3. PLANNING DATA AND DEMAND

General planning information for the utility is given in this chapter. A discussion of the State Growth Management Act and its influence upon the utility service area is provided. It is followed by a summary of current and future land uses, current and future population, water use characteristics and demand forecast.

3.1 GROWTH MANAGEMENT ACT

The State Legislature passed the Growth Management Act (GMA) in 1990 to require local governments in rapidly growing cities and counties to plan for projected growth. The GMA encourages urban growth areas (UGA) that can be supported with adequate facilities, and it encourages setting aside other areas for rural uses and resource protection. Local communities are required to design UGAs to include "areas and densities sufficient to accommodate the county's expected growth for the succeeding 20 years" (GMA, Section 12, RCW 36.70A.12)). Communities will review and revise their plan every ten years to assure that projected growth can be accommodated.

The City has established UGAs, and Lewis County has folded their planning boundaries into the county comprehensive plan. These growth boundaries have been coordinated with the water utility service area to assure support of the community's planned growth without decreasing the level of service to our customers.

3.2 SERVICE AREA

The County provides water service to customers within the water service area shown in Figure 1.1. This area is made up of land within the City limits, City UGA and Lewis County. This service area is not anticipated to change in the foreseeable future.

3.3 LAND USE AND ZONING

A summary of the existing and future land use of the service area is provided in Table 3.1 and Figure 3.1. A comprehensive discussion of the City's UGA and land use is available in the City of Vader's Comprehensive Plan, 2010. Information for land use in the service area was from Lewis County GIS. No change in land use is projected.

TABLE 3.1 – LAND USE DISTRIBUTION

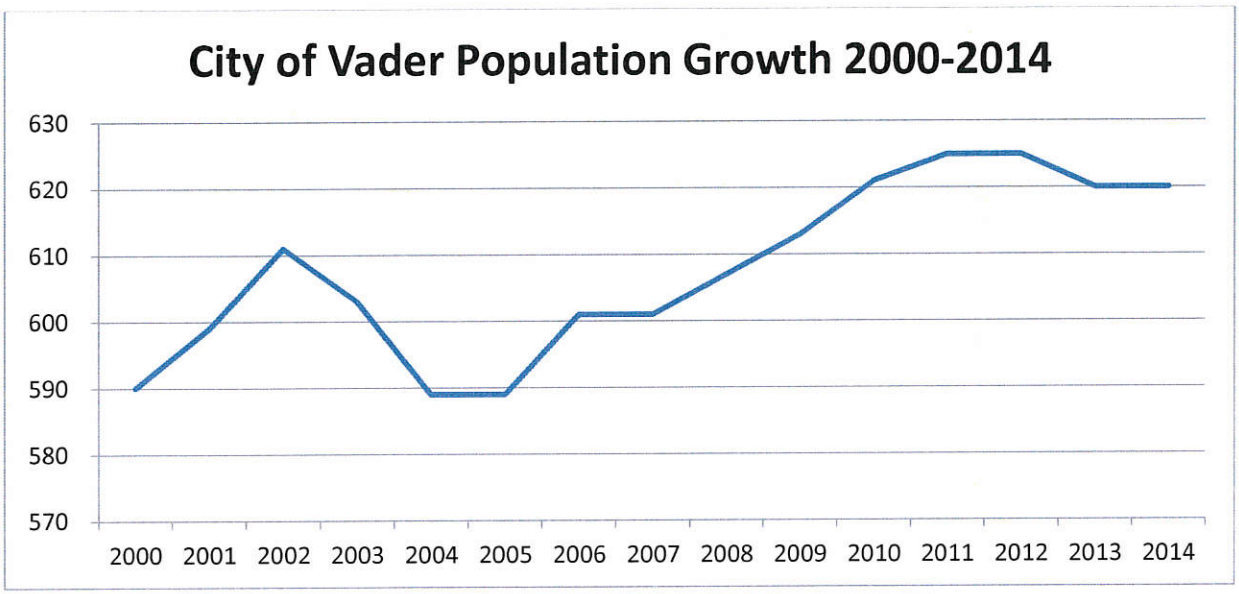
LAND USE DESCRIPTION	EXISTING		FUTURE	
	ACREAGE	PERCENT	ACREAGE	PERCENT
Residential	960.9	82.8	960.9	82.8
Commercial	120.7	10.4	120.7	10.4
Industrial	31	2.7	31	2.7
Community Services	47.3	4.1	47.3	4.1
TOTAL	1159.9	100.0	1159.9	100.0

