2022 Water System Plan

City of Centralia

Centralia, Washington
September 2022

Certification

This Water System Plan for the City of Centralia was prepared by HDR Engineering, Inc., under the direction of the following Registered Professional Engineers:

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1. Introduction

This section provides general information about the City of Centralia (City) water system. Material is presented describing the history and development of the water system, and the current ownership and management of the system. The existing service area is described, including the relationship of the City water system and service area to the surrounding municipalities and water systems. Water system policies are summarized, and other related planning documents are also described in this section.

1.1 Service Area and Adjacent Purveyors

The City currently provides water service to customers within its Retail Service Area, shown in Figure 1-1A. This area is comprised of the majority of the land within City Limits plus portions of the City's Urban Growth Area (UGA) where service is currently provided or is anticipated to be provided in the near future. In addition, there are areas outside of the UGA where the City provides service to customers; thus, these areas (such as Seminary Hill Road to the east of the City, and Blanchard Road to the southwest of the City) are also considered to be within the City's Retail Service Area. Within the retail service area, the City has a duty to serve all new connections when circumstances meet the following threshold factors:

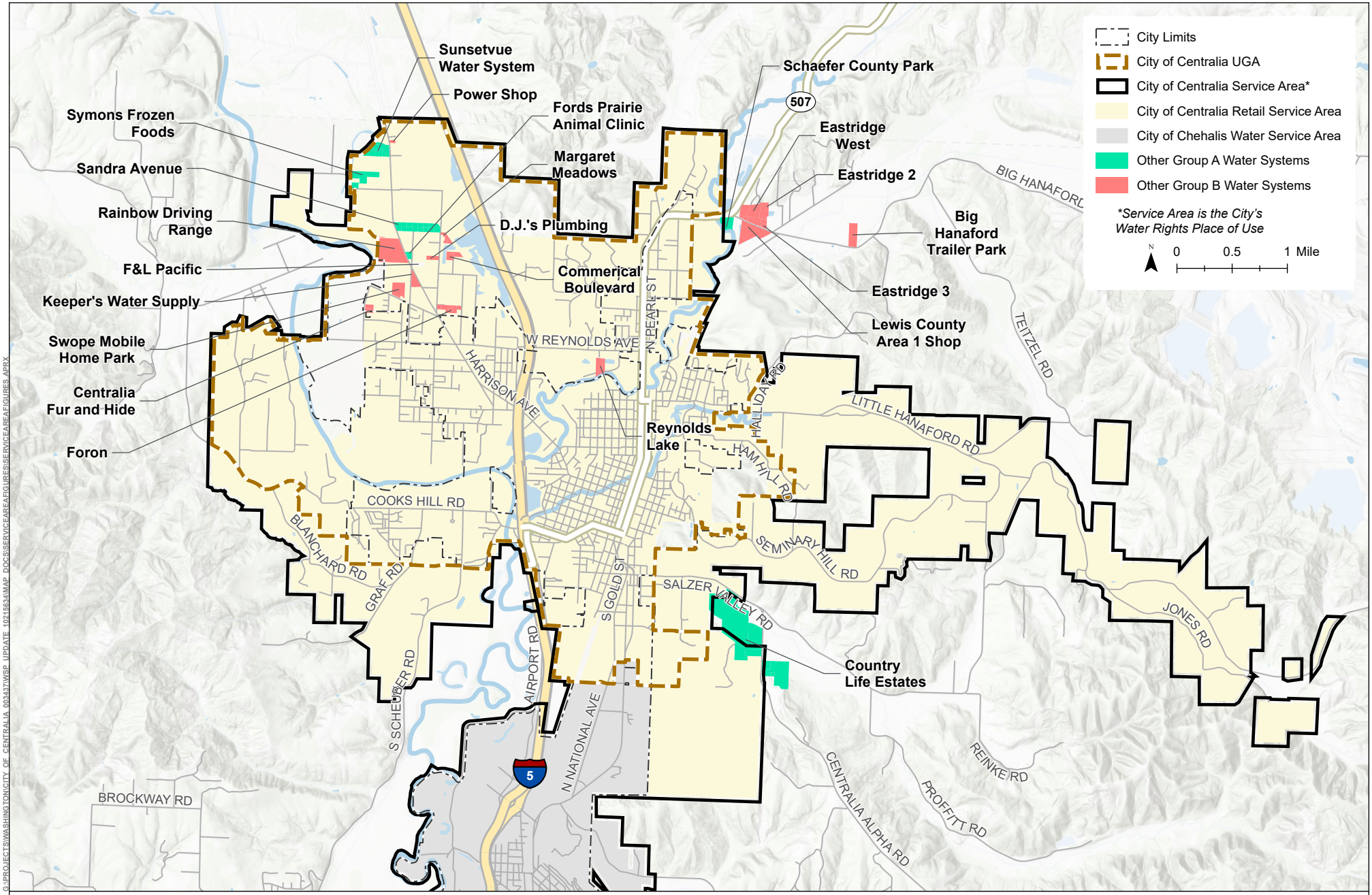
1. The municipal water supplier has sufficient capacity to serve water in a safe and reliable manner.
2. The service request is consistent with adopted local plans and development regulations.
3. The municipal water supplier has sufficient water rights to provide service.
4. The municipal water supplier can provide service in a timely and reasonable manner.

Although the City currently provides service to the majority of parcels within its Retail Service Area, there are some parcels that do not presently receive water service. As such, it is important to note that the City's "Existing Service Area" (i.e., only that area to which service is currently provided) is defined as the part of the Retail Service Area in which water distribution infrastructure currently exists. This is depicted on Figure 5-1 as the areas to which current water distribution piping extends. New connections will be accommodated in the Retail Service Area per the threshold factors listed above.

Contrasted with the City's Retail Service Area, the City's broader Water Service Area includes areas where water service may expand in the future, and the service areas of future wholesale water customers as shown in Figure 1-1B. The Water Service Area boundary indicates the maximum physical extent the City intends to serve in the future. This includes areas within the UGA not currently served but where future growth is anticipated. The level of growth anticipated within the Water Service Area is discussed in Section 2. As is the case with Growth Management Act (GMA) planning, the City's UGA, and therefore its water service area, is subject to change to reflect future development patterns and related planning efforts.

The City is currently planning to construct a large regional groundwater supply to meet the long-term future water needs of the City and other public water systems in the region. This project is discussed in Section 07. The largest Group A water purveyor adjacent to the City's water system service area is the City of Chehalis, with whom the City of Centralia maintains an intertie that is currently used only for emergencies but which will be used for wholesale water deliveries in the future and for delivery of a portion of the new groundwater supply to serve growth demands in Chehalis. The City of Chehalis water service area is shown in Figure 1-1B as a Future Wholesale Service Area. The Chehalis water service area is not expanding as part of this WSP update.

There are several small Group A and Group B water systems located within the City's Retail Service Area. There are also numerous residential wells within the area used both for domestic and irrigation supplies. The City has consolidated several small systems into its service area since the prior Water System Plan was published. Service areas for small systems within the Centralia Retail Service Area are also identified on Figure 1-1A.



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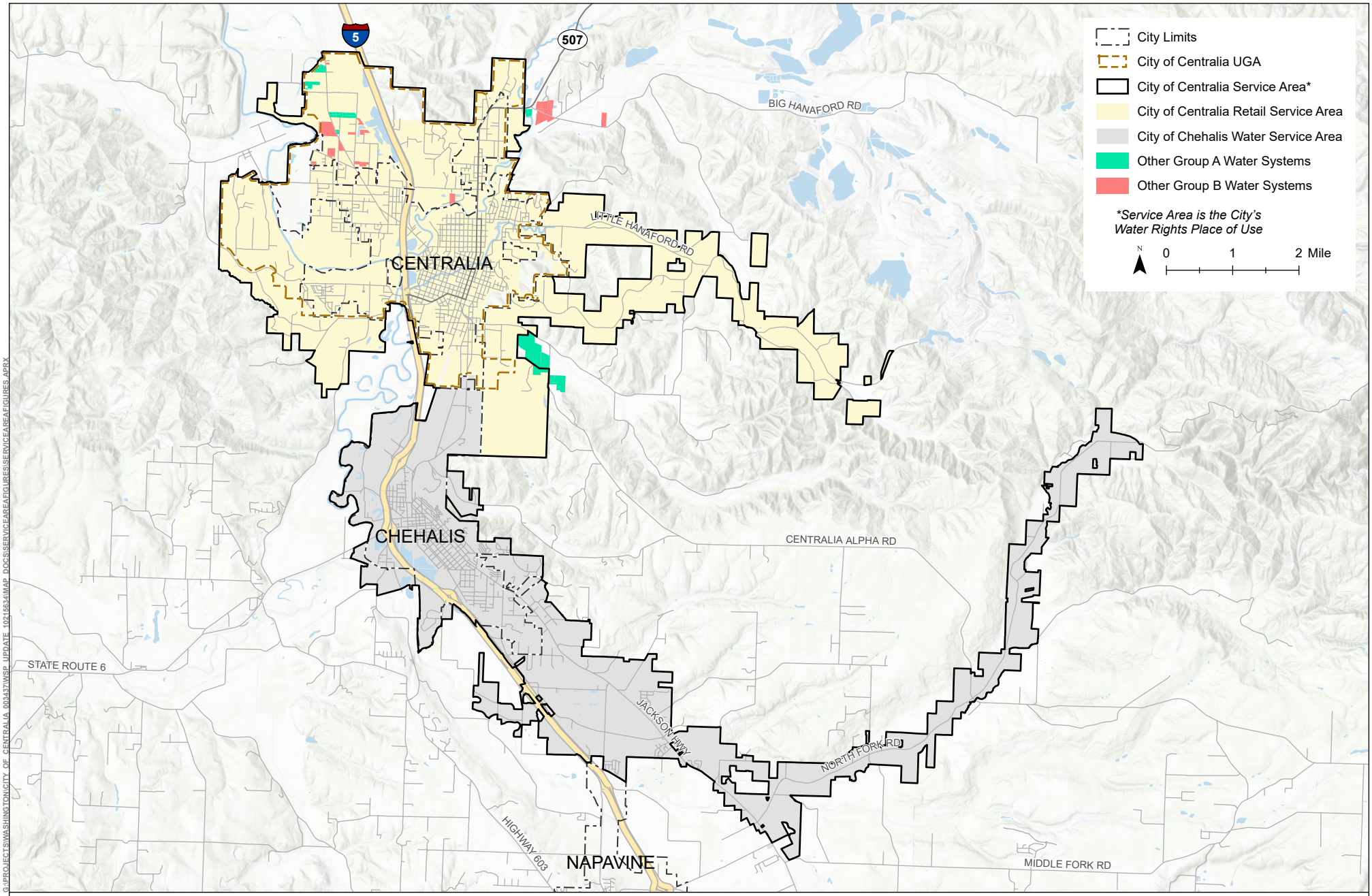
WATER SERVICE AREA
FIGURE 1-1A

City of Centralia Water System Plan
September 2022



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WATER SERVICE AREA

FIGURE 1-1B

City of Centralia Water System Plan
September 2022

1.2 Purpose and Objectives of Water System Plan

The purpose of a Water System Plan (WSP) is to provide a uniform process for water purveyors to:

- Identify present and future needs,
- Set forth the means for addressing those needs, and
- Demonstrate that the system has the operational, technical, managerial, and financial capability to achieve and maintain compliance with all relevant local, State, and federal plans and regulations.

Pursuant to the Municipal Water Law of 2003, the WSP also identifies service areas within which the City's water rights can be used. The City is required to develop a WSP according to DOH regulations under Chapter 246-290-100 (Group A Public Water Supplies) of the Washington Administrative Code (WAC).

1.3 Ownership and Management

This WSP is developed for the public water system owned and operated by the City of Centralia, Washington. The City water system is considered a Group A community water system by DOH and has a Public Water System Identification Number of 12200D. A summary of the system is provided in the utility's Water Facilities Inventory (WFI), included as Appendix A to this WSP.

1.4 Natural Setting

1.4.1 Hydrology and Hydrogeology

Naturally, all aspects of the City's water supply are intricately connected to local and regional hydrology. The major rivers in the area, the Chehalis and the Skookumchuck, will always constrain local patterns of development.

The City enjoys a fortuitous location with respect to the regional hydrogeology. The watercourses of the Skookumchuck River and the Chehalis River confluence, west of the Skookumchuck, are aligned along a wide glacial outwash deposit as much as 130 feet thick. This deposit of sand and gravel is a very productive aquifer (referred to as the Centralia Outwash Gravel Aquifer). There are several dozen wells in and around the City which yield water from this aquifer in excess of 500 gallons per minute (gpm) each.

1.4.2 Geography and Topography

Centralia generally lies within a glaciofluvial plain east of the confluence of the Skookumchuck and Chehalis Rivers. The lowlands extend to the west and south along the Chehalis River, and to the north along the Skookumchuck. The foothills of the Cascade Mountains begin at the eastern edge of the City. These hills form an eastern boundary to the lowlands which extend to the north and south of the City. Other highlands lie to the north-northwest, bordered by Coffee

Creek and Interstate 5 (I-5) to the east and west, respectively. The City of Chehalis lies to the south.

The most intense development has occurred in low-lying areas where gravity's challenge to water delivery has not been severe. The higher areas have been slow to develop due, in part, to lack of water supply. Demands for developable land will increase as the area's population grows, forcing the development of local highlands and requiring the extension of City services there.

1.5 History of Water System

The City has endeavored to supply potable water to its citizenry since 1913, when it acquired a privately owned water system. Originally, the City produced water from the Skookumchuck River. This source of supply was abandoned in 1914 for the Newaukum River source. In the late 1930s, the City began augmenting its surface water supply with groundwater wells. Since then, the City has continued to respond to increasing demands for water by developing new groundwater supplies. In 1990-91, massive landslides in the Newaukum Watershed, combined with surface water quality regulations imposed by the federal Surface Water Treatment Rule (SWTR), led to the discontinued use of the Newaukum surface water source. The Newaukum intake has not been used for potable water production since September 1993.

Currently, the City relies upon its groundwater resources, and is acquiring Skookumchuck River water rights for use as mitigation for the development of additional groundwater rights and sources to meet long-term future needs of the City and neighboring communities.

1.6 Overview of Existing System

In the early 2000's, the City made significant changes to its water supply sources. Water treatment facilities were constructed at the Tennis Court Wells, allowing these supplies to become a primary source. The City also developed the Ford's Prairie Wells in close proximity to the Eshom Well. With treatment facilities constructed to serve all three of these wells, the City now has two significant wellfield supplies that meet the majority of its water supply need. The K Street and Washington Street Wells, two of the City's older wells, serve as seasonal and emergency backup supplies.

All wells pump directly into the City's Central Pressure Zone, where approximately ninety-five percent of the City's demand is exerted. Water extracted from the wells is pumped into the Davis Hill and Seminary Hill reservoirs. Other system facilities include:

- Tennis Court Treatment Facility (air stripping, chlorination, fluoridation)
- Fords Prairie Treatment Facility (air stripping, chlorination, fluoridation)
- Five reservoirs with total storage capacity of 8.0 million gallons
- Six pump stations serving small, pumped zones
- Radio telemetry system enabling remote control and monitoring of most of the system
- One emergency intertie with the City of Chehalis

- Seven pressure zones

Section 5 includes a full inventory of water system facilities, with detailed descriptions of the wells, storage reservoirs, distribution system, and other components that make up the system. The intertie agreement with Chehalis is provided as Appendix B.

1.7 Water Utility Policies

The City's water utility policies have been established to ensure orderly operations through a variety of circumstances. Policies have been developed to cover all aspects of production and delivery of water to the customer. Many of these policies serve as standard operating procedures through various scenarios. New policy is developed on an as-needed basis and must be approved by the City Council.

The City's water utility policies are contained in Title 15 (Water and Sewers) of the Centralia Municipal Code (CMC). Pertinent sections, which are provided in Appendix C of the WSP, include:

- 15.04 – Rules and Regulations
- 15.05 – Water Conservation Program
- 15.08 – Water Supply

The City has a duty to serve all new connections located within its Retail Service Area, so long as the following four threshold factors are met, as described in WAC 246-290-106:

1. The City has sufficient capacity to provide water in a safe and reliable manner.
2. The service request is consistent with the City's adopted plans and development regulations.
3. The City has sufficient water rights to provide service.
4. The City can provide service in a timely and reasonable manner.

In keeping with this requirement, typically new developments occurring within City Limits apply for water service from the City, following the process described in CMC 15.04.030 (Application for Service). This section of the CMC also addresses potential service to development located outside of City Limits. Additional sections of CMC 15.04 address duty to serve related policies, such as CMC 15.04.040 (Availability of Service).

The City also serves water in areas outside the UGA in unincorporated Lewis County. The City must comply with Lewis County Comprehensive Plan and county code policies related to water utilities in these areas. Policies in the Lewis County Comprehensive Plan related to water service are in the utilities and capital facilities element, policies 10.1 through 10.6. Policies in the Lewis County code related to water service are in chapters 13.60 and 13.80.

The relevant Lewis County policies mentioned above are in Appendix C. The City's policies are consistent with Lewis County's water system policies. Specific findings regarding consistency between the City's policies and this WSP in relation to the Lewis County Comprehensive Plan policies are:

- Policy UCF 10.1. *Foster improvements to public water systems, particularly within unincorporated urban growth areas and Limited Areas of More Intensive Rural Development (LAMRIDs), to ensure that adequate water supplies and infrastructure are available to serve the future development of the areas.*

    - Centralia's WSP sets forth a plan for investing in system improvements to ensure adequate supplies and infrastructure are available to serve the City's service area into the future.

- Policy UCF 10.2. *Develop strategies to support the operation of small water systems and help address the technical, managerial, and financial difficulties that are experienced by small water providers.*

    - The City helps address small water system challenges largely through consolidations (see below).

- Policy UCF 10.3. *Encourage the consolidation of water utilities when desirable.*

    - As discussed in Section 1.1, the City has previously consolidated small systems into its water system and is investing in a regional groundwater supply system to bolster water supply reliability to the region and support potential future consolidations.

- Policy UCF 10.4. *Establish standards that require new residential, commercial, and industrial development to use existing water systems (when the facilities are available). The standards should promote the efficient use of existing water resources and encourage a high level of water quality and reliability for existing and future development.*

    - The City's policies and operational practices documented in this WSP promote water use efficiency and encourage a high level of water quality and reliability.

- Policy UCF 10.5. *Implement Engrossed Substitute Senate Bill 6091 related to permit-exempt domestic groundwater withdrawals.*

    - The City's service policies are in alignment with these policies.

- Policy UCF 10.6. *Participate in watershed planning for Water Resources Inventory Areas (WRIAs) 11, 13, 23, and 26 to help shape the amount of groundwater withdrawals available for permit-exempt domestic groundwater withdrawals, and the type of projects used to mitigate groundwater and stream impacts.*

    - The City participates in watershed planning activities related to its service area in WRIA 23.

1.8 Related Plans

The City's previous WSP was prepared in 2013. This WSP serves as an update to that document, and was developed in accordance with Chapter 246-290-100 WAC, the DOH "Water System Planning Handbook", and the DOH Water System Design Manual (dated June 2020).

This WSP has also been prepared in accordance with the City of Centralia Comprehensive Plan (dated August 28, 2018), and the Lewis County Comprehensive Plan (originally approved June 1, 1999, and most recently amended June 2017).

1.9 Review Comments and Responses

The Draft WSP was provided to the City's Community Development Department, Lewis County, City of Chehalis, and DOH for review. Comments on the Draft WSP are provided in Appendix D, along with Consistency Statement Checklists, consistent with Municipal Water Law planning requirements.

In accordance with the State Environmental Policy Act (SEPA), a SEPA checklist has also been completed for the WSP and is provided in Appendix E.

1.10 Limiting Factors and Carrying Capacities

A key element of this WSP is the evaluation of the capacities of various water system elements and their abilities to support current and projected future water supply needs. Resulting from these evaluations are “carrying capacities,” or the maximum number of equivalent residential units (ERUs) that existing facilities can support. Such analyses aid in identifying capacity deficiencies and provide the foundation for some capital improvement projects.

Error! Reference source not found.1-1 summarizes the carrying capacities associated with the City’s primary water system components. Details regarding source and storage capacity analyses are provided in later chapters of the WSP. As noted in the table, source pumping capacity is the limiting water system component, with a current ERU capacity of 19,430.

Carrying capacity analyses have not been conducted for the City’s treatment and distribution facilities, for the following reasons. The treatment systems have been sized commensurate with the pumping capacities at the applicable sources. Therefore, there are no additional limitations imposed by the treatment systems. Regarding distribution facilities, it is difficult to characterize ERU carrying capacities in terms of piping, etc. Water mains are typically designed to convey fire flows, which in the case of the City means that they are also more than adequate to support the average and maximum day demands imposed by customers. Some deficiencies have been identified throughout the system regarding the capability of certain sections of distribution piping to convey required fire flows at minimum pressures. Such deficiencies, however, are not a function of the amount of current or proposed ERUs, and therefore do not factor into a carrying capacity analysis. The City has scheduled improvements to address noted distribution system deficiencies, as described in Chapter 13.

Table 1-1. Water System Physical Capacity Analysis

Note: *Capacity determinations are only for existing facilities that are operational for the water system.*

Specific Single-Family Residential Connection Criteria:

Average Day Demand (ADD): 153 (1) gpd/ERU

Maximum Day Demand (MDD) 294 (2) gpd/ERU

Water System Service Connections correlated to ERUs			
Service Classification	**Total MDD for the classification, gpd (3)**	**Total # Connections in the classification (4)**	**ERUs (5)**
Residential	2,320,000	6,150	7,919
Nonresidential	1,080,000	891	3,679
DSL	820,000 (6)	N/A	2,784
Other (identify)			
Total existing ERUs (Residential + Nonresidential + Non-revenue + Other) = 14,382			

Physical Capacity as ERUs	
Water System Component (Facility)	**Calculated Capacity in ERUs for each component**
Source(s)	19,430 (7)
Treatment	NA (8)
Equalizing Storage	>125,000 (9)
Standby Storage	25,775 (at 20 psi) (10)
Distribution	NA (8)
Transmission	NA (8)
Other (water rights)	33,159 (Qi basis) 44,987 (Qa basis) (11)
Water System Physical Capacity (ERUs) = 19,430 (based on the limiting water system component shown above)	

Notes:

(1) See Section 3.4, based on recent average.
(2) Based on a peaking factor of 1.92 (see Section 3.1), based on recent average.
(3) Based on Table 3-10, for Year 2021.
(4) From Table 2-2, for Year 2020.
(5) Based on Table 3-10, for Year 2021. Values vary slightly from what would be shown if calculated using ERU factors noted above, as these are based on Year 2021 actual ERU factors (which differ slightly from the average over recent years).
(6) This value represents total non-revenue water, not only DSL, as described in the Table 3-10 footnotes.
(7) See Table 7-2. Based on capacity to meet MDD with sources operating 20 hours per day.
(8) Not calculated for reasons specified in the text.
(9) See Tables 8-1, 8-3, and 8-4 for information on equalizing storage calculations. Capacity calculations based on equalizing storage limitations are not shown in those tables, as they are not limiting. However, spreadsheet calculations not included in the WSP indicate that existing equalizing storage volumes can support more than 120,000 ERUs in the Central Zone, more than 4,000 ERUs in the Cooks Hill Zone, and more than 1,000 ERUs in the Ham Hill Zone.
(10) See Tables 8-1, 8-3, and 8-4. Total of Max ERUs displayed on each table, with standby storage being the limiting factor.
(11) See Appendix N and Section 7.1 for details. Based on total Qi of 6,770 gpm and Qa of 7,710 afy, associated with existing water rights. This does not take into account amounts associated with pending water right applications.

2. System Planning Considerations

General planning data for the City of Centralia (City) are presented in this section. A discussion of the Growth Management Act and its influence upon urban planning is provided, followed by a summary of existing and projected future land uses within the City and its Urban Growth Area (UGA), as well as a forecast of service area population.

2.1 Relation to the Growth Management Act

The Washington State Legislature passed the Growth Management Act (GMA) in 1990 to require coordinated planning for growth in the faster growing counties in the State. The GMA emphasizes management of "urban growth," including the type of growth, its intensity, its location, and how it affects utilities and services. The GMA requires all urban counties and their cities to develop and adopt 20-year comprehensive plans, along with regulations to implement those plans. These requirements include Lewis County and the City of Centralia. The County and City comprehensive plans must address specific issues including (but not limited to) land use, transportation, housing, capital facilities and services, natural environment, and economic development. The Legislature has amended the act from time to time.

Highlights of the GMA, as it pertains to water system plans, are described below:

- ***Urban growth.*** Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner.
- ***Reduce sprawl.*** Reduce the inappropriate conversion of undeveloped land into sprawling, low-density development.
- ***Economic development.*** Encourage economic development throughout the State that is consistent with adopted comprehensive plans, promote economic opportunity for all citizens of this State, especially for unemployed and for disadvantaged persons, and encourage growth in areas experiencing insufficient economic growth, all within the capacities of the State's natural resources, public services, and public facilities.
- ***Permits.*** Applications for both State and local government permits shall be processed in a timely and fair manner to ensure predictability.
- ***Environment.*** Protect the environment and enhance the State's high quality of life, including air and water quality, and the availability of water.
- ***Citizen participation and coordination.*** Encourage the involvement of citizens in the planning process and ensure coordination between communities and jurisdictions to reconcile conflicts.
- ***Public facilities and services.*** Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for occupancy and use without decreasing current service levels below locally established minimum standards.
- ***Capital facilities.*** GMA cities and counties must demonstrate that they can afford the infrastructure needed to support expected growth. If the services cannot be provided, the land uses must be revised or the levels of services (LOS) reduced.
- ***Comprehensiveness.*** Comprehensive plans must integrate planning for land use, housing, transportation, capital facilities, and utilities. All areas of cities and counties and all plan elements must be addressed from an area-wide perspective.

- ***Consistency.*** Comprehensive plans must avoid internal contradictions and must not interfere with the successful implementation of the plans of neighboring jurisdictions. Plan policies must be consistent with the direction established by the GMA and adopted county-wide planning policies.

The GMA requires that counties and cities establish Urban Growth Areas (UGAs) to help guide urban growth into the most appropriate areas, encourage orderly development of utilities and transportation networks, and to reduce urban sprawl. The City of Centralia's existing UGA is shown in Figure 2-1. This is the area which contains the forecasted 20-year growth in population and employment.

2.2 Urban Growth Areas and Land Use

A comprehensive discussion of the existing UGA and associated land use is included in the Land Use element of the Centralia Comprehensive Plan 2018-2040 (2018 Comp Plan).

The City of Centralia Water Service Area currently comprises approximately 14,960 acres, or 23.4 square miles. The present land use is approximately 48 percent residential, 3 percent commercial, and 7 percent industrial, with the remainder of the land available for public facilities and natural resources. Figure 2-1 presents zoning within City Limits and the UGA, as well as land use for areas outside of the UGA but within the City's Water Service Area.

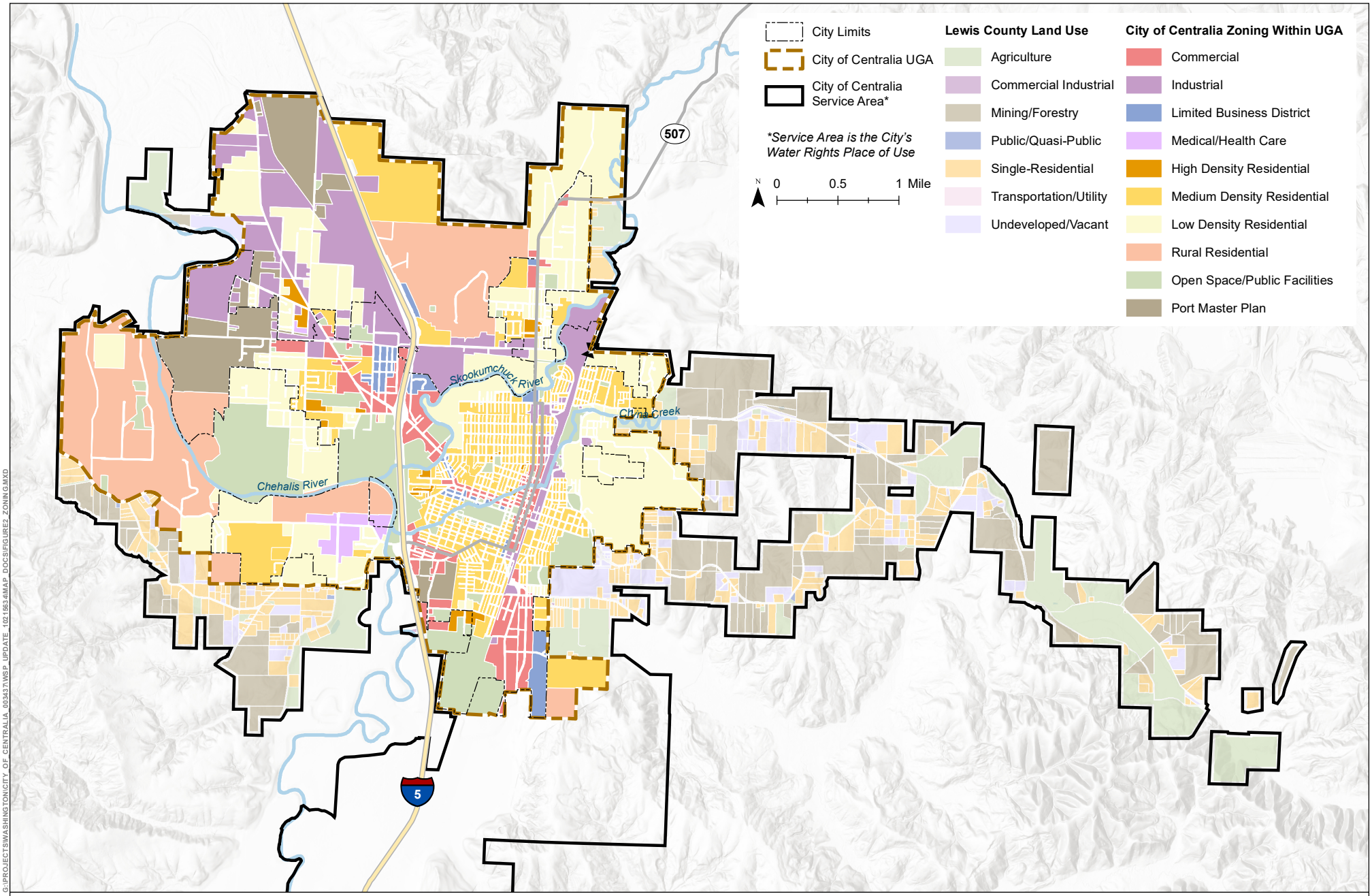
The UGAs that Lewis County has approved are indicated on Figure 2-1. These include areas in the north-central part of the City (Davis Hill and along Reynolds Avenue) and to the west of the City (i.e., Cooks Hill and the area around the Department of Fish and Wildlife Game Farm). The City envisions growth will occur in these areas within the 20-year planning period. It is noted that the Widgeon Hill area to the southeast of the City has been recently made part of the City of Chehalis' UGA. However, it is shown as being within the City's Service Area, as there is still potential for the City to provide water service to this area.

Table 2-1 provides a breakdown of the future land distribution within the Water Service Area classified by the 2018 Comp Plan, taking into account existing and anticipated development.

Table 2-1. Future Land Use Distribution

Land Use Description	Acreage	Percent
Within UGA		
Rural Residential	2,406.19	14.31%
Very Low Density Residential	976.89	5.81%
Low Density Residential	1,553.10	9.24%
Medium Density Residential	1,363.62	8.11%
Med High Density Residential	153.36	0.91%
High Density Residential	76.71	0.46%
Limited Business District	146.57	0.87%
Gateway Commercial District	66.46	0.40%
Central Business District Commercial	147.26	0.88%
Highway Commercial	92.89	0.55%
General Commercial	251.11	1.49%
Medical/Health Care	86.82	0.52%
Port Master Plan	584.28	3.47%
Light Industrial	485.98	2.89%
Heavy Industrial	671.05	3.99%
Public Facilities, Parks, and Open Space	1,103.69	6.56%
Outside UGA		
Agriculture	2,072.43	12.32%
Commercial Industrial	2.22	0.01%
Commercial Retail	0.00	0.00%
Mining/Forestry	2,497.31	14.85%
Multi-Residential	11.74	0.07%
Public/Quasi-Public	172.97	1.03%
Single-Residential	1,261.76	7.50%
Transportation/Utility	4.07	0.02%
Undeveloped/Vacant	628.28	3.74%
Total	**16,816.78**	100%

Note: Acreage of zones does not include water bodies, right of way, etc. Therefore, the total acreage of zoning distribution does not add to the total area within the Water Service Area described in Section 2.2.



