CHAPTER 2

BASIC PLANNING DATA AND WATER DEMAND FORECASTING

OBJECTIVE

Basic planning data is an essential component of a Water System Plan. The objective of this chapter is to present basic planning data and water demand forecasts needed to assess the current and future capabilities of the water system. This chapter will provide existing and future population and service connection projections, water use data, and develop the water demand associated with the planning element known as an equivalent residential unit (ERU).

The water use data and water demand forecasts found in this chapter comprise two of the three elements required for the development of a conservation program. The third required element is the implementation of a conservation program, which is discussed in Chapter 4.

CURRENT POPULATION AND NUMBER OF SERVICE CONNECTIONS

RESIDENTIAL POPULATION

The service area is within unincorporated King County. Zoning is controlled by the County in compliance with the GMA. The total number of lots available per current zoning is estimated to be about 2,550. Some of these lots may not be buildable due to steep slopes or wetlands. Each lot is, however, considered to be a possible service. The average population per residential services is assumed to be approximately 3.2 persons based on School District #410 data. Sallal wholesales water to Wilderness Rim, which currently serves 633 homes. Table 2-1 provides an overview of the total number of services and population served in the combination of the Association's and Wilderness Rim's service areas by year from 2004 through 2007.

TABLE 2-1

Sallal Service Area Population

Year	Service Connections[(1)]	Population
2004	2,036	6,546
2005	2,056	6,640
2006	2,074	6,698
2007	2,092	6,756

(1) Includes 633 connections from Wilderness Rim.

TOTAL SERVICE CONNECTIONS

Table 2-2 provides the number of service connections within the water system by customer class. There are two master meters which serve the Wilderness Rim subdivision, and the two connections are represented here as 633 residential connections.

TABLE 2-2

Sallal Service Connections

Year	Residential[(1)]	Commercial	Irrigation	Total
2004	1999	28	9	2036
2005	2018	29	9	2056
2006	2036	28	11	2074
2007	2049	31	12	2092

(1) Includes 633 connections from Wilderness Rim.

CURRENT WATER USE

PRODUCTION HISTORY

Table 2-3 provides a record of total water production for the period 1995 through 2005.

TABLE 2-3

Annual Water Production

Year	Total Production (gallons)	Average Daily Production (gallons)
1995	180,929,119	495,696
1996	178,349,068	487,293
1997	205,970,648	564,303
1998	192,639,916	527,781
1999	184,841,119	506,414
2000	188,834,870	515,942
2001	167,908,719	460,024
2002	181,456,600	497,141
2003	191,077,482	523,500
2004	181,394,750	495,614
2005	171,799,727	470,684
2006	180,960,865	495,783
2007	180,118,048	493,474

Table 2-4 provides a breakdown of the water produced in the system by each of the three wells for 2004 through 2007.

TABLE 2-4

Annual Water Production by Well (gal)

Year	Well No.1	Well No.2	Well No. 3	Total
2004	76,646,012	83,562,035	21,186,703	181,394,750
2005	77,255,011	81,128,005	13,416,711	171,799,727
2006	88,984,332	73,863,025	18,113,508	180,960,865
2007	52,736,491	107,717,026	19,664,531	180,118,048

AVERAGE DAY DEMAND

Average day residential demand (ADD) is defined by DOH means "the total quantity of water use from all sources of supply as measured or estimated over a calendar year divided by 365" (WAC 246-290-010 – Definitions). The value to be used for projecting future system demands must be judiciously determined in order to avoid either an understatement or an overstatement of projected demands. Using a single year of data could produce widely varying projections depending upon the individual year selected as the base. Therefore, the use of longer-term averages is considered to provide a more reasonable approach. Table 2-5 provides the Association's average day production and average day production on a per capita basis.

TABLE 2-5

Average Day Production and Water Production per Capita

Year	Estimated Service Area Population	Average Day Production (gpd)	Estimated per Capita Production (gpcd)
2004	6,575	495,614	75
2005	6,640	470,684	71
2006	6,698	495,783	74
2007	6,756	493,474	73

CONSUMPTION HISTORY

Table 2-6 provides the consumption by class of service within the water system for the period of 2004 through 2007.

TABLE 2-6

Total Water Consumption by Service Class (gal/yr)

	Residential[(1)]	Commercial[(2)]	Irrigation	Total
2004	160,457,422	5,962,368	443,564	166,863,354
2005	156,662,616	8,188,356	290,972	165,141,944
2006	162,694,488	8,805,456	1,103,300	172,603,244
2007	149,185,211	7,195,359	6,251,248[(3)]	162,631,818

(1) Includes 633 connections from Wilderness Rim.
(2) Includes Truck Town supplemental usage.
(3) 2007 Irrigation Consumption includes water used to establish new landscaping for new Twin Falls Middle School.

