractical by the Public Works Department, transmission and distribution mains must be looped to increase reliability and fire flow capacity and to decrease head losses. Looping will typically be required for all water main extensions over 650 feet in length.
- Looping around large commercial or multi-family buildings will be required when necessary to meet Building Code and Fire Department fire hydrant building coverage. Looping shall be to and from a transmission main unless otherwise approved by the City Engineer.
- In most cases, transmission mains will be defined as water mains greater than eight inches in diameter.
- All mains will comply with the generally recognized design criteria from the AWWA and Department of Health guidelines that follow.
    1. All new construction will be in accordance with City of Bonney Lake *Development Policies and Public Works Design Standards*, of which a copy of Section 400 is included in **Appendix D** of this Plan.
    2. Distribution system design assumes that only adequately-sized service line will be used. All residential service lines will be 5/8-inch diameter or larger. Service lines will be the same size as the meter, unless otherwise approved by the City Engineer.
    3. The minimum diameter of distribution mains will be eight inches. All water mains will be ductile iron pipe, unless otherwise approved by the Public Works Department.
    4. All new transmission mains will be sized by a hydraulic analysis conducted by the City or its representative.
    5. All new mains providing fire flow will be sized to provide the required fire flow at a minimum residual pressure of 20 psi and maximum pipeline velocity of eight feet per second during peak day demand conditions. In general, new water mains that will carry fire flow in residential areas shall be a minimum of eight inches in diameter and looped. New water mains in commercial, business park, industrial, and school areas shall be a minimum of twelve inches in diameter, and looped.
    6. Valve installations will satisfy the following criteria.
        a. Zone valves will be located at all pressure zone boundaries to allow future pressure zone realignment without the need for additional pipe construction.
        b. Isolation valves will be installed in the lines to allow individual pipelines to be shut down for repair or installing services. Unless it is impractical to do so, the distance between isolation valves will not exceed 1,200 feet. A minimum of four valves will be provided per cross, and three valves per tee.
        c. Air/vacuum release valves will be placed at all high points, or “crowns”, in all pipelines.

d. Blowoff assemblies shall be located at main dead ends where there is not a fire hydrant. The blowoff assembly shall have a valve the same size as the main with concrete thrust blocking.

e. Individual pressure-reducing or check valves must be installed in all new customer service lines in the system in all pressure zones below the 748 Zone and in areas where normal static pressure exceeds 80 psi. Pressure-reducing valves protect customers from high pressures in case a mainline pressure-reducing station fails.

f. Check valves must be installed on hot water tanks to prevent the tanks from emptying into the City's distribution system when a nearby water main is empty or when the pressure in the main is less than the pressure in the tank. The check valves shall protect the water system from possible contamination caused by a cross-connection with the customer's pipes and fixtures.

7. Fire hydrant installations will satisfy the following criteria.

a. Fire hydrants serving detached single family dwellings or duplex dwellings on individual lots will be located not more than 600 feet on center, such that all lots are within 400 feet from a fire hydrant, as measured along the path of vehicular access.

b. Fire hydrants serving any use other than detached single family dwellings or duplex dwellings on individual lots will be located not more than 300 feet on center, and will be located so that at least one hydrant is located within 150 feet of all structures, but not closer than 50 feet, unless approved by the East Pierce Fire and Rescue or Fire Marshall.

c. One fire hydrant minimum shall be installed per intersection.

d. The East Pierce Fire and Rescue or Fire Marshall will review all proposed fire hydrant installations to ensure the correct number and spacing of fire hydrants for each project per the Fire Department's standards.

e. Fire hydrants require Storz adapter fittings, and the City will retrofit all existing fire hydrants when funding becomes available.

Supply and Booster Pump Stations

- All existing and future booster pump stations will be modified/ constructed to comply with the following minimum standards.

1. All structures will be non-combustible, where practical.
2. All buildings will have adequate heating, cooling, ventilation, insulation, lighting and work spaces necessary for on-site operation and repair.
3. Sites will be fenced to reduce vandalism and City liability.

4. All stations will be connected to the SCADA system for remote monitoring and operation.
5. Each station will be equipped with a flow meter and all necessary instrumentation to assist personnel in operating and troubleshooting the facility.
6. Emergency power capability will be provided at all booster pump stations supplying each pressure zone.

- Pumps will be operated automatically, with flexibility in pump start/stop settings.
- Stations will be operated with the provision for at least two methods of control, to minimize system vulnerability.
- Manual override of stations will be provided for, and located at the Operations and Maintenance office using the City's telemetry and supervisory control system.
- Stations will be monitored with alarms for the following conditions.
    1. Pump started automatically or manually.
    2. Power phase failure.
    3. Power outage/generator running.
    4. Communication failure.
    5. Water in structure.
    6. Low suction pressure.
    7. High and low discharge pressure.
    8. Intrusion.
    9. Smoke detector.
    10. Heat detector.
- Stations will have the following indicators.
    1. Local flow indication and totalizing.
    2. Flow indication and totalizing at the Operations and Maintenance office.
    3. Recording of combined supply flow to the system.
- Booster pump stations will be placed wherever necessary to fulfill the following criteria.
    1. Provide supply redundancy to a pressure zone.
    2. Improve the hydraulic characteristics of a pressure zone.
    3. Maximize storage availability and transmission capacity.
    4. Improve water quality (i.e., increase circulation) and quantity.

Pressure Reducing Stations

- All pressure reducing valves should be placed in vaults that are large enough to provide ample work space for field inspection and repair of the valves. Vaults should be tall enough to allow operating personnel to stand upright.

- Vaults should drain to daylight or be equipped with sump pumps to prevent vault flooding.
- Pressure relief valves should be provided on the low pressure side of the PRV to prevent system over-pressurization in case of a valve failure.
- High pressure alarms should be transmitted to the central control system to alert operating personnel of the PRV failure.

Control

The City's control system must be capable of efficiently operating the water system's components in accordance with this Plan, and in response to reservoir levels, system pressures, and abnormal system conditions.

Maintenance

- Facility and equipment breakdown is given highest maintenance priority. Emergency repairs will be made even if overtime labor is involved.
- Equipment will be scheduled for replacement when it becomes obsolete, and as funding is available.
- Worn parts will be repaired, replaced, or rebuilt before they represent a high failure probability.
- Spare parts will be stocked for all equipment items whose failure will impact the ability to meet other policy standards.
- Equipment that is out-of-service will be returned to service as soon as possible.
- A preventive maintenance schedule will be established for all facilities, equipment, and processes.
- Tools will be obtained and maintained to repair all items whose failure will impact the ability to meet other policy standards.
- Dry, heated shop space will be available for maintenance personnel to maintain facilities.
- All maintenance personnel will be trained to efficiently perform their job descriptions.
- Maintenance will be performed by the water maintenance staff or other approved sources and supervised by the Water Utility Supervisor.
- Written records and reports showing operation and maintenance history will be maintained on each facility and item of equipment.
- Fire hydrants that are no longer serviceable will be given the highest priority for replacement.
- A computerized work management system will be created that schedules recurring maintenance work as well as one time repairs and construction.
- All as-built drawings from the City and private projects shall be entered into a GIS database and be made available to maintenance workers at remote terminals.

Joint-Use

- All joint use facilities must comply with City of Bonney Lake policy and design standards.
- Joint use facilities which supply a portion of the City that cannot be supplied from other sources in the event the joint use facility is out-of-service will be maintained by the City.
- Joint use facilities will be pursued only in those areas that improve reliability or operating costs.

Reliability

- *The City shall ensure that the water system is constructed, operated and maintained to protect against failures of power supply, treatment process, equipment, or structure with appropriate backup facilities (WAC 246-290-4200).*
- Security measures shall be employed to assure the water source, water treatment processes, water storage facilities and the distribution system are under the strict control of the City.
- Supply to the water service area will be pursued to meet peak day demand during a reasonable "worst case" supply system failure.
- Supply to each pressure zone will be provided to meet peak day demand during a reasonable "worst case" supply system failure.
- System demand planning will use historical demand data and assume all available land will be developed at saturation.

Vulnerability

- *The City shall maintain and implement an emergency response plan (WAC 246-290-490).*
- Supply vulnerability analysis will be performed to determine a reasonable "worst case" failure for each pressure zone or new development. The analysis will consider the following conditions.
    1. Failure of the largest source of supply.
    2. Failure of the largest mechanical component.
    3. Power failure to a single power grid.
    4. Reservoir out of service.
    5. Failure of a transmission main.
- Storage vulnerability analysis will be performed to determine a "worst case" failure for each pressure zone. The analysis will consider the following conditions.
    1. Peak day demand with simultaneous fire flow demand.
    2. Peak day demand with largest supply source out of service.