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ZONING
FIGURE 2-1
City of Centralia Water System Plan
September 2022

2.3 Water Service Area and Current Connections

The City provides water to the majority of the population residing within its corporate limits, as well as some people who reside outside of the City Limits, as described in more detail in Section 1.1. The City serves approximately 7,192 active customer connections (as of July 2021), including residential, commercial, and other users. The City water utility is managed by the City as a part of Centralia Public Works.

The City's Water Service Area is shown on Figure 1-1. Over the next 20 years, the City plans to expand its infrastructure to serve additional customers within the UGA, as discussed in Section 1. In accordance with the principles set forth by the GMA, an urban level of service will be provided to areas within the UGA, while provision of water will generally not be made outside of the UGA, except in specific cases as authorized by the City Council.

2.3.1 Wholesale Service Area

The City plans to serve wholesale water to the City of Chehalis within the 10-year planning horizon using the regional groundwater supply described in Section 1.1. Therefore, the City of Chehalis' water service area is mapped is within the greater City of Centralia Service Area (Figure 1-1B).

The City has entered discussions with the communities of Boistfort and Galvin regarding regionalization of water resources in the future. No formal discussions about wholesale agreements have occurred between these water systems and therefore they are not considered future wholesale areas. As these discussions continue, and should a decision be made to plan to include one or both communities in a regionalization project, this WSP will be updated accordingly.

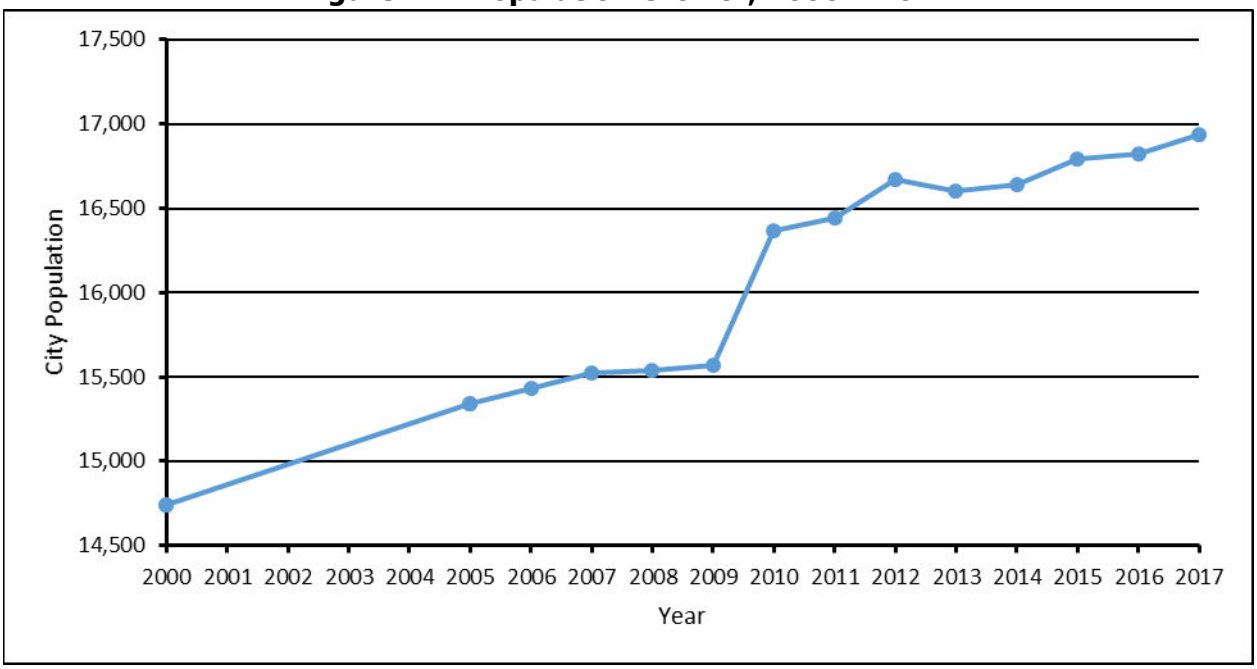
2.4 Population

2.4.1 Historical Population

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

Figure 2-2 depicts the historical trend in population growth for the City of Centralia, based upon OFM information. The data for years 2000 and 2010 are based on US Census data, while the data for other years are based on OFM estimates provided in the 2018 Centralia Comprehensive Plan. The OFM estimates show the City's population has grown from 14,742 in 2000 to approximately 16,940 in 2017. (The abrupt increase from 2009 to 2010 may be due to the estimation procedure used for the years leading up to the 2010 US Census. Census data are typically considered more accurate than estimates in the intervening years.) Population is only shown through 2017 because subsequent year populations are forecast estimates in the current comprehensive plan.

Figure 2-2. Population Growth, 2000 – 2017



Data Source: 2018 Comp Plan, Chapter 3

As discussed in Section 2.3, the City water system serves some connections located outside of City Limits as well. The accounting of the actual population served by the City water system is arrived at through analysis of service connections.

Table 2-2 provides a summary of historical service connections and population served. This information is based on City billing records combined with averages for the number of people per household in both single-family and multi-family dwelling units.

Table 2-2. Water System Connections and Population Served

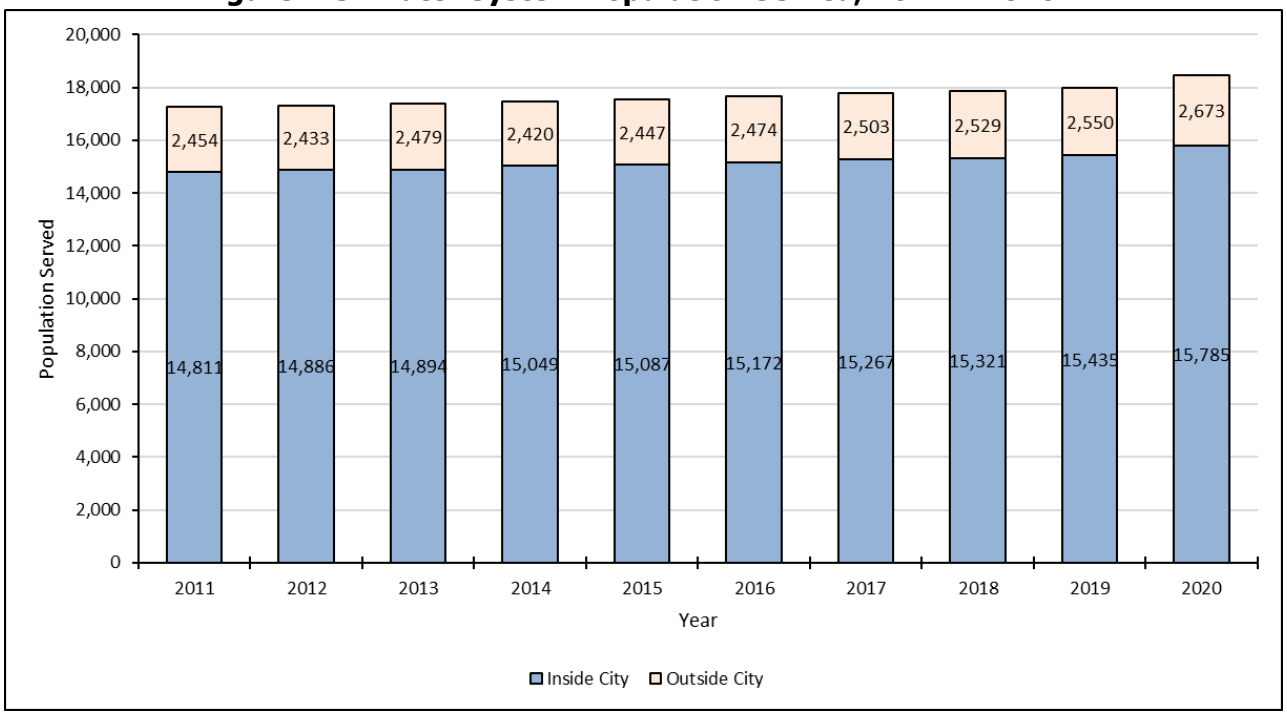
Inside City								
	Connections [1]					Residential Population Served [2]		
	Single-Family Residential	Multi-Family Residential	Commercial	Other	Total	Single-Family Residential	Multi-Family Residential	Total
2011	4,592	308	672	106	5,678	11,296	3,514	14,811
2012	4,590	315	682	107	5,694	11,291	3,594	14,886
2013	4,612	311	684	105	5,712	11,346	3,549	14,894
2014	4,638	319	683	105	5,745	11,409	3,640	15,049
2015	4,658	318	692	101	5,769	11,459	3,628	15,087
2016	4,688	319	698	98	5,803	11,532	3,640	15,172
2017	4,731	318	703	100	5,852	11,638	3,628	15,267
2018	4,821	303	740	103	5,967	11,860	3,461	15,321
2019	4,863	304	760	104	6,032	11,963	3,471	15,435
2020	4,835	341	723	100	5,999	11,894	3,891	15,785
Outside City								
	Connections [1]					Residential Population Served [2]		
	Single-Family Residential	Multi-Family Residential	Commercial	Other	Total	Single-Family Residential	Multi-Family Residential	Total
2011	877	26	46	15	964	2,157	297	2,454
2012	873	25	43	14	955	2,148	285	2,433
2013	878	28	42	13	961	2,160	319	2,479
2014	863	26	43	13	945	2,123	297	2,420
2015	865	28	45	14	952	2,128	319	2,447
2016	876	28	44	15	963	2,155	319	2,474
2017	897	26	46	17	986	2,207	297	2,503
2018	909	26	48	14	997	2,236	293	2,529
2019	917	26	49	15	1,006	2,256	294	2,550
2020	943	31	54	14	1,042	2,320	354	2,673
Total								
	Connections [1]					Residential Population Served [2]		
	Single-Family Residential	Multi-Family Residential	Commercial	Other	Total	Single-Family Residential	Multi-Family Residential	Total
2011	5,469	334	718	121	6,642	13,454	3,811	17,265
2012	5,463	340	725	121	6,649	13,439	3,879	17,318
2013	5,490	339	726	118	6,673	13,505	3,868	17,373
2014	5,501	345	726	118	6,690	13,532	3,936	17,469
2015	5,523	346	737	115	6,721	13,587	3,948	17,534
2016	5,564	347	742	113	6,766	13,687	3,959	17,647
2017	5,628	344	749	117	6,838	13,845	3,925	17,770
2018	5,730	329	788	117	6,964	14,096	3,754	17,850
2019	5,780	330	809	119	7,038	14,219	3,765	17,984
2020	5,778	372	777	114	7,041	14,214	4,245	18,458

[1] Source of Data: City billing records.

[2] Single-Family Residential Population = Single-Family Residential Connections X 2.46 people/connection
Multi-Family Residential Population = Multi-Family Residential Connections X 7 multi-family housing units/connection X 1.63 people/multi-family housing unit. These numbers were provided by the City of Centralia Public Works Department.

The total number of system connections has increased from 6,642 in 2011 to 7,041 in 2020. This translates to an increase in population served of 17,265 to 18,548 during the same time period. The in-City percentage of population served was 86 percent in 2020. This proportion of in-City population served has been historically consistent (Figure 2-3).

Figure 2-3. Water System Population Served, 2011 – 2020



Data Source: Water Utility Billing Records. Population estimates are based upon number of billed services, translated to housing units and population (see Table 2-2).

2.4.2 Population Forecast

The 2018 Comp Plan and 2018 City of Centralia Population Growth Memorandum (2018 Population Forecast), prepared by SCJ Alliance, were used as the basis for population and water demand forecasting in this WSP.

20-year Population Forecast

The 2018 Comp Plan provides a 20-year population forecast, based on OFM's forecast. The City anticipates a population in the city limits of 26,280 by 2040. This projection represents a compound annual growth rate of 1.76 percent between 2020 and 2040. (Source: 2018 Comp Plan Appendix B and 2018 Population Forecast, Table 10.)

50-year Population Forecast

SCJ Alliance produced the City of Centralia Population Growth Memorandum, which extends the 20-year population forecast out to a 50-year medium-to-high-range forecast. The City anticipates a population of 38,172 by 2070. This projection results in an average compound annual growth rate of 1.33 percent between 2040 and 2070. (Source: 2018 Population Forecast, Table 10.)

In the case of long-range utility planning, it is sensible to utilize a conservative (i.e., high) growth assumption that is grounded in land use-based planning. Therefore, the future needs analysis of this WSP is predicated on these growth assumptions. During subsequent WSP updates, growth projections will be revisited to take into account changes in comprehensive planning that will

occur over time. Also, forecasting population over such a distant horizon will inevitably miss population fluctuations caused by unpredictable economic and social events.

2.4.3 Population Forecast for Wholesale Service Area

Future wholesale customers are responsible for conducting their own population and demand forecasts, which are presented in their respective WSPs. The City of Chehalis most recently updated its WSP in 2011.

3. Water Demand Forecast

This section provides a summary of historical water production and consumption for the City of Centralia (City), as well as detailed forecasts of future water demand.

3.1 Water Production History

Water production is defined for the City as the total volume of water withdrawn from its groundwater supplies. Volume is reported in million gallons (MG). The City's annual production history for 2012-2020 is presented in Table 3-1, based upon well meter records. Table 3-2 shows monthly production from 2012 to 2020. Data from 2020 indicates the total system production was approximately 735 MG. Figure 3-1 provides a monthly comparison for the years 2014 to 2020.

Table 3-1. Annual Well Production (MG), 2012-2020

	K St. (1)	Washington(2)	Tennis Court	Port District (3)	Total
2012	0	0	470	306	776
2013	0	0	329	449	778
2014	0	0	411	402	813
2015	0.34	0	490	366	856
2016	0	0	275	476	751
2017	0	0	237	518	755
2018	0	0	180	647	827
2019	0	0	153	600	753
2020	0	0	184	551	735

Notes:
(1) The K St. wells are utilized to meet seasonal demands when necessary and were only used in 2015.
(2) The Washington Wells are emergency sources.
(3) Eshom Well production is included in the Port District wellfield.

Table 3-2. Monthly Well Production (MG), 2012-2020

	2012	2013	2014	2015(1)	2016	2017	2018	2019	2020
January	57.7	57.6	56.6	65.1	52.8	56.9	52.9	52.9	52.8
February	54.8	53.3	54.3	59.4	47.4	47.5	48.3	49.1	48.9
March	59.3	58.1	58.5	71.6	51.1	51.7	53.9	54.6	52.1
April	58.9	57.6	59.1	70.6	53.3	52.7	76.3	54.9	43.2
May	63.8	66.1	62.5	65.0	63.4	57.1	104.9	67.1	57.1
June	62.3	68.9	73.8	89.6	79.2	66.9	60.0	79.1	62.4
July	78.9	93.3	92.9	104.9	80.8	88.9	100.1	83.2	85.4
August	92.4	88.2	93.1	94.7	90.1	93.2	95.1	87.5	90.7
September	79.3	64.9	71.6	67.1	65.2	73.3	66.5	63.4	74.5
October	58.9	58.9	67.0	58.0	59.2	58.3	58.7	56.6	60.7
November	53.2	52.8	62.8	53.2	53.2	53.3	56.6	52.9	52.1
December	56.9	59.2	61.4	57.2	55.4	54.9	53.9	52.0	55.8
Total	**776.6**	**778.8**	**813.5**	**856.6**	**751.0**	**754.8**	**827.2**	**753.3**	**736.0 (2)**

Notes:
(1) Data for May and December of 2015 is estimated, due to data collection interruptions.
(2) Total does not match 2020 production total in Table 3-2 due to rounding.

Figure 3-1. Monthly Water Production (2014-2020)

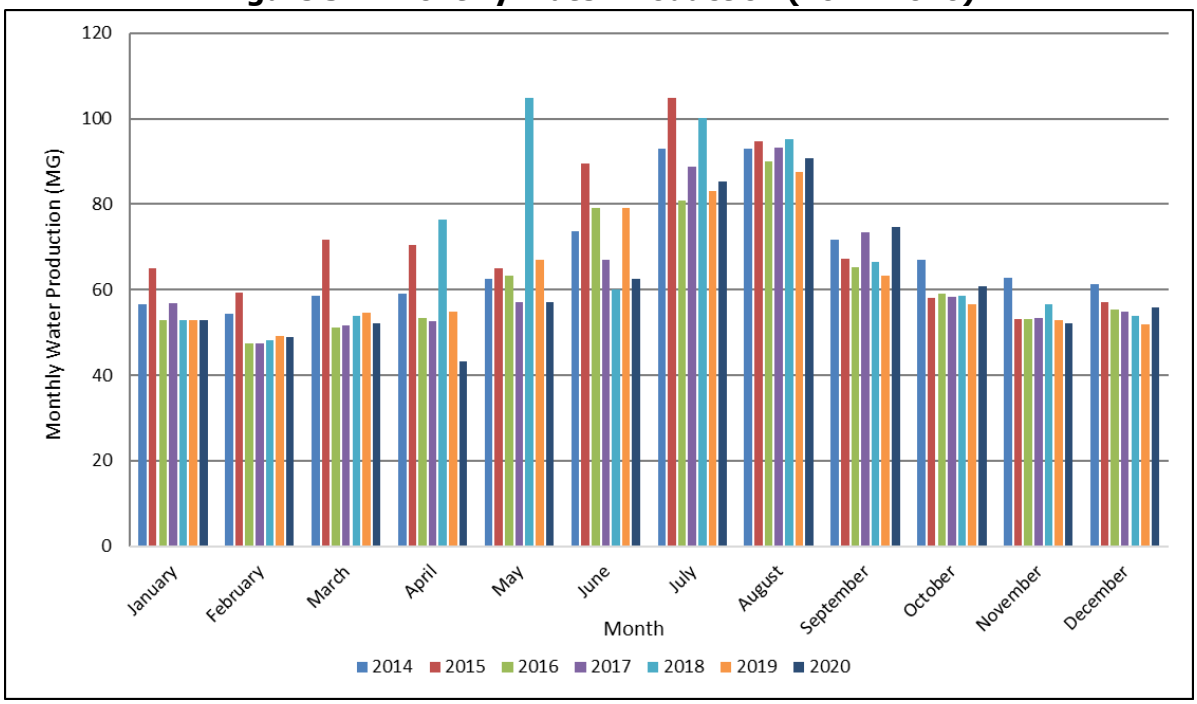


Table 3-3 summarizes average day and maximum day production from 2011 to 2020. Average day production is the total volume produced in a calendar year, divided by the number of days in that year. Maximum day production is defined as the highest amount of water produced on a single day in the calendar year, typically occurring in the summer. Table 3-3 includes the peaking factor, which is determined by dividing the maximum day production by the average daily production.

Average day production has averaged approximately 2.11 million gallons per day (mgd) from 2018 – 2020 (three-year average), while maximum day demand has averaged approximately 4.07 mgd over the same period. The average peaking factor during this same period is 1.92. This factor was used to develop maximum day demand forecasts, as described in a later section.

Table 3-3. Average and Maximum Day Production, 2011-2020

	Average Day Production (MGD)	Maximum Day Production (MGD)	Peaking Factor
2011	2.13	3.33	1.56
2012	2.13	3.74	1.76
2013	2.13	3.24	1.52
2014	2.23	3.85	1.73
2015	2.35	4.10	1.75
2016	2.06	4.88	2.37
2017	2.07	3.97	1.92
2018	2.27	4.50	1.99
2019	2.06	3.75	1.82
2020	2.01	3.95	1.96
3-Year Average	**2.11**	**4.07**	**1.92**

3.2 Customer Categories, Connections, and Consumption

The City maintains billing record summaries for water sold in each customer category. The five customer billing categories are: single family residential, multi-family residential, commercial, industrial, and other (which includes hydrant flushing, hydrant sales, and leak adjustments).

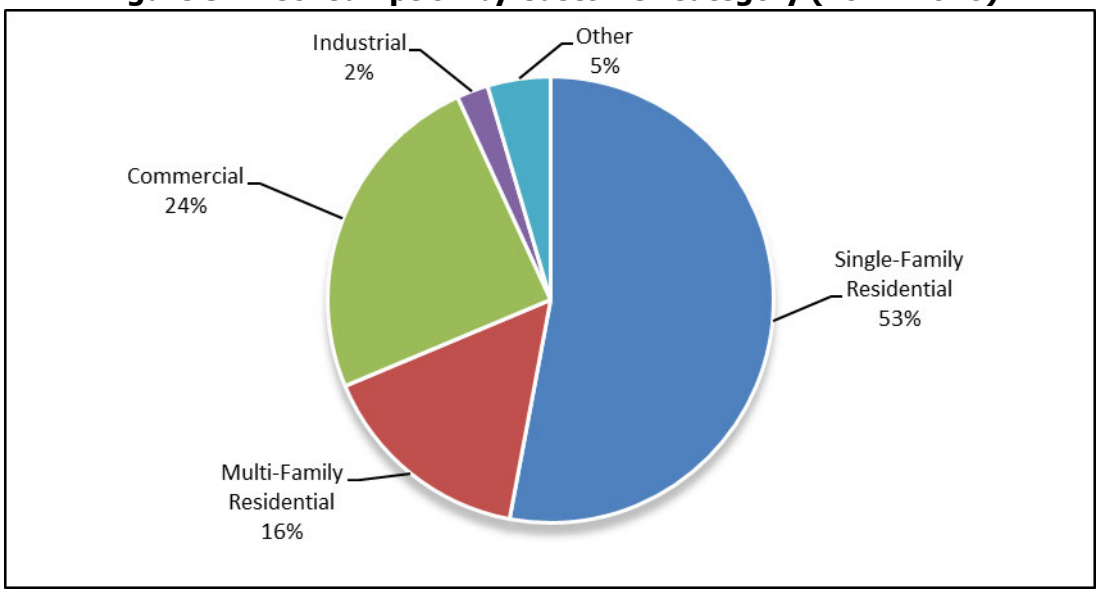
The number of connections from 2011 to 2020 is provided in Table 2-2 of Section 2. In December of 2020, the City served 7,041 connections. The majority of these (82%) were single family residential. Connections are defined by their location either inside the City Limits or outside the City Limits. The total annual consumption from 2011 to 2020 by each customer class is shown in Table 3-4. The percentage of consumption by customer class is shown in Figure 3-2.

Table 3-4. Water Consumption (MG except where noted), 2011-2020 [1]

Inside City							
	Single-Family	Multi-Family	Commercial	Industrial	Other	Total Consumption	Average Daily Consumption (mgd)[2]
2011	252	84	111	11	14	472	1.29
2012	253	80	114	11	16	474	1.30
2013	249	81	114	9	13	466	1.28
2014	250	83	125	15	19	492	1.35
2015	263	82	126	15	26	512	1.40
2016	255	81	120	15	24	495	1.36
2017	256	83	126	15	23	504	1.38
2018	259	83	129	16	30	518	1.42
2019	257	83	128	14	34	517	1.42
2020	266	93	121	14	33	528	1.45
Outside City							
	Single-Family	Multi-Family	Commercial	Industrial	Other	Total Consumption	Average Daily Consumption (mgd)[2]
2011	60	7	23	-	5	95	0.26
2012	60	9	24	-	4	97	0.27
2013	55	9	24	-	4	93	0.25
2014	59	12	22	-	6	99	0.27
2015	60	12	22	-	7	102	0.28
2016	59	11	22	-	7	100	0.27
2017	59	11	23	-	4	98	0.27
2018	61	14	25	-	4	104	0.29
2019	58	14	24	-	4	100	0.27
2020	61	13	25	-	6	105	0.29
Total							
	Single-Family	Multi-Family	Commercial	Industrial	Other	Total Consumption	Average Daily Consumption (mgd)[2]
2011	313	90	134	11	19	567	1.55
2012	313	89	138	11	20	572	1.57
2013	304	91	138	9	17	559	1.53
2014	309	95	148	15	25	591	1.62
2015	323	95	148	15	33	614	1.68
2016	315	92	143	15	31	595	1.63
2017	316	94	150	15	27	602	1.65
2018	320	97	155	16	34	623	1.71
2019	315	97	153	14	38	617	1.69
2020	327	106	146	14	39	633	1.73
Average	**315**	**95**	**145**	**14**	**28**	**597**	**1.64**

Notes:
[1] From water utility records, Billed Consumption Report. Usage converted from units of hundred cubic feet (CCF) to million gallons (MG).
[2]Total consumption in million gallons divided by days per year.

Figure 3-2. Consumption by Customer Category (2011-2020)



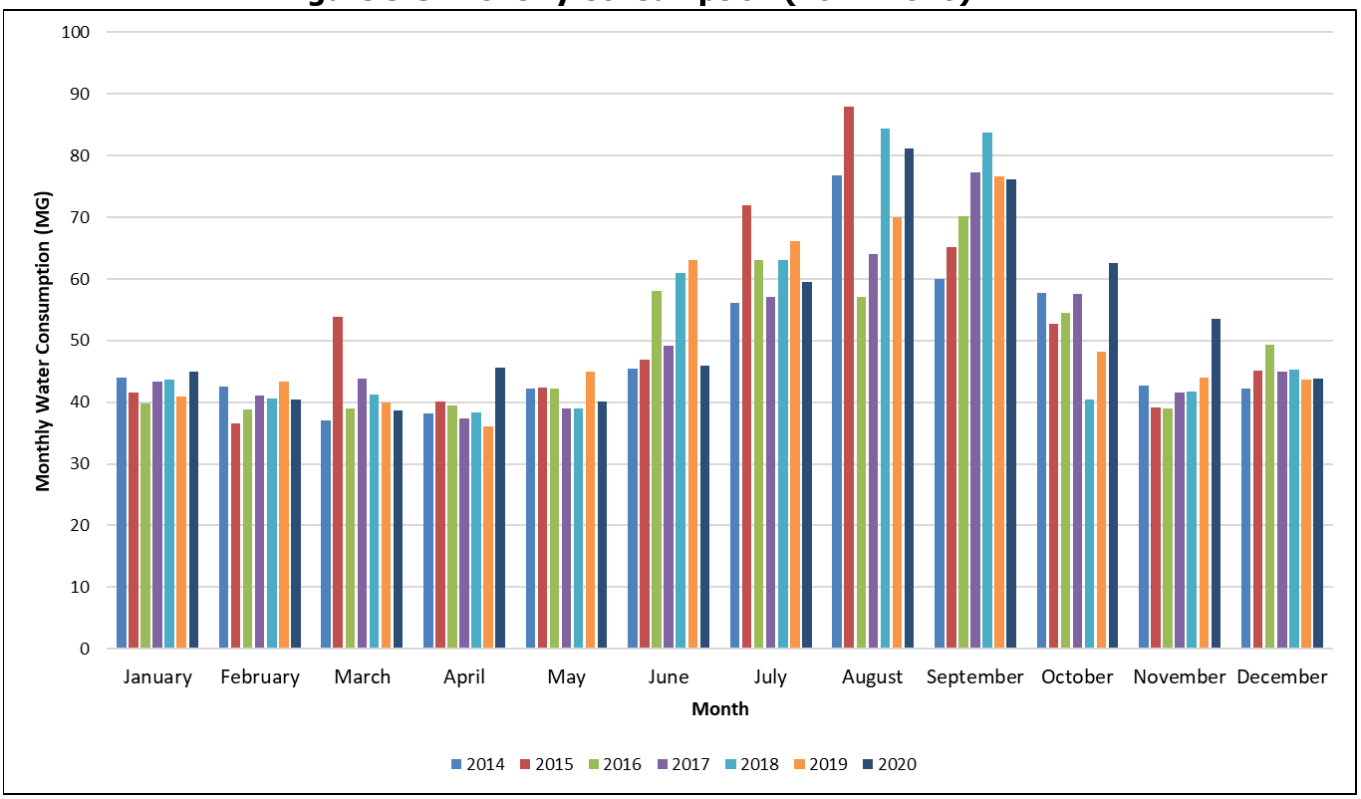
Monthly billed water consumption for 2011-2020 is provided in Table 3-5. The monthly and annual distribution of reported and actual water use may differ somewhat from this representation since billing numbers are based on meter read dates, which lag behind actual use. Monthly distribution of water consumption is shown in Figure 3-3.

Table 3-5. Monthly Water Consumption (MG), 2011-2020 (1)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
January	40	39	39	44	42	40	43	44	41	45
February	40	39	43	43	37	39	41	41	43	41
March	41	36	34	37	54	39	44	41	40	39
April	39	44	37	38	40	40	37	38	36	46
May	38	41	44	42	42	42	39	39	45	40
June	43	47	45	45	47	58	49	61	63	46
July	51	45	49	56	72	63	57	63	66	59
August	57	60	73	77	88	57	64	84	70	81
September	67	74	62	60	65	70	77	84	77	76
October	62	55	43	58	53	54	58	40	48	63
November	35	40	51	43	39	39	42	42	44	54
December	46	45	38	42	45	49	45	45	44	44
Total	**559**	**565**	**561**	**585**	**623**	**590**	**596**	**623**	**617**	**633**

Notes:
(1) From water utility billing records.

Figure 3-3. Monthly Consumption (2014-2020)



The largest customers in the City are in the commercial category. Together, they comprise between 7% and 11% of the total consumption in the system as measured between 2018 and 2020. Table 3-6 summarizes the 15 largest customers.

Larger users may be served in the future, with the potential for industrial expansion at locations such as the Port of Centralia and the Industrial Park at TransAlta. Such industrial growth is envisioned in the Lewis County Comprehensive Plan and is therefore considered in the City's long-range demand forecast, as an "Additional Allowance," presented in Section 3.5.

Table 3-6. Summary of Largest Water Customers [1]

Top Customers in All Three Years				
Name	2018 Consumption (MG)	2019 Consumption (MG)	2020 Consumption (MG)	2018-2020 Average (MG)
Sierra Pacific Industries	8.6	7.8	8.1	8.2
Parks Department	10.0	7.5	6.9	8.1
NW Hardwoods	8.8	6.9	7.3	7.7
Providence Hospital	7.4	7.2	7.0	7.2
Ives & Harrison Family HSG LLC	4.0	5.1	4.4	4.5
Harrison RV Park	3.5	3.6	4.3	3.8
Millard Refrigerated Services (Sprinkler)	3.6	3.3	3.1	3.3
KPS Motels LLC	2.4	3.1	3.9	3.1
Millard Refrigerated Services (2")	2.7	3.0	2.9	2.9
Care Center Centralia Inc	3.2	3.1	2.9	3.1
Safeway, Inc.	2.9	2.7	2.7	2.8
Top Customers Not in All Three Years				
Name	2018 Consumption (MG)	2019 Consumption (MG)	2020 Consumption (MG)	2018-2020 Average (MG)
Centralia Holdings LLC	--	3.5	5.6	4.5
Inland Environmental Resources	--	3.2	2.9	3.1
SW Washington Fair	3.4	2.6	--	3.0
Sharon Care	4.3	--	--	4.3
TOTAL	**64.8**	**62.5**	**62.1**	**63.1**

Notes:
[1] Information from City billing records.

3.3 Water Balance and Distribution System Leakage

A water balance is an accounting of all water that is produced. The City's 2020 water balance is shown in Table 3-7. The table is a slightly modified version of the format recommended for use by the American Water Works Association.