3.4 POPULATION

3.4.1 Historical Population

The State Office of Financial Management (OFM) estimates the population within each county using U.S. Census Bureau data. County and city governments in each county then allocate the projected population to the cities and unincorporated areas in their county.

The city population in the last fourteen years ranged from 589 to 625 people. The peak population was 625 in 2011 and 2012, and it dropped to 620 in 2013 and 2014. The line graph shows the historical trend in population growth for the City of Vader based using OFM data.



Our service area also includes EVCC and county UGA areas of which populations in these areas are listed in OFM's category of unincorporated Lewis County. These areas represent a small portion of unincorporated Lewis County. The unincorporated county population values were analyzed to see if the Vader growth followed a countywide trend and if any growth was projected in the unincorporated areas. The data shows a trend of insignificant population growth in the last three years similar to the Vader graph. The population data is also presented in Table 3.2.

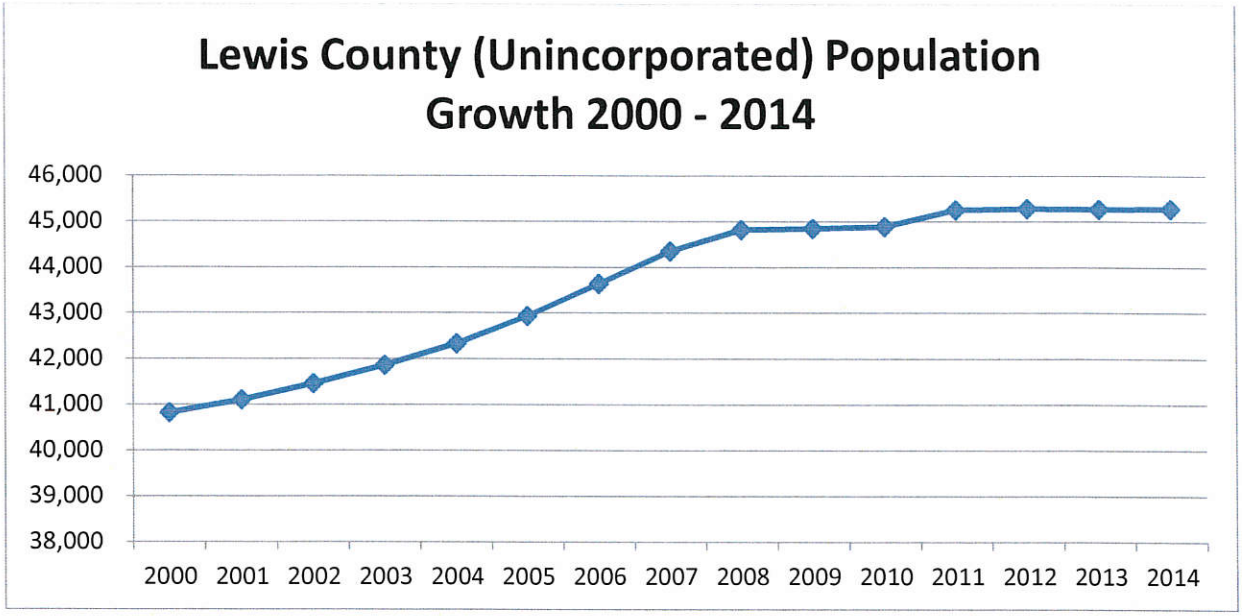


TABLE 3.2 – HISTORICAL POPULATION				
	CITY OF VADER		LEWIS COUNTY, UNINCORPORATED	
YEAR	POPULATION	ANNUAL GROWTH (%)	POPULATION	ANNUAL GROWTH (%)
2000	590	-	40,821	-
2001	599	1.5	41,102	0.7
2002	611	2.0	41,456	0.9
2003	603	-1.3	41,856	1.0
2004	589	-2.3	42,334	1.1
2005	589	0	42,935	1.4
2006	601	1.8	43,637	1.6
2007	601	0	44,352	1.6
2008	607	1.0	44,822	1.0
2009	613	1.0	44,849	0.06
2010	621	1.3	44,892	0.09
2011	625	0.6	45,260	0.8
2012	625	0	45,285	0.05
2013	620	-0.8	45,270	-0.03
2014	620	0	45,280	0.02

The water system serves residents in the EVCC area which is outside of Vader limits. The EVCC water system, before it was purchased and included into the Vader system, was approved for 107 connections according to DOH records. Since operation of the system, the number of accounts in EVCC has ranged from 89 to 102 accounts with an average of 96 accounts. This information is based on utility billing records with a higher degree of confidence placed on records from 2011. The EVCC was developed for single family residences and the EVCC service area has remained the same since the 1970s.

The population of our service area was determined using OFM data and the approved average number of connections for EVCC. Table 3.3 estimates the population based on water customer records and the national average household size of 2.43 people per household (2010 Census, www.census.gov).