FINANCIAL POLICIES

General

- The City will set rates that comply with State regulations.
- Rates and additional charges established for the City should be:
  1. Cost-based rates which recover current, historical, and future costs associated with the City's water system and services;
  2. Equitable charges to recover costs from customers, commensurate with the benefits they receive;
  3. Adequate and stable source of funds to cover the current and future cash needs of the City.
  4. Do not subsidize the operation of other City departments.
- The existing customers of the City will pay the direct and indirect costs of operating and maintaining the facilities through user rates. In addition, the user rates will include debt service incurred to finance the capital assets of the City.
- New customers seeking to connect to the water system will be required to pay a connection charge for an equitable share of the historical cost of the system and for the system's capital improvement program (CIP). Connection charge revenues will be used to fund the CIP in conjunction with rate revenue.
- New and existing customers will be charged for extra services through separate ancillary charges based on the costs to provide the services. Ancillary charges can increase equitability, as well as increase operating efficiency by discouraging unnecessary demand for services. The charges should be reviewed regularly and updated annually, based on increases in the Consumer Price Index. Revenue from ancillary charges will be used to finance annual operations and maintenance.
- The City will maintain information systems that provide sufficient financial and statistical information to ensure conformance with rate-setting policies and objectives.
- User charges must be sufficient to provide cash for the expenses of operating and maintaining the system. To ensure the fiscal and physical integrity of the utility, each year an amount should also be set aside and retained for capital expenditures, which will cover some portion of the depreciation of the physical plant. The amount may be transferred from the Operations and Maintenance Fund to the Water Improvement Fund for general purposes or for specific purposes.
- A Working Capital Reserve will be maintained to cover unanticipated emergencies and fluctuations in cash flow.
- The City will charge for the actual cost of services, material, and equipment required to make a new connection to the system, (hook-up fee or “meter installation charge”) based on an adopted rate per connection.
- Customers should be classified as single-family, multi-family, commercial, industrial, governmental, irrigation, schools, and fire protection. These are the existing customer classes for the utility.

- The water utility provides fire protection services in addition to water services. A separate cost allocation for fire protection services should be established.
- The City's fees and charges should be calculated for the service area as a whole. Rates will be the same regardless of service location (except for the inside city/outside city distinction).

Connection Charges

Owners of properties that have not been assessed, charged, or have not borne an equitable share of the cost of the water system will pay one or more of the following connection charges prior to connection to a water system.

1. Latecomers Fees: Latecomers fees are negotiated with developers and property owners; they provide for the reimbursement of a pro rata portion of the original cost of water system extensions and facilities.
2. Connection Charge: The connection charge will be assessed against any property that has not participated in the development of the water system. Meter charges, or hookup fees, are additional in order to recover the cost of meter and service line installation.
3. Developer Extension Charges: These charges are for the administration, review, and inspection of a developer extension project.

ORGANIZATIONAL POLICIES

Staffing

- The Public Works Department will promote staff training.
- The Public Works Department utility staffing levels are established by the City Council based on the financial resources of the City and needs of the water utility.
- Personnel certification will comply with State standards. The Assistant Public Works Director and Utility Supervisor shall be certified as a Water Distribution Manager III. The Water Utility Lead worker and at least one other water section employee shall be certified as a Water Distribution Manager II. The City shall have at least one employee certified as a Water Treatment Plant Operator II.

Structure

- The water utility shall be operated as an "enterprise utility" which means it will be financially self-supporting.
- Water utility management is accomplished by the Public Works Department managers.
- The water utility shall operate to administer only the municipal water system. Stormwater, wastewater, and other utilities are not administered in the water utility.
- Water utility customer service is performed by the Public Works Department.
- The Water utility has the responsibility for potable water system operation.

Relationship with Other Departments

- The Finance Department is responsible for customer billing, payment collection, project cost accounting, and fund activity reporting.
- The Administrative Services Department is responsible for employee records, and salary schedules.
- The Planning and Community Services Department, East Pierce Fire and Rescue District, and City Engineer shall establish fire flow requirements.
- The East Pierce Fire and Rescue District uses water utility facilities for fire protection.
- The East Pierce Fire and Rescue District is responsible for emergency responses to hazardous events at water system facilities.
- The Police Department and/or the Public Works Department are responsible for enforcing violations of City water ordinances.
- The East Pierce Fire and Rescue District or its representative is responsible for hydrant fire flow testing under the supervision of the Public Works Department.
- Fire hydrant testing is performed jointly by the East Pierce Fire and Rescue District and the Public Works Department.

CHAPTER 6

WATER SOURCE AND QUALITY

INTRODUCTION

Drilling of Ball Park Well No. 2

The two basic objectives of a water system are to provide a sufficient quantity of water to meet customer usage demands and to provide high quality water. **Chapter 7** discusses the City of Bonney Lake's (City) ability to supply a sufficient quantity of water and identifies future source requirements. This chapter discusses the City's existing water sources, water rights, water quality regulations, and water quality monitoring results.

The City currently relies upon five wells and two spring sources to meet its water demands. Water supply to meet future growth will have to be achieved within the constraints of State water law (not impairing senior water rights) and the Instream Resources Protection Program (*Chapter 173-510 WAC*). For instance, Fennel Creek and most other tributaries to the Puyallup and White Rivers are specifically closed to further consumptive appropriations of surface water. To assess the physical conditions in which new sources of supply must be developed and to begin identifying measures necessary to protect existing sources, an investigation of the region's

geologic and hydrologic characteristics was conducted. The first part of this chapter summarizes the findings and recommendations of the existing water resources investigation, including information on hydrogeology, water quality, and water rights.

EXISTING WATER SOURCES

Five wells and two spring sources comprise the City's current water supply. The initial delineation of recharge areas for each of these sources is based on surface water divides and geomorphology. The seven sources are described below.

Grainger Springs

The Grainger Springs facilities are located in the southwest section of the City. Water emerges from the steep hillside above the Puyallup River at an altitude of about 600 feet which is about 150 feet below the Lake Tapps plateau. The spring water is now collected in a system of underground pipes that discharge to a clearwell. The water is pumped from the clearwell up the hill to the service area. Historically, flows from the springs have ranged from 650 to 1,500 gpm. The lowest recorded flow from this source, 650 gpm, occurred in 1985. Recharge appears to come from an area of approximately 900 acres extending to the east that encompasses Fennel Creek. The City owns all property within a 100-foot horizontal radius from each collection pipe, and this allows the City to protect the immediate recharge area for this water source. The springs are approximately 1,000 feet from the nearest commercial area.

Victor Falls Springs

The Victor Falls Springs are located on Bissan-Scannel Road, east of its intersection with Angeline Road near the southern limits of the City. Springs emerge at an elevation of approximately 480 feet near the toe of the slope in the steep south wall of the Fennel Creek Valley above Fennel Creek. Victor Falls occurs where Fennel Creek flows over the edge of a stratum that resists erosion more than the sediments that underlie it. This stratum is a dense, widespread and nearly flat lying volcanic mudflow deposit that is highly resistant to erosion and relatively impermeable to groundwater. Fennel Creek has swept loose sediment off the top of the dense mudflow deposit and undermined it where the Creek starts spilling down into the Puyallup Valley, thus creating Victor Falls. This mudflow deposit is an aquitard, a geologic unit that is so impermeable that groundwater moves through it very slowly. Consequently, precipitation that infiltrates the ground and becomes groundwater moves down to the mudflow stratum where it is blocked from further downward flow. There it accumulates and builds a groundwater reservoir that overflows at the springs. This groundwater reservoir extends nearly two miles to the southeast of Victor Falls. The City's water supply springs emerge from the south valley wall a short distance above Fennell Creek, and thus they are not recharged by, nor can they become contaminated by Fennel Creek. Surface water drainage patterns and preliminary geologic data indicate that the recharge to this source comes from an area of approximately 500 acres to the east and southeast of the springs. Historically, flows from this source have varied from 540 to 1,700 gpm. The lowest recorded flow of 540 gpm occurred in 1985.

Ball Park Well No. 1

Ball Park Well No.1 is located immediately south of the intersection of 192nd Avenue and 60th Street East, to the southeast of Lake Tapps. The 12-inch diameter well withdraws water through screened intervals installed at depths of 197 to 205 feet and 214 to 231 feet below the ground surface. The top of the saturated zone or water table is 102 feet below ground surface. This well is capable of producing up to 1,300 gpm.

Ball Park Well No. 2 (City Well No. 8)

Ball Park Well No. 2 is located on the northwest corner of the Emerald Hills Elementary School property located on South Tapps Drive East. The 20-inch diameter well withdraws water through a screened interval installed at a depth of 214 to 234 feet below the ground surface. The top of the saturated zone or water table is 135 feet below ground surface. This well is capable of producing 270 to 300 gpm.

Tacoma Point Wells

The Tacoma Point wellfield is located near the north end of Lake Tapps, at 1110 182nd Avenue East. All three wells have a common header so they may be operated as a wellfield. The three wells are described individually below.

Well No. 2

Well No. 2 is a 12-inch diameter well, and it is screened from a depth of 289 to 307 feet below the ground surface. This well is capable of producing 750 gpm. Static water level was recorded at 246 feet below ground surface January 20, 1986.

Well No. 4

Tacoma Point Well No. 4 lies about 200 feet west of Well No. 2. It is also a 12-inch diameter well, and it withdraws water from the same aquifer as Well No. 2 through screens 287 to 310 feet below the ground surface. It is capable of producing approximately 1,000 gpm. Static water level was recorded at 248 feet below ground surface.

Well No. 6

Tacoma Point Well No. 6 lies about 200 feet west of Well No. 2. It is also a 12-inch diameter well, and it withdraws water from the same aquifer as Well No. 2 and 4 through screens 287 to 310 feet below the ground surface. It is capable of producing approximately 1,300 gpm. Static water level was recorded at 248 feet below ground surface.