Table 3-7. 2020 Water Balance

	Level 1	Level 2	Level 3	Volume (mg)	% of Produced Water
Water Produced	Revenue Water	Billed Authorized Consumption	1. Billed Water Exported	0.0 [1]	0%
			2. Billed Metered Consumption	633 [2]	86%
			3. Billed Unmetered Consumption	0.0 [1]	0%
	Non-Revenue Water	Unbilled Authorized Consumption	4. Unbilled Metered Consumption	0.0 [3]	0%
			5. Unbilled Unmetered Consumption	66 [4]	9%
		Apparent Losses	6. Unauthorized Consumption	0.0 [3]	0%
			7. Customer Metering Inaccuracies	0.0 [3]	0%
		Real Losses	8. Known Leakage	0.0 [3]	0%
			9. Assumed Leakage	36 [5]	5%
Total				735	100%

Notes:
(1) This category does not apply to Centralia.
(2) Data Source: City records, Billed Consumption Report.
(3) City staff do not track this number; therefore zero was used in the water balance.
(4) City estimates unbilled authorized consumption is 9% of production.
(5) Water Production minus all other categories.

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 in understanding what percent of water production generates income for the City. Additionally, non-revenue water needs to be factored into the demand forecast. The City's 2020 water production is divided into 86% Revenue Water and 14% Non-Revenue Water.

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

- **Unbilled Authorized Consumption:** Includes uses such as water system flushing, firefighting, and unbilled contractor use. Typically, it is standard practice not to charge for uses falling into this sub-category. However, it is always a prudent idea to review these uses to ensure that a legitimate revenue opportunity is not missed. The City estimates that 9% of production has been unbilled authorized consumption. This is based on records kept in 2020, which includes receiving and documenting information from the fire department and public works regarding authorized uses. The City plans to refine their accounting of unbilled authorized consumption using the Lucity water loss module to improve documentation in the future.
- **Apparent Losses:** Includes unauthorized uses and customer meter inaccuracies, both of which are lost revenue opportunities.

- **Real Losses:** Includes various types of system leaks. A certain level of leakage is unavoidable; however, leakage beyond that level should be repaired to avoid unduly burdening both the natural resource and the physical infrastructure. Any amount that cannot be assigned to another category is considered a real loss under the American Water Works Association's protocol, as well as per the formula for calculating distribution system leakage under Washington State's Water Use Efficiency Rule.

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

A longer history of other water balance elements, namely distribution system leakage and non-revenue water is provided in Table 3-8.

Table 3-8. Distribution System Leakage and Non-Revenue Water (mg)

Year	Water Produced[1]	Authorized Consumption[2]	Billed Consumption	Non-Revenue Water		Distribution System Leakage[4]	
				Qty	Percent of Billed Consumption[3]	Qty	Percent of Production & Purchases
2011	778	668	567	211	37%	110	14.1%
2012	777	663	572	205	36%	114	14.7%
2013	779	660	559	220	39%	119	15.2%
2014	813	679	591	222	38%	134	16.5%
2015	856	692	614	242	39%	164	19.2%
2016	751	651	595	156	26%	100	13.3%
2017	755	671	602	153	25%	84	11.1%
2018	827	697	623	204	33%	130	15.7%
2019	753	685	617	136	22%	68	9.1%
2020	735	699	633	102	16%	36	4.9%
2011-2020 Average	**782**	**676**	**597**	**185**	**31%**	**106**	**13.4%**
2018-2020 Average	**772**	**694**	**624**	**147**	**24%**	**78**	**9.9%**

Notes:
[1] Data Source: Table 3-1.
[2] Data Source: Water utility records, Billed Consumption Report.
[3] Used for developing the demand forecast. Note this is intentionally different than non-revenue as a percent of production.
[4] Distribution system leakage is defined in the Water Use Efficiency Rule as water production minus authorized consumption.

The City's distribution system leakage has been an average of 13.4% of production from 2011-2020. The three-year average from 2018 to 2020 was 9.9%. This is below the 10% threshold mandated by the Water Use Efficiency Rule; therefore, the City is not required to develop a Water Loss Action Plan.

3.4 Water Use Factors and Equivalent Residential Units

ERUs are a method of representing all types of water use as an equivalent number of single-family households. The ERU value represents the average amount of water consumption by a single-family household and is calculated by dividing the system-wide total single-family water consumption by the number of single-family connections. Table 3-9 summarizes the single-

family water consumption from 2011-2020, the number of connections, and the calculated ERU value. The three-year average for 2018-2020 is 153 gpd per ERU.

This analysis also yielded information regarding the number of ERUs for the other water use categories defined in Section 3.2. For each category, the total consumption was divided by the ERU value to arrive at the equivalent number of ERUs.

Table 3-9. Equivalent Residential Unit (ERU) Analysis

	Single-Family Residential Consumption (MG) [1]	Single-Family Residential Connections or ERUs [2]	ERU Water Demand Factor (GPD) [3]	Multi-Family ERUs [4]	Commercial ERUs [5]	Industrial ERUs [6]	"Other" ERUs [7]	Non-revenue ERUs [8]	Total ERUs [9]
2011	313	5,469	157	1,580	2,341	191	336	3,692	13,610
2012	313	5,463	157	1,555	2,417	198	352	3,589	13,573
2013	304	5,490	152	1,641	2,495	169	309	3,968	14,072
2014	309	5,501	154	1,690	2,627	259	440	3,962	14,479
2015	323	5,523	160	1,617	2,526	262	564	4,143	14,635
2016	315	5,564	155	1,630	2,522	265	542	2,760	13,284
2017	316	5,628	154	1,679	2,673	274	485	2,723	13,461
2018	320	5,730	153	1,736	2,765	290	611	3,648	14,780
2019	315	5,780	149	1,772	2,799	258	701	2,494	13,803
2020	327	5,778	155	1,872	2,571	255	686	1,806	12,968
Average ('18–'20)	**321**	**5,763**	**153**	**1,793**	**2,712**	**268**	**666**	**2,649**	**13,850**

Notes:
[1] From Table 3-4.
[2] From Table 2-2.
[3] Single-family residential consumption divided by number of single-family residential connections.
[4] Multi-family residential consumption (from Table 3-4) divided by the ERU value.
[5] Commercial consumption (from Table 3-4) divided by the ERU value.
[6] Industrial consumption (from Table 3-4) divided by the ERU value.
[7] Other consumption (from Table 3-4) divided by ERU value.
[8] Non-revenue consumption (from Table 3-8) divided by the ERU water demand factor.
[9] Sum of all calculated ERUs.

Another water use factor is calculated for industrial and commercial use. Appendix D in the 2018 City of Centralia Comprehensive Plan reports that the current developed commercial and industrial land areas are 351 acres and 668 acres respectively. From Table 3-4, the commercial and industrial consumption is divided by the current developed area to yield a water use factor of 1,171 gpd/acre for commercial consumption and 63 gpd/acre for industrial consumption. These values are used in the water demand forecast presented in the following section.

3.5 Water Demand Forecast

As the City's population grows and commercial/industrial development occurs, demands on the water system will increase accordingly. To anticipate the level of water supply requirements and to adequately plan for system improvements required to meet future needs, the City has developed a water demand forecast. The forecast takes into account the planning

considerations presented in Section 2, while also factoring in the effects of future conservation efforts and accounting for potential large industrial development.

While the time horizon for the WSP is 20 years in length (i.e., to year 2042), the demand forecast has been developed considering a 50-year horizon (i.e., to year 2072). This was done to investigate the effects of continued growth upon the water system and to help guide long-term water supply strategies. The following sections describe how the water demand forecast was prepared.

3.5.1 50-Year Water Demand Forecast

A multi-step process was taken in developing the water demand forecast, as described below:

- **Step 1 Single-Family Demands**. The projection for single-family demands began with the 2020 number of single family ERUs as a base, with the number of ERUs projected out to Year 50 (2072) using an annual growth rate of 1.76% from years 2021-2041 and an annual growth rate of 1.33% for years 2042-2072. These growth rates are based on demographic forecasts in the Comprehensive Plan and the SCJ Alliance Population Projections for the City. The number of ERUs is then multiplied by the ERU value of 153 gpd. For the purpose of long-range planning, the City is employing this as a conservative (i.e., “high”) estimate of potential water demands that may need to be met in the long term. The City should monitor demand growth from decade to decade as actual demands might grow quicker or slower than forecasted.

- **Step 2 Multifamily Demands**. The projection for multi-family demands began with the 2020 actual consumption, which was then increased by the same annual growth rates identified in step 1.

- **Step 3 Commercial Demands**. The projection for the commercial demands began with the 2020 actual consumption for the commercial billing category minus the Largest Users. For Year 20 (2042), the expected number of commercial acres developed in Year 20 (per the Comprehensive Plan) is multiplied by the commercial water use factor, 1,171 gpd/acre. For Year 10 (2032), the demand is interpolated between the Base Year and Year 20, using a compound growth rate. For Year 50 (2072), the Year 20 demand is increased by annual growth rates consistent with what is described in step 1.

- **Step 4 Industrial Demands**. The projection for industrial demands began with the 2020 actual consumption. For Year 20 (2042), the expected number of industrial acres developed in Year 20 (per the Comprehensive Plan) is multiplied by the industrial water use factor, 63 gpd/acre. For Year 10 (2032), the demand is interpolated between the Base Year and Year 20, using a compound growth rate. For Year 50 (2072), Year 20 (2042) demand is increased by annual growth rates consistent with what is described in step 1.

- **Step 5 Largest Users Demands**. The demand projection for the “Large Users” category used the 2020 actual consumption, which was held constant through Year 50 (2072) as no substantial growth is anticipated by these customers.

- **Step 6 Other Uses**. The demand projection for Other Uses began with the 2020 actual consumption, which was then increased by annual growth rates as described in step 1.

- **Step 7 Regional Wholesale Demands**. The City is in discussions with the neighboring City of Chehalis for a wholesale water agreement. Centralia recognizes that there may be other neighboring communities who may purchase water wholesale in the future as well. This regional supply will be associated with additional water rights the City acquired from TransAlta (see Section 7.1.4 - Water Rights Self-Assessment for more information). The regional wholesale demands could be up to 3 mgd maximum day demand beginning in the mid-2020s (no specific date set as of the writing of this plan). Therefore, 3 mgd was applied as MDD at the 10-year planning horizon and ADD was calculated by dividing MDD by the peaking factor (3 mgd ÷ 1.92 = 1.6 mgd approximately). For the 20-year planning horizon, the forecast assumes both ADD and MDD are 3 mgd. This reflects a planning assumption that 3 mgd will not be used on a daily basis by the 10-year horizon, but that it could be by the 20-year horizon.
- **Step 8 Industrial Additional Allowance Demands**. The demand projection for the Industrial Allowance begins with zero demand in the Base year then adds 0.5 mgd every five years. This allowance accounts for demands related to potential industrial expansion that would bring more intensive water uses than that of the current industrial sector in Centralia. with the supply to meet these potential additional demands also comes from the water rights the City acquired from TransAlta.
- **Step 9 Subtotal Average Day Demand (ADD)**. The subtotal for the Average Day Demand is a summation of all the categories above.
- **Step 10 Non-Revenue Water**. The demand projection for Non-Revenue Water multiplies the subtotal ADD, excluding the regional wholesale and industrial additional allowance, by the non-revenue factor of 24%.
- **Step 11 Total Average Day Demand (ADD)**. The subtotal ADD and non-revenue water added together.
- **Step 12 Maximum Day Demand (MDD)**. A peaking factor of 1.92 (2018-2020 average) is applied to the ADD for all categories except the Industrial Additional Allowance and Regional Wholesale, assuming that high water use industries do not exhibit seasonal or diurnal peaking like other uses. Regional Wholesale MDD is described in step 7.
- **Step 13 Conservation**. As discussed in Section 4.4, the City has established two water use efficiency goals. One of them calls for a more aggressive reduction in distribution system leakage (DSL) than is envisioned in the baseline demand forecast, by maintaining DSL at less than ten percent of production by 2019. This has been achieved since the goal was adopted.

As presented in Table 3-10, the Year 10 (2032) water demand (with additional conservation effects considered) is projected to be 5.28 mgd on an average day basis and 9.23 mgd on a maximum day basis. This level of demand increases to 8.46 mgd and 11.65 mgd by Year 20 (2042), on average and maximum day bases, respectively. The Year 50 (2072) demand forecast reaches 13.07 mgd and 17.74 mgd on average and maximum day bases.

The results of the forecast without the effects of additional conservation are slightly higher. These more conservative demand projections are used throughout the WSP in such efforts as the water system analysis and development of system improvements.

Table 3-10. Water Demand Forecast

Water Use Category	Base (2021)			10-Year (2032)			20-Year (2042)			50-Year (2072)		
	No. of ERUs	Demand (MGD)		No. of ERUs	Demand (MGD)		No. of ERUs	Demand (MGD)		No. of ERUs	Demand (MGD)	
		ADD	MDD [2]		ADD	MDD [2]		ADD	MDD [2]		ADD	MDD [2]
Single-Family Residential [1]	5,981	0.91	1.75	7,247	1.11	2.13	8,628	1.32	2.53	12,880	1.97	3.78
Multi-Family Residential [1]	1,938	0.30	0.57	2,348	0.36	0.69	2,796	0.43	0.82	4,173	0.64	1.22
Commercial [3]	1,585	0.24	0.46	2,869	0.44	0.84	4,746	0.72	1.39	7,084	1.08	2.08
Industrial [4]	270	0.04	0.08	411	0.06	0.12	590	0.09	0.17	880	0.13	0.26
Other Uses [5]	710	0.11	0.21	861	0.13	0.25	1,025	0.16	0.30	1,529	0.23	0.45
Largest Users [6]	1,114	0.17	0.33	1,114	0.17	0.33	1,114	0.17	0.33	1,114	0.17	0.33
Regional Wholesale [7]	0	0.00	0.00	10,226	1.56	3.00	19,654	3.00	3.00	19,654	3.00	3.00
Additional Allowance [8]	0	0.00	0.00	6,551	1.00	1.00	13,103	2.00	2.00	32,757	5.00	5.00
Subtotal	11,598	1.77	3.40	31,627	4.83	8.36	51,655	7.88	10.54	80,072	12.22	16.11
Non-Revenue Water [9]	2,784	0.42	0.82	3,564	0.54	1.05	4,536	0.69	1.33	6,639	1.01	1.95
Total Demand	14,382	2.20	4.22	35,191	5.37	9.40	56,190	8.58	11.87	86,710	13.24	18.06
Additional Conservation [10]	0.00	0.00	0.00	(594)	(0.09)	(0.17)	(756)	(0.12)	(0.22)	(1,106)	(0.17)	(0.32)
Total Demand with Conservation	**14,382**	**2.20**	**4.22**	**34,597**	**5.28**	**9.23**	**55,435**	**8.46**	**11.65**	**85,604**	**13.07**	**17.74**

ERU = Equivalent Residential Unit; ADD = Average Day Demand; MDD = Maximum Day Demand; MGD = Million Gallons per Day

[1] For years 2021-2041, the projected annual growth rate is 1.76% per year as documented in the 2018 Centralia Comprehensive Plan. For years 2042-2072, the projected annual growth rate is 1.33% per year as documented in the 2018 SCJ Alliance City of Centralia Population Growth Memorandum. ADD is based on a water use factor of 153 gallons per day/ERU.

[2] Based on a peaking factor of 1.92.

[3] Year 2042 projection reflects additional commercial development accommodated by existing and available commercial parcels in the UGA expansion areas. Commercial water use factor is 1,171 gpd/acre. Year 2021 and 2032 projection is based upon interpolation between 2019 and 2042. Projections beyond year 2042 are based upon growth rates as defined in footnote 1.

[4] Year 2042 projection reflects additional industrial development accommodated by existing and available industrial parcels in the UGA expansion areas. Industrial water use factor is 63 gpd/acre. Year 2021 and 2032 projection is based upon interpolation between 2019 and 2042. Projections beyond year 2042 are based upon growth rates as defined in footnote 1.

[5] Other Uses projection is based on growth rates defined in footnote 1.

[6] Largest Users is a subset of the commercial demand and is assumed to be constant through the entire planning period.

[7] Reflects water demands reserved for future regional wholesale demands described in step 7 of section 3.5.1.

[8] Reflects allowances for unforeseen large industrial demands. Between 2021 and 2072, an allowance of 0.5 MGD is added every 5 years. A peaking factor is not applied to this category.

[9] Assumed as 24% of Subtotal consumption.

[10] Additional conservation efforts assume reduction in distribution system leakage (DSL) that beginning in 2021, DSL is no more than 10% of production and remains at this level into the future. The reductions in overall demand associated with this are depicted here.

3.5.2 Water Demand Forecast Apportioned to Pressure Zones

The 20-year water demand forecast presented in Table 3-10 has been divided amongst existing and envisioned future pressure zones, for the purpose of system analysis (as presented later in the WSP). As described above, the demand forecast without the adjustment for additional conservation effects is used. The key assumptions used to develop the pressure zone-based forecast for the 10-year and 20-year time horizons are summarized in Table 3-11. The 50 year forecast is not apportioned to pressure zones because the hydraulic modeling only goes though the 20 year time horizon. Water demand by pressure zone is summarized in Table 3-12.

Existing demand – The majority (i.e., 95 percent) of the existing demand is within the Central Zone. The remainder of the existing demand is allocated according to percentages shown in Table 3-11. All industrial and wholesale demands are allocated to the central zone.

New demand – New non-industrial demands were allocated to pressure zones based on the forecasted allocation percentages in the prior water system plan, which in turn were based on projected growth patterns throughout the City, which have remained the same since development of the prior plan. These allocations are presented in Table 3-11. All new industrial demands, including the additional allowance, were allocated to the central pressure zone.

Table 3-11. Pressure Zone Non-Industrial Demand Allocations

Pressure Zone	2021	2032	2042
Central Zone	95.1%	89.7%	81.0%
Cooks Hill	1.8%	4.1%	7.7%
Davis Hill	0.4%	1.6%	3.5%
Ham Hill	0.6%	0.5%	0.5%
Seminary Hill	1.1%	1.0%	0.9%
Winterwood Estates	0.5%	0.5%	0.4%
Zenkner Valley	0.5%	0.5%	0.4%
Widgeon Hill	0.0%	2.2%	5.7%

Table 3-12. Water Demand Forecast by Pressure Zone (in mgd)

	Base (2021)		10-Year (2032)		20-Year (2042)	
Pressure Zones	ADD	MDD	ADD	MDD	ADD	MDD
Central Zone	2.090	4.016	5.089	8.858	7.916	10.604
Cooks Hill	0.039	0.075	0.112	0.215	0.270	0.518
Davis Hill	0.009	0.017	0.043	0.084	0.121	0.233
Ham Hill	0.013	0.025	0.015	0.029	0.016	0.031
Seminary Hill	0.024	0.046	0.028	0.053	0.030	0.057
Winterwood Estates	0.011	0.021	0.013	0.024	0.013	0.026
Zenkner Valley	0.011	0.021	0.013	0.024	0.013	0.026
Widgeon Hill [(1)]	0.000	0.000	0.060	0.115	0.197	0.379
TOTAL	**2.195**	**4.219**	**5.372**	**9.402**	**8.577**	**11.874**

[(1)] The Widgeon Hill area to the southeast of the City has been recently made part of the City of Chehalis' UGA. However, it is shown as being within the City's Service Area, as there is still potential for the City to provide water service to this area.

4. Water Conservation

Water conservation consists of any beneficial reduction in water losses, waste, or use. Efficient water use benefits the environment, public health, and economy by helping to improve water quality, maintain aquatic ecosystems, and protect water resources. Through activities such as public education and leak detection, the City of Centralia (City) has realized water savings via conservation in recent years. However, the City is committed to strengthening and expanding its conservation efforts.

This section of the Water System Plan (WSP) presents a water conservation program for the City. The emphasis upon water conservation was bolstered by passage of 2E2SH1338 (Municipal Water Law – Efficiency Requirements Act, Chapter 5 Laws of 2003). This section provides information to comply with DOH guidance regarding Municipal Water Law requirements. Included is a statement of conservation objectives, evaluations of water conservation measures, and identification of selected water conservation activities.

4.1 Water Use Efficiency Requirements and Compliance Summary

The conservation planning requirements that must be addressed in water system plans are contained in the following sources:

- State of Washington Water Use Efficiency Rule (January 2007)
- Department of Health Water Use Efficiency Guidebook (January 2017)
- Department of Health Water System Planning Handbook (August 2020)

The State of Washington recently revised water conservation planning requirements as a result of the 2003 Municipal Water Law. An outgrowth of that law is the Water Use Efficiency Rule (Rule), which was finalized in January 2007. The Rule has several requirements and corresponding compliance dates. Some of the requirements are associated with water system plans, while other requirements are independent of the ten year water system planning cycle.

There are seven main categories of requirements: 1) meters, 2) data collection, 3) distribution system leakage, 4) goals, 5) efficiency program, 6) demand forecast, and 7) performance reports. Table 4-1 lists the requirements of the Rule and shows that the City is in compliance with current requirements, and is well prepared to comply with upcoming requirements.

Table 4-1. Compliance with Water Use Efficiency Rule Requirements

Category	Requirement	Centralia Compliance Status
Meters	1. Meter all sources.	Yes, all sources are metered.
	2. Meter all service connections.	Yes, all service connections are metered.
Data Collection	1. Provide annual consumption by customer class.	Yes, provided in Section 3.2
	2. Provide "seasonal variations" consumption by customer class.	Yes, provided in Section 3.2
	3. Evaluate reclaimed water opportunities.	Yes, provided in Section 4.3
	4. Consider water use efficiency rate structure.	Yes, Centralia's rate structure is conservation based.
	5. Provide monthly and annual production for each source.	Yes, provided in Section 3.1
Distribution System Leakage	1. Calculate annual volume and percent using formula defined in the Rule.	Yes, distribution system leakage is calculated and reported to DOH on an annual basis. See Section 4.6 for the City's Water Loss Control Action Plan.
	2. Report annually: annual leakage volume, annual leakage percent, and for systems not fully metered, meter installation progress and leak minimization activities.	
	3. Develop water loss control action plan (if leakage is over 10% for 3 year average).	
Goals	1. Establish measurable (in terms of water production or usage) conservation goals and re-establish every 6 years. Provide schedule for achieving goals.	Yes, measurable goals were originally established via a public process in October 2005. These goals were re-established in early 2012, during the course of the prior WSP update. The goals were then revised and adopted in August 2019, during the course of this WSP update.
	2. Use a public process to establish goals.	
	3. Report annually on progress.	Yes, report submitted annually to DOH
Efficiency Program	1. Describe existing conservation plan.	Yes. This information is contained in section 4.3
	2. Estimate water saved over last 6 years due to conservation program.	
	3. Describe conservation goals.	
	4. Implement or evaluate 1-12 measures, depending on size. (Six measures for Centralia).	
	5. Describe conservation programs for next 6 years including schedule, budget, and funding mechanism.	
	6. Describe how customers will be educated on efficiency practices.	
	7. Estimate projected water savings from selected measures.	Yes. The City evaluated seven measures, as reported in this water system plan update.
	8. Describe how efficiency program will be evaluated for effectiveness.	
	9. Estimate leakage from transmission lines (if not included in distribution system leakage).	N/A. All leakage is included in the distribution system leakage number.

Category	Requirement	Centralia Compliance Status
Demand Forecast	Provide demand forecast reflecting no additional conservation.	Yes, provided in Section 3
	Provide demand forecast reflecting savings from efficiency program.	
	Provide demand forecast reflecting all "cost effective" evaluated measures.	N/A. Since Centralia is implementing the required minimum number of measures, this forecast is not required.
Performance Reports	Develop annual report including: goals and progress towards meeting them, total annual production, annual leakage volume and percent and, for systems not fully metered, status of meter installation and actions taken to minimize leakage.	Yes, Centralia has submitted annual performance reports beginning in 2009.
	Submit annually by July 1 to DOH and customers and make available to the public.	

4.2 Current Conservation Program

The City established programs that strive to decrease the amount of unaccounted-for water and make efficient use of water. The City's commitment to conservation is reflected in the following objectives:

- Promote public awareness about the need for the wise use of water through an effective water conservation public education and technical assistance program.
- Decrease the City's level of unaccounted-for water use through implementation of proven supply-side demand management strategies such as leak detection and repair and replacement of inferior water mains.
- Achieve long-term reductions in average demands for water through effective implementation of feasible demand-side water conservation strategies.

The City's recent conservation program has consisted of eight components. A summary of each over the last six years is shown in Table 4-2. The details of each measure are discussed below.

Table 4-2. Current Conservation Program

Components	Currently Implemented by Centralia
1. Leak Detection and Repair	X
2. Service Meters	X
3. Source Meters	X
4. Conservation Kits	X
5. Public Outreach	X
6. Escalating Rate Structure	X
7. Landscape Management	X
8. Reclaimed Water	X

1. Leak Detection and Repair

There have been very significant improvements in the efficiency of water delivery in the City water system in the past 30 years. Currently, distribution system leakage is estimated at approximately 10 percent of total production. This is significantly less than the 40 percent level that existed in 1991.

To prevent major distribution system leakage the City is proactive in repairing and replacing failed water lines. Between 2011 and 2020, the City repaired 834 service leaks, replaced 270 service lines, repaired 316 main breaks, and replaced thousands of feet of old water main. The City continues proactive leak detection to assist in finding leaks that are not apparent at the ground surface.

2. Service Meters

All services within the City water system are metered. In 2003, the City began a meter replacement program to upgrade their meters to a mobile automated-read network. The program is complete. With the new system in place, the City has been identifying service leaks and making repairs based on the increased level of data provided by the meters.

3. Source Meters

The City has meters on all its sources.

4. Conservation Kits

The City distributes faucet aerators, hose nozzles, low flow showerheads, and toilet leak detection tablets to its customers to encourage water conservation. These kits are made available through the customer service center for all customer classes.

5. Public Outreach

An important component of the Water Conservation Program will be a means of alerting the water system customers to the need for water conservation. Typical approaches to public education about water conservation include:

- Public displays of water conservation educational materials at libraries, fairs, and other public places.
- Educational presentations in schools, before civic groups, etc.;
- Presentation of information on the City's website; and,
- Direct mail of water conservation promotional materials. The latter has been accomplished frequently through mailings of educational pamphlets and other materials in monthly water service billings.

The City regularly provides its water system customers with conservation-related educational materials enclosed in monthly billings. There were a few education programs conducted in the elementary school that included water conservation books and a discussion by City staff.

6. Escalating Rate Structure

The City uses an escalating rate structure. The 2021 consumption charge for single family residents begins at a rate of $3.21 per 100 cubic feet (CCF) for 1-6 CCF, increases to $4.30 per CCF for 6-15 CCF, and is at a maximum of $5.33 per CCF for over 15CCF.

7. Landscape Management

The City offers incentives to irrigation customers to have an irrigation meter installed at no cost if the customer incorporates conservation measures such as timers and water saving techniques to reduce irrigation water use. The City also promotes the use of rain gardens to capture storm water and reduce irrigation.

8. Reclaimed Water

The City's Wastewater Treatment Plant (WWTP) currently produces Class D reclaimed water. This water is used at the WWTP for in-plant purposes such as cleaning, spray water, and some landscape irrigation, and has reduced the amount of potable water used by the WWTP. At a maximum, the WWTP can produce 875 gallons per minute (i.e. approximately 1.25 mgd) of Class D reclaimed water. There are no plans to expand reclaimed water usage within the City, as it is cost-prohibitive at this time. However, a list of potential future reclaimed water uses is provided in Appendix F.

4.3 2019-2028 Conservation Program

The time period for the City's conservation program aligns closely with the 10-year planning period for the Water System Update. In the sections below, the conservation goals for the next 10 years are defined as well as the next phase of the City's conservation program.

4.4 Goals

The activities outlined in Section 4.5 constitute the City's key water conservation actions and implementation strategies. However, another key element in a conservation plan is to identify a specific water conservation target, thereby providing a goal by which the City can evaluate the effectiveness of its conservation strategies.

The Water Use Efficiency goals previously adopted by the City in 2012 are listed below, along with discussion of the City's progress in meeting those goals.

2011-2017 WUE Goals

1. ***Reduce distribution system leakage to less than ten percent of total production by 2031, as calculated on a rolling three-year average***. As described in more detail in Section 4.6, the City has made significant strides in resolving leaks over recent years, reducing the amount of leakage to 11 percent of production in 2017. This has been further reduced to 9.9 percent by 2020. Through the efforts described in Section 4.6 (i.e., full implementation of automated meter reading, periodic leak detection, and annual pipeline renewal and replacement activities), the City will proactively work to continue lowering the level of leakage. Because the City is already close to meeting the goal of maintaining leakage to less than ten percent of production, this goal has been modified, as noted below.

2. ***Maintain an average day demand Equivalent Residential Unit (ERU) water use factor of less than 200 gpd***. The City's per-ERU water use declined from an average of 212 gpd in 1997-2003, to an average of 172 gpd in 2006-2010. As described in Section 3.4, per-ERU water use has continued to decline, reaching an average of 155 gpd for the period of 2011-2017. This has further decreased to 153 gpd as of 2020. This is in part a result of conservation measure implementation during the past two decades. The current ERU water use factor is equal to or lower than that of other western Washington utilities and it is unlikely to be reduced further without significant investment in costly conservation measures. To reflect the City's gains in reducing per-ERU water use, this goal has been modified, as noted below.

Based on the discussion above regarding the City's progress towards meeting its previously defined water use efficiency goals, revised goals have been established for the 2019-2028 time horizon. Those goals are:

2019-2028 WUE Goals

1. ***Reduce distribution system leakage to less than ten percent of total production by 2019, as calculated on a rolling three-year average***. As noted above, distribution system leakage has been reduced to 11 percent of production, as of 2017. A large leak that went undetected for a long time caused this value to rise to 15 percent in 2018. However, the City is confident that through its continued water conservation efforts, it can achieve a three-year rolling average of less than ten percent, effective in 2019. Therefore, that is the goal the City has set regarding this metric. (NOTE: Since this goal was first adopted in 2019, this objective has been achieved.)

2. ***Maintain an average day demand Equivalent Residential Unit (ERU) water use factor of less than 175 gpd***. As noted above, per-ERU water use has declined to approximately 150 gpd in recent years. The City anticipates maintaining usage at this level, but to account for abnormally hot, dry years or other factors outside the City's control, a goal of 175 gpd has been established, which reflects a reduction from the previously established goal.

The system-wide demand forecast presented in Section 3.5.1 (see Table 3-10) includes adjustments for reduced non-revenue water, reflecting the first goal stated above. It should be noted that accurate data reporting of system production and usage by customer classes is critical to measure conservation effectiveness. Even with such data, annual fluctuations in weather, meter inaccuracies, and other system changes occasionally make verification of reductions difficult. Therefore, these goals should be considered as approximate targets.

4.5 Measures

The City's conservation program for 2019-2028 consists of the eight measures shown in Table 4-3. According to the Municipal Water Law, the City is required to implement or evaluate six measures. The City is currently in compliance with the conservation requirements and the details of each measure are discussed further below.

Table 4-3. 2019-2028 Conservation Program

Measure	Relationship to Current Program
1. Faucet Aerators	Continuation
2. Low Flow Showerheads	Continuation
3. Toilet Leak Detection Tablets	Continuation
4. Conservation Pamphlets	Continuation
5. School Conservation Programs	Continuation
6. Escalating Rate Structure	Continuation
7. Irrigation Conservation Program	Continuation
8. Rain Gardens	Continuation

These measures have been selected due to a combination of factors including applicability to the City's service area, customer acceptance, cost effectiveness, and/or savings potential. The City will continue to use source meters, service meters, and system leak detection and repair, although those activities are not counted as official conservation "measures" under the new conservation Rule.

1. Faucet Aerators

The City will continue to distribute faucet aerators to its customers through the service center.

2. Low Flow Showerheads

The City will continue to distribute low flow showerheads to its customers through the service center.

3. Toilet Leak Detection Tablets

The City will continue to distribute toilet leak detection tablets to its customers through the service center.

4. Conservation Pamphlets

The City will continue to distribute conservation literature to its customers through conservation kits, monthly billing mailers, the annual Customer Confidence Report, and on the City website.

5. School Conservation Program

The City will continue to conduct public education programs in its schools where presentations will be provided by City Staff on conservation techniques and other information is distributed to students.

6. Escalating Rate Structure

The City plans to continue using its current rate structure, including escalating rates for water consumption block as described in Section 4.2.

7. Irrigation Conservation Program

The City plans to continue its incentive to irrigators of providing free installation of irrigation meters if the customer employs water saving techniques and devices to reduce irrigation.