TABLE 3.3 – CUSTOMER POPULATION								
YEAR	CONNECTIONS					POPULATION		
	City SFR	EVCC SFR	Total SFR	Commercial	Total	City*	EVCC*	Total
2010	233	89	322	12	334	566	216	782
2011	247	90	337	14	351	600	219	819
2012	247	94	341	14	355	600	228	828
2013	244	96	340	15	355	593	233	826
2014	245	99	344	15	359	595	241	836

*Single Family Residential Population is based at 2.43 people/connection.

3.4.2 Projected Population

A growth rate of 2.5% was used in the 2008 WSP so our analysis assumed this 2.5% projection. Table 3.4 tabulates a population projection based on a growth rate of 2.5%, and number of single family service connections based on 2.43 people per household.

Table 3.4 also tabulates projections for population and service connection based on an adjusted growth rate. An adjustment to 1.2% was considered because of: 1) the economic downturn that started in 2008 and subsequent slow recovery; 2) the alignment of the UGA boundaries for this population forecast with the current service area boundaries; and 3) the dissolution of the Vader school district in 2007. All of these factors indicate slow economic growth of the area.

Both of these projections are tabulated in Table 3.4 for comparison.

TABLE 3.4 – PROJECTED POPULATION								
Year	Population at 2.5%				Population at 1.2%			
	Existing	Projected	Total	#SF Connections	Existing	Projected	Total	#SF Connections
2014	**836**	**0**	**836**	**344**	**836**	**0**	**836**	**344**
2015	836	21	857	353	836	10	846	348
2016	857	21	878	361	846	10	856	352
2017	878	22	900	370	856	10	866	357
2018	900	23	923	380	866	10	877	361
2019	923	23	946	389	877	10	887	365
2020	**946**	**24**	970	**399**	**887**	**11**	**898**	**370**
2021	970	24	994	409	898	11	909	374
2022	994	25	1019	419	909	11	920	378
2023	1019	25	1044	430	920	11	931	383
2024	1044	26	1070	440	931	11	942	388
2025	1070	27	1097	451	942	11	953	392
2026	1097	27	1124	463	953	12	965	397
2027	1124	28	1152	474	965	12	976	402

2028	1152	29	1181	486	976	12	988	407
2029	1181	30	1211	498	988	12	1000	411
2030	1211	30	1241	511	1000	12	1012	416
2031	1241	31	1272	523	1012	12	1024	421
2032	1272	32	1304	537	1024	12	1036	426
2033	1304	33	1336	550	1036	12	1049	432
2034	**1336**	**33**	**1370**	**564**	**1049**	**13**	**1061**	**437**

3.5 WATER USE CHARACTERISTICS

3.5.1 Production and Peaking Factor

The utility uses a billing year instead of a calendar year. Water billings are made on even numbered months and on a bimonthly cycle so a billing year is from December of the preceding year through November of that year.