WATER SUPPLY AQUIFERS

Regional Geology

The regional geologic history of the Bonney Lake area is well known. Sediments deposited by at least four ice sheets that advanced into the Puget Lowland from Canada, and mudflows from Mount Rainier, dominate the stratigraphy of the unconsolidated earth underlying the Lake Tapps plateau. Geomorphic evidence of the most recent glaciation, called the Vashon glaciation, which culminated 14,000 years ago, is well preserved as north-south aligned ridges and troughs and "kame and kettle" topography throughout much of the Bonney Lake region. Outcrops of sediments along roads, in ravines, and on hillsides, and samples of earth acquired during well drilling, permit analysis of the hydrogeologic properties of the glacial drift and volcanic mudflow deposits. The predominant components of the glacial drift are outwash sands and gravels, dense silt and clays of ancient lakes, and dense till (hardpan). Sediments deposited by glacial rivers (outwash) may occur as beds or lenses of gravel and well-sorted sand, and they form aquifers that are very favorable for producing potable water. However, the dense silts, clay, till and volcanic mudflow deposits do not have sufficient intergranular space to store and transmit water in quantities favorable for municipal supply. They form aquitards which confine or place walls between the aquifers or underground reservoirs the City depends upon for water supply.

Description

Previous hydrogeologic investigations and well logs in the region were reviewed to provide an overview of the extent and characteristics of aquifers in the Bonney Lake region (including areas beyond the present boundaries of the City). For this analysis, the region was divided into four quadrants as follows:

Southwest
Township 20 N, Range 5 E: Sections 28, 29, 32, and 33
Township 19 N, Range 5 E: Sections 4, 5, 8, and 9
Southeast
Township 20 N, Range 5 E: Sections 26, 27, 34, and 35
Township 19 N, Range 5 E: Sections 2, 3, 10, and 11
Northwest
Township 20 N, Range 5 E: Sections 4, 5, 8, 9, 16, 17, 20, and 21
Northeast
Township 20 N, Range 5 E: Sections 2, 3, 10, 11, 14, 15, 22, and 23

Topographically, much of the southwest section is characterized by steep slopes. This area contains both Grainger Springs and Victor Falls Springs. A total of 49 wells are located in this region, with productions ranging from 6 to 275 gpm. Several wells with yields of more than 50 gpm withdraw water from a shallow alluvial aquifer less than 100 feet below the floor of the White and Puyallup River valleys. These wells tap an aquifer that occurs at about sea level and which likely underlies much of the ancient floodplain areas of these rivers. This area shows considerable promise for ground water development. However, the cost of pumping this water

up nearly 700 feet to elevations that would serve the City and the cost of long transmission lines required to connect to the City's system may make this an expensive alternative.

East of the White River lies an upland area at elevations between approximately 400 and 650 feet MSL. Production from domestic wells in this area ranges from approximately 4.5 gpm to 210 gpm. These wells appear to tap two principal aquifer systems: (1) a middle aquifer between elevations of approximately 490 and 570 feet MSL which yields between 17 and 70 gpm, and (2) a deeper aquifer system between elevations of approximately 300 to 400 feet MSL with yields of up to about 200 gpm. Production appears to diminish to the east where well yields fall to 10 to 20 gpm.

Southeast

The southeast area lies at elevations between approximately 540 feet and 650 feet MSL. A total of 108 wells, mostly small domestic wells, are recorded with the Department of Ecology. Well yields range from 10 to 40 gpm. Three wells produce 100 gpm or more, with the maximum yield at 211 gpm. This information indicates that this area is not favorable for developing a municipal supply of 500 gpm or more.

Northwest

Of the 39 wells located in the northwestern section of the City, most are relatively low production wells ranging from 4 to 60 gpm. However, the City's three production wells, the Ball Park and Tacoma Park Wells, are located in this quadrant to the northwest and southwest of Lake Tapps, respectively. These deep wells yield approximately 900 gpm. Careful consideration must be given to the potential for interference of these wells with each other and a pump test is planned to measure impacts of water withdrawals on nearby wells. These hydrologic tests will provide the basis for recommendations for further development in this area.

Northeast

The northeasterly portion of the City is dominated by the perched water table of Lake Tapps and steep slopes down to the White River valley. On this portion of the Lake Tapps plateau, 216 domestic wells are reported in the records of the Department of Ecology. Many of these wells are deep (150 to 400 feet) yet yields are generally low. Well production varies from 5 to 200 gpm, with most wells yielding between 20 and 40 gpm.

Additional information on each of the City's existing sources is presented in **Chapter 2** and contained in **Appendix J**.

WATER RIGHTS

Overview

A water right is a legal authorization to use a specified amount of public water for specific beneficial purposes. The water right amount is expressed in terms of instantaneous withdrawal

rate and annual withdrawal volume. Washington State law requires users of public water to receive approval from the Washington State Department of Ecology (Ecology) prior to actual use of the water. This approval is granted in the form of a water right permit or certificate. However, a water right is not required for certain purposes (typically individual residences) that use 5,000 gallons per day or less of groundwater from a well.

The process for obtaining a water right involves obtaining a water right permit first, then a water right certificate. A water right permit provides permission to develop a water right by constructing, developing and testing the water source. A water right permit remains in effect until a water right certificate is issued (if all conditions of the permit are met) or until the permit has been canceled. A water right certificate is issued by Ecology following a review process and determination that the amount of water put to beneficial use is consistent with the amount and conditions indicated on the water right permit. The results of this review are summarized in a public document called the "Report of Examination."

A water right permit is issued by Ecology, only if the proposed use meets the following requirements:

- Water will be put to beneficial use
- No impairment to existing or senior rights
- Water is available for appropriation
- Issuance of the requested water right will not be detrimental to the public's interest

The water right decision process also considers existing basin management plans, stream closures, instream flows, hydraulic continuity (surface water interconnected to groundwater), seawater intrusion, utilization of existing water sources, water conservation, and availability of alternative water supplies, among other things. The water right decision process is increasingly becoming more complex and time consuming, due to the many competing interests for water, environmental issues, and regulatory requirements. At the present time, Ecology is not granting permits for new water rights for surface water or groundwater diversions in watersheds where flows in streams have become too low due to anthropogenic changes in the hydrology. The low flows of Fennel Creek and the White and Puyallup River are senior water rights to any new diversion and they are protected from further impairment by the Instream Resources Protection Program (*Chapter 173-510 WAC*).

Existing Water Rights

The City currently holds water right permits and certificates for its sources of municipal water supply. A summary of this water rights information is presented in **Table 6-1 – *Existing Water Rights***.

The place of use of most of the City's water rights is defined as the area served by the City of Bonney Lake. The 2003 Municipal Water Law defines the place of use as the service area of a municipality. Thus, the place of use for all of the City's water rights (except 3428A, Debra Lake Jane) is the City of Bonney Lake's service area, which extends beyond the City of Bonney Lake's

corporate boundaries. Additional water rights information for each source may be found on the certificates and permits, which are included in **Appendix G**.

Table 6-1
Existing Water Rights

DOH Source No.	Source Name	Permit or Certificate Number	Priority Date	Primary or Supplemental Right	Quantities on Certificate in Bold: Instantaneous (Qi) — Values not in bold are calculated or from ROE (gpm)	Instantaneous (Qi) (cfs)	Annual (Qa) Primary (acre-ft)	Annual (Qa) Supplemental (acre-ft)
S10	Tacoma Point Old Well	C 2809-A	1/23/57	Primary	**100**	0.22	**45**	
S10	Tacoma Point Well No. 2	C G2-26854	2/5/86	Primary	**1,000**	2.23	**800**	
S11	Tacoma Point Well No. 4	P G2-27693	1/30/90	Primary	**1,200**	2.67	**1,600**	
S13	Tacoma Point Well No. 6	Wellfield*		Primary				
S12	Tacoma Point Wells 2, 4, & 6	Wellfield**		Primary				
	sub-total				*2,300*	*5.12*	*2,445*	
S14	Ball Park Well No. 2	C 6671-A	3/4/68	Primary	**270**	0.60	**185**	
S06	Ball Park Well No. 1	C G2-26853	3/5/86	Primary	**1,000**	2.23	**800**	
	sub-total				*1,270*	*2.83*	*985*	
S02	Grainger Springs	C 9328	3/1/61	Primary	85	**0.22**	**22.4**	
S02	Grainger Springs	C S2-20715	1/19/73	Primary/Supplemental	1,500	**3.33**	55	1,945
	sub-total				*1,585*	*3.55*	*77.4*	*1,945*
S01	Victor Falls No. 1	C 6459	10/3/55	Primary	224	**0.50**	360	
S01	Victor Falls No. 2	C 9652	7/2/63	Primary	314	**0.70**	**504**	
S01	Victor Falls No. 3	C 11485	7/2/63	Primary	314	**0.70**	**504**	
S01	Victor Falls No. 4	C S2-00840	8/28/56	Primary	247	**0.55**	403	
	sub-total				*1,099*	*2.45*	*1,771*	
	McDonald Well	C 2679-A	8/28/56	Primary	**30**	0.07	**48**	
	McDonald Well	C G2-22219	4/15/74	Supplemental	**30**	0.07		24
	sub-total				*60*	*0.13*	*48*	*24*
	*Sub-total of Water Rights for City Operated Sources****				*6,314*	*14.09*	*5,326.4*	*1,969*
	Tacoma Intertie				1,390	3.10	1,047.4	
	sub-total				*1,390*	*3.10*	*1,047.4*	
	TOTAL WATER RIGHTS**				**7,704**	**17.18**	**6,373.8**	**1,969**
Other Water Rights								
	Debra Jane Lake	3428A	8/6/1993	Primary, for Lake Level Maintenance	**180**	0.4	**40**	

*There is no specific water right associated with this well. This well is a replacement/backup for well 2 which is bent and it is used by the City to ensure the reliability of full beneficial use under the Tacoma Point water rights well 4 permit.
**Showing of Compliance filed with Ecology certifying that these wells are operated as a wellfield
***The total of 6,314 gpm (14.07 cfs) is taken as the City's total water right. The difference between 14.07 and 14.09 comes from different values for Qi (0.22 cfs and 85 gpm) on Certificate 9328 and other documents for Grainger Spring.