8. Rain Gardens

The City will continue its program that promotes the use of rain gardens along with guidance on their construction and use.

The City will be using the eight measures listed above to meet the conservation goals defined in Section 4.4. The current conservation goals are scheduled to be re-evaluated as part of the next water system update.

4.6 Water Loss Control Action Plan

As described in Section 3.3, the City's distribution system leakage averaged 9.9 percent of production from 2018 to 2020. This is below the 10 percent threshold that triggers the need to develop a Water Loss Control Action Plan (WLCAP). Therefore, the City did not develop a WLCAP for this planning cycle. However, the City will continue to implement projects and monitor progress related to reducing distribution system leakage.

The City is currently replacing automated meter reading transmitters that have had battery failures. This will result in a more accurate accounting of water usage and will aid in efficiently identifying leaks presently occurring at old meter sites. As a result of replacing these units, the City expects revenue from billed consumption to increase.

The City is active in identifying and repairing leaks. As a result of past activity, the City has repaired leaking infrastructure that reduced distribution system leakage from 40 percent in 1991 to 4.9 percent in 2020. The City will continue to conduct leak detection periodically per Project WD-3 in the capital improvement program outlined in Table 13-1. Additionally, the City budgets annually for pipeline renewal and replacement in Project WD-1, also included in Table 13-1.

5. Existing System Description

This section provides a description of the City of Centralia's (City) existing water system components. An inventory of supply source, treatment, storage, and distribution system facilities is presented in detail. Additional information regarding asset age, condition, criticality rating, and remaining life is shown in the asset inventory in Appendix O. The City will use this tool for asset management and capital improvement planning. Figure 5-1 depicts the general location of all major facilities and Figure 5-2 provides a hydraulic schematic of the system.

5.1 Sources of Supply

The City's water system currently relies entirely on groundwater for potable water supply. Use of the Newaukum River intake has been discontinued since September 1993, due to its status as an unfiltered surface water source which can not meet the requirements of the Surface Water Treatment Rule (SWTR).

The primary sources of supply for the City are the Tennis Court and Fords Prairie Wellfields (including Eshom Well). Seasonal peaking supply is provided by the K Street Well and the Washington Well exists as an emergency backup supply. The remaining City wells are considered inactive due to a variety of water quality concerns. Table 5-1 provides summary information regarding these sources.

Table 5-1. Source Water Pumping Facilities

Well Name/Location	Pump Characteristics			Date Drilled	Date Pump Installed	Comments
	HP	Capacity (gpm)	Head (ft)			
Fords Prairie Wells						
-Well No. 1	40	960	321	2002	2002	Primary Source
-Well No. 2	30	1,270	321	2002	2002	Primary Source
Eshom Well	125	1,200	275	1991	1991	Primary Source
Tennis Court Wells						
-Well No. 1	125	605	296	1996	1998	Primary Source
-Well No. 2	50	1,300	279	1996	1998	Primary Source
K St Well	75	750	300	1935	1985	Seasonal Source
Washington Well	150	1,000	Unknown	1935	1975	Emergency Source (1)
N. Tower Well	40	400	245	1935	1992	Emergency Source (1)
Downing Well	200	700	375	1977	1977	Emergency Source (1)
Riverside Well	75	700	284	1971	1971	Emergency Source (1)
Borst Park Wells						
-Well No. 1	100	812	305	1993	1993	Emergency Source (1)
-Well No. 2	100	1,200	305	1993	1993	Emergency Source (1)

(1) Use of the term emergency source reflects only the current status of wells and does not imply any intention by the City to relinquish or abandon water rights associated with the wells or the ability to use such water rights differently in the future.

Details regarding the City's two primary sources of supply are provided in the sections below.

5.1.1 Tennis Court Wellfield

The Tennis Court wells were drilled in 1996 in response to water quality concerns at the previously drilled Borst Park wells and the older wells in the system. Although capable of substantial yield, the Tennis Court wells have required corrosion control treatment to comply with the Lead and Copper Rule. Air stripping facilities were constructed, and since 2000, the Tennis Court site has provided a significant amount of the City's supplies.

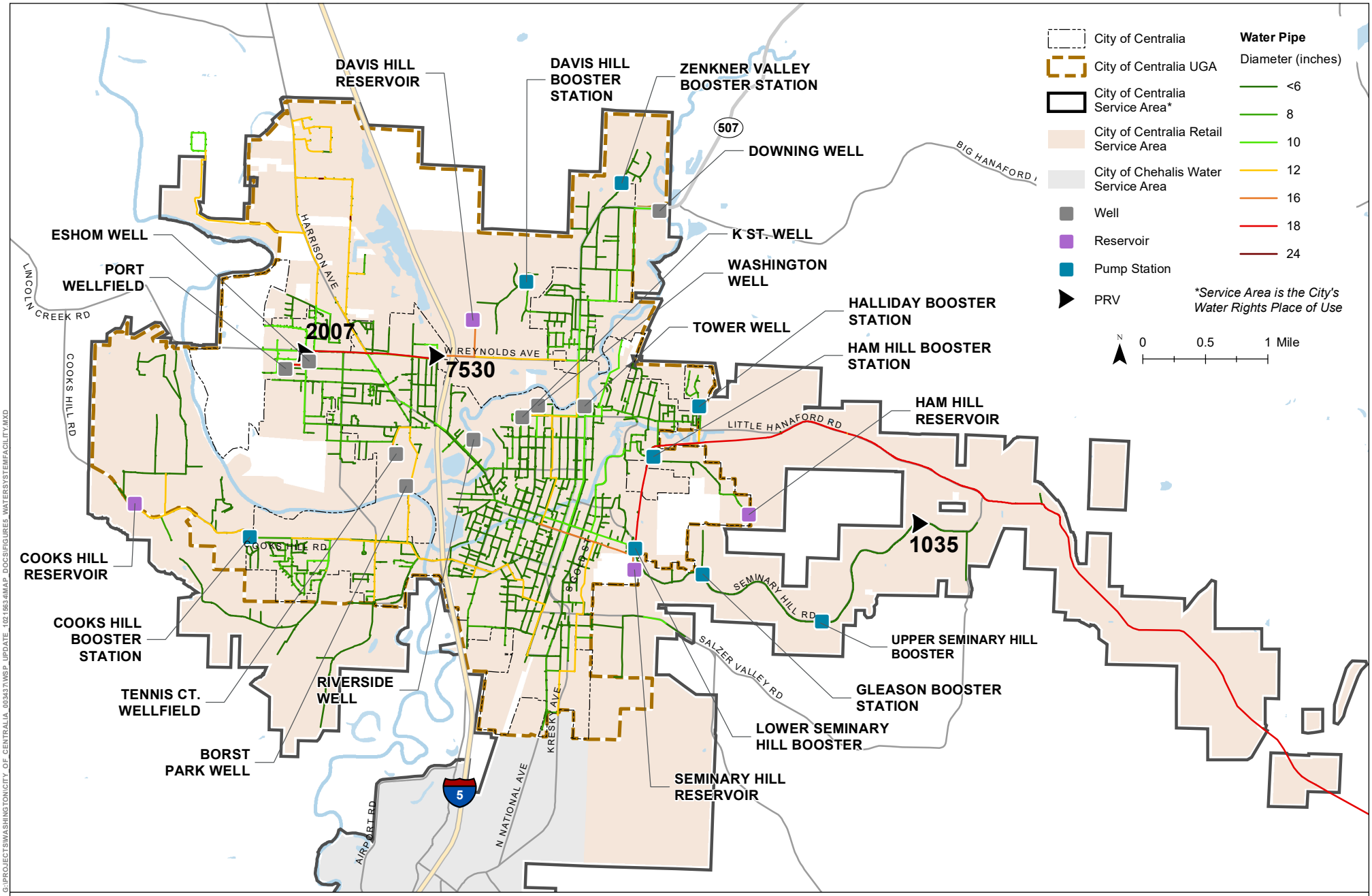
5.1.2 Fords Prairie Wellfield

The Fords Prairie Wellfield, also referred to as the Port District Wellfield, includes Eshom Well (drilled in 1991), as well as two newer wells drilled in 2002, and that are located to the west of Eshom Well. All three wells are part of a project referred to as the Fords Prairie Aquifer Restoration Project, the goal of which is to remove perchloroethylene (PCE, also known as tetrachloroethylene) from a portion of the Centralia Outwash Gravel Aquifer (COGA), and to then utilize the treated water for potable purposes. The project was initiated after water quality tests in the Eshom Well in 1988 indicated that there was PCE contamination in the well. Subsequent tests of other nearby wells revealed contamination throughout the area of Centralia known as Fords Prairie. The likely source of contamination was identified in 1990, when PCE was detected in shallow wells in and around Village Park, a mobile home and recreational vehicle park located approximately 3,000 feet east-southeast of the Eshom Well. The contamination source may have originated from a dry cleaning business that was reported to have operated at that site.

Although the City bears no responsibility for the contamination, it has entered into a voluntary agreement with the Department of Ecology to perform the cleanup. As a part of that agreement, the City has developed the two newer wells which, in conjunction with the Eshom Well, serve to capture the contaminant plume. An air-stripping treatment facility was constructed to remove PCE from the extracted water, which is then conveyed to the City's distribution system. The Fords Prairie facility began producing water in 2003, and is anticipated to provide the majority of the City's near-future supply, in conjunction with the Tennis Court Wells.

5.2 Water Treatment

The City's reliance on groundwater limits the water treatment requirements to disinfection and corrosion control. Hypochlorite disinfection is employed at the Tennis Court and Fords Prairie Treatment Facilities. As described in the previous section, air stripping is also used at these facilities. At the Tennis Court site, the objective is corrosion control, to maintain compliance with the Lead and Copper Rule. At the Fords Prairie site, the objective is removal of PCE contamination. Fluoridation is also conducted at the Tennis Court and Fords Prairie facilities. The City installed a hypochlorite tank and injection system at the K Street well. The tank is filled with fresh hypochlorite if the facility will be used. The Washington well is an emergency source only and has no associated treatment equipment.



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WATER SYSTEM FACILITIES

FIGURE 5-1

City of Centralia Water System Plan
September 2022

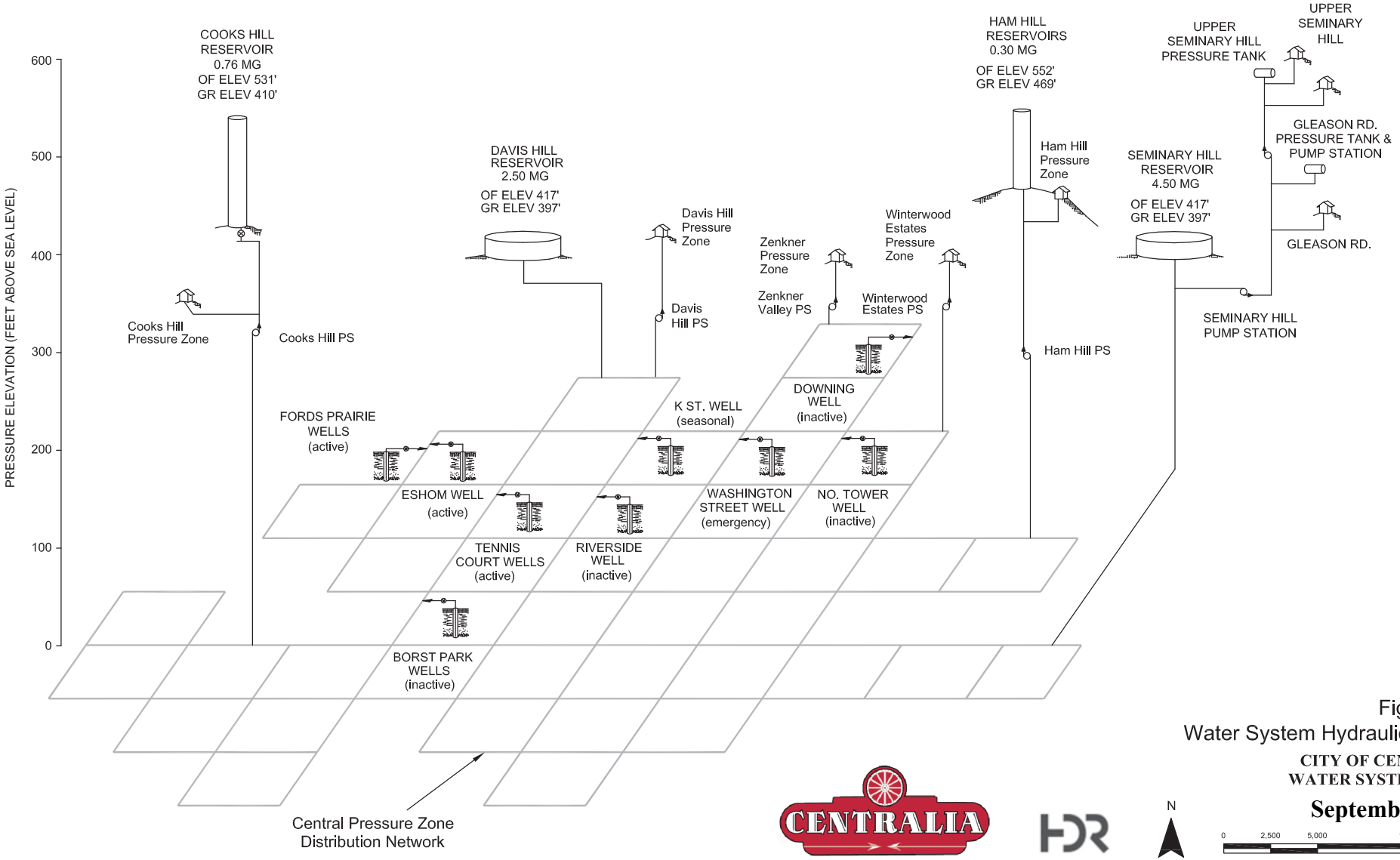


Figure 5-2
Water System Hydraulic Profile

CITY OF CENTRALIA
WATER SYSTEM PLAN

September 2022

N

0 2,500 5,000 10,000

5.3 Storage

A summary of the City's existing water storage facilities is provided in Table 5-2. In total, the City's storage volume is approximately 8 million gallons (MG).

Table 5-2. Existing Water Storage Facilities

Name	Date of Construction	Capacity (MG)	Const. Material	Elevations		Dimensions	
				Over-flow	Floor	Ht.	Dia.
Seminary Hill	1993	4.500	Concrete	417'	397	20'	203'
Davis Hill	1982	2.500	Welded Steel	417'	397	20'	150'
Ham Hill – Tank 1	1982	0.071	Welded Steel	552'	469'	83'	12'
Ham Hill – Tank 2	2005	0.230	Welded Steel	552'	469'	83'	22'
Cooks Hill	2005	0.760	Welded Steel	531'	410'	121'	33'

Notes:
MG = Million Gallons

5.4 Distribution System

5.4.1 Pressure Zones

The City's water system is divided into seven pressure zones, as summarized in Table 5-3.

Table 5-3. Pressure Zones

Pressure Zone	Source	Maximum HGL (ft)
Central	Seminary Hill and Davis Hill Reservoirs	417
Ham Hill	Ham Hill BPS and Reservoirs	552
Zenkner Valley	Zenkner Valley BPS	Variable
Davis Hill	Davis Hill BPS	Variable
Cooks Hill	Cooks Hill BPS and Reservoir	531
Seminary Hill	Seminary Hill and Gleason BPS	Variable
Winterwood Estates	Halliday Ridge BPS	Variable

Notes:
HGL = Hydraulic Grade Line

5.4.2 Booster Pump Stations

Table 5-4 describes the City's seven booster pumping stations and their facilities.

Table 5-4. Booster Pumping Stations and Zone Pressure Tanks

Pump Station Name/Location	Number of Pumps	Pump Characteristics		
		Hp	Q (gpm)	Head (ft.)
Cooks Hill				
- Lead Pump	1	5	145	156
- Lag Pump	1	10	145	156
- Fire Pump	None			
Davis Hill				
- Lead Pump	1	5	50	100
- Lag Pump	1	5	50	160
- Fire Pump	1	25		
Ham Hill				
- Lead Pump	1	5	90	164
- Lag Pump	1	5	90	164
- Fire Pump	None			
Gleason				
- Lead Pump	1	7.5	75	160
- Lag Pump	1	7.5	Combined	160
- Fire Pump	None			
Seminary Hill				
- Lead Pump	1	30	250	140
- Lag Pump	1	30	250	140
- Fire Pump	Combined			
Winterwood Estates (Halliday Ridge BPS)				
- Lead Pump	1	7.5	150	115
- Lag Pump	1	7.5	150	115
- Fire Pump	1	30		
Zenkner Valley				
- Lead Pump	1	7.5	50	200
- Lag Pump	1	7.5	50	200
- Fire Pump	1	25		

Pressure Tank Name/Location	Tank Set-Pressures (psi)	
	Pump-On	Pump-Off
Gleason Rd	40	60
Upper Seminary Hill Rd.	50	70
Note: Pressures are adjustable using the telemetry system.		

5.4.3 Distribution Lines

Table 5-5 provides a summary of the distribution system piping present in the water system. This includes approximately seven miles of the 18-inch transmission piping extending to the City from the old Newaukum River supply. This piping is currently maintained for water that is fed from the system (i.e., not from the Newaukum River) to customers along the line.

Table 5-5. Water Distribution Pipe Inventory

Pipe diameter (inch)	Length by material (feet)									Total (feet)	Total (miles)
	Asbestos cement	Cast iron	Copper	Ductile iron	Galvanized iron	HDPE	PVC	Steel	Unknown		
Unknown	8	160		804	351		1,482		5,237	8,042	1.52
1/2					410					410	0.08
3/4			657		3,205	140	187		391	4,581	0.87
1			1,282		11,872	81	2,884		531	16,650	3.15
1-1/4					1,154					1,154	0.22
1-1/2			59		8,230		2,296		49	10,634	2.01
2		21		6	37,591		36,891		1,077	75,585	14.32
2-1/2					183					183	0.03
3					109		893			1,002	0.19
4	17,583	24,537		3,660	849		2,380	112	185	49,307	9.34
5		23								23	0.00
6	52,281	75,589		25,293	244		90,678		585	244,670	46.34
8	9,147	31,972		67,309			5,749		213	114,390	21.66
10	20,038	18,232		21,520					16	59,806	11.33
12		3,868		85,991						89,859	17.02
16	262	3,475		2,810		2,188				8,735	1.65
18	61,635			7,204						68,839	13.04
24								293		293	0.06
Total (feet)	160,955	157,876	1,998	214,596	64,198	2,409	143,441	406	8,284	754,163	
Total (miles)	30.48	29.90	0.38	40.64	12.16	0.46	27.17	0.08	1.57	142.83	

Data Source: City of Centralia GIS database

5.4.4 Pressure Reducing Valves

The transmission main along Galvin Road, conveying water from the Fords Prairie Treatment Facility to the eastern side of the City, is a high pressure line. Two distribution lines that come off of the Galvin Road transmission main (i.e., at Sandra Avenue and Lum Road) require pressure reductions to provide suitable service to customers. Therefore, two pressure reducing valves (PRVs) have been installed at these locations. Both PRVs are set with an operating pressure of 100 pounds per square inch (psi).

5.5 Telemetry

The City of Centralia Water Utility uses SCADA for control of the water system. The City uses radio telemetry and the Wonderware system for SCADA communications. The WIN911 software is used for alarm notification.

5.6 Auxiliary Power

The City maintains a 750 kW onsite generator at the Fords Prairie wellfield. In addition, the City owns a 100 kW trailer-mounted portable generator, for use at Davis Hill, Zenkner Valley, and Halliday Ridge Booster Pump Stations. The City also has auxiliary power switches at the Tennis Court well and Lower Seminary Hill booster station.

6. Design Standards and Construction Specifications

This section presents the City of Centralia's (City) Design Standards and Construction Specifications. The Design Standards have been developed to ensure that a consistent minimum level of service is maintained throughout the system and to facilitate planning, design, and construction of water system projects. Developed separately, but for use in conjunction with the Design Standards, the Construction Specifications present a detailed description of the design and materials specifications to be observed during any water system improvement project.

The purpose of the inclusion of Construction Specifications is such that by having them approved with this Water System Plan (WSP) and kept on file at the Department of Health (DOH), construction documents do not need to be submitted for each project concerning distribution main construction. This is done in accordance with WAC 246-290-125 (project report and construction document submittal exceptions).

6.1 Design Standards

6.1.1 Supply

Supply facilities must be designed to meet the maximum day demand (MDD). Supply capacity will be sufficient to replenish storage within three days of fire or emergency drawdown during MDD conditions. The supply will be provided at a hydraulic grade line (HGL) that meets replenishment needs of storage facilities.

6.1.2 Storage

The Department of Health (DOH) requires public water systems to provide sufficient storage to meet any seasonal or diurnal variations in demand, fire flows, and emergency demands such as during power outages and equipment failures. These standards utilize these guidelines as criteria for determination of reasonable treated water storage required in each pressure zone, as well as for the City's system as a whole.

For a given reservoir design, each of the five storage components listed below must be considered:

- Operational Storage;
- Equalizing Storage;
- Standby (Emergency) Storage;
- Fire Suppression Storage; and
- Dead Storage, if any.

Only effective storage may be used in determining actual available, or design storage volume. Effective storage is equal to the total volume minus the dead storage built into the reservoir.

The required storage volume has been interpreted as the sum of Equalizing Storage, Standby (Emergency) Storage, and Fire Suppression Storage at an elevation sufficient to provide 20 psi (static) to the highest customer in any pressure zone. In addition, equalizing storage is evaluated with the requirement that 30 psi (static) is provided to the highest customer within the analyzed pressure zone. Operational storage is any surplus storage that is available after subtracting the other required storage components.

Operational Storage

Operational storage is the volume of the reservoir devoted to supplying the water system while, under normal operating conditions, the sources of supply are in "off" status. Operational storage is additive to the other components of storage and provides an additional factor of safety. The volume of operational storage should be sufficient to prevent excessive pump cycling.

Equalizing Storage

Equalizing storage capacity is utilized to meet the daily (diurnal) variations in demand. Peak use periods typically occur during the morning and evening hours, especially during the breakfast and dinner hours. Water is typically withdrawn from storage during these peak demand periods and replenished during low demand periods during late evening and early morning hours.

For systems like Centralia that supply water to storage based upon the reservoir water levels (on-call-demand), the DOH guidelines specify that the following equation be used to estimate equalizing storage:

Equalizing Storage (gal)	=	$(PHD - Q_S)(150\ min)$, where
PHD	=	Peak Hourly Demand (gpm)
Q_S	=	Source production rate (gpm)

In Centralia's situation, Q_S is greater than the PHD in most cases, resulting in a negative value for Equalizing Storage. In this case, a value of 0 has been used as an assumed minimum.

Standby Emergency Storage

The purpose of standby storage is to provide a measure of reliability should sources fail or when unusual conditions impose higher demands than anticipated. The volume of emergency storage required is dependent upon the reliability of the source of supply and the ability to provide an alternative supply. If the system or zone has multiple sources of supply, the volume of water produced by the supply sources, after assuming the largest source is out of service, can reduce the standby storage requirement.

For the City, the largest source in any pressure zone is taken out of production before the storage volume is calculated. Booster pumps in a pressure zone are considered a source in this analysis. For pump stations, the capacity of the largest single pump is removed from service during this calculation, not the full pump station capacity.

The recommended standby storage should not be less than 200 gallons per equivalent residential units (ERU). For systems with multiple sources the standby storage is based on the following equation:

Standby Storage (gal) = (2*ADD)(N) – t_m (Q_S- Q_L) where

ADD = Average Day Demand/ERU (gpd/ERU)
N = Number of ERUs
Q_S = Sum of all installed and available sources of supply in gpm
Q_L = the largest capacity source available to the system in gpm
t_m = Time that remaining sources are pumped on the day that the largest source is not available, in minutes (day is assumed as a full 24 hours)

The larger of the amount calculated in the equation above, or 200 gallons per ERU, is used for Standby Emergency Storage in this analysis.

Fire Suppression Storage

Water systems are required to construct and maintain facilities capable of delivering fire flows in accordance with the determination of the fire flow requirements made by the local fire protection authority while maintaining 20 psi pressure throughout the distribution system. Based on information provided by City Fire Department staff, the current minimum fireflow requirements for the City were developed. They range from 1,000 gpm for 2 hours for residential occupancies to 5,000 for 5 hours for commercial/industrial occupancies. Appendix G provides documentation of communication from the Fire Marshal. These flow requirements were used in hydraulic modeling and the development of capital improvements for the City's infrastructure.

The minimum fire suppression storage for systems is the product of the required flow rate multiplied by the flow duration and is based on the following equation:

Fire suppression storage (gal) = FF (t_m) where

FF = required fire flow rate
t_m = Duration of FF rate (in minutes)

Dead Storage

Dead storage is the volume of stored water not available to all customers at the minimum design pressure, as set forth in WAC 246-290-230(5) and (6). As such, dead storage is excluded from the volumes provided to meet the effective storage. For the purpose of design, the City considers dead storage to be that volume which is at an elevation lower than the elevation necessary to provide 20 psi (static) at the meter of the highest customer in the highest pressure zone served by a given reservoir. However, as stated above in the discussion regarding fire suppression storage, the City also acknowledges that its system must be able to deliver fire flows while providing at least 20 psi to all customers under dynamic conditions (maximum day demands plus fire flows), as compared to static conditions.

The analyses conducted in Sections 8 and 9 of this WSP consider all of the conditions noted above. In addition, while the City requires that the minimum amount of recommended standby storage (as calculated per the above equation) be provided above the dead storage elevation (i.e., above 20 psi), the City does consider the portion of dead storage that can physically be withdrawn and conveyed into the system as available to meet extended standby (emergency) needs, even though pressures may drop below 20 psi to some customers. This provides an additional level of reliability in the event of severe emergencies.

6.1.3 Distribution System

General

The function of the distribution system is to convey water to customers at adequate service pressures and to provide fire flows. During the peak-hour demand, the capacity of the distribution system must meet demands with a residual pressure of no less than 30 psi. During fire-fighting events, the minimum residual pressure permitted at the fire location is 20 psi, while maintaining positive system pressures throughout the rest of the distribution system (under maximum day demand conditions).

Usually, the inability to meet the above demand conditions results from inadequate distribution capacity; that is, pipes are not large enough or pipeline gridding is poor. The capacity of the distribution system is greatly reduced when head loss is greater than about 10 feet per 1,000 feet of pipe length.

Sometimes increasing pipe diameters or pipeline grid spacing is not sufficient to significantly increase flows. In these cases, it is better to consider adjusting the hydraulic elevation of either the supply or storage facilities. When analyzing the distribution system, the capability to replenish equalizing storage volume must be considered. The equalizing volume must be replenished at a rate sufficient to refill the storage reservoirs during the late evening/early morning replenishment hours.

Pressure Zones

Pressure zones are determined by evaluating ground elevation as it relates to available hydraulic gradient. The static pressure at the lowest elevation will generally not be greater than 100 psi, while at the highest elevation of the zone, it must be sufficient to ensure that at peak demand conditions the pressure is not less than 30 psi. Pressure reducing valves (PRVs) are used to intertie pressure zones in order to utilize stored water at higher elevations and to lower pressures to acceptable service levels. PRV stations will be sized to provide the maximum instantaneous demand or the required fire flow, whichever is greater.

To the extent possible, the City will keep the number of pressure zones to a minimum. Wherever pressure zones are made, the system becomes fragmented, and the water conveyance capacity can be affected because distribution mains cannot be interconnected at pressure zone boundaries.

Pump Stations

A minimum of two pumps are required at each pump station to provide flexibility and system redundancy. Each pump must be able to meet maximum day demand design conditions in the pressure zone served.

6.2 Construction Specifications

The City maintains a complete set of water system construction specifications and standard detail drawings as Chapter 2 (Water) of the City's Design and Development Guidelines. A copy of the current guidelines is located in Appendix H. Discussed therein are the specific construction requirements for the City of Centralia, as related to water system components and

improvements. These documents will govern the installation of new water infrastructure. The design and development guide for water is also accessible on the City's website at this link: http://www.cityofcentralia.com/Files/Chapter%202%20Water.pdf.

7. Source Capacity Analysis

This chapter addresses existing water rights and their ability to support current and projected future levels of water demand. A comparison is also made between source pumping capacity and demands, for the water system as a whole as well as for each pressurized zone.

7.1 Water Rights Evaluation

7.1.1 Existing Water Rights

Since the City's last Water System Plan update, the City hired water rights attorney Thomas M. Pors to evaluate its water rights portfolio and update the City's water right self-assessment. Mr. Pors' assessment is reflected in this section, including Table 7-1, and in the self-assessment forms included as Table 7-2.

The water rights associated with each of the City's sources of water supply are described in Table 7-1 and discussed below. As demonstrated in Table 7-2, the City's rights are adequate to meet current water demands and projected demands through 2042. The need for additional water rights and/or additional sources of supply is discussed in Section 7.2.

Primary and Supplemental Water Rights

The City's water rights are noted as either primary (additive) or supplemental (non-additive) water rights, and where appropriate these interpretations are explained in footnotes to Table 7-1 and/or in the text below. Generally, primary water rights are additive to pre-existing rights and can be used to the full extent of the authorized quantities, regardless of the use being made under other water rights. The use of supplemental water rights is conditional based on the language in the water right decision documents and is often dependent on the use being made under prior rights. In most cases, supplemental water rights can be used as an alternative source for previously-issued water rights, and do not increase the total authorized annual quantity of water allowed to be withdrawn and used by the City.

The City's initial water source and water right was from the North Fork Newaukum River, and all subsequent water rights are sourced from groundwater in the Centralia area. The initial Newaukum River water right is a primary water right and is discussed in more detail below. Though the Newaukum River source is not presently used, the associated water right is still valid and is being exercised through groundwater wells that were issued as supplemental to the older Newaukum River water right. Not all of the City's groundwater rights are supplemental to the Newaukum River water right, however.