The Association's commercial consumption has fluctuated in large part due to water use by the Truck Town development at the east end of the system. This development has its own well and uses water from the Association to supplement its well. Recent problems with the Truck Town well have resulted in some additional usage of water from the Association.

In 2007, a large volume of irrigation water was used upon completion of the new Twin Falls Middle School to help establish the newly planted landscaping. The irrigation use of the School is anticipated to decrease as the landscaping becomes more established.

UNMETERED WATER

Unmetered water is the metered source production less the metered consumption of water. This difference is due to leaks in the system and unmetered uses such as unauthorized water use, faulty meters, flushing of mains and fire flows. Water used for flushing or fire flows that is estimated or measured is removed from the calculation of unmetered water. Table 2-7 provides the Association's unmetered water use for the period 2004 through 2007.

TABLE 2-7

Unmetered Water

	Production (gal/yr)	Consumption (gal/yr)	Percent Unmetered
2004	181,394,750	166,863,354	8.0%
2005	171,799,727	165,141,944	3.9%
2006	180,960,865	172,603,244	4.6%
2007	180,118,048	162,631,819	9.7%
Average	178,568,348	166,810,090	6.6%

The Association's unmetered water volume is less than 10 percent of the production volume, and will meet the new DOH requirements.

PEAKING FACTORS

In order to project future maximum day demand and peak hour demand, peaking factors are used. The ratio between average day demand and peak day demand is not the same each year. A peaking factor is a ratio between average day and maximum day based on historical system data, or other data, if system specific data is not available.

Maximum Day Demand

The Association does not record its production or consumption in a manner that readily provides a comparison of peak day to average day water use. The DOH Water Design Manual provides a maximum day demand factor of 2 as a reference point. Using the monthly production data for the period 2004 through 2007, the average monthly production for the Association was 14.88 million gallons. The maximum monthly water produced by the system was in August 2004, during which 29.89 million gallons were produced. This provides a maximum month to average day peaking factor of approximately 2.0. The previous report, *Edgewick and Middle Fork System Capacity and Storage Improvements Predesign Report,* used a peak day factor of 2.25. For the purposes of this report, a 2.25 peak day factor will be used.

Peak Hour Demand

The maximum quantity of water consumed over a 1-hour period during a maximum day demand is termed the peak hour demand. The Association does not have precise records of peak hour demand. If precise records of peak hour demand are not available, the peak hour demand is often expressed in terms of a peaking factor. The peaking factor for the peak hour demand is defined as the ratio of peak hour demand in gpm to the maximum day demand expressed in gpm. It is generally accepted that peak hour factors range from 1.5 to 2.5. The DOH *Water System Design Manual* provides a methodology for calculating peak hour demand (PHD). The equation has been structured to accommodate the ranges of peak hourly to maximum daily demand ratios reported as a function of system size in the literature and by various water systems in Washington. The generalized equation is as follows:

$$PHD = (MDD/1440)[(C)(N) + F] + 18$$

Where:

PHD = *Peak Hourly Demand, (gallons per minute, gpm)*
C= *Coefficient Associated with Ranges of ERUs*
N= *Number of Service Connections, ERUs*
F= *Factor Associated with Ranges of ERUs*
MDD= *Maximum Day Demand, (gpd/ERU)*

The values for C and F in the peak hour demand formula are taken from the DOH *Water System Design Manual*, Table 5-1, page 5-8. For the Association, C is equal to 1.6 and F is equal to 225. Based on the 2004 maximum day demand and the above formula, the Association's maximum day to peak hour factor is approximately 1.7.

EQUIVALENT RESIDENTIAL UNIT

The use of Equivalent Residential Units (ERUs) is a method of comparing water use of residential customers to the average water use of non-residential customers. An ERU is computed by dividing total volume of water consumed by single-family units by the number of this class of water users.

Current ERU Calculation

Table 2-8 presents the water use per ERU. The water used by an ERU is calculated by taking the total residential consumption and dividing it by the number of residential connections in the system. The residential connections include the 633 connections associated with the Wilderness Rim system. Table 2-9 provides an estimate of ERU water consumption for the Association by year from 2004 to 2007, and the average of these 4 years.

TABLE 2-8

Equivalent Residential Units

Year	Residential Consumption (gal)	Residential Connections	Consumption/ERU	Production/ERU[(1)]
2004	160,457,422	1,999	219	233
2005	156,662,616	2,018	213	227
2006	162,694,488	2,036	219	233
2007	149,185,211	2,049	199	212
		AVERAGE	213	227

(1) Includes unmetered water at 6.6 percent (see Table 2-7).

The value of an ERU averages to 213 gallons consumed per day per residential connections. As indicated, water use per ERU can fluctuate from year to year based on consumption patterns, weather and other factors.