Tacoma Point Wells

The Tacoma Point "old well" (Certificate 2809-A: 100 gpm/45 acre-feet) was not included by Ecology in its last review of the City's water rights (Jill Walsh, review of 1997 WSP) because the Tacoma Point Well 2 (TP2) decision stated that the City will relinquish this water right. However, this water right was never relinquished and Bonney Lake continues to need and use this water by withdrawing the water from the TP2, TP4 and TP-6 wells.

After meeting with Jill Walsh, Ecology agreed not to pursue relinquishment and approved the inclusion of this Certificate in **Table 6-1 – *Existing Water Rights*** as an existing primary water right. The City will submit affidavits of compliance with *RCW 90.44.100* to Ecology for these wells and a well field designation for the TP2, TP4 and TP-6 wells.

Ball Park Wells

Ball Park Well No. 2 is a replacement well within same Tract B as the old Ball Park Well No. 2, and is associated with Certificate 6671. An affidavit of compliance with *RCW 90.44.100* was approved by Ecology on June 29, 2005 (letter to Rick Shannon at the City of Bonney Lake from Jill Walsh at the Department of Ecology) regarding this replacement well. Ball Park Well No. 1 is associated with Certificate G2-26853C. The annual and instantaneous quantities for both these water rights are listed in **Table 6-1 - *Existing Water Rights*** as existing primary water rights.

Grainger Springs

The City of Bonney Lake believes Ecology erred in the determination of the City's future growth demand requirements when this water right for Grainger Springs was determined. The City discussed this with Ecology. The problem was the calculation of future demand using gallons per day per service rather than gallons per day per capita. As a result of the meeting with Ecology, it was agreed that the Grainger Springs water rights are as depicted in **Table 6-1 - *Existing Water Rights***. Specifically, there is a total of 77.4 acre-feet (22.4 acre-feet under C-9328 and 55 acre-feet under C S2-20715) and 1945 acre-feet of supplemental supply (also under C S2-20715). While the water right certificate did not specify primary or supplemental supply, the Report of Exam for C S2-20715 identified 2,000 acre-feet of which 55 acre-feet was primary and the remaining 1945 acre-feet is supplemental. **Table 6-1** reflects the current status of the water right for the Grainger Springs source.

Victor Falls

The City has four water right certificates for its Victor Falls source of supply. The oldest of these, Certificate 6459, does not express an annual quantity (no acre-foot limitation), but merely allows 0.55 cfs (224) gpm. The absence of an annual quantity limitation in a municipal water right certificate was not unusual for certificates issued pre-1970, before the Department of Ecology was created. Such water rights have typically been construed as allowing continuous diversion of the instantaneous quantity year-round, as a primary right. This is especially common with surface water sources where a diversion works is constructed and allowed to divert water continuously as opposed to a ground water well where a pump cycles on and off depending on

system demand. Based on the record of this water right and other related rights, the annual quantity of water associated with water right certificate 6459 is 360 acre-feet. This quantity is included **Table 6-1 - *Existing Water Rights*** as a primary water right.

McDonald Wells

Water rights certificates 2979 and G2-22219 were originally associated with wells in the McDonald Tracts. These wells have not been used for many years; however, municipal water rights are not subject to relinquishment for nonuse. The annual quantity of these water rights, as listed in **Table 6-1 - *Existing Water Rights***, is part of the total annual quantity of all Bonney Lake primary water rights. The City's supplemental water right at Grainger Springs is used, at least partially, as an additional source to withdraw the annual quantity of certificates 2979 and G2-22219.

Other Water Rights

Debra Jane Lake Beautification

Recent water right decisions by Ecology characterize the Jane Lake water right (Certificate 3428) as municipal; however, Bonney Lake changed the purpose of this water right to "Lake Beautification" and it is no longer used for municipal or domestic purposes. This water right is not included in the **Table 6-1 - *Existing Water Rights*** inventory of primary water rights. However, because maintaining lake levels, or Lake Beautification, are a beneficial use of water, the water right is not being abandoned or relinquished. The City may use this water right in the future for another purpose, including municipal, or use it as mitigation for another water right or water right change application.

Water Rights Evaluation

An evaluation of the City's existing water rights was performed to determine the sufficiency of the water rights to meet both existing and future water demands. **Table 6-2 – *Existing Water Rights Evaluation*** compares the combined maximum instantaneous water right amounts of the sources with the peak day demand of the system and the combined maximum annual water right amounts of the sources with the average day demand of the system. As shown in the table, the City has sufficient water rights (both instantaneous and annual amounts) to meet the demands of the existing customers.

Table 6-2
Existing Water Rights Evaluation

Description	Instantaneous Rights Peak Day Demand (gpm)	Annual Rights Average Day Demand (acre-feet)	(MGD)
Total Certificated Water Rights	7,704	6,374	5.69
Existing Water Demand	6,268	4,536	4.05
Surplus (or Deficient) Rights	1,436	1,838	1.64

An evaluation of the production capacity of each source was performed and compared to the source's existing instantaneous water rights to determine the sufficiency of the source to utilize the complete water rights. **Table 6-3 – *Water Rights (Q_i) vs. Production Capacity*** shows the instantaneous water right amounts of the sources and the historic production capacity based on a 9-year period of data.

Table 6-3
Water Rights (Q_i) vs. Production Capacity

Source of Supply	Water Rights		Reliable Capacity		
	Instantaneous (Qi)	Annual (Qa)	Normal	9-year Average	9-year Low
Tacoma Point Wellfield	2,300 gpm	2,445 acre*ft	2,300 gpm	2,300 gpm	2,300 gpm
Ball Park Wellfield[1]	1,270 gpm	985 acre*ft	1,270 gpm	1,270 gpm	1,270 gpm
Grainger Springs[2]	1,585 gpm	77.4 acre*ft	1,200 gpm	880 gpm	740 gpm
Victor Falls Springs	1,099 gpm	1,771 acre*ft	1,099 gpm	980 gpm	750 gpm
McDonald Wells	60 gpm	72 acre*ft	0 gpm	0 gpm	0 gpm
Tacoma Intertie	1,390 gpm	1,047.4 acre*ft	1,390 gpm	1,390 gpm	1,390 gpm
Total	**7,704 gpm**	**6,397.8 acre*ft**	**7,259 gpm**	**6,820 gpm**	**6,450 gpm**

[1]Ball Park recently expanded so reliable capacity assumed at 1,270 gpm

[2]Grainger Springs Qa includes 77 ac*ft primary plus 1945 ac*ft supplemental

Little or no variation of production capacity for the wells is seen seasonally. Although fluctuations in the static water levels of the aquifers and drawdown levels do vary seasonally and with usage, the City is able to withdraw its full water rights year round. However, production capacity at the spring sources typically falls off starting in late summer and usually achieving a low in late fall or early winter, then recovering by late spring. **Table 6-3 - *Water Rights (Q_i) vs. Production Capacity*** lists the production capacity of each source during normal, or maximum production periods, the 9-year average seen at the end of the City's peak demand season (beginning of September), and the historical low that occurred in late fall. See **Table 6-4 – *Spring Source Production Capacity*.**

Table 6-4
Spring Source Production Capacity

Spring Sources - Peak Season Low Flow Rates										
Source of Supply	1998 1-Sep	1999 26-Jul	2000 4-Aug	2001 1-Sep	2002 1-Sep	2003 1-Sep	2004 1-Sep	2005 1-Sep	2006 1-Sep	9-yr Avg
Grainger Springs	930 gpm	900 gpm	890 gpm	740 gpm	930 gpm	870 gpm	840 gpm	870 gpm	950 gpm	880 gpm
Victor Falls Springs	920 gpm	1,100 gpm	1,000 gpm	750 gpm	1,100 gpm	1,100 gpm	820 gpm	1,085 gpm	1,010 gpm	980 gpm
Total	1,850 gpm	2,000 gpm	1,890 gpm	1,490 gpm	2,030 gpm	1,970 gpm	1,660 gpm	1,955 gpm	1,960 gpm	1,860 gpm

An evaluation of the maximum withdrawal from each source is compared to each source's annual water rights to determine the sufficiency of the water rights to meet the City's annual demands. **Table 6-5 – *Water Rights (Q_a) vs. Maximum Withdrawals*** compares the maximum total withdrawal from each source, in this case using data from the year 2006 since it was the largest total demand year, to each source's annual water right. Because Ball Park was recently expanded the 9-year average was not accurate so the reliable capacity is assumed at 1,270 gpm. As shown in the table, the City is currently utilizing only 64 percent of its existing annual water rights.