Table 7-1. City of Centralia Water Rights

Permit Certificate or Claim #	Name of Righthold er or Claimant	Priority Date	Source Name/ Number Active	Primary or supplemental **Cumulative Qa of <u>Groundwater</u> in AFY[1]**	Individual Water Right Capacity Maximum Instanta-neous Flow Rate (Qi)	 Maximum Annual Volume (Qa) **Primary**/Supp	Existing System Capacity Per Source, based on Water Right Limits Maximum Instantaneous Flow Rate (Qi)	 Maximum Annual Volume (Qa) (**Primary**/Supp)
1. S2-CV1P31 (SW Change Vol. 1, p 31)	City of Centralia	1912	North Fork Newaukum R.		4.8 MGD	**5,376 AFY**	4.8 MGD = 7.4 cfs = 3,333 gpm[1]	**5,376** AFY
2. 562-D	City of Centralia	1937	N. Tower #2 and Tennis Ct #1& 2	Primary **186 AFY[1]**	700 gpm	**186 AFY**	See G2-24010C for combined capacity Tennis Court WF	
3. 563-D	City of Centralia	1937	K Street #4 and Fords Prairie Wellfield	Primary **424 AFY[1]**	900 gpm	**238 AFY**	See G2-28215C for combined capacity of K Street Well #4	
4. 564-D	City of Centralia	1937	Washington #5 and Fords Prairie Wellfield	Primary **796 AFY[1]**	1,400 gpm	**372 AFY**	**Washington #5** 1,400 gpm See G2-28214C for combined capacity of Fords Prairie WF	**Washington #5** 2,258 AFY (**372**)
5. G2-*04714	City of	10/10/1	Eshom #9	Primary	1,200	**1,920 AFY**	See G2-28212C for combined capacity of	

(Cert 4491-A)	Centralia	957	and BP #1, BP #2	**2,716 AFY[1],**	gpm		Eshom Well #9	
6. G2-00168C	City of Centralia	9/28/1960	Riverside #11	Supplemental (Aggregate Cap) **2,716 AFY[1]**	1,000 gpm	1,600 AFY	**Riverside #11 total** 1,000 gpm	**Riverside #11 total** 1,600 AFY
7. G2-24010C	City of Centralia	11/10/1975	Downing #10 and Tennis Ct #1& 2	Primary/Supp **4,284 AFY[1]**	1,300 gpm	**1,568/**432 AFY	**Tennis Court WF total** 2,000 gpm	**Tennis Court WF total** 2,000 AFY **(1,754**/246)
8. G2-28212C	City of Centralia	7/9/1991	Eshom #9 and BP #1 and #2 (Inactive)	Partially Supplemental **4,604 AFY[1, 2]**	200 gpm	320 AFY	**Eshom #9 total** 1,470 gpm	**Eshom #9 total** 2,246 AFY **(2,246**)
9. G2-28214C	City of Centralia	7/9/1991	Washington #5 and Fords Prairie WF	Partially Supplemental **6,490 AFY[1, 2]**	1,400 gpm (Suppl. Qi)	1,886 AFY	See 564-D for combined capacity of Washington Well #5 **Fords Prairie WF total** 2.800 gpm	See 564-D for combined capacity of Washington Well #5 **Fords Prairie WF total** 2,258 AFY **(1,886)**
10. G2-28215C	City of Centralia	7/9/1991	K Street #4 and Fords Prairie WF	Partially Supplemental **7,704 AFY[1, 2]**	900 gpm (Suppl. Qi)	1,214 AFY	**K Street #4 total** 1,800 gpm	**K Street #4 total** 1,452 AFY **(1,452)**
11. CG2-00731 (LEWI-15-01)	City of Centralia	10/23/1970	Eshom Road Well	Primary **7,710 AFY[1]**	70 gpm	**6 AFY**	See G2-28212C for combined capacity of Eshom Well #9	

Total				**7,710AFY[1, 3]**	6,770 gpm (9.75 MGD)	**9,666 AFY** +5,452 AFY supplemental	6770 gpm (9.75 MGD)	**7,710AFY**
Claims								
S2-302347CL[3]	City of Centralia							
Pending Applications								
G2-28782	City of Centralia	3-18-1993	North Tower Well	N/A	700 gpm	1,129 AFY	Pending	Pending
G2-22908	City of Centralia	3-15-2000	Related to Eshom Well cleanup	N/A	4,000 gpm	6,440 AFY	Pending	Pending
S2-30405	City of Centralia	4-13-2007	Skookumchuck River	N/A	26 cfs	unknown	Pending	Pending
G2-30763	City of Centralia	1-31-2020	Groundwater Borst Park	NA	8,333 gpm	8, 961 AFY	Pending	Pending

Notes:

(1) The cumulative annual quantities shown in this column are for groundwater rights only, and do include the North Fork Newaukum River (NFNR) water right, the exercise of which would limit some of these groundwater rights to supplemental (non-additive) status.

(2) The "supplemental to existing rights" limitation in these groundwater rights refers to a specific condition in the state Reports of Examination (ROEs) relating to the NFNR water right. There is no intention expressed in the documentation for these water rights to make the annual quantity supplemental to the City's other groundwater rights. To the extent the NFNR water rights are not exercised, this water right is an alternative to that source, and is interpreted as additional annual groundwater quantity in Column 5. As of the publication of this plan, these rights allow Centralia to access 3,420 AFY of the 5,376 AFY (64%) of the NFNR right.

(3) This claim is for the same source as the NFNR vested right (see Note 1), but was not necessary when filed because the water right was certificated under the Water Code as a change certification.

North Fork Newaukum River

From 1914 until late 1991, the City's major source of supply was a diversion from the North Fork of the Newaukum River. A Notice of Appropriation of Water was filed with Lewis County on September 20, 1912, for a quantity of 10 cfs (6.5 mgd). A Certificate of Change in Point of Diversion (POD) was issued to the City on May 19, 1923, by the State Supervisor of Hydraulics (Vol. 1, Page 31). This certificate authorized the POD to be changed from the SE 1/4 of SW 1/4, Section 20, Township 14 N., Range 1 E. W.M. to a point in the SW 1/4 of the SE 1/4 of Sec. 20, T. 14 N., R.1 E. W.M. The City's claim to a vested right under the Notice of Appropriation, as amended by the Certificate of Change, was confirmed by Lewis County Superior Court Decree No. 22433, dated October 4, 1954. The priority date for this pre-code vested right is likely 1912 or earlier. The quantity confirmed was 4.8 mgd, the capacity of the source transmission main at that time. This water right was certified without an annual limitation and qualifies as a "pumps and pipes" water right in good standing per RCW 90.03.330(3). Calculated as a continuous withdrawal, 4.8 mgd is equivalent to 3,333 gpm, and totals 5,376 AF/year. The quantities of 4.8 mgd and 5,376 AF/yr are therefore shown in Table 7-1 as the primary water rights related to this source.

The Newaukum River source has been out of use since 1991 due to catastrophic failure of the reservoir, but the water right is still valid and is used as the primary water right that supports ground water rights issued as supplemental (non-additive) to this water right. (See text below regarding G2-28212, G2-28214, and G2-28215).

Pre-Code Ground Water Declarations

The City established three vested rights to groundwater prior to the adoption of the Ground Water Code in 1945, which were confirmed in certificates issued in 1948.

Certificate No. 562-D, with a 1937 priority date, allows a 700 gpm instantaneous withdrawal rate and an annual withdrawal of 186 AF/yr from the North Tower Well. In 1996, the City applied for a change of point of withdrawal to the new Tennis Court well field, which was approved by Ecology on May 14, 1998.

Certificate No. 563-D, with a 1937 priority date, allows a 900 gpm instantaneous withdrawal and an annual withdrawal of 238 AF/yr from the City's K Street Well #4. In 2002, the City applied for a change to Certificate 563-D to add the Fords Prairie Well Field (also known as the Port Wells) as an additional place of withdrawal, which was approved with no additional conditions affecting total instantaneous or annual quantity.

Certificate No. 564-D, with a 1937 priority date, authorizes 1,400 gpm and 372 AF/yr from the City's Washington Well #5. In 2002, the City applied for a change to Certificate 564-D to add the Fords Prairie Well Field (also known as the Port Wells) as an additional place of withdrawal, which was approved with no additional conditions affecting total instantaneous or annual quantity.

Eshom Well

Certificate 4491-A, with a priority date of September 10, 1957, authorizes 1,200 gpm and 1,920 AF/yr from the Eshom Well, with no supplemental conditions or limitations. In 1992, the City applied for a change to Certificate 4491-A to add two new well sites as alternative sources due

to contamination detected in the Eshom Well. Ecology approved the change application, adding the Borst Park wells under Certificate 4491-A, and issued a superseding certificate (G2-*04714C), which confirmed the quantity of this water right as 1,200 gpm and 1,920 AF/yr, with no supplemental limitation.

Riverside Well

Certificate G2-00168C, with a priority date of September 28, 1960, authorizes 1,000 gpm and 1,600 AF/yr from the Riverside Well. The report of examination dated November 18, 1960 mistakenly calculated the City's pre-existing total annual quantity of water rights at only 1,600 AF/yr, and approved the water right for 640 AF/yr of primary plus 1,600 AF/yr of supplemental annual quantity. The annual quantity was later reduced in the certificate to 1,600 AF/yr. The ROE and Permit for this water right include an "aggregate cap limitation" that states, "The total annual withdrawal under this application shall be limited to 2,240 acre-feet less any quantity withdrawn under existing rights." While this language does not affect the scope of the City's existing water rights, in light of the City's self-assessment that it already possessed more than 2,240 AF/yr of primary water rights, Certificate G2-000168 is interpreted as wholly supplemental as to annual quantity.

The Riverside Well is not currently in use due to a determination by WSDOH that it is "under the influence of surface water" and requires treatment. That means that this water right cannot currently be accessed by the City. While this is not a primary water right, it is a candidate for a change application to add another ground water source as necessary. Currently, the well is maintained as an emergency source. Downing and Tennis Court Wells

Certificate G2-24010C, with a priority date of November 10, 1975, authorizes 1,300 gpm and 2,000 AF/yr from the Downing Well. In 1996, the City applied for a change in the point of withdrawal from the Downing Well to the new Tennis Court Wells in Borst Park. Ecology approved the change in 1998. The superseding certificate for this water notes that of the 2,000 AF/yr of annual quantity, 1,568 AF/yr is a primary right and 432 AF/yr is a supplemental right, which is how the City interprets this water right.

1991 Ground Water Applications

In 1991, after landslides impacted the Newaukum River source, the City filed three applications to permit additional ground water sources as an alternative supply. These water rights were approved as alternative sources to the Newaukum River, but were not limited as supplemental to the City's other groundwater rights.

Application G2-28212 requested an additional 200 gpm (320 ac-ft/year) from the Eshom Well and the two Borst Park Wells. The application was approved, permit granted, and certificate G2-28212C was issued. The 320 AF/yr is supplemental to the Newaukum River water right, but not to other groundwater rights.

Application G2-28214 requested 1,400 gpm continuously from the Washington Well. The application was approved, permit granted, and certificate G2-28214C was issued for 1,400 gpm and 1,886 AF/yr. The annual quantity of G2-28214C is supplemental to the Newaukum River water right, but not to other City ground water rights. The instantaneous quantity of 1,400 gpm issued under G2-28214C, however, is supplemental to the 1,400 gpm issued under Certificate 564-D, because the intent of this right was to increase the total authorized annual quantity from

this well, not the rate of instantaneous withdrawal. In 2001, the City applied to the Lewis County Water Conservancy Board to add the Fords Prairie Wellfield to this water right and to Certificate 564-D, which was subsequently approved by the Board and Ecology.

Application G2-28215 requested 900 gpm continuously from the K Street Well. The application was approved, permit granted, and certificate G2-28215C was for 900 gpm and 1214 AF/yr. The annual quantity of G2-28215C is supplemental to the Newaukum River water right, but not to other City ground water rights. The instantaneous quantity of 900 gpm issued under G2-28215C, however, is supplemental to the 900 gpm issued under Certificate 563-D, because the intent of this right was to increase the total authorized annual quantity from this well, not the rate of instantaneous withdrawal. In 2001, the City applied for a change to Certificate G2-28215 to add the Fords Prairie Wellfield as an additional place of withdrawal, which was approved with no additional conditions affecting total instantaneous or annual quantity.

Eshom Road Well – Mobile Home Park Consolidation and Appeal

In 2015, the City acquired water right certificate G2-00731C from a mobile home park as part of a consolidation of the mobile home park's water system into the City's municipal system. The City applied to the Lewis County Water Conservancy Board to change the purpose and place of use of this water right to the City's municipal service area and to change the point of withdrawal to the Eshom Road Well. The Board approved the application in the full amount of the original certificate's quantity, 70 gpm and 7 AF/yr. Ecology modified the Board's order, reducing the annual quantity to 5.3 AF/yr. The City appealed Ecology's modification order to the Pollution Control Hearings Board (PCHB). Following discovery and negotiations, the City and Ecology agreed to settle the appeal at a higher annual quantity of 6.0 AF/yr, representing the highest annual quantity of metered historical use of water by the mobile home park.

The City's appeal of Ecology's order and the settlement agreement focused on the validity of inchoate municipal purpose water rights following a consolidation-type of transfer to a larger municipal water system. Ecology, WSDOH, and the Washington Water Utility Council are meeting and negotiating an update to Ecology's policies and procedures regarding inchoate water right consolidations as a result of the City's appeal.

7.1.2 Pending Water Right Applications

There are four pending applications for new water rights by the City. They include G2-28782 which was filed in March 1993 for an additional 700 gpm from the North Tower Well, and G2-29908 which was filed in March 2000 for 4,000 gpm for two wells to be used in conjunction with the cleanup effort for the Eshom well, also with the intent to later use this source for municipal supply.

In addition, the City filed an application in April 2007 for 26 cubic feet per second (cfs) for a new surface water right from the Skookumchuck River in follow-up to the discussion presented in Section 7.1.3. No action has been taken on this application by Ecology at this time.

Tables 7-1 and 7-2 summarize the pending applications.

7.1.3 Skookumchuck River

The City initiated negotiations in 1967 with the private utility PacifiCorp relating to PacifiCorp's development on the Skookumchuck River (Surface Water Permit No. 14966 and Reservoir Permit No. R-359). A draft agreement was developed in May 1967, but was never signed by the two parties. The draft agreement set forth an option for the City to acquire up to 2 mgd from the reservoir for its own use or for an industry of its choice.

The City also initiated negotiation with PacifiCorp many years ago to ratify a Memorandum of Understanding (MOU) by which the City would have access to up to 8.8 mgd of water from the development in exchange for some share of the expense to operate and maintain the reservoir.

TransAlta is the successor to PacifiCorp and is the current holder of the Skookumchuck River water rights. TransAlta is in the process of transferring its water right into a water bank managed by the State's Trust Water Program, with the intention of mitigation credits being sold to interested users. This is expected to be approved and operating in 2021. The City recognizes the value of purchasing these mitigation credits as a means of developing new groundwater sources to meet forecasted demands, notably wholesale and potential new large user demands. The City would look to expand its pumping capacity within the existing aquifer after acquisition of mitigation credits.

On January 31, 2020, the City filed an application with Ecology for 8 mgd of groundwater near the confluence of the Skookumchuck and Chehalis Rivers for future use. This is approximately 5,556 gpm instantaneous, or 8,961 acre-feet per year annually. The City, with their consultant Pacific Groundwater Group, is assisting Ecology in processing the application and anticipates approval in late 2021 or early 2022. Ecology will determine how much groundwater the City can develop and how much mitigation credit is needed from the TransAlta water bank.

The City has discussed providing wholesale water to the City of Chehalis through what is currently an emergency intertie. Chehalis would purchase the wholesale water to supplement their local supply, particularly during peak demand times in the summer. Centralia and Chehalis working to establish an agreement for up to 3 mgd of wholesale water on an average and max day basis. Deliveries could start as early as 2022 depending on the timing of establishing a wholesale contract.

7.1.4 Comparison of Water Rights with Future Water Demand

Appendix N is the City's water rights self-assessment in Department of Health's format and includes a comparison of existing water rights to current usage from all sources and to the future demand forecast. This table includes the North Fork Newaukum River surface water right as an existing water right, even though this source is not currently being utilized, because this water right is tied to several of the City's groundwater rights.

The average day demand (ADD) without conservation for the ten- year forecast period (2032) is 5.37 mgd which equates to 6,015 AF/yr, with a maximum day requirement (MDD) of 9.40 mgd. The 20-year (2042) forecast is for an ADD of 8.58 mgd which equates to 9,611 AF/yr, with a MDD of 11.87 mgd (would require continuous pumping at 8,243 gpm). The 50-year (2072) forecast is for an ADD of 13.24 mgd, which equates to 14,831 AF/yr, with a MDD of 18.06 mgd, which is equivalent to 12,542 gpm.

The City's water rights are sufficient to meet forecasted demands throughout the 50-year planning horizon.

7.2 Source Capacity Evaluation

The source capacity analyses presented below examine the ability of the City's existing sources of supply to meet current and projected future water demands. The analyses are conducted by comparing the City's water demand forecast, as presented in Section 3, with current source (i.e., groundwater well and/or booster pump station) capacities. Capacity is analyzed for the following four criteria:

- Ability to provide MDD with sources operating for 24 hours per day (DOH requirement)
- Ability to provide MDD with sources operating for 20 hours per day (DOH recommendation)
- Ability to provide ADD with sources operating 20 hours per day with the largest source offline (DOH recommendation)
- For open pressure zones, ability to provide fire storage replenishment during MDD with sources operating 24 hours per day (DOH recommendation)

Closed pressure zones require the two following analyses:

- Ability to provide peak hour demand (DOH requirement)
- Ability to provide fire flows during MDD conditions (DOH requirement)

The ability to meet fire flow requirements in closed zones is analyzed in the distribution system analysis (Chapter 9).

Deficiencies noted in these analyses form the basis for supply-related improvements included in the capital improvement program presented in Chapter 13.

7.2.1 Total System Capacity

According to DOH planning requirements, sources of supply must be sufficient to meet needs on a maximum day demand (MDD) basis. This must hold true for the system as a whole, as well as for each "open" pressure zone that has storage.

The source capacity analysis for the City's entire system is summarized in Table 7-2. Two wells were not included: the Washington Well, which is considered available only for emergency situations, and the Riverside Well, which is currently inactive.

Three demand forecasts are considered in this analysis: a baseline forecast focusing on the current retail service area, a forecast adding the regional wholesale demands to the baseline, and a forecast adding the industrial allowance to the baseline and regional demands.

As shown in Table 7-2, existing source capacities are capable of meeting maximum day demands in the baseline forecast currently and through the ten-year planning horizon. Sources become inadequate in the 20-year planning horizon. In the forecasts incorporating regional wholesale demands and industrial allowance, sources become inadequate by the 10-year planning horizon.

Based on this approach, the analysis indicates that development of additional sources should take place within the next 10 years. The timing of additional source development could be linked to activation of regional wholesale deliveries and expected activation of new large industrial customers. As previously noted, the City has begun such efforts related to the Skookumchuck River water rights. The City plans to make use of these newly acquired water rights to expand overall groundwater production. These plans are further described in the capital improvement program (Chapter 13).

Figures 7-1 and 7-2 graphically display the relationship between the three demand scenarios, current available source, and total water rights for average day and max day demands, respectively.

Table 7-2. Source Capacity for the Full System

	Year				
	2021	2032	2042	2072	Max[5]
Available Source: 24-hour Pumping (gpd)					
Fords Prairie & Eshom Wells (2,200 gpm)	3,168,000	3,168,000	3,168,000	3,168,000	3,168,000
Tennis Court Well No. 1 (600 gpm)	864,000	864,000	864,000	864,000	864,000
Tennis Court Well No. 2 (1,200 gpm)	1,728,000	1,728,000	1,728,000	1,728,000	1,728,000
Washington Well (1,000 gpm)[1]	0	0	0	0	0
K Street Well (750 gpm)[2]	1,080,000	1,080,000	1,080,000	1,080,000	1,080,000
Riverside Well (inactive)[3]	0	0	0	0	0
Total Available Source (gpd)	6,840,000	6,840,000	6,840,000	6,840,000	6,840,000
Total Available Source, Largest Offline (gpd)	5,112,000	5,112,000	5,112,000	5,112,000	5,112,000
Available Source: 20-hour Pumping (gpd)					
Fords Prairie & Eshom Wells (2,200 gpm)	2,640,000	2,640,000	2,640,000	2,640,000	2,640,000
Tennis Court Well No. 1 (605 gpm)	720,000	720,000	720,000	720,000	720,000
Tennis Court Well No. 2 (1,200 gpm)	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
Washington Well (1,000 gpm)[1]	0	0	0	0	0
K Street Well (750 gpm)[2]	900,000	900,000	900,000	900,000	900,000
Riverside Well (inactive)[3]	0	0	0	0	0
Total Available Source (gpd)	5,700,000	5,700,000	5,700,000	5,700,000	5,700,000
Total Available Source, Largest Offline (gpd)	4,176,000	4,176,000	4,176,000	4,176,000	4,176,000
Baseline Demands					
Projected ERUs and Demand[4]					
Equivalent Residential Units (ERU's)	14,382	18,413	23,434	34,299	19,430
Average Day Demand (gpd)	2,195,214	2,810,628	3,576,892	5,235,439	2,965,828
Maximum Day Demand (gpd)	4,218,965	5,401,724	6,874,400	10,061,948	5,700,000
Fire Flow Requirement (gpd)	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	2,621,035	1,438,276	(34,400)	(3,221,948)	1,140,000
MDD - 20 hr capacity	1,481,035	298,276	(1,174,400)	(4,361,948)	0
ADD with Largest Source Offline - 20 hr capacity	1,080,786	465,372	(300,892)	(1,959,439)	310,172
Fire Storage Replinishment During MDD - 24 hr capacity	2,121,035	938,276	(534,400)	(3,721,948)	640,000
Baseline + Regional Wholesale					
Projected ERUs and Demand[4]					
Equivalent Residential Units (ERU's)	14,382	28,640	43,088	53,954	19,430
Average Day Demand (gpd)	2,195,214	4,371,590	6,576,892	8,235,439	2,965,828
Maximum Day Demand (gpd)	4,218,965	8,401,724	12,640,076	15,827,624	5,700,000
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	2,621,035	(1,561,724)	(5,800,076)	(8,987,624)	1,140,000
MDD - 20 hr capacity	1,481,035	(2,701,724)	(6,940,076)	(10,127,624)	0
ADD with Largest Source Offline - 20 hr capacity	1,080,786	(1,095,590)	(3,300,892)	(4,959,439)	310,172
Fire Storage Replinishment During MDD - 24 hr capacity	2,121,035	(2,061,724)	(6,300,076)	(9,487,624)	640,000
Baseline + Regional Wholesale + Industrial Allowance					
Projected ERUs and Demand[4]					
Equivalent Residential Units (ERU's)	14,382	35,191	56,190	86,710	19,430
Average Day Demand (gpd)	2,195,214	5,371,590	8,576,892	13,235,439	2,965,828
Maximum Day Demand (gpd)	4,218,965	10,323,616	16,483,860	25,437,083	5,700,000
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	2,621,035	(3,483,616)	(9,643,860)	(18,597,083)	1,140,000
MDD - 20 hr capacity	1,481,035	(4,623,616)	(10,783,860)	(19,737,083)	0
ADD with Largest Source Offline - 20 hr capacity	1,080,786	(2,095,590)	(5,300,892)	(9,959,439)	310,172
Fire Storage Replinishment During MDD - 24 hr capacity	2,121,035	(3,983,616)	(10,143,860)	(19,097,083)	640,000

Notes:

(1) Washington Well is an emergency source and is not available for maximum day demand.

(2) K Street Well is a seasonal source and is available during periods of peak demand.

(3) Riverside Well is inactive and the source is unavailable.

(4) Projected ERUs and demand forecasts taken from Demand Forecast Summary table.

(5) Maximum ERUs to be served with current sources based on limiting factor of capacity analysis.

Figure 7-1. Annual Source Capacity Analysis

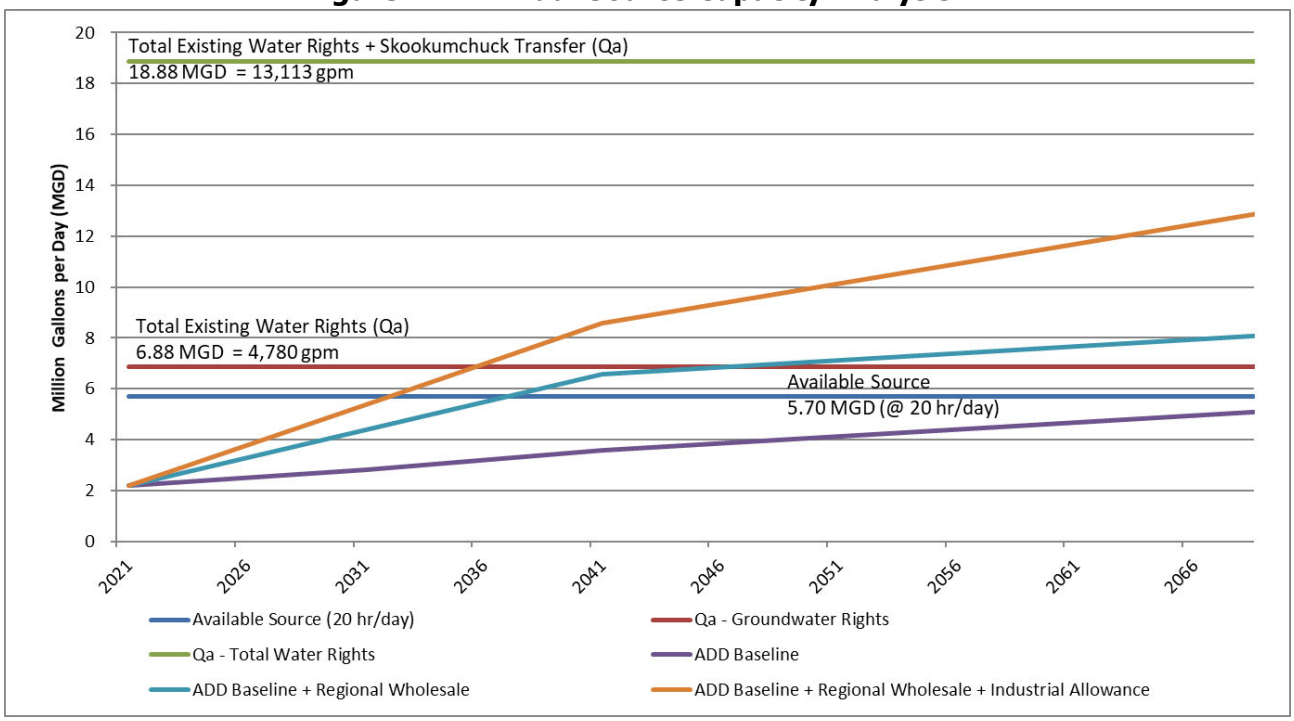
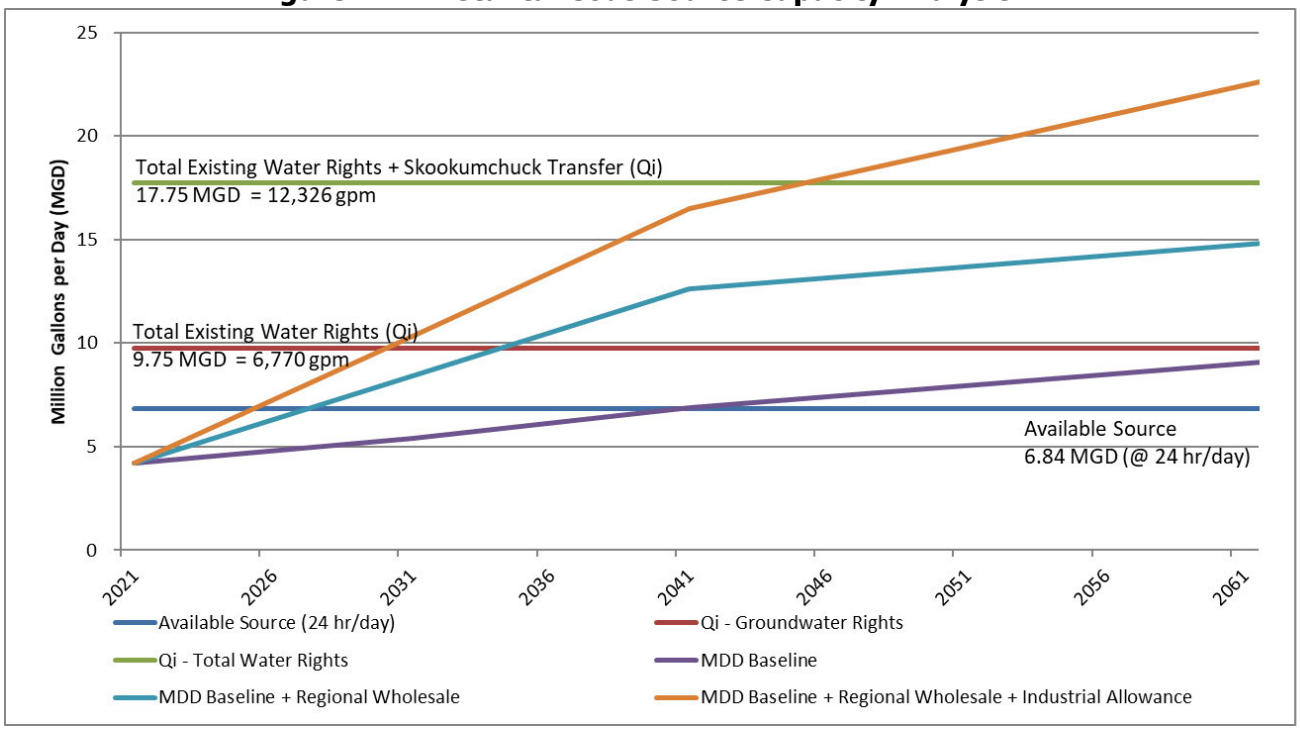


Figure 7-2. Instantaneous Source Capacity Analysis



7.2.2 Cooks Hill Pressure Zone

Table 7-3 presents the source capacity analysis for the Cooks Hill Pressure Zone. The existing pump station is deficient in its ability to meet projected 2042 MDD, due to the significant amount of growth planned for in the Cooks Hill area. The supply deficiency of approximately 100,000 gpd (MDD at 24-hour source capacity) in 2042 could be addressed by increasing the capacity of the pump station. The capital improvement program (see Chapter 13) includes project WB-1 which meets this need. A deficiency remains in meeting MDD with 20-hour pumping, though this is not a requirement.

Table 7-3. Evaluation of Source Adequacy for Cooks Hill

	Year			
	2021	2032	2042	Max[5]
Projected ERUs and Demand [1]				
MDD Equivalent Residential Units (ERU's)	254	734	1,766	1,140
Average Day	38,773	112,006	269,564	174,000
Maximum Day	74,517	215,263	518,073	334,409
Fire Storage Requirement (1,000 gpm for 2 hours)	120,000	120,000	120,000	120,000
Available Source: 24 hour pumping (gpd)				
Cooks Hill Pump 1 (145 gpm)	208,800	208,800	208,800	208,800
Cooks Hill Pump 2 (145 gpm)	208,800	208,800	208,800	208,800
Total Available Source (gpd)	417,600	417,600	417,600	417,600
Total Available Source, Largest Offline (gpd)	208,800	208,800	208,800	208,800
Future Cooks Hill Pump (110 gpm)[2]	0	158,400	158,400	158,400
Available Source: 20 hour pumping (gpd)				
Cooks Hill Pump 1 (145 gpm)	174,000	174,000	174,000	174,000
Cooks Hill Pump 2 (145 gpm)	174,000	174,000	174,000	174,000
Total Available Source (gpd)	348,000	348,000	348,000	348,000
Total Available Source, Largest Offline (gpd)	174,000	174,000	174,000	174,000
Future Cooks Hill Pump (110 gpm)[2]	0	132,000	132,000	132,000
Capacity Analysis With Existing Sources - Surplus/(Deficiency)[3]				
MDD - 24 hr capacity	343,083	202,337	(100,473)	83,191
MDD - 20 hr capacity	273,483	132,737	(170,073)	13,591
ADD with Largest Source Offline - 20 hr capacity	135,227	61,994	(95,564)	0
Fire Storage Replinishment During MDD - 24 hr capacity	303,083	162,337	(140,473)	43,191
Capacity Analysis With Future Sources - Surplus/(Deficiency)[4]				
MDD - 24 hr capacity	343,083	360,737	57,927	241,591
MDD - 20 hr capacity	273,483	264,737	(38,073)	145,591
ADD with Largest Source Offline - 20 hr capacity	135,227	193,994	36,436	132,000
Fire Storage Replinishment During MDD - 24 hr capacity	303,083	320,737	17,927	201,591

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) Upgrade to pump stations as described in capital improvement program project WB-1

(3) Source capacity analysis for all sources currently online.

(4) Source capacity analysis for all sources currently online and future planned sources.

(5) Maximum ERUs to be served with current sources based on limiting factor of capacity analysis.

7.2.3 Ham Hill Pressure Zone

Table 7-4 presents the source capacity analysis for the Ham Hill Pressure Zone. As indicated in the table, the Ham Hill Booster Pump Station is capable of meeting water demands in this pressure zone beyond the 20-year time frame.

Table 7-4. Evaluation of Source Adequacy for Ham Hill

	Year			
	2021	2032	2042	Max[2]
Projected ERUs and Demand [1]				
MDD Equivalent Residential Units (ERU's)	85	99	106	708
Average Day	12,924	15,055	16,185	108,000
Maximum Day	24,839	28,935	31,107	207,564
Fire Storage Requirement (1,000 gpm for 2 hours)	120,000	120,000	120,000	120,000
Available Source: 24 hour pumping (gpd)				
Ham Hill BPS Pump 1 (90 gpm)	129,600	129,600	129,600	129,600
Ham Hill BPS Pump 2 (90 gpm)	129,600	129,600	129,600	129,600
Total Available Source (gpd)	259,200	259,200	259,200	259,200
Total Available Source, Largest Offline (gpd)	129,600	129,600	129,600	129,600
Available Source: 20 hour pumping (gpd)				
Ham Hill BPS Pump 1 (90 gpm)	108,000	108,000	108,000	108,000
Ham Hill BPS Pump 2 (90 gpm)	108,000	108,000	108,000	108,000
Total Available Source (gpd)	216,000	216,000	216,000	216,000
Total Available Source, Largest Offline (gpd)	108,000	108,000	108,000	108,000
Capacity Analysis With Existing Sources - Surplus/(Deficiency)				
MDD - 24 hr capacity	234,361	230,265	228,093	51,636
MDD - 20 hr capacity	191,161	187,065	184,893	8,436
ADD with Largest Source Offline - 20 hr capacity	95,076	92,945	91,815	0
Fire Storage Replinishment During MDD - 24 hr capacity	194,361	190,265	188,093	11,636

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) Maximum ERUs to be served with current sources based on limiting factor of capacity analysis.