Water production data is collected daily from the source meter at the Plant. Table 3.5 shows the annual production of water from 2010 to 2014 as gallons and as average day which is the annual production divided by 365 days. Table 3.6 shows the monthly production of water from 2011 to 2014. Data for the billing year 2010 is presented for comparison purposes in Table 3.5; and is not used in this WSP to derive existing system characteristics and forecasting.

TABLE 3.5 – ANNUAL WATER PRODUCTION

YEAR	TOTAL ANNUAL PRODUCTION (gallons)	AVERAGE DAY (gpd)
2010*	39,401,200	107,948
2011	31,194,300	85,464
2012	30,510,700	83,591
2013	29,288,600	80,243
2014	26,418,900	72,381
Average	**29,353,125**	**80,420**

*2010 data is shown for comparison purposes only and not used in the average values.

Table 3.5 shows decreasing water production since county management of the water utility in 2011. This is primarily due to the repairs of numerous leaky mains and service lines. Compared to 2010, we have reduced production of about 13 MG/yr (=39,401,200-26,418,900 gal) or about 33% of the 2010 water production volume

TABLE 3.6 – 2011 to 2014 MONTHLY PRODUCTION				
MONTH	2011 (gallons)	2012 (gallons)	2013 (gallons)	2014 (gallons)
December	2,833,700	2,392,500	2,442,500	2,574,300
January	2,905,400	2,348,700	2,567,700	2,387,600
February	2,476,800	2,194,600	2,135,000	2,185,100
March	2,704,200	2,549,000	2,393,200	2,551,100
April	2,913,600	2,300,200	2,297,000	2,446,500
May	2,654,100	2,475,300	2,488,800	2,527,600
June	2,677,700	2,613,200	2,628,700	2,487,300
July	2,697,400	2,809,800	2,840,800	2,791,200
August	2,589,900	2,980,600	2,654,600	1,873,900
September	2,365,800	2,794,900	2,273,400	1,604,700
October	2,201,800	2,685,900	2,305,600	1,603,400
November	2,173,900	2,366,000	2,261,300	1,386,200
TOTAL	31,194,300	30,510,700	29,288,600	26,418,900

Table 3.7 shows the maximum day versus average day usages for 2011 to 2014, and the resultant peaking factors. This information is derived from daily production records.

TABLE 3.7 – PEAKING FACTOR OF MAXIMUM DAY TO AVERAGE DAY				
YEAR	AVERAGE DAY (gpd)	MAXIMUM DAY (gpd)	MAXIMUM DAY (gpm)	PEAKING FACTOR
2011	85,464	110,300	77	1.3
2012	83,591	114,400	79	1.4
2013	80,243	107,700	75	1.3
2014	72,381	126,200	88	1.7
Average	**80,420**	**110,800**	**80**	**1.4**

3.5.2 Customer Categories, Connections and Consumption

Consumption data is collected bimonthly from service meter readings. The billing categories are residential, commercial and others. The latter category is for approved hydrant withdrawals. Table 3.8 shows the annual consumption by customer classifications for the last three billing years.

TABLE 3.8 – CONSUMPTION BY CUSTOMER CLASSIFICATION								
REVENUE WATER, BILLED AUTHORIZED CONSUMPTION								
YEAR	RESIDENTIAL		COMMERCIAL		OTHERS*		TOTAL	
	(gallons)	%	(gallons)	%	(gallons)	%	(gallons)	%
2011	13,758,059	95.7	613,410	4.2	0	0	14,371,469	100
2012	14,157,392	93.8	525,040	3.5	415,000	2.7	15,097,432	100
2013	13,822,306	94.2	762,699	5.2	95,000	0.6	14,680,005	100
2014	14,688,279	91.6	731,420	4.5	623,045	3.9	16,042,744	100

*Contractor Water Sales

Table 3.9 shows the number of service connections. Some of the residential connections have no water usage because of either vacancies or our customers' wish to keep a water connection. The majority of the customer base and water usage is residential. There are no large apartment complexes so the use of residential connections is a good direct correlation with the number of households in the service area.