Table 6-5
Water Rights (Q_a) vs. Maximum Withdrawals

Source of Supply	Annual (Qa)		Max Year (2006)		Percent
Tacoma Point Wellfield	2,445 acre*ft	2.18 MGD	1,504 acre*ft	1.34 MGD	62%
Ball Park Wellfield	985 acre*ft	0.88 MGD	365 acre*ft	0.33 MGD	37%
Grainger Springs	77 acre*ft	0.07 MGD	77 acre*ft	0.07 MGD	100%
Grainger Supplemental	*1,945 acre*ft*	*1.74 MGD*	*864 acre*ft*	*0.77 MGD*	*44%*
Victor Falls Springs	1,771 acre*ft	1.58 MGD	1,151 acre*ft	1.03 MGD	65%
Tacoma Interie	1,047 acre*ft	0.94 MGD	59 acre*ft	0.05 MGD	6%
Total	6,326 acre*ft	5.65 MGD	4,020 acre*ft	3.59 MGD	64%

Table 6-6 – *Future Water Rights Evaluation* summarizes the results of the future water rights evaluation, which compares the water rights of the existing sources with the future 6-year and 20-year demand projections of the system. The analysis considered future demand projections with and without additional water use reductions from planned conservation efforts, as shown in the table. The results of the future water rights evaluation indicate the City has sufficient annual water rights to meet the projected average day demands through 2012, but insufficient instantaneous rights to meet the peak day demands by 2012. Prior to 2026, demand will exceed the available annual and instantaneous water rights. The City should either acquire new water rights or obtain additional wholesale water supply to meet the projected demands.

Table 6-6
Future Water Rights Evaluation

Description	Instantaneous Rights Peak Day Demand (gpm)	Annual Rights Average Day Demand (acre-ft)	Annual Rights Average Day Demand (MGD)
Year 2012 Without Conservation			
Total Certificated Water Rights	7,704	6,374	5.69
Projected (2012) Water Demand	7,589	5,491	4.90
Surplus (or Deficient) Rights	115	883	0.79
Year 2026 Without Conservation			
Total Certificated Water Rights	7,704	6,374	5.69
Projected (2026) Water Demand	10,199	7,379	6.59
Surplus (or Deficient) Rights	-2,495	-1,005	-0.90
Year 2012 With Conservation			
Total Certificated Water Rights	7,704	6,374	5.69
Projected (2012) Water Demand	7,209	5,216	4.66
Surplus (or Deficient) Rights	495	1,158	1.03
Year 2026 With Conservation			
Total Certificated Water Rights	7,704	6,374	5.69
Projected (2026) Water Demand	9,179	6,641	5.93
Surplus (or Deficient) Rights	-1,475	-268	-0.24

Water Rights Planning

The City well facilities currently have the capability to provide supply to the system at their maximum instantaneous water rights. Thus, the facilities are able to fully utilize their existing water rights. The City has sufficient water rights to supply the water system through 2012 and likely beyond, but deficiencies will be encountered prior to 2026. In order to meet the projected future demands, additional water rights or wholesale water supply will need to be obtained. It is more likely that the City will be able to obtain water from the City of Tacoma, Lakewood Water District, Cascade Water Alliance or other purveyors, which will be discussed further in later sections of this chapter and **Chapter 7**. In addition, the City will strive to use its existing water sources efficiently by continuing the current water conservation measures, leaky main replacements, water rate incentives, and implementing other proposed measures, as outlined in the City's Water Conservation Plan, which is included in **Appendix C**.

LONG-TERM WATER SUPPLY PLANNING

The City has emergency interties with the City of Tacoma and the City of Auburn.

Additionally, the City has been negotiating with holders of existing water rights in the Lake Tapps area. Consideration is being given to the purchase of these senior rights for conversion to municipal use from different high use irrigators. Ideally, the City would like to have 15 to 20 percent more water rights than the projected peak day demand level.

SOURCE WATER QUALITY AND TREATMENT

This section describes the water quality treatment provided at each of the sources and also discusses the current and upcoming water quality regulations. The City's 2006 Water Quality Report is includes in **Appendix N**.

Water Quality Treatment

Each of the City's water supply sources receives water quality treatment prior to entering the distribution system. The treatment processes and goals are described briefly for each source below.

Victor Falls Springs

The City chlorinates this source to provide a minimum of a 0.2 mg/l free chlorine residual. The City generates a dilute sodium hypochlorite solution using a process known as on-site generation. This process uses salt, water, and electricity to generate a 0.8 percent sodium hypochlorite solution. Recent improvements include the addition of a large diameter pipeline following injection of the hypochlorite solution in order to provide additional contact time. The City now meets or exceeds the State disinfection requirement of a CT of 6.0 mg/l-min for this source.

Grainger Springs

The City chlorinates this source to provide a minimum of a 0.2 mg/l free chlorine residual. They also adjust the pH to 7.5 in order to optimize the corrosion control treatment for compliance with the Lead and Copper rule. The City uses the same on-site generation process for chlorination as at Victor Falls Springs. Recent improvements include the addition of a large diameter pipeline following injection of the hypochlorite solution in order to provide additional contact time. The City now meets or exceeds the State disinfection requirement of a CT of 6.0 mg/l-min for this source.

The pH adjustment process uses a sodium hydroxide solution. The City is currently preparing to monitor the distribution system for compliance with the Lead and Copper rule.

Ball Park Wellfield

The two well sources at Ball Park are combined together in a common header to receive treatment. The well sources are high in manganese and iron and also have a presence of hydrogen sulfide. The treatment processes for these wells include chlorination using the on-site generation process and filtration with an adsorptive media. The water treatment goals for the facility include non-detection of hydrogen sulfide, a free chlorine residual of at least 0.2 mg/l, and removal of the manganese to less than the MCL.

Tacoma Point Wellfield

All three Tacoma Point wells are combined into a common header pipe for water quality treatment prior to the distribution system. Treatment includes chlorination with a high strength sodium hypochlorite solution and pH adjustment with sodium hydroxide. Chlorination provides a minimum free chlorine residual of at least 0.2 mg/l. pH adjustment for corrosion control will be optimized along with the process at Grainger Springs. The initial target pH is 7.5. As sampling and optimization occurs for the next year, the pH adjustment target may have to be raised.

DRINKING WATER REGULATIONS

Overview

The quality of drinking water in the United States is regulated by the Environmental Protection Agency (EPA). Under provisions of the Safe Drinking Water Act (SDWA), the EPA is allowed to delegate primary enforcement responsibility for water quality control to each state. In the State of Washington, the Department of Health (DOH) is the agency responsible for implementing and enforcing the drinking water regulations. For the State of Washington to maintain primacy (delegated authority to implement requirements) under the SDWA, the State must adopt drinking water regulations that are at least as stringent as the federal regulations. In meeting these requirements, the State, in cooperation with DOH, has published drinking water regulations that are contained in *WAC 246-290*.

Existing Regulations

The Safe Drinking Water Act (SDWA) was enacted in 1974, as a result of public concern about water quality. The SDWA sets standards for quality of drinking water and require water treatment if these standards are not met. The SDWA also sets water testing schedules and methods that water systems must follow. In 1986, the SDWA was amended as a result of additional public concern and frequent contamination of groundwater from industrial solvents and pesticides. The 1986 amendments require water systems to monitor and treat for a continuously increasing number of water contaminants identified in the new federal regulations. EPA regulated approximately 20 contaminants between 1974 and 1986. The 1986 amendments identified 83 contaminants that EPA was required to regulate by 1989. Implementation of the

new regulations has been marginally successful due to the complexity of the regulations and the associated high costs. To rectify the slow implementation of the new regulations, the SDWA was amended again and re-authorized in August 1996.

In response to the 1986 SDWA amendments, EPA established six rules, known as the Phase I Rule, Phase II & IIb Rules, Phase V Rule, Surface Water Treatment Rule, Total Coliform Rule, and Lead & Copper Rule. All of the City's currently active groundwater sources are affected by these rules. EPA regulates most chemical contaminants through the Phase I, II, IIb, and V Rules.

EPA set two limits for each contaminant that is regulated under the rules. The first limit is a health goal, referred to as the Maximum Contaminant Level Goal (MCLG). The MCLG is zero for many contaminants, especially known cancer-causing agents (carcinogens). The second limit is a legal limit, referred to as the Maximum Contaminant Level (MCL). The MCLs are equal to or higher than the MCLGs. However, most MCLs and MCLGs are the same, except for contaminants that are regulated as carcinogens. The health goals (MCLGs) for these are typically zero, because they cause cancer and it is assumed that any amount of exposure may pose some risk of cancer. A summary of each rule follows.

To fully understand the discussion that follows, a brief definition of several key terms is provided below:

- Organic Chemicals – Animal or plant produced substances containing carbon and other elements such as hydrogen and oxygen.
- Synthetic Organic Chemicals (SOCs) – Man-made organic substances including herbicides, pesticides, and various industrial chemicals and solvents.
- Volatile Organic Chemicals (VOCs) – Chemicals, as liquid, which evaporates easily.
- Inorganic Chemicals – Chemicals of mineral origin that are naturally occurring elements. These include metals such as lead and cadmium.

Phase I Rule

The Phase I Rule, which was EPA's first response to the 1986 amendments, was published in the Federal Register on July 8, 1987, and became effective on January 9, 1989. This rule provided limits for eight volatile organic chemicals (VOCs) that may be present in drinking water. VOCs are used by industries in the manufacture of rubber, pesticides, deodorants, solvents, plastics, and other chemicals. VOCs are found in everyday items such as gasoline, paints, thinners, lighter fluid, mothballs, and glue, and are typically encountered at dry cleaners, automotive service stations, and elsewhere in industrial processes.

The City of Bonney Lake currently complies with all regulated chemicals tested under this rule.