7.2.4 Davis Hill Pressure Zone

Being a “closed” pressure zone, the sources for the Davis Hill Pressure Zone must be sufficient to meet peak hour demands (PHD) and the fire flow requirement (1,000 gpm) during MDD conditions.

As indicated in Table 7-5, the Davis Hill Booster Pump Station is deficient in its ability to meet projected 2032 peak hour water demands due to the significant amount of growth potential in the Davis Hill area and is deficient in meeting fire flow throughout the forecast horizon. The supply deficiencies could be addressed by an upgrade of the pump station. The capital improvement program (see Chapter 13) includes a project WB-2 which meets this need. The planned project would not only address the supply deficiency but would also allow for reconfiguring of the pump station to accommodate a potential future Upper Davis Hill Reservoir if needed, to which it would then pump.

Table 7-5. Evaluation of Source Adequacy for Davis Hill

	Year			
	2021	2032	2042	Max[6]
Projected ERUs and Demand [1]				
MDD Equivalent Residential Units (ERU's)	56	285	795	291
Average Day (gpd)	6	30	84	31
Maximum Day (gpd)	11	58	162	59
Fire Flow Requirement (1,000 gpm)	1,000	1,000	1,000	1,000
Peak Hour (gpm) [2]	52	148	323	150
Available Source (gpm)				
Davis Hill Pump 1	50	50	50	50
Davis Hill Pump 2	50	50	50	50
Davis Hill Pump 3	50	50	50	50
Total Available Source	150	150	150	150
Future Davis Hill Pump [3]	0	175	175	175
Fire Pump Capacity (gpm)	600	600	600	600
Future Davis Hill Fire Pump [3]	0	1,000	1,000	1,000
Capacity Analysis With Existing Sources - Surplus/(Deficiency)[4]				
Peak Hour Demand	98	2	(173)	0
MDD + Fire Flow	(311)	(358)	(462)	(359)
Capacity Analysis With Future Sources - Surplus/(Deficiency)[5]				
Peak Hour Demand	98	177	2	175
MDD + Fire Flow	(261)	867	763	866

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N)
(C & F values obtained from Table 3-1 in DOH June 2020 WSDM)

(3) Upgrade to pump stations as described in capital improvement program project WB-2

(4) Source capacity analysis for all sources currently online.

(5) Source capacity analysis for all sources currently online and future planned sources.

(6) Maximum ERUs to be served with current sources based on limiting factor of capacity analysis.

7.2.5 Zenkner Valley Pressure Zone

Table 7-6 presents the source capacity analysis for the Zenkner Valley Pressure Zone, a "closed" pressure zone. As indicated in the table, the Zenkner Valley Booster Pump Station is deficient in its ability to provide fire flows during maximum day demands. The pump station is sufficient to meet peak hour demands. The supply deficiency could be addressed by an upgrade of the pump station. The capital improvement program (see Chapter 13) includes a project WB-3 which meets this need. Similar to the situation at Upper Davis Hill, this project would allow for reconfiguring of the pump station to accommodate a potential future Zenkner Valley Reservoir.

Table 7-6. Evaluation of Source Adequacy for Zenkner Valley

	Year			
	2021	2032	2042	Max[6]
Projected ERUs and Demand [1]				
MDD Equivalent Residential Units (ERU's)	71	82	88	164
Average Day (gpm)	7	9	9	17
Maximum Day (gpm)	14	17	18	33
Fire Flow Requirement (1,000 gpm)	1,000	1,000	1,000	1,000
Peak Hour (gpm) [2]	59	65	68	100
Available Source (gpm)				
Zenkner Pump 1	50	50	50	50
Zenkner Pump 2	50	50	50	50
Total Available Source	100	100	100	100
Fire Pump Capacity	600	600	600	600
Future Zenkner Fire Pump [3]	0	1,000	1,000	1,000
Capacity Analysis With Existing Sources - Surplus/(Deficiency)[4]				
Peak Hour Demand	41	35	32	0
MDD + Fire Flow	(314)	(317)	(318)	(333)
Capacity Analysis With Future Sources - Surplus/(Deficiency)[5]				
Peak Hour Demand	41	35	32	0
MDD + Fire Flow	(314)	683	682	667

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N)
(C & F values obtained from Table 3-1 in DOH June 2020 WSDM)

(3) Upgrade to pump stations as described in capital improvement program project WB-3

(4) Source capacity analysis for all sources currently online.

(5) Source capacity analysis for all sources currently online and future planned sources.

(6) Maximum ERUs to be served with current sources based on limiting factor of capacity analysis.

7.2.6 Winterwood Estates Pressure Zone

Table 7-7 presents the source capacity analysis for the Winterwood Estates Pressure Zone, a "closed" pressure zone (meaning the analysis evaluates peak hour pumping capacity). As indicated in the table, the Winterwood Estates Booster Pump Station is capable of meeting water demands in this pressure zone beyond the 20-year time frame.

Table 7-7. Evaluation of Source Adequacy for Winterwood Estates

	Year			
	2021	2032	2042	Max[3]
Projected ERUs and Demand [1]				
MDD Equivalent Residential Units (ERU's)	71	82	88	491
Average Day (gpd)	7	9	9	52
Maximum Day (gpd)	14	17	18	100
Fire Flow Requirement (1,000 gpm)	1,000	1,000	1,000	1,000
Peak Hour (gpm) [2]	59	65	68	223
Available Source (gpm):				
Winterwood Pump 1	150	150	150	150
Winterwood Pump 2	150	150	150	150
Total Available Source	300	300	300	300
Fire Pump Capacity	800	800	800	800
Capacity Analysis With Existing Sources - Surplus/(Deficiency)[3]				
Peak Hour Demand	241	235	232	77
MDD + Fire Flow	86	83	82	0

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 5-1 in DOH Oct. 2019 WSDM)

(3) Maximum ERUs to be served with current sources based on limiting factor of capacity analysis.

7.2.7 Seminary Hill Pressure Zone

Table 7-8 presents the source analysis for the Seminary Hill Pressure Zone, a “closed” pressure zone. As indicated in the table, the Seminary Hill Pump Station is deficient in its ability to provide fire flows during maximum day demands. The pump station is sufficient to meet peak hour demands. The supply deficiency could be addressed by an upgrade of the pump station. The capital improvement program (see Chapter 13) includes a project WB-4 which meets this need. This project would allow for reconfiguring of the pump station to accommodate a potential future Seminary Hill Reservoir.

Table 7-8. Evaluation of Source Adequacy for Seminary Hill

	Year			
	2021	2032	2042	Max[6]
Projected ERUs and Demand [1]				
MDD Equivalent Residential Units (ERU's)	155	181	194	1,338
Average Day (gpd)	16	19	21	142
Maximum Day (gpd)	32	37	40	273
Fire Flow Requirement (1,000 gpm)	1,000	1,000	1,000	1,000
Peak Hour (gpm) [2]	97	107	112	500
Available Source (gpm)				
Seminary Pump 1	250	250	250	250
Seminary Pump 2	250	250	250	250
Total Available Source (gpd)	500	500	500	500
Future Seminary Hill Fire Pump [3]	0	1,000	1,000	1,000
Capacity Analysis With Existing Sources - Surplus/(Deficiency)[4]				
Peak Hour Demand	403	393	388	0
MDD + Fire Flow	(532)	(537)	(540)	(773)
Capacity Analysis With Future Sources - Surplus/(Deficiency)[5]				
Peak Hour Demand	403	393	388	0
MDD + Fire Flow	(532)	463	460	227

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) PHD : (Maximum Day Demand per ERU / 1440) * [(C)
(C & F values obtained from Table 3-1 in DOH June 2020 WSDM)

(3) Upgrade to pump stations as described in capital improvement program project WB-4

(4) Source capacity analysis for all sources currently online.

(5) Source capacity analysis for all sources currently online and future planned sources.

(6) Maximum ERUs to be served with current sources based on limiting factor of capacity analysis.

7.2.8 Future Widgeon Hill Pressure Zone

Widgeon Hill is an undeveloped area located to the south of the City. Widgeon Hill was recently moved into the City of Chehalis' UGA, but Centralia continues to consider the source demands of a potential Widgeon Hill pressure zone since the area remains in Centralia's retail service area. Provision of water service to this area will require a new pump station and reservoir. Table 7-9 presents the source capacity analysis for the Widgeon Hill Pressure Zone. A 500-gpm pump station (two pumps at 250 gpm) and a fire pump capable of moving 250 gpm would be required to meet this zone's forecasted demands in 2042.

Table 7-9. Evaluation of Source Adequacy for Future Widgeon Hill Pressure Zone

		Year			
		2021	2032	2042	Max[4]
Projected ERUs and Demand [1]					
	MDD Equivalent Residential Units (ERU's)	0	391	1,293	1,295
	Average Day	0	41	137	137
	Maximum Day	0	80	263	264
	Fire Flow Requirement (1,000 gpm)	0	1,000	1,000	1,000
	Peak Hour (gpm)[2]	0	187	485	486
Available Source (gpm)					
	Widgeon Hill Pump 1	0	250	250	250
	Widgeon Hill Pump 2	0	250	250	250
Total Available Source (gpm)		0	500	500	500
	Widgeon Hill Fire Pump (gpm)	0	250	250	250
Capacity Analysis With Future Sources - Surplus/(Deficiency)[3]					
	Peak Hour Demand	0	313	15	14
	MDD + Fire Flow	0	484	1	0
(1)	Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.				
(2)	PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F]				
	(C & F values obtained from Table 3-1 in DOH June 2020 WSDM)				
(3)	Source capacity analysis for all future planned sources.				
(4)	Maximum ERUs to be served with future planned sources based on limiting factor of capacity analysis.				

7.3 Interties

The City of Centralia has an emergency intertie with the City of Chehalis. As noted in section 7.1.3, this intertie is likely to be converted into a wholesale supply intertie to the City of Chehalis within the next few years. Centralia maintains no other interties with adjacent utilities.

8. Storage Capacity Analysis

This section presents a capacity analysis of the City of Centralia's (City) water storage facilities. Adequacy of the existing facilities is first examined, followed by recommendations for future storage improvements.

8.1 Evaluation of Existing Storage Facilities

The design standards for storage facilities presented in Section 6 were used to analyze the adequacy of the City's existing reservoirs for each pressure zone where storage is currently provided. The ERU and demand forecasts utilized for these analyses are the same as those used for the source capacity analyses presented in Section 7.

It is important to note what potential regional wholesale demands are not factored into these storage capacity analyses, as it is assumed that storage will be provided by the utilities receiving wholesale supply (i.e., Centralia will not be responsible for providing fire suppression or standby storage to wholesale customers).

8.1.1 Central Zone

The Davis Hill and Seminary Hill reservoirs presently provide 7.0 million gallons (MG) of storage to the Central Zone. As depicted in Table 8-1, this is more than sufficient to meet the storage needs of this zone within the ten-year time horizon. If the industrial allowance is not considered, existing storage capacities remain sufficient to provide needed volumes beyond 2042.

However, considering the additional demands represented by the industrial allowance, there is a storage deficiency of approximately 1.76 MG in this zone by 2042. Some projects listed in the City's capital improvement program address a portion of this potential deficiency by connecting the Central Zone to some of the higher pressure zones via pressure reducing valves. This will make the storage in these upper zones available to the Central Zone, allowing the noted deficiency to be partially corrected. Table 8-2 presents the revised Central Zone storage analysis, with the incorporation of Cooks Hill, Zenkner Hill, and Widgeon Hill reservoir storage volumes.

It is also noted that the deficiency associated with the industrial allowance identified in Tables 8-1 and 8-2 is due solely to the additional standby storage demands imposed by potential future large industrial use. The assumptions used in defining these standby needs are the same as those used for calculating standby storage requirements for the rest of the City's system. Standby requirements exerted on the City's system may be less than assumed here if a particular industry has lower standby needs or can meet its own requirements through self-provided (i.e., on-site) storage. Such reductions in potential City system standby needs should be examined prior to development of additional storage facilities to meet future industrial needs.

Table 8-1. Evaluation of Storage Adequacy for Central Zone (Considering Davis Hill and Seminary Hill Reservoirs Only)

	Year			
	2021	2032	2042	Max[11]
Projected ERUs and Demand[1]				
Retail Service Area - Baseline Demand				
Equivalent Residential Units (ERU's)	14,043	17,581	21,562	23,755
Average Day Demand (gpd)	2,143,517	2,683,567	3,291,143	3,626,016
Maximum Day Demand (gpd)	4,119,609	5,157,527	6,325,220	6,968,811
ADD - Industrial Allowance (gpd)	0	1,000,000	2,000,000	2,000,000
MDD - Industrial Allowance (gpm)	0	694	1,389	3,472
PHD (gpm)	4,641	6,489	8,481	11,279
Available Source (gpd)[2]				
Existing				
Fords Prairie and Eshom (2,220 gpm)	3,196,800	3,196,800	3,196,800	3,196,800
Tennis Court Well No. 1 (600 gpm)	864,000	864,000	864,000	864,000
Tennis Court Well No. 2 (1,200 gpm)	1,728,000	1,728,000	1,728,000	1,728,000
K Street Well (750 gpm) - Seasonal	1,080,000	1,080,000	1,080,000	1,080,000
Washington Well (1,000 gpm) - Emergency	0	0	0	0
Total Available Source (gpd)	6,868,800	6,868,800	6,868,800	6,868,800
Multi-Source Credit (gpd)[3]	5,040,000	5,040,000	5,040,000	5,040,000
Required Storage Calculations				
Operational Storage (gal)[4]	1,272,539	1,272,539	1,272,539	1,272,539
Equalizing Storage (gal)[5]	0	257,830	556,612	976,377
Fire Flow Storage (gal)[6]	1,500,000	1,500,000	1,500,000	1,500,000
Standby Storage - No Industrial Allowance (gal)[7]	2,808,600	3,516,215	4,312,306	4,751,083
Standby Storage - Includes Industrial Allowance (gal)[7]	2,808,600	4,826,492	6,932,859	7,371,636
Required Storage				
Greater than 30 psi at highest meter (gal)[8]	1,272,539	1,530,369	1,829,151	2,248,917
Greater than 20 psi at highest meter - No Industrial Allowance (gal)[9]	4,081,140	5,046,584	6,141,458	7,000,000
Greater than 20 psi at highest meter - With Industrial Allowance (gal)[9]	4,081,140	6,356,861	8,762,011	9,620,553
Existing Storage Greater Than 30 psi (gal)[10]				
Davis Hill	4,500,000	4,500,000	4,500,000	4,500,000
Seminary Hill	2,500,000	2,500,000	2,500,000	2,500,000
Total Existing Storage at 30 psi (gal)	7,000,000	7,000,000	7,000,000	7,000,000
Storage Surplus/(Deficiency) at 30 psi (gal)	**5,727,461**	**5,469,631**	**5,170,849**	**4,751,083**
Existing Storage Greater Than 20 psi (gal)[10]				
Davis Hill	4,500,000	4,500,000	4,500,000	4,500,000
Seminary Hill	2,500,000	2,500,000	2,500,000	2,500,000
Total Existing Storage at 20 psi (gal)	7,000,000	7,000,000	7,000,000	7,000,000
Storage Surplus/(Deficiency) at 20 psi - No Industrial Allowance (gal)	**2,918,860**	**1,953,416**	**858,542**	**0**
Storage Surplus/(Deficiency) at 20 psi - With Industrial Allowance (gal)	**2,918,860**	**643,139**	**(1,762,011)**	**(2,620,553)**

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.

(3) Multi-source credit assumes largest source is out of service.

(4) Required operational storage is based on observed tanks levels fluctuations of 3.4 feet.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 3-1 in DOH June 2020 WSDM)

(6) Required Fire Flow Storage = 5,000 gpm x 5 hours.

(7) Required Standby Storage is the greater of (2*ADD less multi-source credit) or (200 gallons per ERU).

(8) Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.

(9) Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of either standby or fire flow storage.

(10) The storage volume available in existing reservoirs at 30 and 20 psi is based on the elevation of the highest customer (~320 ft).

(11) Maximum ERUs served by available storage located solely in the Central Zone.

Table 8-2. Evaluation of Storage Adequacy for Central Zone (Considering PRV-Connections to Upper Pressure Zones)

	Year			
	2021	2032	2042	Maxn[11]
Projected ERUs and Demand[1]				
Retail Service Area - Baseline Demand				
Equivalent Residential Units (ERU's)	14,297	18,315	23,328	26,917
Average Day Demand (gpd)	2,182,290	2,795,573	3,560,707	4,108,617
Maximum Day Demand (gpd)	4,194,126	5,372,789	6,843,293	7,896,317
ADD - Industrial Allowance (gpd)	0	1,000,000	2,000,000	2,000,000
MDD - Industrial Allowance (gpm)	0	694	1,389	3,472
PHD (gpm)	4,724	6,728	9,056	12,310
Available Source (gpd)[2]				
Existing				
Fords Prairie and Eshom (2,220 gpm)	3,196,800	3,196,800	3,196,800	3,196,800
Tennis Court Well No. 1 (600 gpm)	864,000	864,000	864,000	864,000
Tennis Court Well No. 2 (1,200 gpm)	1,728,000	1,728,000	1,728,000	1,728,000
K Street Well (750 gpm) - Seasonal	1,080,000	1,080,000	1,080,000	1,080,000
Washington Well (1,000 gpm) - Emergency	0	0	0	0
Total Available Source (gpd)	6,868,800	6,868,800	6,868,800	6,868,800
Multi-Source Credit (gpd)[3]	5,040,000	5,040,000	5,040,000	5,040,000
Required Storage Calculations				
Operational Storage (gal)[4]	1,392,913	1,392,913	1,392,913	1,392,913
Equalizing Storage (gal)[5]	0	293,707	642,958	1,130,962
Fire Flow Storage (gal)[6]	1,500,000	1,500,000	1,500,000	1,500,000
Standby Storage - No Industrial Allowance (gal)[7]	2,859,403	3,662,973	4,665,510	5,383,423
Standby Storage - Includes Industrial Allowance (gal)[7]	2,859,403	4,973,250	7,286,063	8,003,976
Required Storage				
Greater than 30 psi at highest meter (gal)[8]	1,392,913	1,686,620	2,035,871	2,523,875
Greater than 20 psi at highest meter - No Industrial Allowance (gal)[9]	4,252,317	5,349,594	6,701,381	7,907,298
Greater than 20 psi at highest meter - With Industrial Allowance (gal)[9]	4,252,317	6,659,870	9,321,934	10,527,851
Existing Storage Greater Than 30 psi (gal)[10]				
Davis Hill	4,500,000	4,500,000	4,500,000	4,500,000
Seminary Hill	2,500,000	2,500,000	2,500,000	2,500,000
Zenkner Reservoir	0	0	148,077	148,077
Cooks Hill Reservoir	0	262,352	262,352	262,352
Widgeon Hill Reservoir	0	107,692	107,692	107,692
Total Existing Storage at 30 psi (gal)	7,000,000	7,370,044	7,518,121	7,518,121
Storage Surplus/(Deficiency) at 30 psi (gal)	**5,607,087**	**5,683,424**	**5,482,250**	**4,994,246**
Existing Storage Greater Than 20 psi (gal)[10]				
Davis Hill	4,500,000	4,500,000	4,500,000	4,500,000
Seminary Hill	2,500,000	2,500,000	2,500,000	2,500,000
Zenkner Reservoir	0	0	175,000	175,000
Cooks Hill Reservoir	0	407,298	407,298	407,298
Widgeon Hill Reservoir	0	325,000	325,000	325,000
Total Existing Storage at 20 psi (gal)	7,000,000	7,732,298	7,907,298	7,907,298
Storage Surplus/(Deficiency) at 20 psi - No Industrial Allowance (gal)	**2,747,683**	**2,382,705**	**1,205,917**	**0**
Storage Surplus/(Deficiency) at 20 psi - With Industrial Allowance (gal)	**2,747,683**	**1,072,428**	**(1,414,636)**	**(2,620,553)**

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.

(3) Multi-source credit assumes largest source is out of service.

(4) Required operational storage is based on observed tanks levels fluctuations of 3.4 feet.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 3-1 in DOH June 2020 WSDM)

(6) Required Fire Flow Storage = 5,000 gpm x 5 hours.

(7) Required Standby Storage is the greater of (2*ADD less multi-source credit) or (200 gallons per ERU).

(8) Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.

(9) Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of either standby or fire flow

(10) The storage volume available in existing reservoirs at 30 and 20 psi is based on the elevation of the highest customer (~320 ft).

(11) Maximum ERUs served by available storage located solely in the Central Zone.

8.1.2 Cooks Hill

The Cooks Hill Reservoir provides 760,000 gallons of storage to the Cooks Hill Pressure Zone. As depicted in Table 8-3, this is more than sufficient to meet the storage needs of this zone within the ten-year time horizon. The slight deficiency that is depicted for the 20 psi requirement at the 20-year time horizon (2042) is based on increased standby storage needs. However, based on DOH regulations, storage volumes at elevations providing less than 20 psi to the highest service can be considered available to meet standby storage needs. There is sufficient volume (i.e., more than 350,000 gallons) of this type of storage (which is used to elevate fire flow and equalizing storage) to meet this stated 20 psi related “deficiency”. Adequate fire flow storage is available above 20 psi beyond the planning horizon. Therefore, there are no overall storage deficiencies in this zone.

Table 8-3. Evaluation of Storage Adequacy for Cooks Hill

	Year			
	2021	2032	2042	Max[11]
Projected ERUs and Demand[1]				
Retail Service Area				
Equivalent Residential Units (ERU's)	254	734	1,766	1,490
Average Day Demand (gpd)	38,773	112,006	269,564	227,432
Maximum Day Demand (gpd)	74,517	215,263	518,073	437,100
PHD (gpm)	137	303	639	550
Available Source (gpd)[2]				
Existing				
Cooks Hill Pump 1 (145 gpm)	208,800	208,800	208,800	208,800
Cooks Hill Pump 2 (145 gpm)	208,800	208,800	208,800	208,800
Total Available Source (gpd)	417,600	417,600	417,600	417,600
Multi-Source Credit (gpd)[3]	208,800	208,800	208,800	208,800
Required Storage Calculations				
Operational Storage (mg)[4]	70,374	70,374	70,374	70,374
Equalizing Storage (mg)[5]	0	1,953	52,421	38,925
Fire Flow Storage (mg)[6]	120,000	120,000	120,000	120,000
Standby Storage (mg)[7]	50,803	146,758	353,204	297,999
Required Storage				
Greater than 30 psi at highest meter (mg)[8]	70,374	72,327	122,795	109,299
Greater than 20 psi at highest meter (mg)[9]	190,374	219,085	475,999	407,298
Existing Storage Greater Than 30 psi (mg)[10]				
Cooks Hill	262,352	262,352	262,352	262,352
Total Existing Storage at 30 psi (mg)	262,352	262,352	262,352	262,352
Storage Surplus/(Deficiency) at 30 psi (mg)	**191,978**	**190,026**	**139,557**	**153,053**
Existing Storage Greater Than 20 psi (mg)[10]				
Cooks Hill	407,298	407,298	407,298	407,298
Total Existing Storage at 20 psi (mg)	407,298	407,298	407,298	407,298
Storage Surplus/(Deficiency) at 20 psi (mg) - Fire Flow Storage	**216,924**	**214,972**	**164,503**	**177,999**
Storage Surplus/(Deficiency) at 20 psi (mg) - Standby Assumption	**216,924**	**188,213**	**(68,701)**	**0**

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) Available source assumes source pumps are on for 20 hours in a day, at the maximum production rate.

(3) Multi-source credit assumes largest source is out of service.

(4) Required operational storage is based on observed tanks levels fluctuations of 11 feet.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 3-1 in DOH June 2020 WSDM)

(6) Required Fire Flow Storage = 1,000 gpm x 2 hours.

(7) Required Standby Storage is the greater of (2*ADD less multi-source credit) or (200 gallons per ERU).

(8) Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.

(9) Total required storage greater than 20 psi is equal to the total of operational, equalizing and the greater of either standby or fire flow storage.

(10) The storage volume available in existing reservoirs at 30 and 20 psi is based on the elevation of the highest customer (~420 ft).

(11) Maximum ERUs served by Available Storage located solely in the Cooks Hill Zone.

8.1.3 Ham Hill

Together, the two Ham Hill Reservoirs provide 760,000 gallons of storage to the Ham Hill Pressure Zone. As depicted in Table 8-4, this is more than sufficient to meet the storage needs of this zone within the 20-year time horizon. It should be noted that approximately half of the Ham Hill Reservoir storage is considered dead storage, as it serves to elevate the effective storage to appropriate elevations in the standpipes.

During the prior planning period, Ham Hill Tank 1 was removed from service for maintenance. Therefore, the analysis includes additional line items depicting surplus or deficiency considering Ham Hill Tank 1 offline. In this scenario, the Ham Hill zone has insufficient storage at 20 psi. However, this is not a permanent operational configuration and therefore there is no storage deficiency in the Ham Hill zone.

There is one service next to the reservoir at an elevation of approximately 480 feet. This service is excluded from the elevation-based calculations below so as not to trigger a 20 psi related deficiency in the reservoir.

Table 8-4. Evaluation of Storage Adequacy for Ham Hill

	Year			
	2021	2032	2042	Max[11]
Projected ERUs and Demand[1]				
Retail Service Area				
Equivalent Residential Units (ERU's)	85	99	106	530
Average Day Demand (gpd)	12,924	15,055	16,185	80,837
Maximum Day Demand (gpd)	24,839	28,935	31,107	155,360
PHD (gpm)	66	73	76	249
Available Source (gpd)[2]				
Existing				
Ham Hill Pump 1 (100 gpm)	144,000	144,000	144,000	144,000
Ham Hill Pump 2 (100 gpm)	144,000	144,000	144,000	144,000
Total Available Source (gpd)	288,000	288,000	288,000	288,000
Multi-Source Credit (gpd)[3]	144,000	144,000	144,000	144,000
Required Storage Calculations				
Operational Storage (gal)[4]	38,351	38,351	38,351	38,351
Operational Storage - Ham Hill 1 Offline (gal)[4]	34,121	34,121	34,121	34,121
Equalizing Storage (gal)[5]	0	0	0	7,358
Fire Flow Storage (gal)[6]	120,000	120,000	120,000	120,000
Standby Storage (gal)[7]	16,934	19,727	21,207	105,919
Required Storage				
Greater than 30 psi at highest meter (gal)[8]	38,351	38,351	38,351	45,709
Greater than 20 psi at highest meter (gal)[9]	158,351	158,351	158,351	165,709
Existing Storage Greater Than 30 psi (gal)[10]				
Ham Hill 1	19,203	19,203	19,203	19,203
Ham Hill 2	63,095	63,095	63,095	63,095
Total Existing Storage at 30 psi (gal)	82,298	82,298	82,298	82,298
Storage Surplus/(Deficiency) at 30 psi (gal)	**43,948**	**43,948**	**43,948**	**36,589**
Storage Surplus/(Deficiency) at 30 psi (gal) - Ham Hill 1 Offline	**20,515**	**20,515**	**20,515**	**13,157**
Existing Storage Greater Than 20 psi (mg)[10]				
Ham Hill 1	38,665	38,665	38,665	38,665
Ham Hill 2	127,044	127,044	127,044	127,044
Total Existing Storage at 20 psi (mg)	165,709	165,709	165,709	165,709
Storage Surplus/(Deficiency) at 20 psi (mg)	**7,358**	**7,358**	**7,358**	**0**
Storage Surplus/(Deficiency) at 20 psi (gal) - Ham Hill 1 Offline	**(27,077)**	**(27,077)**	**(27,077)**	**(34,436)**
Existing Available Storage (mg)[10]				
Ham Hill 1	70,000	70,000	70,000	70,000
Ham Hill 2	230,000	230,000	230,000	230,000
Total Existing Storage at 20 psi (mg)	300,000	300,000	300,000	300,000
Storage Surplus/(Deficiency) at 0 psi (mg)	**141,649**	**141,649**	**141,649**	**134,291**
Storage Surplus/(Deficiency) at 0 psi (gal) - Ham Hill 1 Offline	**67,420**	**67,420**	**67,420**	**60,061**

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.

(3) Multi-source credit assumes largest source is out of service.

(4) Required operational storage is based on observed tanks levels fluctuations of 12 feet.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 3-1 in DOH June 2020 WSDM)

(6) Required Fire Flow Storage = 1,000 gpm x 2 hours.

(7) Required Standby Storage is the greater of (2*ADD less multi-source credit) or (200 gallons per ERU).

(8) Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.

(9) Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of either standby or fire flow storage.

(10) The storage volume available in existing reservoirs at 30, 20, and 0 psi is based on the elevation of the highest customer (~460 ft).

(11) Maximum ERUs served by available storage located solely in the Ham Hill Zone.

8.2 Evaluation of Future Storage Facilities

As indicated in Section 8.1, the City's existing storage facilities provide sufficient volume to meet the needs associated with current and projected 20-year levels of water demand, with the possible exceptions noted relating to potential future large industrial growth.

However, it is also acknowledged that the City maintains some small "closed" pressure zones, for which there is no gravity storage currently provided. At the current levels of demand, these zones and their associated pump stations operate sufficiently to meet needs. But if significant development is proposed for these zones in the future, the City may elect to incorporate gravity storage in these areas, which include Upper Davis Hill, Zenkner Hill, and Upper Seminary Hill. Such reservoirs would serve primarily to meet growth needs but would also bolster fire suppression reliability. Fire flow deficiencies that currently exist in some of the City's boosted zones are currently planned to be resolved through pipeline replacements and pump station upgrades. However, potential future reservoirs could also meet these needs. The sizing of such facilities to meet these needs is provided in the subsections that follow. At the end of this section, the preliminary sizing of a potential future reservoir to serve the Widgeon Hill area, a portion of the City's UGA that is presently undeveloped, is also provided.

It is important to note that these future reservoirs will likely be fully funded through developer contributions, as it will be significant development pressure that triggers their implementation.

8.2.1 Upper Davis Hill Reservoir

The Davis Hill Pressure Zone is unable to achieve required fire flows, as discussed in Section 9.6. While this is primarily a function of undersized distribution pipes, fire suppression reliability would also be enhanced with the addition of gravity water storage, thus eliminating the reliance upon fire pumps. Such storage would also serve additional growth in this area, which will likely be the primary trigger for implementation of storage in this zone.

The analysis assumes the reservoir would come online between the 10- and 20-year planning horizons. A storage reservoir with a volume of 250,000 gallons is sufficient to meet these needs, as shown in Table 8-5. This does not account for any dead storage, which may be required dependent upon final siting of the reservoir.