The largest commercial users are the City of Vader wastewater treatment plant and buildings, Little Crane restaurant, local grocery stores, and the Cowlitz-Lewis County Fire District #20 facilities.

TABLE 3.9 – NUMBER OF CONNECTIONS

YEAR	RESIDENTIAL W/ USAGE	RESIDENTIAL W/O USAGE	TOTAL RESIDENTIAL	COMMERCIAL	TOTAL
2011	329	8	337	14	351
2012	338	3	341	14	355
2013	331	9	340	15	355
2014	333	11	344	15	359

3.5.3 Water Balance and Leakage

A water balance is an accounting of all water that is produced. The Utility's 2014 water balance is shown in Table 3.10. The table is a slightly modified version of the format recommended for use by the American Water Works Association (AWWA).

TABLE 3.10 – 2014 WATER BALANCE

	Level 1	Level 2	Level 3	Volume (gallons)	% of Produced Water
Water Produced	Revenue Water	Billed Authorized Consumption	1. Billed Water Exported	0	0%
			2. Billed Metered Consumption	15,419,699	58.4%
			3. Billed Unmetered Consumption	623,045	2.4%
	Non-Revenue Water	Unbilled Authorized Consumption	4. Unbilled Metered Consumption	0	0%
			5. Unbilled Unmetered Consumption	5,296,655	20%
		Apparent Losses	6. Unauthorized Consumption	0	0%
			7. Customer Meter Inaccuracies	0	0%
		Real Losses	8. Known Leakage	0	0%
			9. Assumed Leakage	5,079,501	19.2%
TOTAL				26,418,900	100%

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

Level 1 allocates the water to either Revenue Water or Non-Revenue Water. As implied by the names, Revenue Water generates income while Non-Revenue water does not. This is helpful to understand how much water production generates income for the Utility and how much non-revenue water production needs to be considered into the demand forecast. The Utility's 2013 water production is divided into 50.1% Revenue Water and 49.9% Non-Revenue Water.

Level 2 splits Non-Revenue Water into three sub-categories which are useful to identify future revenue sources and the magnitude of losses that could be addressed.

- Unbilled Authorized Consumption includes uses such as water system flushing, firefighting, and unbilled contractor use. Typically, it is standard practice not to charge for uses in this category; but it is a good practice to review these uses to ensure a legitimate revenue opportunity is not missed. Losses from repairs are estimated and included in this sub-category.

- Apparent Losses include unauthorized uses and meter inaccuracies which are both lost revenue opportunities.

- Real Losses include various types of system leaks. A certain level of leakage is unavoidable; but leakage beyond that level should be repaired to avoid unduly burdening both the natural resource and the physical infrastructure. Any amount that cannot be assigned to another category is considered a loss under the AWWA's protocol and per the formula for calculating distribution system leakage under the State's Water Use Efficiency Rule.

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

Table 3.11 shows a longer history of other water balance elements, namely system distribution leakage and non-revenue water. Non-revenue water loss is defined as the difference between metered source production and authorized usage. Authorized usage includes revenue and non-revenue consumption. Non-revenue water losses can be from leaks, illegal service connections, unbilled service connections, meter inaccuracies, meter reading errors, calculation errors, unreported fire-fighting (hydrant) uses, incomplete closure of valves, and faulty valves and related assemblies.

Table 3.11 lists the non-revenue water losses from 2011 to 2014. The average water loss is about 41% which is unacceptably high. The 2008 WSP reported water losses over 40% and the water loss peaked at 60% in 2010. The 2010 water loss is shown for comparison but it is not used as indications of the system trend under county management.