Phase II & IIb Rules

The Phase II & IIb Rules were published in the Federal Register on January 30, 1991 and July 1, 1991, and became effective on July 30, 1992 and January 1, 1993, respectively. These rules

updated and created limits for 38 contaminants (organics and inorganics), of which 27 were newly regulated. Some of the contaminants are frequently applied agricultural chemicals (nitrate), while others are more obscure industrial chemicals.

The City of Bonney Lake currently complies will all regulated chemicals tested under this rule.

Phase V Rule

The Phase V Rule was published in the Federal Register on July 17, 1992, and became effective on January 17, 1994. This rule set standards for 23 additional contaminants, of which 18 are organic chemicals (mostly pesticides and herbicides) and 5 are inorganic chemicals (such as cyanide).

The City of Bonney Lake currently complies will all regulated chemicals tested under this rule.

Surface Water Treatment Rule

The Surface Water Treatment Rule (SWTR) was published in the Federal Register on June 29, 1989, and became effective on December 31, 1990. Surface water sources, such as rivers, lakes, and reservoirs (which are open to the atmosphere and subject to surface runoff), and groundwater sources that are under the direct influence of surface water (referred to as GWI sources) are governed by this rule. The SWTR seeks to prevent waterborne diseases caused by microbes, Legionella and Giardia Lamblia that are present in most surface waters. The rule requires disinfection of all surface water sources and GWI sources. All surface water sources and GWI sources must also be filtered unless a filtration waiver is granted. A filtration waiver may be granted to systems with pristine sources that continuously meet stringent source water quality and protection requirements.

The City of Bonney Lake does not currently operate any sources that are classified as surface water or GWI; therefore, this rule does not currently affect the City. Wholesale water from Tacoma is surface water but Bonney Lake is not responsible for operating the treatment facility for this source.

Interim Enhanced Surface Water Treatment Rule

EPA proposed the Interim Enhanced Surface Water Treatment Rule (IESWTR) on July 29, 1994. The final rule was published in the Federal Register on December 16, 1998, and became effective on February 16, 1999, concurrent with the Stage 1 Disinfectants/Disinfection By-products Rule. The rule primarily applies to public water systems that serve 10,000 or more people and use surface water sources or GWI sources. The rule also requires primacy agencies (i.e., Department of Health in Washington State) to conduct sanitary surveys of all surface water and GWI systems, regardless of size. The rule is the first to directly regulate the protozoan Cryptosporidium and has set the MCLG for Cryptosporidium at zero. Water systems affected by this rule needed to comply with it by December 16, 2001.

The City of Bonney Lake does not currently operate any sources that are Surface Waters; therefore, this rule does not currently affect the City.

Long Term 1 Enhanced Surface Water Treatment Rule

This is the follow up rule to the Interim Enhanced Surface Water Treatment Rule, which became effective in December 1998. The final Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) was published on January 14, 2002, and became effective February 13, 2002. The rule addresses water systems using surface water or groundwater under the direct influence of surface water serving fewer than 10,000 people. The rule extends protections against Cryptosporidium for smaller water systems.

The City of Bonney Lake does not currently operate any sources that are Surface Waters; therefore, this rule does not currently affect the City.

Total Coliform Rule

The Total Coliform Rule was published in the Federal Register on June 29, 1989, and became effective on December 31, 1990. The rule set both health goals (MCLGs) and legal limits (MCLs) for total coliform levels in drinking water, and the type and frequency of testing that is required for water systems. The rule requires more monitoring than under the prior requirements, especially for small systems. In addition, every public water system is required to develop a coliform monitoring plan, subject to approval by DOH.

Coliforms are a group of bacteria that live in the digestive tract of humans and many animals, and are excreted in large numbers with feces. Coliforms can be found in sewage, soils, surface waters, and vegetation. The presence of any coliforms in drinking water indicates a health risk and potential waterborne disease outbreak, which may include gastroenteric infections, dysentery, hepatitis, typhoid fever, cholera, and other infectious diseases.

The rule established the health goal for total coliforms at zero. To comply with the legal limit, systems must not find coliforms in more than five percent of the samples taken each month. For systems like Bonney Lake that take 30 samples per month, having more than one sample that contains coliforms would exceed the legal limit and trigger the follow-up sampling requirements.

The City's current water quality and chlorination practices have resulted in compliance with this Rule.

Lead & Copper Rule

The Lead and Copper Rule was published in the Federal Register on June 7, 1991, and became effective on December 7, 1992. On January 12, 2000, the EPA published some minor revisions to the rule in the Federal Register, which primarily improved the implementation of the rule. The rule identifies "action levels" for both lead and copper. An action level is different than a MCL in that a MCL is a legal limit for a contaminant, and an action level is a trigger for additional prevention or removal steps. The action level for lead is greater than 0.015 mg/L. The action level for copper is greater than 1.3 mg/L. If the 90th percentile concentration of either lead or copper from the group of samples exceeds these action levels, a corrosion control study must be

undertaken to evaluate strategies and make recommendations for reducing the lead or copper concentration below the action levels. The rule requires systems that exceed the lead level to educate the affected public about reducing its lead intake. Systems that continue to exceed the lead action level after implementing corrosion control and source water treatment may be required to replace piping in the system that contains the source of lead. Corrosion control is typically accomplished by increasing the pH of the water to make it less corrosive, which reduces its ability to breakdown water pipes and absorb lead or copper.

Lead is a common metal found throughout the environment in lead-based paint, air, soil, household dust, food, and certain types of pottery, porcelain, pewter, and water. Lead can pose a significant risk to health if too much of it enters the body. Lead builds up in the body over many years and can cause damage to the brain, red blood cells, and kidneys. The greatest risk is to young children and pregnant women. Lead can slow down normal mental and physical development of growing bodies.

Copper is a common, natural, and useful metal found in our environment. It is also a trace element needed in most human diets. The primary impact of elevated copper levels in water systems is stained plumbing fixtures. At certain levels (well above the action levels), copper may cause nausea, vomiting, and diarrhea. It can also lead to serious health problems in people with Wilson's disease. Long-term exposure to elevated levels of copper in drinking water could also increase the risk of liver and kidney damage.

The City's monitoring program found that it was in compliance with the lead action level, but was above the copper action level. The City instituted a corrosion control program that first treated water from Tacoma Point Wellfield and more recently started treating water from the Grainger Springs source. Compliance monitoring is ongoing and final results are expected by June 2006.

Radionuclides Rule

EPA established interim drinking water regulations for radionuclides in 1976, under the Safe Drinking Water Act. MCLs were established for alpha, beta and photon emitters, and radium 226/228. Radionuclides are elements that undergo a process of natural decay and emit radiation in the form of alpha or beta particles and gamma photons. The radiation can cause various kinds of cancers, depending on the type of radionuclide exposure from drinking water. The regulations address both man-made and naturally occurring radionuclides in drinking water.

The 1986 amendments to the SDWA finalized the regulations for radionuclides by eliminating the term "interim." The amendments also directed EPA to promulgate (publish as law) health-based maximum contaminant level goals, as well as maximum contaminant levels. EPA failed to meet the statutory schedules for promulgating the radionuclide regulations, which resulted in a lawsuit. In 1991, EPA proposed revisions to the regulations, but a final regulation based on the proposal was never promulgated. The 1996 amendments to the SDWA directed EPA to revise a portion of the earlier proposed revisions, adopt a schedule, and review and revise the regulations

every six years, as appropriate, to maintain or improve public health protection. Subsequent to the 1996 amendments, a 1996 court order required EPA to either finalize the 1991 proposal for radionuclides or to ratify the existing standards by November, 2000.

The final rule was published in the Federal Register on December 7, 2000 and became effective on December 8, 2003. The rule established an MCLG of zero for the four regulated contaminates and MCLs of 5 pCi/L for combined radium-226 and radium-228, 15 pCi/L for gross alpha (excluding radon and uranium), 4 mrem/year for beta particle and photon radioactivity, and 30 ug/L for uranium.

The City of Bonney Lake currently complies will all regulated chemicals tested under this rule.

Wellhead Protection Program

Section 1428 of the 1986 SDWA Amendments mandates that each state develop a wellhead protection program. The Washington State mandate for wellhead protection and the required elements of a wellhead protection program are contained in *WAC 246-290-135* Source Protection, which became effective in July of 1994. In Washington State, DOH is the lead agency for the development and administration of the State's wellhead protection program.

A wellhead protection program is a proactive and ongoing effort of a water purveyor to protect the health of its customers by preventing contamination of the groundwater that it supplies for drinking water. All federally defined Group A public water systems that use groundwater as their source are required to develop and implement a wellhead protection program. All required elements of a local wellhead protection program must be documented and included in either the Comprehensive Water System Plan (applicable to Bonney Lake) or Small Water System Management Program document (not applicable to Bonney Lake).

A copy of the City's Wellhead and Watershed Protection Program is contained in **Appendix H** of this plan.

Consumer Confidence Report

The final rule for the Consumer Confidence Report (CCR) was published in the Federal Register on August 19, 1998, and became effective on September 18, 1998. Minor revisions were posted in the Federal Register on May 4, 2000. The Consumer Confidence Report is the centerpiece of the right-to-know provisions of the 1996 amendments to the SDWA. All community water systems, like Bonney Lake, were required to issue the first report to customers by October 19, 1999. The annual report must be updated and re-issued to all customers by July 1 of each year thereafter.

The CCR is a report on the quality of water that was delivered to the system during the previous 12 months. The reports must contain certain specific elements but may also contain other information that the purveyor deems appropriate for public education. Some, but not all, of the information that is required in the reports, include the source and type of the drinking water, type

of treatment, contaminants that have been detected in the water, potential health effects of the contaminants, identification of the likely source of contamination, violations of monitoring and reporting, and variances or exemptions to the drinking water regulations.