Current Number of ERUs

The total number of ERUs within the system is calculated by dividing the consumption of the non residential customer classes by the water use value of the ERU. This provides an overall number of ERU that are being served. Table 2-9 provides the conversion to the total number of ERUs by customer class including unmetered water. Based upon a 4-year average water use the average water consumption is 213 gpd/ERU (Table 2-8). Assuming a value of 213 gpd/ERU the estimated amount of ERUs in the system will vary from year to year depending upon water use (Table 2-9). For the purposes of this report, the average of the number of ERUs calculated for 2006 and 2007 is used as a basis to project future growth.

TABLE 2-9

Total Number of Equivalent Residential Units

Year	Residential		Commercial		Irrigation		Unmetered		Total ERUs
	Consumptions (CF/yr)	ERUs[(1)]	Consumption (CF/yr)	ERUs[(1)]	Consumption (CF/yr)	ERUs[(1)]	Consumption (CF/yr)	ERUs[(1)]	
2004	21,448,660	2,058	797,108	76	59,300	6	1,942,700	186	2,327
2005	20,941,400	2,015	1,094,700	105	38,900	4	890,078	86	2,210
2006	21,747,690	2,093	1,177,200	113	147,500	14	1,117,329	108	2,328
2007	19,941,881	1,919	961,946	93	835,728	80	2,337,731	225	2,317

(1) Based on 213 gpd/ERU consumption.

TOTAL DEMAND PER ERU

The effect of unmetered water upon the value of the ERU can have a profound effect upon future planning. As indicated in Table 2-9, the number of ERUs associated with unmetered water varies by year. The actual quantity of unmetered water and the total production quantity both affect the impact this component of system demand has on the water use projections, particularly when peaking factors are involved. With the relatively low percentages of unmetered water indicated in Table 2-7, and the variability in the number or ERUs represented by the unmetered water in Table 2-9, ALL FUTURE WATER USE PROJECTIONS IN THIS REPORT WILL UTILIZE THE TOTAL WATER PRODUCTION PER ERU, 227 GPD/ERU, AS THE BASIS FOR THE PROJECTIONS.

FUTURE WATER USE

Projection of Future Services

The Association has seen moderate growth in the number of service connections. However, the Wilderness Rim area is essentially built out (633 of 640 proposed lots). From the December 2003 report, *2003 Population and Employment Forecasts, Central Puget Sound Region*, the Puget Sound Regional Council has predicted population growth of approximately 0.5 percent for the North Bend, Snoqualmie, and East King County area. This was done through the Forecast Analysis Zones (FAZ) whose designations for the area are FAZ6506 Snoqualmie/North Bend and FAZ 6910 East King County. This growth rate appears to be low based on the past experience in the area. Expected rezoning and the installation of sewer service is expected to increase the growth in the Association's service area. For the production and demand analysis in Chapter 2 and Chapter 3, a growth rate of 3 percent will be used. Table 2-10 shows the growth in customers in the water system through 2025.

In the calculations of growth for the system, the growth rate was applied to all connections within the Association service area, although the connections associated with Wilderness Rim will not contribute to any growth due to the area being essentially at the maximum number of connections with 633. This approach may overestimate the actual growth observed by the Association over time; however, it is also a more conservative approach in terms of assuring the ability to serve future growth.

TABLE 2-10

Projection of Equivalent Residential Units

Year	Number of ERUs[(1)]
2008[(1)]	2,392
2009	2,464
2010	2,538
2011	2,614
2012	2,692
2015	2,942
2020	3,411
2025	3,954

(1) The estimated number of ERU in 2008 is the average of that calculated for 2006 and 2007 plus 3 percent growth.

Water Demand Projections

Water demand projections are calculated by using the ERU projections found in Table 2-10. Using the previously determined value of 227 gallons per day per residential connection, Table 2-11 calculates the projected average day demand for the Association. In addition, the peaking factors previously discussed are applied to show the projected maximum day demand and the peak hour demand for the water system.

TABLE 2-11

Projection of Future Water Production

Year	Number of ERUs	Average Day Demand (gpd)[(2)]	Maximum Day Demand (gpd)[(3)]	Peak Hour Demand (gpm)[(4)]
2008	2,392[(1)]	542,984	1,221,714	1,455
2009	2,464	559,328	1,258,488	1,496
2010	2,538	576,126	1,296,284	1,538
2011	2,614	593,378	1,335,101	1,581
2012	2,692	611,084	1,374,939	1,626
2015	2,942	667,834	1,502,627	1,767
2020	3,411	774,297	1,742,168	2,034
2025	3,954	897,558	2,019,506	2,342

(1) The estimated number of ERUs in 2008 is the average of that calculated for 2006 and 2007 plus 3 percent growth.
(2) Number of ERUs * ERU value of 227 gpd/ERU which includes unmetered water.
(3) Maximum Day Demand(MDD) = ADD*MDD Peaking Factor (2.25).
(4) Peak Hour Demand = (MDD*/1440)[(C)(N)+F]+18) (See text for factors).

TABLES