TABLE 3.11 – NON-REVENUE WATER LOSS						
Year	Metered Source Production	Authorized Consumption			Non-Revenue Water Loss	
		Revenue	Non-Revenue	Total		
	(gallons)	(gallons)	(gallons)	(gallons)	(gallons)	(%)
*2010**	*39,401,200*	*15,691,595*	*N/A*	*15,691,595*	*23,709,605*	*60*
2011	31,194,300	14,371,469	780,000	15,151,469	16,042,831	51
2012	30,510,700	15,097,432	86,420	15,183,852	15,326,848	50
2013	29,288,600	14,680,005	2,145,557	16,825,562	12,463,038	43
2014	26,418,900	16,042,744	5,296,655	21,339,399	5,079,501	19
2011-2014 AVERAGE	**29,353,125**	**15,047,912**	**2,077,158**	**17,125,070**	**12,228,055**	**41**

*2010 water loss is based on metered production and metered revenue from City records.

WSDOH adopted the Water use Efficiency Rule under WAC 246-290-490 in September 2006 as part of the 2003 Municipal Water Law. The new rule set a maximum leakage standard of 10% in the distribution system of all Municipal Water Suppliers, and annual compliance with the leakage standard by 2011 for Municipal Water Suppliers with less than 1,000 connections. Because system water losses exceed 10%, a water loss action plan has been developed to implement measures to reduce non-revenue water losses. The water loss action plan is in Appendix XX.

3.5.4 Water Use Factors and Equivalent Residential Units (ERU)

The use of Equivalent Residential Unit (ERU) is a means to express all water use by non-residential customers. An ERU is a system-specific unit of measure to express the average consumption by one single-family residence. An ERU value for one system is not the same for another water system.

The value of an ERU is calculated by dividing the total volume of water for the residential customer class by the total number of **residential connections with usage**. Some water connections or active accounts have no water usage. ERU water demand is calculated using the residential consumption volume divided by the number of residential water connections with water usage. Water use by other customer classes and residential customers with no water usage can then be converted to a corresponding number of ERUs. Table 3.12 shows the historical ERU values from 2011 to 2014. Information about customer connections is provided in Table 3.8. The four-year average is 116 gpd per ERU.

TABLE 3.12 – ERU ANALYSIS				
YEAR	RESIDENTIAL CONSUMPTION (gallons)	RESIDENTIAL CONSUMPTION (gpd)	#RESIDENTIAL CONNECTIONS w/ USAGE	ERU WATER DEMAND (gpd)
2011	13,758,059	37,693	329	115
2012	14,157,392	38,787	338	115
2013	13,822,306	37,869	331	114
2014	14,688,279	40,242	331	121
AVERAGE				≈116

Table 3.13 shows the ERUs for all customer classes using the billed, authorized consumption in Table 3.8 and an ERU water demand of 116 gpd. Information about water consumption by customer classification is provided in Table 3.8, and about non-revenue water losses in Table 3.10. The system serves an averaged total of 694 ERUs.

TABLE 3.13 – ERU BY CUSTOMER CLASSIFICATION

Year	#RESIDENTIAL ERU (1)	#COMMERCIAL ERU (2)	#OTHER AUTHORIZED ERU (3)	#NON-REVENUE ERU (4)	#TOTAL ERU
2011	337	14	18	379	748
2012	341	12	2	362	717
2013	340	18	51	294	703
2014	344	17	125	120	606
AVERAGE	**341**	**15**	**49**	**289**	**694**

1) From Table 3.9, column 4.
2) From Table 3.8, column 4 divided by the ERU value of 116 gpd.
3) From Table 3.11, column 4 divided by the ERU value of 116 gpd.
4) From Table 3.11, column 6 divided by the ERU value of 116 gpd.

3.6 WATER DEMAND FORECAST

3.6.1 Demand Forecast Methodology

The methodology used to develop the demand forecast is outlined in this section. The forecast uses two time horizons (6-year and 20-year).

The forecast also factors in an industrial customer classification based on an industrial land use and zoning in the service area. The City of Vader approved a 28.74 acre area for industrial use and zoning in 2010. Although there has been no City issued development approvals or application for water service, our forecast includes an industrial water use category.