A copy of the City's latest Consumer Confidence Report is contained in **Appendix N** of this plan.

Stage 1 Disinfectants/Disinfection By-products Rule

Disinfection by-products (DBPs) are formed when free chlorine reacts with organic substances, most of which occur naturally. These organic substances (called "precursors") are a complex and variable mixture of compounds. The disinfection by-products themselves may pose health risks. Trihalomethanes is a category of disinfection by-products that has been regulated. However, systems with groundwater sources that serve a population of less than 10,000 people have not been required to monitor for trihalomethanes in the past.

EPA proposed the Stage 1 Disinfectants/Disinfection By-products Rule (D/DBPR) on July 29, 1994. The final rule was published in the Federal Register on December 16, 1998, and became effective on February 16, 1999. The rule applies to the City of Bonney Lake and most other water systems, including systems serving fewer than 10,000 people, which add a chemical disinfectant to the drinking water during any part of the treatment process. The rule reduced the MCL for total trihalomethanes, which are a composite measure of four individual trihalomethanes, from the previous interim level of 0.10 mg/L to 0.08 mg/L. The rule established MCLs and requires monitoring of three additional categories of disinfectant by-products (0.06 mg/L for five haloacetic acids, 0.01 mg/L for bromate, and 1.0 mg/L for chlorite). The rule also established maximum residual disinfectant levels (MRDLs) for chlorine (4.0 mg/L), chloramines (4.0 mg/L), and chlorine dioxide (0.8 mg/L). The rule also requires systems using surface water or groundwater directly influenced by surface water to implement enhanced coagulation or softening to remove DBP precursors, unless alternative criteria is met. Compliance with this rule must be satisfied by December 16, 2001, for large surface water systems (those serving over 10,000 people) and by December 16, 2003, for smaller surface water systems and all groundwater systems (i.e., City of Bonney Lake).

The City of Bonney Lake currently complies will all regulated chemicals tested under this rule.

Arsenic Rule

EPA established interim drinking water regulations for arsenic in 1976, under the Safe Drinking Water Act. Arsenic is highly toxic, affects the skin and nervous system, and may cause cancer. The 1996 SDWA Amendments requires EPA to conduct research to assess health risks associated with exposure to low levels of arsenic. The EPA issued a proposed regulation on June 22, 2000, and allowed a 90 day public review period. The final rule, which was published in the Federal Register on January 22, 2001, was to become effective on March 23, 2001, except for certain amendments to several sections of the rule. However, on May 22, 2001, EPA announced that it was delaying the effective date for the rule until February 22, 2002, to allow time to

reassess the rule and to afford the public a full opportunity to provide further input. On October 31, 2001, EPA implemented the final rule.

The rule sets the MCLG of arsenic at zero and reduces the MCL from the current standard of 0.05 mg/L to 0.01 mg/L. Arsenic's monitoring requirements will be consistent with the existing requirements for other inorganic contaminants. The regulation will require Bonney Lake to meet the lower MCL starting January 23, 2006.

Current monitoring results from the City's sources indicate that the Arsenic level is less than the new MCL; therefore, the City is in compliance with this rule.

Filter Backwash Recycling Rule

The 1996 SDWA Amendments required the EPA to promulgate a regulation governing the recycling of filter backwash water within public water system's treatment processes. Public water systems using surface water or groundwater under the direct influence of surface water, which utilize filtration processes and recycling, must comply with the rule. The rule aims to reduce risks associated with recycling contaminants removed during filtration. The EPA issued a proposed regulation on June 22, 2000, and allowed a 90 day public review period. The final rule was published in the Federal Register on June 8, 2001, and became effective on August 7, 2001.

The rule requires filter backwash water be returned to a location that allows complete treatment. In addition, filtration systems must provide detailed information regarding the treatment and recycling process to the State. The regulation requires compliance with the rule as of December 8, 2003 if filter backwash water was recycled.

The City does not currently operate a surface water filtration facility; therefore, they do not need to comply with this rule.

Future Regulations

The drinking water regulations are continuously changing in an effort to provide higher quality and safer drinking water. Modifications to the existing rules described above and implementation of new rules are planned for the near future. A summary of upcoming drinking water regulations that will most likely affect the City of Bonney Lake is presented below.

Groundwater Rule

In accordance with the 1986 SDWA Amendments, EPA is developing a Groundwater Rule (GWR) that specifies the use of disinfectants for groundwater systems, as necessary. The proposed rule was published May 10, 2000, in the Federal Register. EPA's target date was the spring of 2003 for the final rule, but the rule has not been published to date. The proposed rule requires periodic groundwater sanitary surveys, hydrogeologic assessments of wells, source water monitoring for at risk wells, correction of sensitive wells and/or eliminating the contamination and/or disinfecting, and monitoring of disinfection treatment. It is likely that the rule will require

all public water systems using groundwater to disinfect at each source, unless the system qualifies for a variance or satisfies "natural disinfection" criteria. Natural disinfection criteria considers historical source water contamination, distances to nearest potential source of fecal contamination, groundwater and pathogen travel time, hydrogeologic features, and well construction standards.

The City is currently disinfecting at all sources, so the final rule should have a minimal impact on the City.

Stage 2 Disinfectants/Disinfection By-products Rule

This rule is the second part of the Disinfectants/Disinfection By-products Rule, of which the Stage 1 D/DBPR became effective in February 1999. The Stage 2 Disinfectants/Disinfection By-products Rule (Stage 2 D/DBPR) was published on August 18, 2003, in the Federal Register and the target date for the final rule was summer 2004, but the rule has not been published as of this writing. The EPA is expected to implement this rule simultaneously with the Long Term 2 Enhanced Surface Water Treatment Rule.

Similar to the Stage 1 D/DBPR, this rule applies to most water systems which add a chemical disinfectant to the drinking water during any part of the treatment process. The proposed Stage 2 D/DBPR changes the calculation procedure requirement of the MCLs established in Stage 1 D/DBPR by requiring each sampling location to determine compliance with MCLs based on their individual annual average disinfectant by-product levels (termed the Locational Running Annual Average), rather than utilizing a system-wide annual average. The rule also proposes new MCLGs for chloroform (0.07 mg/L), trichloroacetic acid (0.02 mg/L) and monochloroacetic acid (0.03 mg/L). Additionally, the proposed rule will require systems to document peak disinfectant by-product levels and prepare an Initial Distribution System Evaluation (IDSE) report to identify Stage 2 D/DBPR compliance monitoring sites.

Increased reporting and new MCLGs will likely have an impact on the City, although the current performance on the existing D/DBP Rule indicates that the impact may be minor.

Long Term 2 Enhanced Surface Water Treatment Rule

Following the publishing of the Interim Enhanced Surface Water Treatment Rule, EPA introduced the Long Term 1 Enhanced Surface Water Treatment Rule to supplement the preceding regulations. The second part of the regulations of the Long Term 1 Enhanced Surface Water Treatment Rule, which recently became effective in February 2002, will be mandated in the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). The proposed rule was published in the Federal Register on August 11, 2003. The final rule's target date was summer 2004, after which it was expected to be implemented simultaneously with the Stage 2 D/DBPR described in the previous section. This rule has not been published at the time of this writing. This rule applies to all systems which use surface water or GWI sources.

This rule establishes treatment technique requirements for filtered systems based on their risk level for contamination, calculated from the system's average Cryptosporidium concentration.

Additional requirements will include up to 2.5 log Cryptosporidium treatment in addition to existing requirements under the IESWTR and LT1ESWTR. Filtered systems which demonstrate low levels of risk will not be required to provide additional treatment. Unfiltered systems under this proposed rule must achieve at least a 2-log removal of Cryptosporidium if the source water is monitored for Cryptosporidium and its mean level remains below 0.01 oocysts/L. If an unfiltered system elects not to monitor, or the mean level of Cryptosporidium exceeds 0.01 oocysts/L, the proposed LT2ESWTR will require the system to provide a minimum 3-log removal of Cryptosporidium. All unfiltered systems will also be required to utilize a minimum of two disinfectants in their treatment process.

The LT2ESWTR also addresses systems with unfinished water storage facilities. Under this rule, systems must either cover their storage facilities, provide at least a 4-log virus removal, or perform state-approved risk mitigation. Lastly, the proposed rule extends the requirement of the disinfection profiles mandated under the LT1ESWTR to the proposed Stage 2 D/DBPR.

The City does not currently operate any surface water or GWI sources; therefore, this rule will not currently impact the City.

Radon Rule

In July 1991, EPA proposed a regulation for radon, as well as three other radionuclides. The 1996 SDWA Amendments required EPA to withdraw the 1991 proposal, due to several concerns that were raised during the comment period. A new proposed regulation was published in the Federal Register on November 2, 1999. Comments on the proposed rule were due to EPA by February 4, 2000. Final federal requirements for addressing radon are expected to be implemented in 2003; however, they have not been published to date. The rule proposes a 300 pCi/L MCL for community water systems that use ground water or an alternative, less-stringent MCL of 4,000 pCi/L for water systems where their state implements an EPA-approved program to reduce radon risks in household indoor-air, as well as tap water.

It is not currently known what the implementation of this rule in the State will be and also what the concentrations of radon are in the City's sources. Therefore, the impact of this rule is unknown at this time.