Table 8-5. Evaluation of Storage Adequacy for Upper Davis Hill

	Year			
	2021	2032	2042	Max[11]
Projected ERUs and Demand[1]				
Retail Service Area				
Equivalent Residential Units (ERU's)	56	285	795	926
Average Day Demand (gpd)	8,616	43,457	121,294	141,313
Maximum Day Demand (gpd)	16,559	83,519	233,114	271,589
PHD (gpm)	52	148	323	366
Available Source (gpd)[2]				
Davis Hill Pump 1 (50 gpm)	72,000	72,000	72,000	72,000
Davis Hill Pump 2 (50 gpm)	72,000	72,000	72,000	72,000
Davis Hill Pump 3 (50 gpm)	72,000	72,000	72,000	72,000
Total Available Source (gpd)	216,000	216,000	216,000	216,000
Multi-Source Credit (gpd)[3]	144,000	144,000	144,000	144,000
Required Storage Calculations				
Operational Storage (gal)[4]	0	0	25,000	25,000
Equalizing Storage (gal)[5]	0	0	33,428	39,840
Fire Flow Storage (gal)[6]	0	0	120,000	120,000
Standby Storage (gal)[7]	0	0	158,929	185,160
Required Storage				
Greater than 30 psi at highest meter (gal)[8]	0	0	58,428	64,840
Greater than 20 psi at highest meter (gal)[9]	0	0	217,357	250,000
Planned Storage Greater Than 30 psi (gal)[10]				
Upper Davis Reservoir	0	0	96,154	96,154
Total Planned Storage at 30 psi (gal)	0	0	96,154	96,154
Storage Surplus/(Deficiency) at 30 psi (gal)	**0**	**0**	**37,726**	**31,314**
Planned Storage Greater Than 20 psi (mg)[10]				
Upper Davis Reservoir	0	0	250,000	250,000
Total Planned Storage at 20 psi (mg)	0	0	250,000	250,000
Storage Surplus/(Deficiency) at 20 psi (mg)	**0**	**0**	**32,643**	**0**
Planned Available Storage (mg)[10]				
Upper Davis Reservoir	0	0	250,000	250,000
Total Planned Storage at 20 psi (mg)	0	0	250,000	250,000
Storage Surplus/(Deficiency) at 0 psi (mg)	**0**	**0**	**32,643**	**0**

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.

(3) Multi-source credit assumes largest source is out of service.

(4) Operational storage is estimated at 10% of reservoir volume.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 3-1 in DOH June 2020 WSDM)

(6) Required Fire Flow Storage = 1,000 gpm x 2 hours.

(7) Required Standby Storage is the greater of (2*ADD less multi-source credit) or (200 gallons per ERU).

(8) Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.

(9) Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of either standby or fire flow storage.

(10) The storage volume available in planned reservoirs at 30, 20, and 0 psi is based on the elevation of the highest customer (~400 ft).

(11) Maximum ERUs served by future storage located solely in the Upper Davis Hill Zone.

8.2.2 Zenkner Hill Reservoir

Similar to Upper Davis Hill, portions of the Zenkner Valley Pressure Zone are unable to achieve required fire flows. While this is primarily a function of undersized distribution pipes, fire suppression reliability would also be enhanced with the addition of gravity water storage, thus eliminating the reliance upon fire pumps. Such storage would also serve additional growth in this area, which will likely be the primary trigger for implementation of storage in this zone.

A storage reservoir with a volume of 175,000 gallons is sufficient to meet these needs, as shown in Table 8-6. This does not account for any dead storage, which may be required dependent upon final siting of the reservoir.

Table 8-6. Evaluation of Storage Adequacy for Zenkner Hill

	Year			
	2021	2032	2042	Max[11]
Projected ERUs and Demand[1]				
Retail Service Area				
Equivalent Residential Units (ERU's)	71	82	88	655
Average Day Demand (gpd)	10,770	12,546	13,488	99,917
Maximum Day Demand (gpd)	20,699	24,112	25,922	192,030
PHD (gpm)	59	65	68	277
Available Source (gpd)[2]				
Zenkner Pump 1 (50 gpm)	72,000	72,000	72,000	72,000
Zenkner Pump 2 (50 gpm)	72,000	72,000	72,000	72,000
Total Available Source (gpd)	144,000	144,000	144,000	144,000
Multi-Source Credit (gpd)[3]	72,000	72,000	72,000	72,000
Required Storage Calculations				
Operational Storage (gal)[4]	0	0	17,500	17,500
Equalizing Storage (gal)[5]	0	0	0	26,581
Fire Flow Storage (gal)[6]	0	0	120,000	120,000
Standby Storage (gal)[7]	0	0	17,673	130,919
Required Storage				
Greater than 30 psi at highest meter (gal)[8]	0	0	17,500	44,081
Greater than 20 psi at highest meter (gal)[9]	0	0	137,500	175,000
Planned Storage Greater Than 30 psi (gal)[10]				
Zenker Reservoir	0	0	148,077	148,077
Total Planned Storage at 30 psi (gal)	0	0	148,077	148,077
Storage Surplus/(Deficiency) at 30 psi (gal)	**0**	**0**	**130,577**	**103,996**
Planned Storage Greater Than 20 psi (mg)[10]				
Zenkner Reservoir	0	0	175,000	175,000
Total Planned Storage at 20 psi (mg)	0	0	175,000	175,000
Storage Surplus/(Deficiency) at 20 psi (mg)	**0**	**0**	**37,500**	**0**
Planned Available Storage (mg)[10]				
Zenkner Reservoir	0	0	175,000	175,000
Total Planned Storage at 20 psi (mg)	0	0	175,000	175,000
Storage Surplus/(Deficiency) at 0 psi (mg)	**0**	**0**	**37,500**	**0**

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.

(3) Multi-source credit assumes largest source is out of service.

(4) Operational storage is estimated at 10% of reservoir volume.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 3-1 in DOH June 2020 WSDM)

(6) Required Fire Flow Storage = 1,000 gpm x 2 hours.

(7) Required Standby Storage is the greater of (2*ADD less multi-source credit) or (200 gallons per ERU).

(8) Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.

(9) Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of either standby or fire flow storage.

(10) The storage volume available in planned reservoirs at 30, 20, and 0 psi is based on the elevation of the highest customer (~400 ft).

(11) Maximum ERUs served by future storage located solely in the Zenkner Hill Zone.

8.2.3 Upper Seminary Hill Reservoir

Similar to Upper Davis Hill and Zenkner Valley, portions of the Seminary Hill Pressure Zone are unable to achieve required fire flows. While this is primarily a function of undersized distribution pipes, fire suppression reliability would also be enhanced with the addition of gravity water storage, thus eliminating the reliance upon pumping to fight fires. Such storage would also serve additional growth in this area, which will likely be the primary trigger for implementation of storage in this zone.

A storage reservoir with a volume of 300,000 gallons is sufficient to meet these needs, as shown in Table 8-7. This does not account for any dead storage, which may be required dependent upon final siting of the reservoir.

Table 8-7. Evaluation of Storage Adequacy for Upper Seminary Hill

	Year			
	2021	2032	2042	Max[11]
Projected ERUs and Demand[1]				
Retail Service Area				
Equivalent Residential Units (ERU's)	155	181	194	658
Average Day Demand (gpd)	23,694	27,601	29,673	100,390
Maximum Day Demand (gpd)	45,538	53,047	57,029	192,938
PHD (gpm)	97	107	112	301
Available Source (gpd)[2]				
Seminary Pump 1 (250 gpm)	360,000	360,000	360,000	360,000
Seminary Pump 2 (250 gpm)	360,000	360,000	360,000	360,000
Total Available Source (gpd)	720,000	720,000	720,000	720,000
Multi-Source Credit (gpd)[3]	360,000	360,000	360,000	360,000
Required Storage Calculations				
Operational Storage (gal)[4]	0	30,000	30,000	30,000
Equalizing Storage (gal)[5]	0	0	0	0
Fire Flow Storage (gal)[6]	0	120,000	120,000	120,000
Standby Storage (gal)[7]	0	36,166	38,880	131,538
Required Storage				
Greater than 30 psi at highest meter (gal)[8]	0	30,000	30,000	30,000
Greater than 20 psi at highest meter (gal)[9]	0	150,000	150,000	161,538
Planned Storage Greater Than 30 psi (gal)[10]				
Upper Seminary Hill Reservoir	0	92,308	92,308	92,308
Total Planned Storage at 30 psi (gal)	0	92,308	92,308	92,308
Storage Surplus/(Deficiency) at 30 psi (gal)	**0**	**62,308**	**62,308**	**62,308**
Planned Storage Greater Than 20 psi (mg)[10]				
Upper Seminary Hill Reservoir	0	161,538	161,538	161,538
Total Planned Storage at 20 psi (mg)	0	161,538	161,538	161,538
Storage Surplus/(Deficiency) at 20 psi (mg)	**0**	**11,538**	**11,538**	**0**
Planned Available Storage (mg)[10]				
Upper Seminary Hill Reservoir	0	300,000	300,000	300,000
Total Planned Storage at 20 psi (mg)	0	300,000	300,000	300,000
Storage Surplus/(Deficiency) at 0 psi (mg)	**0**	**150,000**	**150,000**	**138,462**

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.

(3) Multi-source credit assumes largest source is out of service.

(4) Operational storage is estimated at 10% of reservoir volume.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 3-1 in DOH June 2020 WSDM)

(6) Required Fire Flow Storage = 1,000 gpm x 2 hours.

(7) Required Standby Storage is the greater of (2*ADD less multi-source credit) or (200 gallons per ERU).

(8) Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.

(9) Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of either standby or fire flow storage.

(10) The storage volume available in planned reservoirs at 30, 20, and 0 psi is based on the elevation of the highest customer (~500 ft).

(11) Maximum ERUs served by future storage located solely in the Upper Seminary Hill zone.

8.2.4 Widgeon Hill Reservoir

There is potential for growth within the Widgeon Hill area within the 20-year time frame. Though Widgeon Hill is part of the City of Chehalis' UGA, Centralia continues to consider the need for storage in the area since it remains within the Centralia retail service area. Future water system infrastructure needed to provide service to this area would include a storage reservoir. A reservoir with a volume of 325,000 gallons is sufficient to meet the projected 20-year growth needs, as shown in Table 8-8. This does not account for any dead storage, which may be required dependent upon final siting of the reservoir.

Table 8-8. Evaluation of Storage Adequacy for Widgeon Hill

	Year			
	2021	2032	2042	Max[11]
Projected ERUs and Demand[1]				
Retail Service Area				
Equivalent Residential Units (ERU's)	0	391	1,293	1,330
Average Day Demand (gpd)	0	59,678	197,328	202,947
Maximum Day Demand (gpd)	0	114,695	379,244	390,043
PHD (gpm)	0	187	485	497
Available Source (gpd)[2]				
Widgeon Hill Pump 1 (160 gpm)	230,400	230,400	230,400	230,400
Widgeon Hill Pump 2 (160 gpm)	230,400	230,400	230,400	230,400
Total Available Source (gpd)	460,800	460,800	460,800	460,800
Multi-Source Credit (gpd)[3]	230,400	230,400	230,400	230,400
Required Storage Calculations				
Operational Storage (gal)[4]	0	32,500	32,500	32,500
Equalizing Storage (gal)[5]	0	0	24,783	26,583
Fire Flow Storage (gal)[6]	0	120,000	120,000	120,000
Standby Storage (gal)[7]	0	78,195	258,555	265,917
Required Storage				
Greater than 30 psi at highest meter (gal)[8]	0	32,500	57,283	59,083
Greater than 20 psi at highest meter (gal)[9]	0	152,500	315,838	325,000
Planned Storage Greater Than 30 psi (gal)[10]				
Widgeon Hill Reservoir	0	107,692	107,692	107,692
Total Planned Storage at 30 psi (gal)	0	107,692	107,692	107,692
Storage Surplus/(Deficiency) at 30 psi (gal)	**0**	**75,192**	**50,409**	**48,609**
Planned Storage Greater Than 20 psi (mg)[10]				
Widgeon Hill Reservoir	0	325,000	325,000	325,000
Total Planned Storage at 20 psi (mg)	0	325,000	325,000	325,000
Storage Surplus/(Deficiency) at 20 psi (mg) - Standby Storage	**0**	**172,500**	**9,162**	**0**
Planned Available Storage (mg)[10]				
Widgeon Hill Reservoir	0	325,000	325,000	325,000
Total Planned Storage at 20 psi (mg)	0	325,000	325,000	325,000
Storage Surplus/(Deficiency) at 0 psi (mg)	**0**	**172,500**	**9,162**	**0**

Notes:

(1) Projected ERUs developed from the demand forecast by pressure zone in Table 3-12.

(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.

(3) Multi-source credit assumes largest source is out of service.

(4) Operational storage is estimated at 10% of reservoir volume.

(5) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 3-1 in DOH June 2020 WSDM)

(6) Required Fire Flow Storage = 1,000 gpm x 2 hours.

(7) Required Standby Storage is the greater of (2*ADD less multi-source credit) or (200 gallons per ERU).

(8) Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.

(9) Total required storage greater than 20 psi is equal to the total of operational, equalizing, and the greater of either standby or fire flow storage.

(10) The storage volume available in planned reservoirs at 30, 20, and 0 psi is based on the elevation of the highest customer (~570 ft).

(11) Maximum ERUs served by future storage located solely in the Widgeon Hill Zone.

9. Distribution System Analysis

This section presents analysis of the City of Centralia's (City) distribution system. Hydraulic modeling was performed to evaluate the adequacy of existing facilities for conveying current and future flows, and to aid in determining improvements that would ensure future viability of the distribution system.

9.1 Methodology

As required by DOH, the City's water distribution system was analyzed and deficiencies were identified for the following two conditions: peak hour demands (PHD), and maximum day demands (MDD) plus fire flow. All modeling calculations were performed within the WaterGEMS software produced by Bentley.

Pressure is the primary hydraulic parameter analyzed via computer modeling to identify system deficiencies. The target minimum system operating pressure is 30 pounds per square inch (psi) during peak hour demand conditions. During fire flow conditions, a residual pressure of 20 psi must be maintained throughout the analyzed pressure zone. Available fire flow is also limited by keeping pipe velocities below a maximum velocity of 10 feet per second.

The general methodology of this hydraulic modeling analysis was to examine the current distribution system during various demand and fire flow conditions. According to the above pressure criteria, deficiencies were noted and distribution system improvements proposed. Further analysis was performed to verify that additional improvements associated with growth of the City meet the minimum distribution system criteria. All distribution system improvements, relating either to remedy of current deficiencies or accommodation of future growth are presented in Section 13.

9.2 Demand Allocation

Section 3 presents information on City water demands for the existing system and provides an estimate of projected water demands for the 10-year and 20-year planning horizons[1]. For the hydraulic model, the demand forecast was used to determine the total demand for customers within the City's service area.

As part of the demand forecast, the forecasted demand for each pressure zone was determined as described in Section 3. The forecasted demands by pressure zone were allocated in the model by equally distributing the pressure zone demands to the model junctions within the pressure zone. These allocated demands include both revenue and non-revenue demands.

As such, demands were allocated across every node in the model with the exclusion of some nodes that are located on a transmission line or near a storage reservoir, pump station, or PRV

[1] The demand forecast horizon, as presented in Section 2, was adjusted to 2032 and 2042 (from 2031 and 2041, respectively) after local government and DOH review on the draft plan. The project team chose not to rerun the hydraulic analysis with the one year offset because the new results would not be materially different. Therefore, the original horizons of 2031 (10-year) and 2041 (20-year) were maintained for the hydraulic analysis.

station. A thorough review of the system was conducted, checking to see if demands were assigned to nodes in a reasonable manner.

Demands were allocated in the model for average day, maximum day, and peak hour demand conditions.

9.3 Calibration

A critical step in the development of a hydraulic model, prior to using it as a tool to analyze system performance, is calibration. Calibration consists of measuring pressure and flows in the field and comparing them with the same pressures and flows simulated in the model. For the previous 2013 Water System Plan, a steady-state calibration was completing using a total of 12 hydrant tests.

As part of the 2022 Water System Plan, an additional four hydrant tests were completed in the Central Zone, two of which focused on new piping installed in the northwest corner of the system. The test locations were selected to provide adequate coverage for each pressure zone and to maximize the friction losses across the system by placing the test locations as far from sources of water for each pressure zone as possible.

For the hydrant test, a pressure gage was placed on the “residual” hydrant and pressure was measured under normal operating (where no hydrant was flowing) or “static” conditions. Once the pressure was recorded, a second hydrant was opened and the flow at this hydrant was measured using a pitot gage. While the second hydrant was open, the pressure was observed and recorded (once the gage readings stabilized) at the residual hydrant.

To conduct calibration, the system operations or boundary conditions are recorded during the time the hydrant tests are conducted. Boundary conditions of concern typically include system demands, reservoir levels, well operation, and pump station flows.

For the City, the levels in the reservoirs were recorded for each hydrant test occurring in the system. Pump station and well operations were also recorded. Demands were allocated as described above, with total demand adjusted to match the calculated average demand for the day of the field testing.

Adjustments of model friction factors were made within the system to achieve steady state calibration. Friction factors were adjusted based on pipe material and age as summarized in Table 9-1. Table 9-2 contains the field data collected for the hydrant tests and the results of the model simulations both before and after making the friction factor adjustments in Table 9-1. One of the four tests (Test #4) was not used for steady state calibration because the field measurements indicated a pressure drop not reasonably predicted by the model. Even when adjusting all pipes in the model to have a friction factor of C = 160, the model was predicting a much greater drop than what was measured in the field. This may be caused by a valve not fully closing in the field that was planned for the test. For the other tests, possible errors may occur due to measurement differences in pressure, flow, and elevation data assumed in the mode. However, after making the friction factor adjustments, the model results much better aligned to the field measurements as seen in Table 9-2.

Comparing the model results with the field measurements for static pressures indicates the overall accuracy of the model node elevations, tank elevations, and PRV settings under normal

demand conditions. As shown in Table 9-2, the simulated model pressures, with the exception of one, indicate a reasonable match between modeled and observed conditions.

Table 9-1. Adjusted pipe friction factor assumptions

Material	Installation Decade	Hazen-Williams Friction Factor, C
Asbestos Cement	All	145
Cast Iron	Unknown, Prior to 1950	90
Cast Iron	1950	110
Cast Iron	1960	115
Cast Iron	1970	130
Cast Iron	1980	140
Ductile Iron	Unknown	135
Ductile Iron	Prior to 1950	120
Ductile Iron	1950	130
Ductile Iron	1960 through 2000	140
Ductile Iron	2010 through 2020	150
Galvanized Iron	Prior to 1970	100
Galvanized Iron	1970 and later	120
PVC	All	150

Table 9-2. Calibration Results

Hydrant Test No.	Pressure Zone	Fire flow (gpm)	FIELD Static Pressure (psi)	MODEL Static Pressure (psi)	Static Pressure Difference (psi) (1)	FIELD Residual Pressure (psi)	MODEL Residual Pressure (psi)	Field Pressure Drop (psi) (2)	Model Pressure Drop (psi) (3)	Difference in Field and Model Pressure Drops (psi)(4)
Based on original model friction factors										
1	Central	1,405	105	101.4	-3.6	78	52.0	27	49.4	22.4
2	Central	1,405	105	101.5	-3.5	75	55.9	30	45.6	15.6
3	Central	920	95	97.7	2.7	30	2.5	65	95.2	30.2
4	Central	1,405	100	99.2	-0.8	80	19.5	20	79.7	59.7
Based on revised model friction factors										
1	Central	1,405	105	105.8	0.8	78	67.4	27	38.4	11.4
2	Central	1,405	105	105.7	0.7	75	69	30	36.7	6.7
3	Central	920	95	98.2	3.2	30	30.6	65	67.6	2.6
4	Central	1,405	100	100.3	0.3	80	50.1	20	50.2	30.2

Footnotes:

(1) Calculated: Model Static Pressure (psi) minus Field Static Pressure (psi)

(2) Calculated: Field Residual Pressure (psi) minus Field Static Pressure (psi)

(3) Calculated: Model Residual Pressure (psi) minus Model Static Pressure (psi)

(4) Calculated: Model Pressure Drop (psi) minus Field Pressure Drop (psi)

9.4 Modeling Scenarios

In accordance with WAC 246-290-230, a minimum pressure of 30 psi must be maintained at all customer connections under peak hour demand (PHD) conditions with equalizing storage depleted in the reservoirs. A minimum of 20 psi must be maintained for fire flows under MDD conditions with equalizing and fire flow storage depleted. If these criteria could not be met, improvements were identified and through an iterative trial-and-error process, implemented until pressure criteria could be satisfied with a minimum of total pipe and facility additions.

A number of steady state hydraulic analyses were completed for each pressure zone for existing (2021), ten-year (2031), and twenty-year (2041) demand conditions. These considered peak hour demand and fire flow demand (MDD plus fire flow) conditions. Table 9-3 describes the modeling scenarios conducted, and the sequence within which they were performed. The results of the peak hour and fire flow analyses are described in greater detail below.

Table 9-3. Modeling Scenarios

Description	Demand	Purpose
Maximum pressure	Static (zero) demand with full tanks	Evaluate system for maximum possible pressures
Existing Year Peak Hour	2021 Peak Hour Demand	Evaluate system
Existing Year Fire Flow	2021 Maximum Day Demand plus fire flow	Evaluate system
Plan Year 10 Peak Hour	Plan Year 10 Peak Hour Demand	Evaluate system performance and develop CIP for peak hour conditions
Plan Year 10 Fire Flow	Plan Year 10 Maximum Day Demand plus fire flow	Evaluate system performance and develop CIP for Plan Year 10 fire flow conditions
Plan Year 20 Peak Hour	Plan Year 20 Peak Hour Demand	Evaluate system and develop CIP for Plan Year 20 peak hour conditions
Plan Year 20 Fire Flow	Plan Year 20 Maximum Day Demand plus fire flow	Evaluate system performance and develop CIP for Plan Year 20 fire flow conditions

9.5 Maximum Pressure Analysis Results

The DOH Water System Design Manual recommends that working pressures in the distribution system should be limited to 80 psi. A model run was completed with static (zero) distribution system demands with storage facilities at their full level which represents a scenario of the highest possible pressures in the distribution system.

The analysis found that most of the Central pressure zone is around 100 psi with a few areas having pressures as high as 115 psi. In the same scenario, the lowest pressures in the Central zone are several service connections near the intersection of E Main St and S Baker Street (about 900 feet north of the Seminary Hill Tank) with pressures around 20 psi.

In cases where a customer is concerned about high pressure and potentially adverse effects on in-premise plumbing, it is the customer's responsibility to install and maintain their own individual pressuring reducing valve on their side of the meter. Typically, City customers implement this approach only when pressures are frequently in excess of 100 psi.

A map of maximum distribution system pressures is given in Figure 9-2.

9.6 Peak Hour Analysis Results

PHD pressure results given existing infrastructure for 2021, 2031, and 2041 are provided in Figure 9-3, Figure 9-4, and Figure 9-5, respectively. Figure 9-6 provides PHD pressure results for 2031 given the 10-year capital improvement plan (CIP) piping while Figure 9-7 presents the PHD pressure results for 2041 with 20-year CIP piping. All PHD model runs have operational and equalizing storage depleted. Modeling has found two areas of the distribution system with low pressures (less than 30 psi).

There is an area of low pressure in the vicinity of the Seminary Hill Reservoir (near the intersection of E Main St and S Baker St) due to the local topography. This includes a multifamily unit that connects at a lower elevation and uses a small booster pump station to provide pressure. A double-check backflow assembly is installed on the complex's fire system, and it is inspected annually. Additionally, an in-line check valve is installed on the City's side of the booster pump.

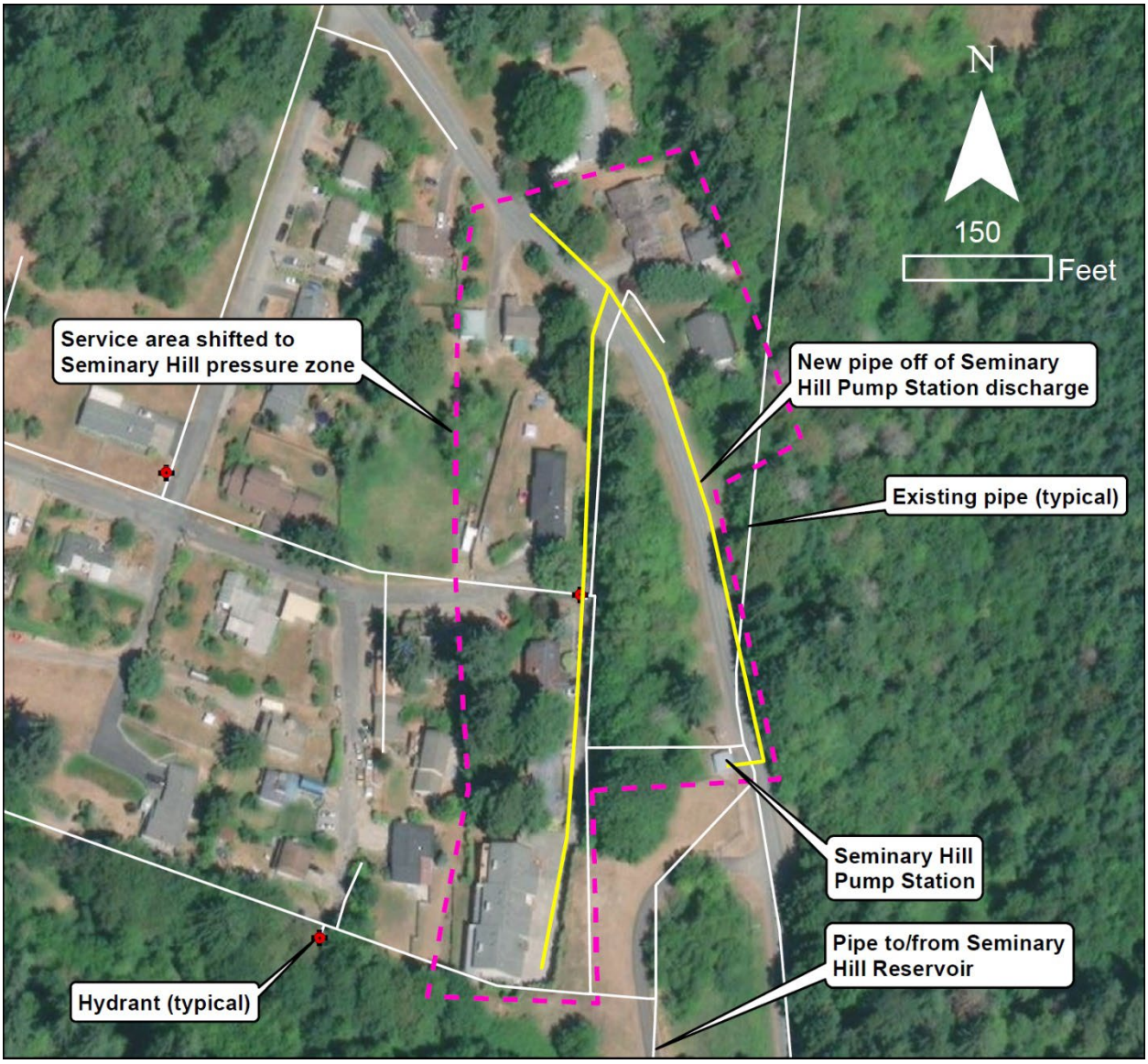
Another area of low pressure is on Blanchard Rd at the end of the piping connected to the Central zone. Figure 9-3 shows that this area currently has a pressure of 24 psi. Figure 9-5 shows that with 2041 PHD, the pressure drops to 15 psi.

There are other services that are affected with delivery pressures between 20 and 30 psi. Historically, there have not been complaints from any of the affected customers and no new development is planned at these locations. However, as discussed in Section 9.7, these areas not only have low pressures during PHD, but also limit available fire flow if including these areas as part of the 20 psi minimum pressure constraint.

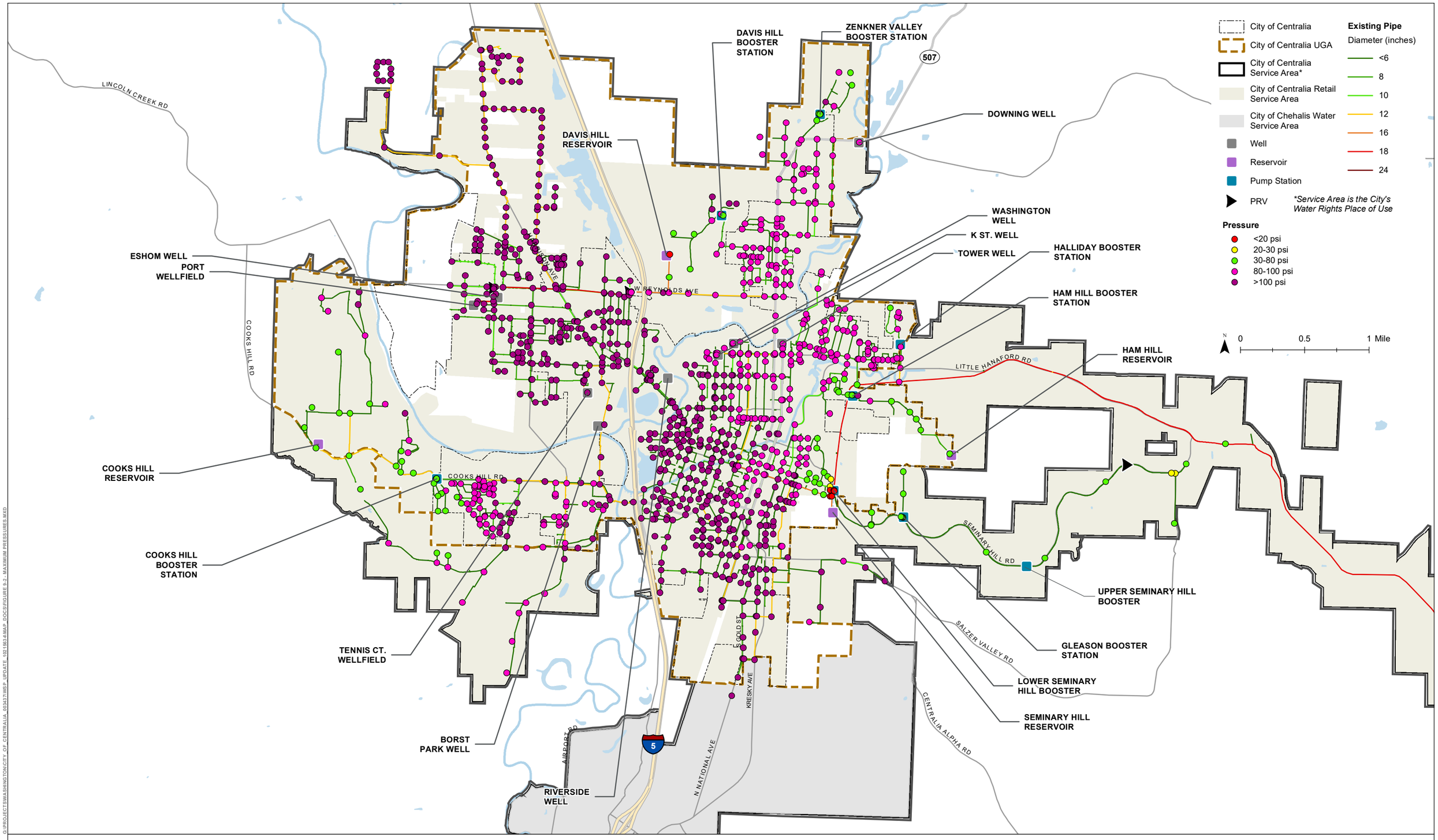
To resolve the low pressures around S Baker St, the low pressure area could be connected to the Seminary Hill pressure zone. This could be done by adding approximately 1,300 feet of piping from the Seminary Hill pump station north along Seminary Hill Rd and the south along Baker St and running parallel to the existing Central Zone piping (project WD-55 in Section 13). Service connections with low pressures within the Central Zone would then shift to the newly installed pipe Seminary Hill pressure zone piping. This is shown on Figure 9-1. While the piping in the Central Zone would continue to have pressures below 30 psi, as the service connections in the low pressure area are no longer connected to the Central Zone pipe, they can then be considered transmission pipe (instead of distribution pipe) which has a minimum required pressure of 5 psi.

During PHD conditions, the highest velocity seen throughout the system is 5 feet per second located where the Tennis Court Wells discharge into the system.

Figure 9-1. Baker Street Modifications



The area of low pressure on Blanchard Rd can be resolved by installing approximately 900 feet of water line on Blanchard Rd closing the gap between the Central and Cooks Hill Zones. The low pressure area would then become part of the Cooks Hill Zone. An isolation valve would then be added to separate the Cooks Hill and Central Zones.