At this time, there is an automobile wrecking facility (German Auto) located in one of the four industrial zoned parcels. The proposed water demand for the automobile wrecking facility is 2 ERU. Recent news in January 2014 state the owner of German Auto is also interested in constructing medicinal marijuana growing and retail facilities on the four parcels. However, there have been no projections of water demand and water service applications provided to the Utility so no speculative demand projections are included in this WSP. According to Utility policy, an amendment to this WSP will be required and funded by future developers once a proposed project is approved by State and local regulatory agencies.

The process used to develop the demand forecast is described as the following steps in this section.

1. DEMOGRAPHICS – Demographics were developed as described in Section 3.4.

2. WATER USE FACTORS – Water use factors were developed as described in Section 3.5.

3. RETAIL DEMAND – The demand for residential and non-residential customer categories were made by multiplying the demographic projections in Step 1 with Step 2.

4. NON-REVENUE DEMAND – The sum of all demands was multiplied by the 2014 "non-revenue water, losses" percentage which is 24% of the authorized consumption as shown in Table 3.10.

   = 5,079,501 gal / (15,419,699+623,045+5,296,655) gal
   = 5,079,501 gal/21,339,399 gal
   = 0.238 x 100
   = 23.8% ≈ 24%

5. TOTAL AVERAGE DAY DEMAND (ADD) – The ADD was calculated by adding the demands from Steps 1 through 4.

6. TOTAL MAXIMUM DAY DEMAND (MDD) – The MDD was derived by applying a peaking factor of 1.4 to the ADD. See Table 3.7 for derivation of the average peaking factor of 1.4.

7. PEAK HOUR DEMAND (PHD) – The PHD was derived by using the equation in the WSDOH Water System Design Manual, December 2009. The equation is:

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

   Where, MDD = MDD in gpd/ERU
   N = number of ERUs
   C = 1.6 for N>500
   F = 225

8. CONSERVATION ADJUSTMENT – Steps 1 through 6 create a baseline demand forecast which is adjusted for conservation efforts by customers. Prior conservation goals were to reduce water loss to 10% by 2025 and to reduce average daily consumption per capita by 1 gallon.

   The average residential use per connection from 2011 to 2014 was 116 gallons per connection. Considering that most of the residential connections primarily serve one to two people, the usage is pretty low. Because the current water use is pretty low, the goal is to not exceed daily consumption at 116 gallons per residential connection. However, the Utility plans to conduct conservation efforts throughout the planning period so a demand forecast was also made using a 5% reduction of residential water usage.

3.6.2 Water Demand Projections

The projected demands are summarized in Table 3.14.

TABLE 3.14 – WATER DEMAND FORECAST												
WATER USE CATEGORY	BASE (2014)				6-YEAR (2020)				20-YEAR (2034)			
	#ERU	DEMAND (gpd)		PHD	#ERU	DEMAND (gpd)		PHD	#ERU	DEMAND (gpd)		PHD
		ADD	MDD			ADD	MDD			ADD	MDD	
Residential	344	39,908	55,871	-	370	42,869	60,018	-	437	50,660	70,924	-
Commercial	18	2,088	2,923	-	19	2,249	3,149	-	24	2,771	3,879	-
Industrial	0	0	0	-	0	0	0	-	0	0	0	-
Other	15	1,740	2,436	-	15	1,741	2,436	-	15	1,744	2,442	-
Subtotal	377	43,736	61,230	-	404	46,859	65,603	-	476	55,175	77,245	-
Non-Revenue Water	90	10,497	14,696	-	97	11,246	15,745	-	114	13,242	18,539	-
TOTAL DEMAND WITHOUT CONSERVATION	**468**	**54,232**	**75,925**	**127 gpm**	**501**	**58,106**	**81,348**	**134 gpm**	**590**	**68,417**	**95,784**	**150 gpm**
Conservation	N/A	N/A	N/A	N/A	-32	-3,706	-4,817	-	-40	-4,564	-5,933	-
TOTAL DEMAND WITH CONSERVATION	**446**	**51,758**	**72,461**	**123 gpm**	**478**	**55,448**	**77,627**	**129 gpm**	**563**	**65,276**	**91,387**	**145 gpm**