SOURCE WATER QUALITY

This section presents the current water quality standards for groundwater sources and the results of the City's recent source water quality monitoring efforts. A discussion of the water quality requirements and monitoring results for the City's distribution system is presented in the section that follows.

Drinking Water Standards

Drinking water quality is regulated at the federal level by EPA and at the State level by DOH. Drinking water standards have been established to maintain high quality drinking water by limiting the levels of specific contaminants (i.e., regulated contaminants) that can adversely affect public health and are known or are likely to occur in public water systems. Non-regulated contaminants do not have established water quality standards and are generally monitored at the discretion of the water purveyor and in the interest of customers.

The regulated contaminants are grouped into two categories of standards – primary standards and secondary standards. Primary standards are drinking water standards for contaminants that could affect health. Water purveyors are required by law to monitor and comply with these standards and notify the public if water quality does not meet any one of the standards. Secondary standards are drinking water standards for contaminants that have aesthetic effects, such as unpleasant taste, odor, or color (staining). The national secondary standards are unenforceable federal guidelines or goals where federal law does not require water systems to comply with them. States may, however, adopt their own enforceable regulations governing these contaminants. The State of Washington has adopted regulations that require compliance with some of the secondary standards. Water purveyors are not required to notify the public if water quality does not meet the secondary standards.

Source Monitoring Requirements and Waivers

The City of Bonney Lake is required to perform water quality monitoring at each of the active sources for inorganic chemical and physical substances, organic chemicals, and radionuclides. The monitoring requirements that the City must comply with are specified in *WAC 246-290-300*. A description of the source water quality monitoring requirements and procedures for each group of substances is contained in the City's Water Quality Monitoring Plan that is included in **Appendix F** of this plan.

In 1994, DOH developed the Susceptibility Assessment Survey Form for water purveyors to complete for use in determining a drinking water source's potential for contamination. The results of the susceptibility assessment may provide monitoring waivers that allow reduced source water quality monitoring. DOH assigned a high susceptibility rating to the City's spring sources, a moderate susceptibility rating for the Ball Park Well, and a low susceptibility rating for the Tacoma Points Wells, based on the results of the susceptibility assessment survey for each source. A rating of high susceptibility is typically ascribed to spring sources. The high ratings for Victor Falls and Grainger Springs are not substantiated by any water quality or other evidence of surface water contamination.

The sources were granted a susceptibility waiver that allowed the City to avoid monitoring of synthetic organic chemicals (SOCs) during the 1993–1995, 1996–1998, 1999-2001, and 2002-2004 three-year compliance periods. The sources were also granted an inorganic contaminant waiver (IOC) through 2004. Although the City has obtained these waivers, they have historically completed the water quality testing for information purposes.

Source Monitoring Results

The quality of the City's sources has been good and meets or exceeds all drinking water standards, except for slightly higher than allowable levels of manganese at the Ball Park Wells. The City monitored each source for volatile organic chemicals (VOCs), including trihalomethanes, once during each of the two past compliance periods. Monitoring of inorganic chemical and physical substances was accomplished once per year since 1993, although monitoring is only required once every three years. Nitrate monitoring has also been performed once per year since 1993. The results of inorganic chemical (including nitrate) monitoring in April 2002 and volatile organic chemical monitoring in May 2001 for the City's sources indicate that all primary and secondary standards were met. The results of Radionuclide monitoring, which was done in 2000, indicated that all of the City's sources were in compliance with the regulations. As required by the DOH, the City sampled once in 1998 and 2001 for the chemical ethylene dibromide (EDB), which was once commonly used as a pesticide and gasoline additive, and the chemical dibromo-chloropropane (DBCP), which resulted in Bonney Lake meeting the regulatory requirements. Most recently, the City sampled for arsenic in 2002 and found that the levels were well below the maximum contaminant levels, per the new arsenic rule.

DISTRIBUTION SYSTEM WATER QUALITY

Monitoring Requirements and Results

The City is required to perform water quality monitoring within the distribution system for coliform bacteria, disinfectant (chlorine) residual concentration, lead and copper, and asbestos in accordance with *WAC 246-290*. A description of the distribution system water quality monitoring requirements and procedures are contained in the City's Water Quality Monitoring Plan that is included in **Appendix F** of this plan.

The City has been in compliance with all monitoring requirements for the past several years. A summary of the results of distribution system water quality monitoring within the City's system is presented below.

Coliform Monitoring

The City is required to collect a minimum of 30 coliform samples per month from different locations throughout the system, based on a population served of 32,637 in 2006. The results of coliform tests from 2006 were all satisfactory. In 2007 one sample tested positive for coliforms. The cause of the positive sampling was likely due to contamination during collection and handling, since all follow-up samples were satisfactory.

Lead and Copper Monitoring

The Lead and Copper Rule identifies the action level for lead as being greater than 0.015 mg/L and the action level for copper as being greater than 1.3 mg/L.

In accordance with the Lead and Copper Rule (LCR), the City of Bonney Lake conducted three rounds of lead and copper monitoring at their customers' taps from mid-1992 to the end of 1993. The lead action level was never exceeded for the 90th percentile concentration; however, the copper action level was exceeded in two of the sampling rounds and equaled in the third round. As a result, the City had a corrosion control report prepared in 1995. The report determined that the Tacoma Point source supplied the most corrosive water to the system and recommended pH adjustment at that source only.

Upon implementation of corrosion control treatment at the Tacoma Point wellfield, two rounds of lead and copper sampling were conducted. In both rounds, the City did not exceed the 90th percentile action level for copper; however, the Grainger Springs zone-of-influence continued to be subject to copper corrosion and low pH. Therefore, the Department of Health determined that treatment of the Grainger Springs source was required.

In accordance with requirements of the GWI rule, the City conducted water quality and Microscopic Particulate Analyses (MPA) testing at the Victor Falls and Grainger Springs sources. The water quality testing demonstrated that the sources are in "hydraulic connection" with surface water, but the MPA testing showed that they are not considered to be directly influenced by surface water. Therefore, the City is being required by DOH to provide a minimum disinfection CT of 6.0 mg/l-min.

In addition to the evaluation of increasing the CT to an acceptable level, the City is also evaluating the transition from providing disinfection through gas chlorination to using on-site generation of sodium hypochlorite. Other improvements at the sources are also evaluated as part of this report.

After the implementation of the Tacoma Point Corrosion Control Treatment Facility (CCTF) in the year 2000, the City conducted two rounds of lead and copper sampling to determine compliance with the Lead and Copper rule (LCR). The first round of sampling showed that the 90th percentile copper concentrations in the distribution system were less than the MCL of 1.3 mg/l. However, the second round of sampling (conducted during the summer) showed that the 90th percentile was equal to the MCL. More importantly, the sampling results showed that the Grainger Springs zone-of-influence in the distribution system was higher than the MCL. DOH determined that in order to provide an equal level of water quality for all customers in the distribution system, the City must provide corrosion control treatment for the Grainger Springs source.

By the summer of 2005, the City's treatment process at the Grainger Springs source will adjust pH to reduce lead and copper levels. Monitoring in 2002, which included 40 homes, indicated a range of 0.000 mg/L to 0.006 mg/L for lead and a range of 0.039 mg/L to 0.416 mg/L for copper. Another two rounds of lead and copper samples will be collected after the new facility is on-line.

GWI Testing

Groundwater under the direct influence of surface water (GWI) testing was conducted in several stages. The first stage of water quality sampling results were analyzed by the Department of Health in December 2000, and it was determined that the Victor Falls Springs and Grainger Springs sources were considered to be in "hydraulic connection" with surface water and that they may be under the direct influence of surface water. DOH required a second round of testing that consisted of Microscopic Particulate Analyses (MPA) of samples collected at two different times during the year from each spring collection box at Victor Falls Springs and from Grainger Springs.

The results of the MPA testing indicated to DOH that the sources are not considered to be directly influenced by surface water. Therefore, the City does not have to proceed with providing a level of treatment equivalent to surface water treatment for the spring sources. However, since the sources are considered to be in "hydraulic connection" with surface water, the level of CT must be increased to six in order to comply with DOH regulations. The CT of six is a level of disinfection required prior to the first customer receiving water from a source of supply. In systems that chlorinate the water, CT is equal to the concentration of the available chlorine in the water times the amount of contact time prior to the first customer.

Disinfection

The City transitioned from gas chlorination to the on-site generation of sodium hypochlorite process. In this process, a brine solution is pumped through electrolytic cells where it reacts to form liquid sodium hypochlorite and hydrogen gas. The dilute (0.8 percent) sodium hypochlorite solution is stored in a day tank and the small quantity of hydrogen gas generated is vented outside of the building. The dilute hypochlorite solution is injected into the water main from the day tank via a metering pump. According to the manufacturer, the on-site generation process requires approximately 2.5 kWh, 15 gallons of water, and 3.5 pounds of salt per pound equivalent of chlorine generated.

Asbestos

Asbestos monitoring is required if the sources are vulnerable to asbestos contamination or if the distribution system contains more than 10 percent of asbestos cement (AC) pipe. Although none of the City's sources are susceptible to asbestos contamination, AC pipe composes more than 10 percent of the City's distribution system. Therefore, the City must monitor for asbestos in the distribution system. The current MCL for asbestos is 7 million fibers per liter and greater than 10 microns in length. Monitoring must be accomplished during the first three-year compliance period of each nine-year compliance cycle. The water sample must be taken at a tap that is served by an asbestos cement pipe under conditions where AC contamination is most likely to occur. The City's most recent sample in 1999 did not contain asbestos contamination.