ERU = 116 gpd/residential customer

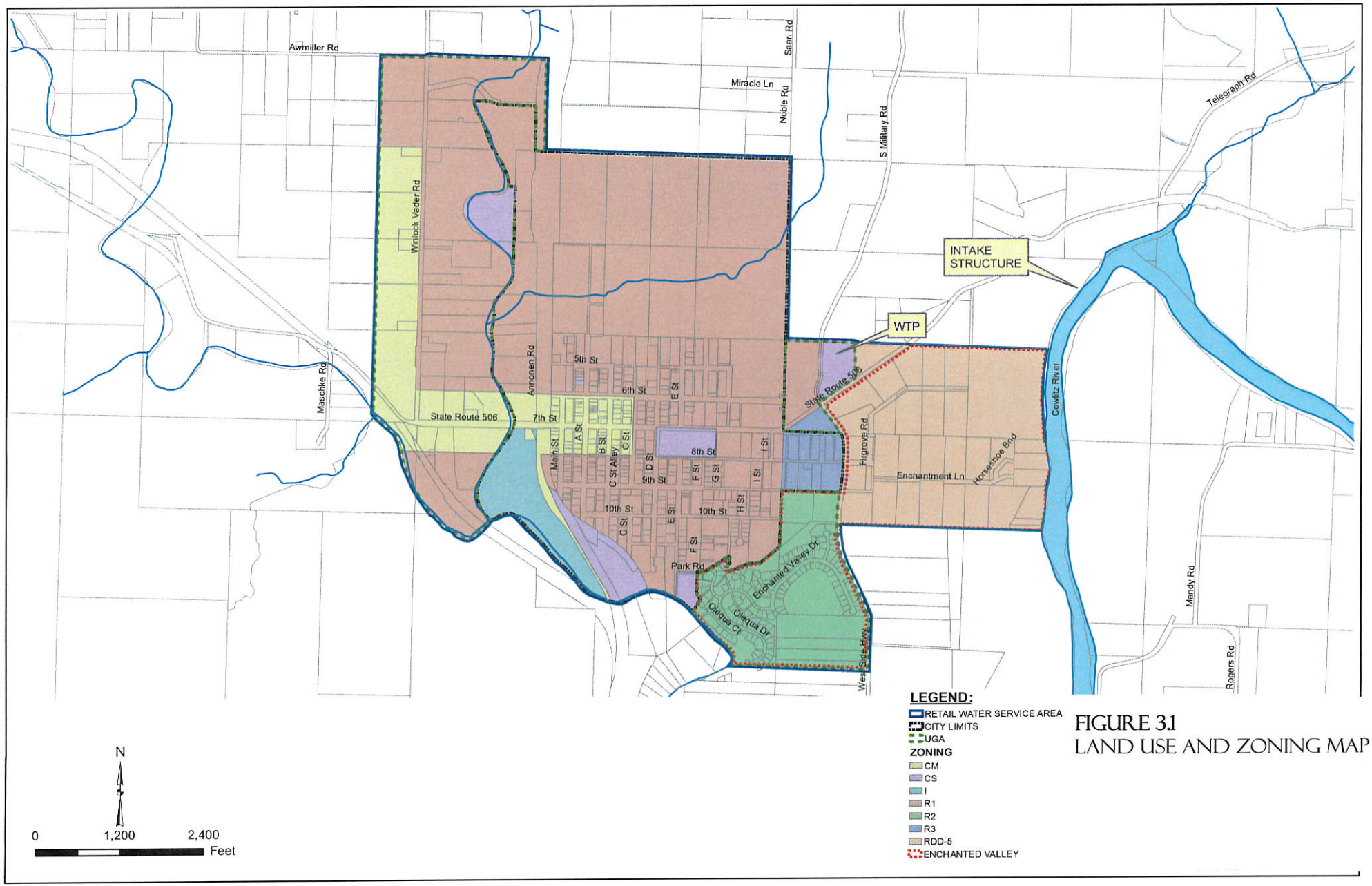


FIGURE 3.1
LAND USE AND ZONING MAP