G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_00337\WSP_UPDATE_102163\MAP_DOCS\FIGURE 9-2_MAXIMUM PRESSURES.MXD

MAXIMUM SYSTEM PRESSURES

FIGURE 9-2

City of Centralia Water System Plan
September 2022

DAVIS HILL BOOSTER STATION
ZENKNER VALLEY BOOSTER STATION
507
DOWNING WELL
DAVIS HILL RESERVOIR
LINCOLN CREEK RD
WASHINGTON WELL
K ST. WELL
TOWER WELL
HALLIDAY BOOSTER STATION
ESHOM WELL
PORT WELLFIELD
HAM HILL BOOSTER STATION
HAM HILL RESERVOIR
LITTLE HANAFORD RD
COOKS HILL RD
W REYNOLDS AVE
COOKS HILL RESERVOIR
COOKS HILL BOOSTER STATION
SEMINARY HILL RD
UPPER SEMINARY HILL BOOSTER
SALZER VALLEY RD
GLEASON BOOSTER STATION
TENNIS CT. WELLFIELD
LOWER SEMINARY HILL BOOSTER
SEMINARY HILL RESERVOIR
CENTRALIA ALPHA RD
BORST PARK WELL
AIRPORT RD
KRESKY AVE
E GOLD ST
N NATIONAL AVE
RIVERSIDE WELL
5

City of Centralia
City of Centralia UGA
City of Centralia Service Area*
City of Centralia Retail Service Area
City of Chehalis Water Service Area
Well
Reservoir
Pump Station
PRV

*Service Area is the City's Water Rights Place of Use

Existing Pipe Diameter (inches)
<6
8
10
12
16
18
24

Pressure
<20 psi
20-30 psi
30-80 psi
80-100 psi
>100 psi

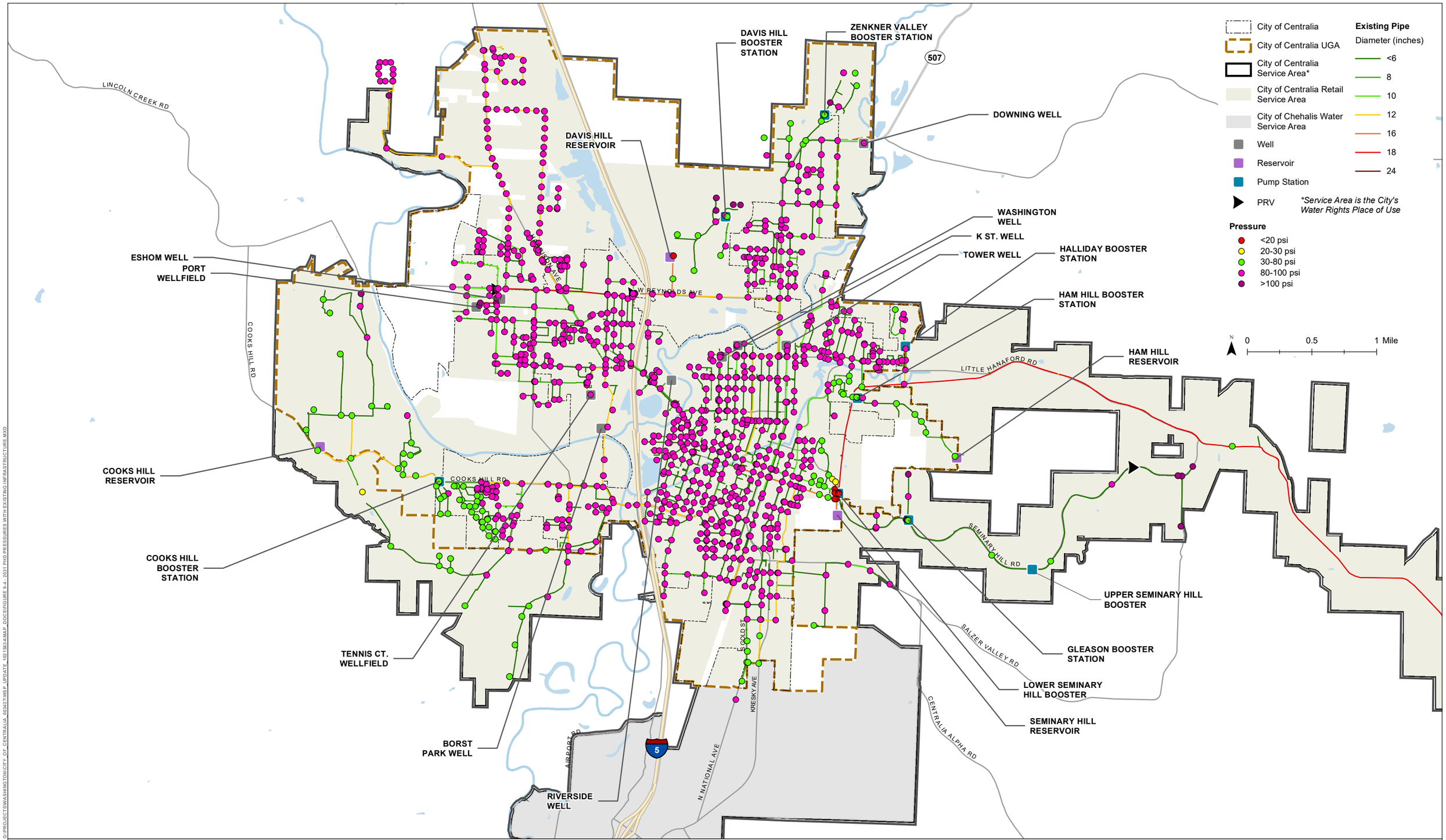
N 0 0.5 1 Mile

G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_102163\MAP_DOCS\FIGURE 9-3_2021 PHD PRESSURES.MXD

2021 PEAK HOUR PRESSURE MAP

FIGURE 9-3

City of Centralia Water System Plan
September 2022

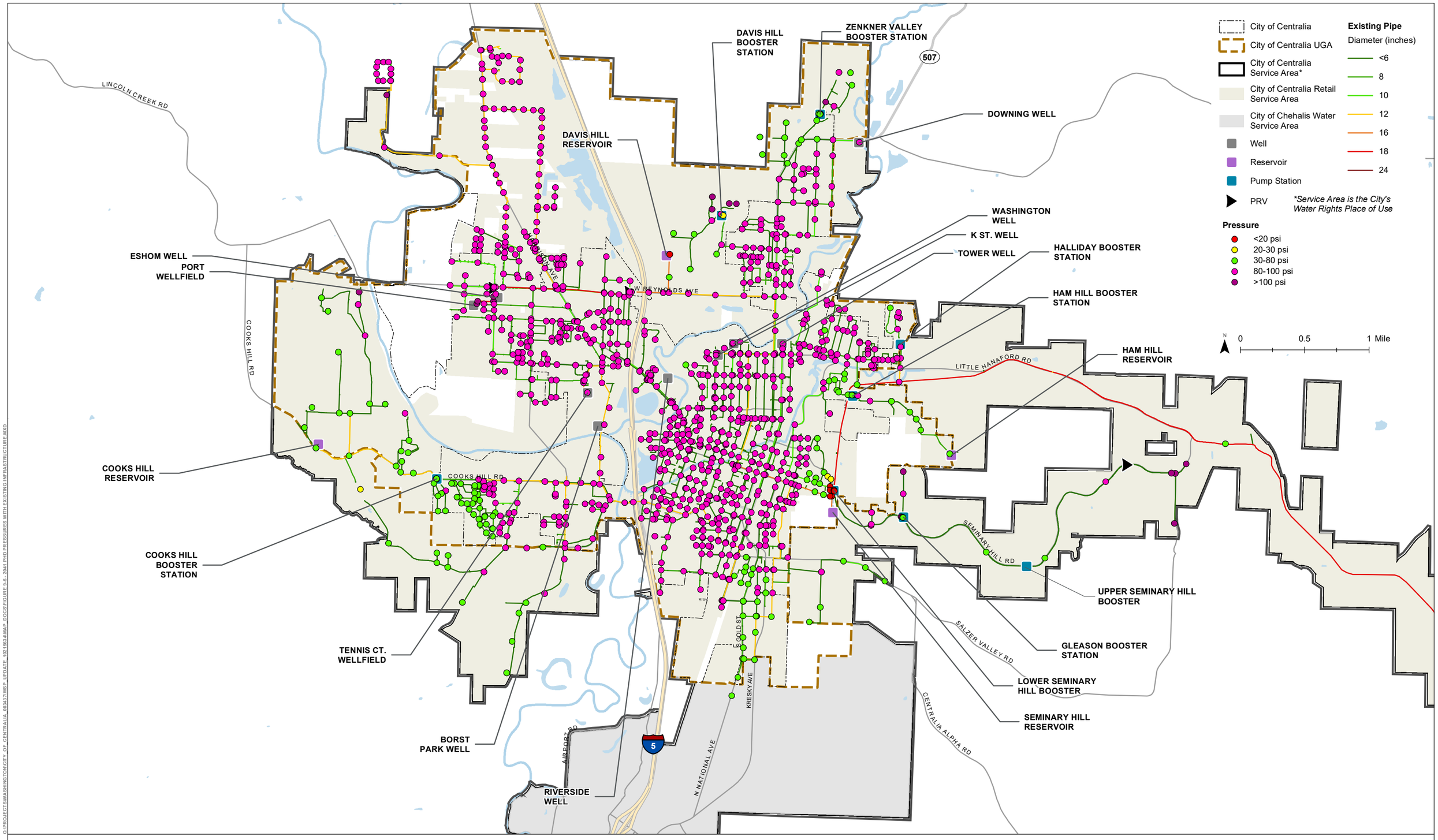


G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_102163\MAP_DOCS\FIGURE 9-4 - 2031 PHD PRESSURES WITH EXISTING INFRASTRUCTURE.MXD

2031 PEAK HOUR PRESSURE MAP WITH EXISTING INFRASTRUCTURE

FIGURE 9-4

City of Centralia Water System Plan
September 2022

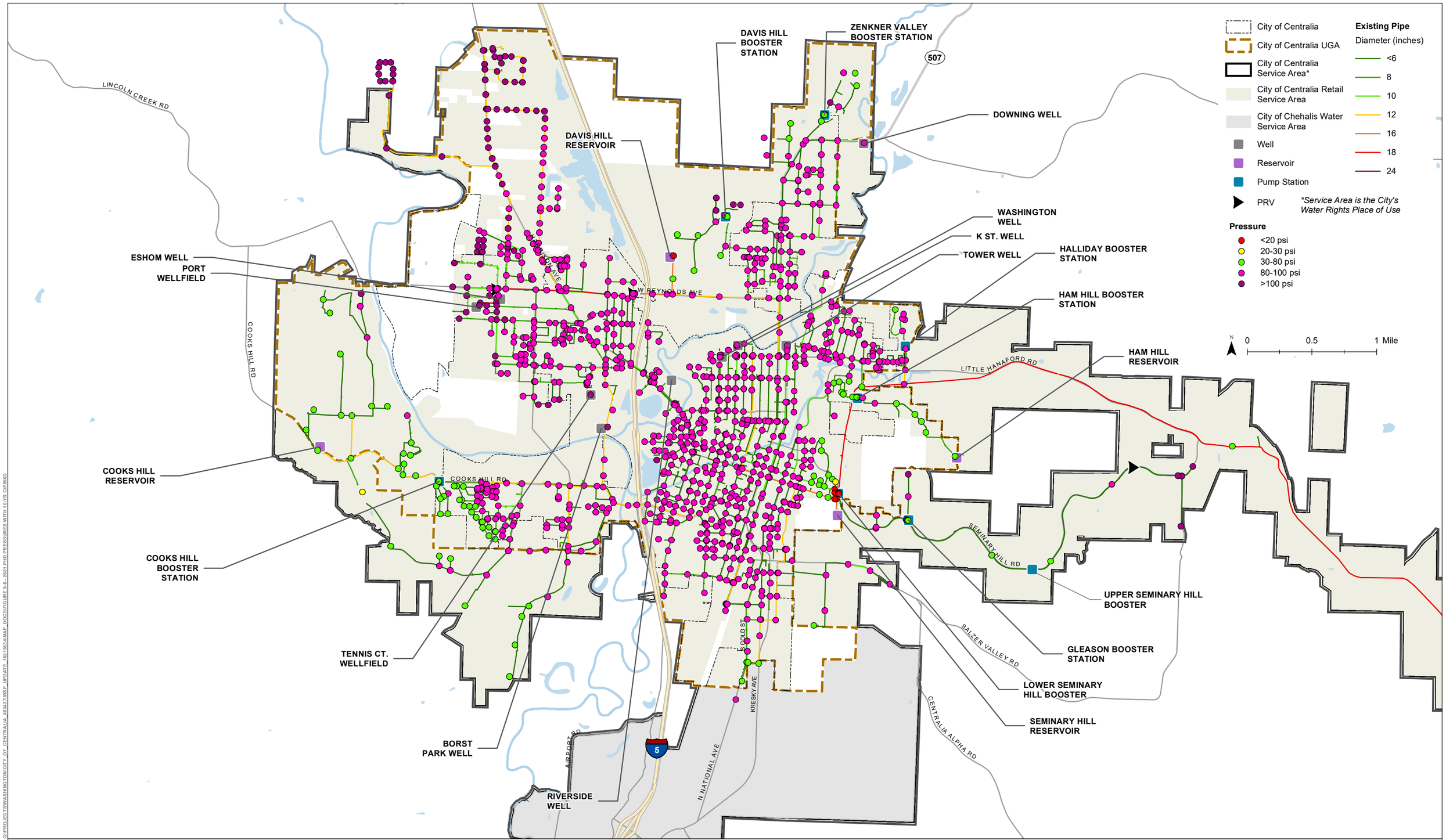


G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_102163\MAP_DOCS\FIGURE 9-5 - 2041 PHD PRESSURES WITH EXISTING INFRASTRUCTURE.MXD

2041 PEAK HOUR PRESSURE MAP WITH EXISTING INFRASTRUCTURE

FIGURE 9-5

City of Centralia Water System Plan
September 2022

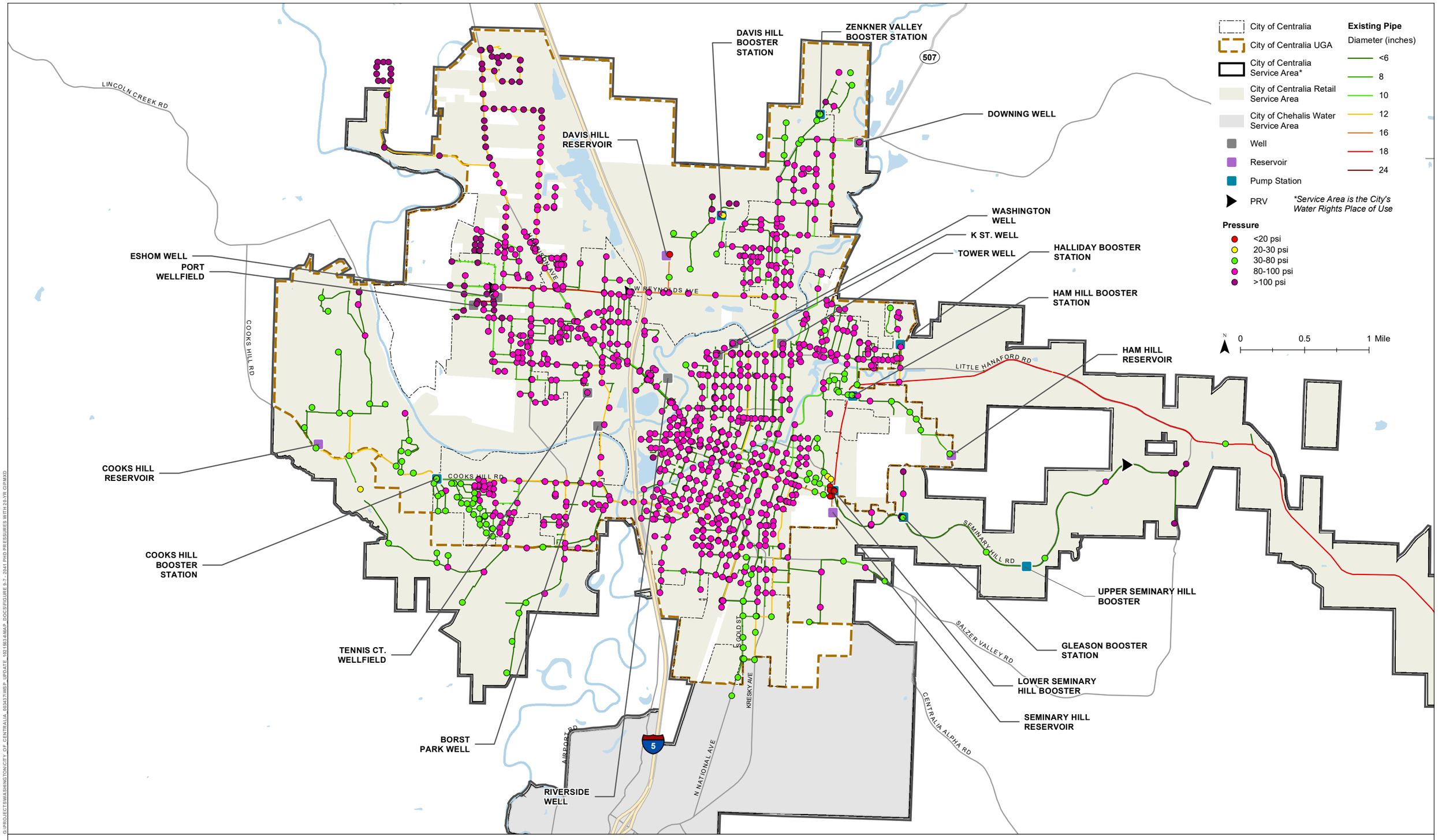


G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_102163\MAP_DOCS\FIGURE 9-6_2031 PHD PRESSURES WITH 10-YR CIP.MXD

2031 PEAK HOUR PRESSURE MAP WITH 10-YEAR CIP

FIGURE 9-6

City of Centralia Water System Plan
September 2022



G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_00437\WSP_UPDATE_102163\MAP_DOCS\FIGURE 9-7_2041 PHD PRESSURES WITH 20-YR CIP.MXD

2041 PEAK HOUR PRESSURE MAP WITH 20-YEAR CIP

FIGURE 9-7

City of Centralia Water System Plan
September 2022

9.7 Fire Flow Analysis Results

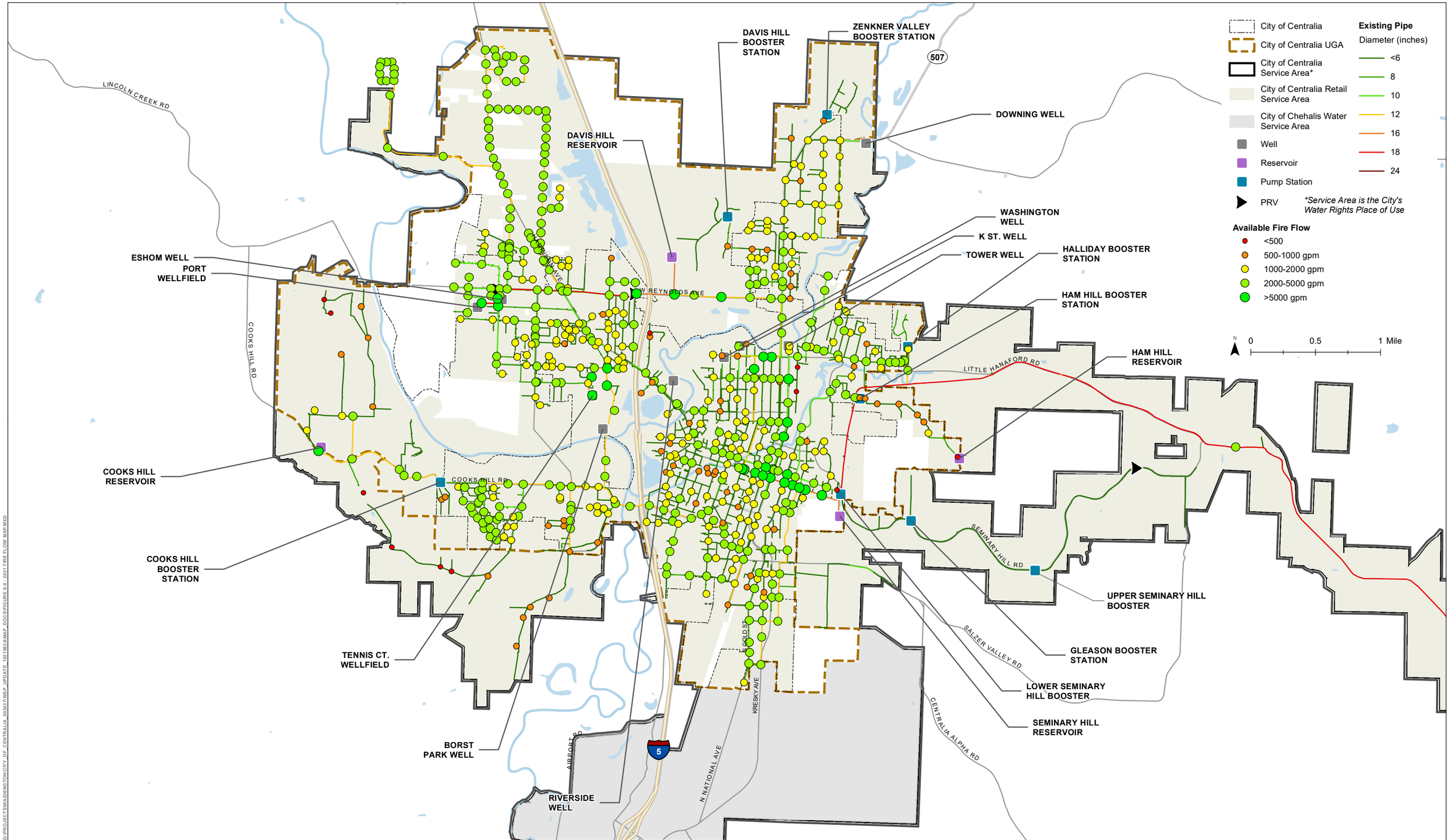
The available fire flow for 2021 (assuming the existing system and current levels of demand) is provided in Figure 9-8. The available fire flow for 2031 and 2041 given existing infrastructure is provided in Figure 9-9 and Figure 9-10, respectively. The amount of fire flow deficiency compared to fire flow goals for 2021 is provided in Figure 9-11, and for 2031 and 2041 given existing infrastructure in Figure 9-12 and Figure 9-13, respectively. Figure 9-14 provides the available fire flow for 2031 with the 10-year CIP while Figure 9-15 provides the available fire flow for 2041 with the 20-year CIP. Figure 9-16 provides the fire flow deficiency for 2031 with the 10-year CIP while Figure 9-17 provides the fire flow deficiency for 2041 with the 20-year CIP.

Numerous deficiencies have been identified in the model, mostly a result of inadequately sized piping throughout portions of the system and inadequately sized booster pump stations for the elevated pressure zones. Improvements have been listed that improve or eliminate these deficiencies in the future. These improvements are described in more detail in Section 13 (Capital Improvement Program). A portion of the deficiencies listed do not have an assigned improvement, because the Annual Small Waterline Replacement program will address the deficiency.

Throughout the Central pressure zone, available fire flow is limited due to the 20 psi pressure constraint being reached at the lower pressure area near Baker Street discussed in Section 9.6. The improvement discussed in Section 9.6 helps to resolve this (also described as project WD-55 in Section 13).

There are three areas that have larger 5,000 gpm fire flow goals. This includes the Port of Centralia Park II located at the northwest end of the system that currently has an available fire flow of approximately 3,500 gpm. Similarly, the current available fire flow for the Industrial Drive area is approximately 3,000 gpm. The Galvin Road industrial area has an available fire flow of approximately 2,500 gpm. Projects have been identified in the CIP to address these deficiencies and increase available fire flow in these areas above 5,000 gpm. This includes project WD-51 to address the Port of Centralia Park II deficiencies, project W-52 to address the Industrial Drive deficiency, and project WD-53 to address the Galvin Rd deficiency.

Other areas of deficiencies shown on Figure 9-11 have projects identified in Section 13 to address those deficiencies. Figure 9-17 does show some areas that continue to have deficiencies. However, these areas are either located in low pressure areas (such as near a reservoir), a single hydrant located on a dead-end main that is limited by the velocity constraint, or have hydrants in the vicinity that do not have a deficiency.

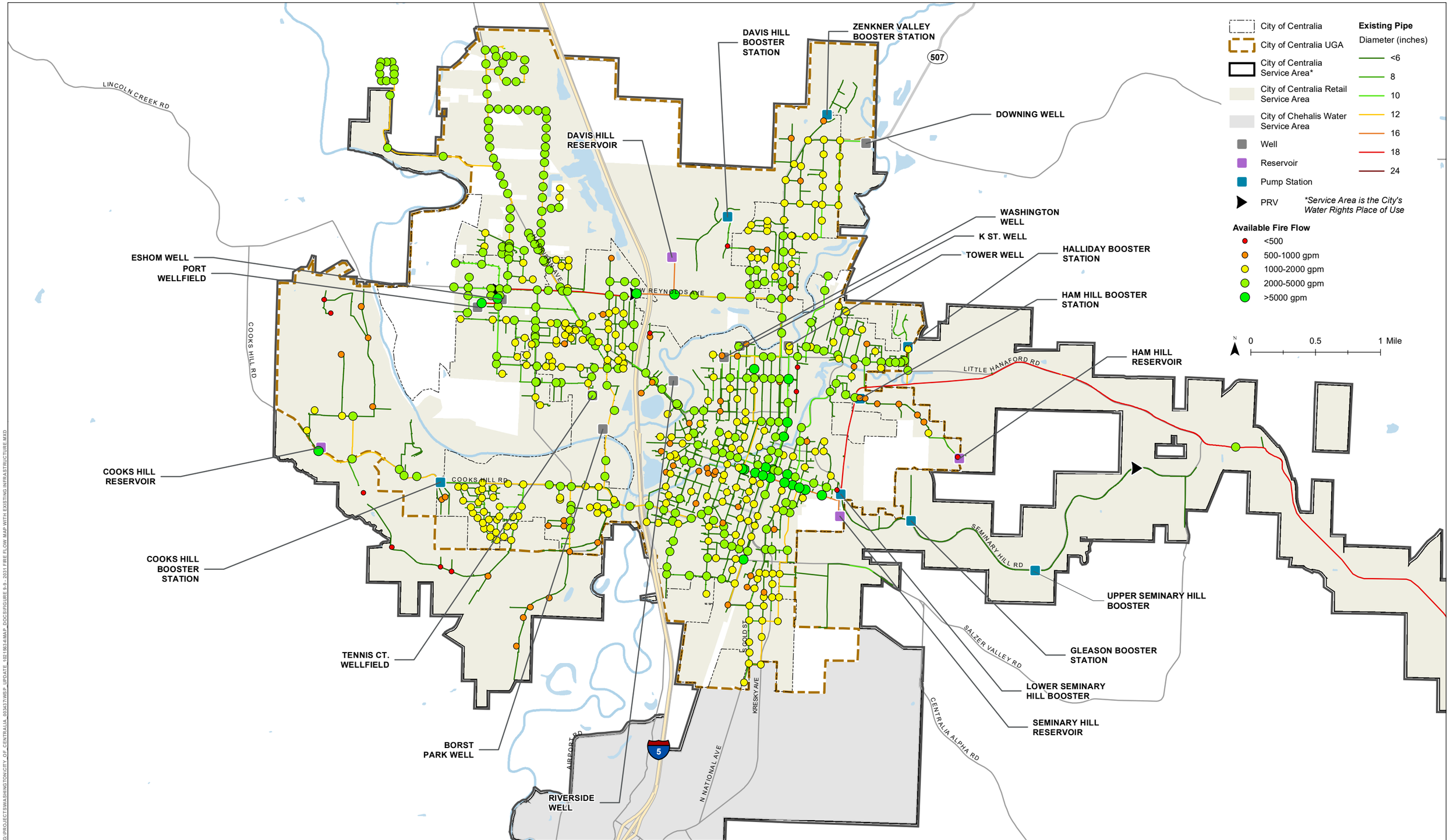


G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_10215634\MAP_DOCS\FIGURE 9-8 - 2021 FIRE FLOW MAP.MXD

2021 AVAILABLE FIRE FLOW MAP

FIGURE 9-8

City of Centralia Water System Plan
September 2022

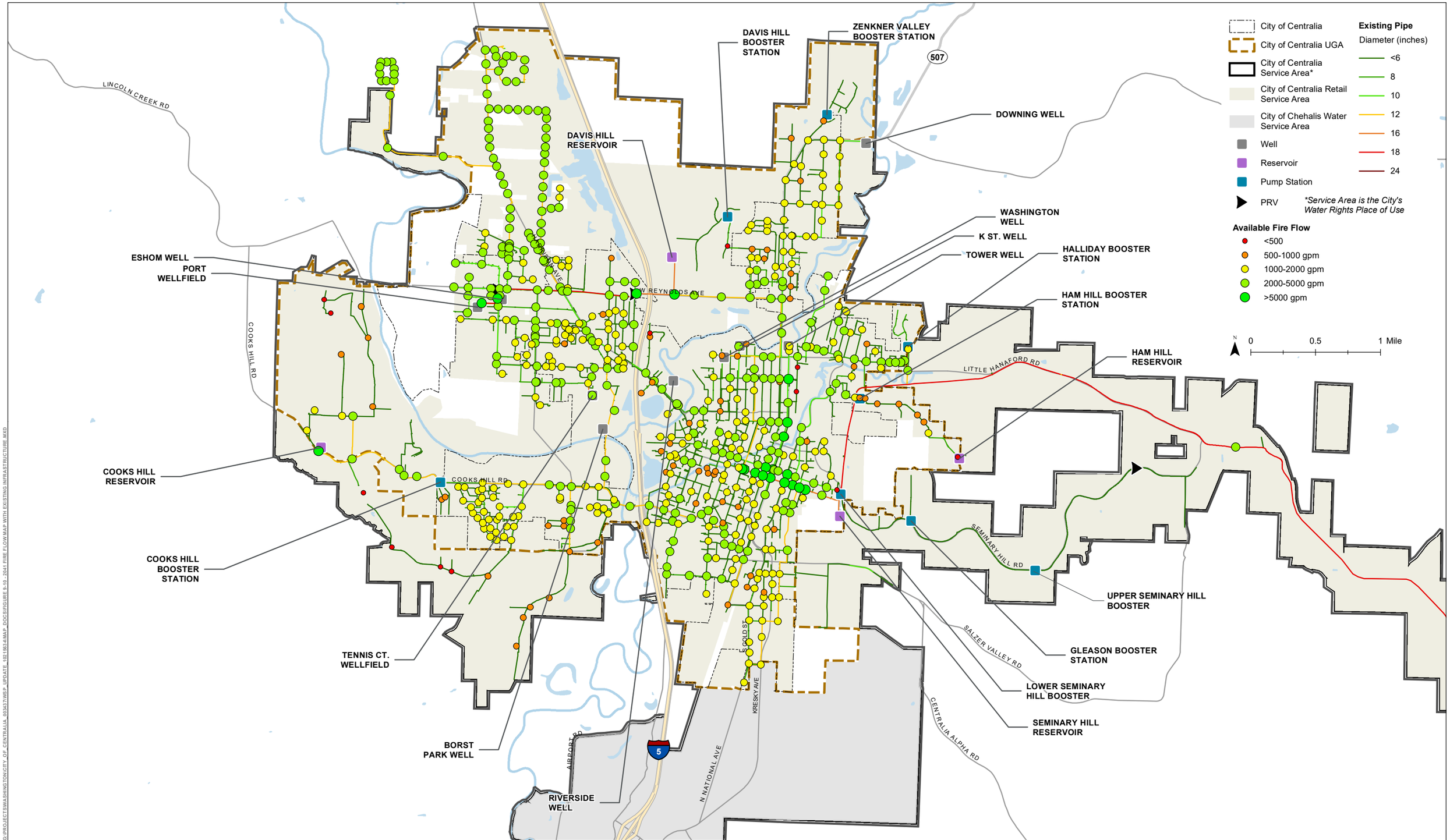


G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_10215634\MAP_DOCS\FIGURE 9-9 - 2031 FIRE FLOW MAP WITH EXISTING INFRASTRUCTURE.MXD

2031 AVAILABLE FIRE FLOW MAP WITH EXISTING INFRASTRUCTURE

FIGURE 9-9

City of Centralia Water System Plan
September 2022

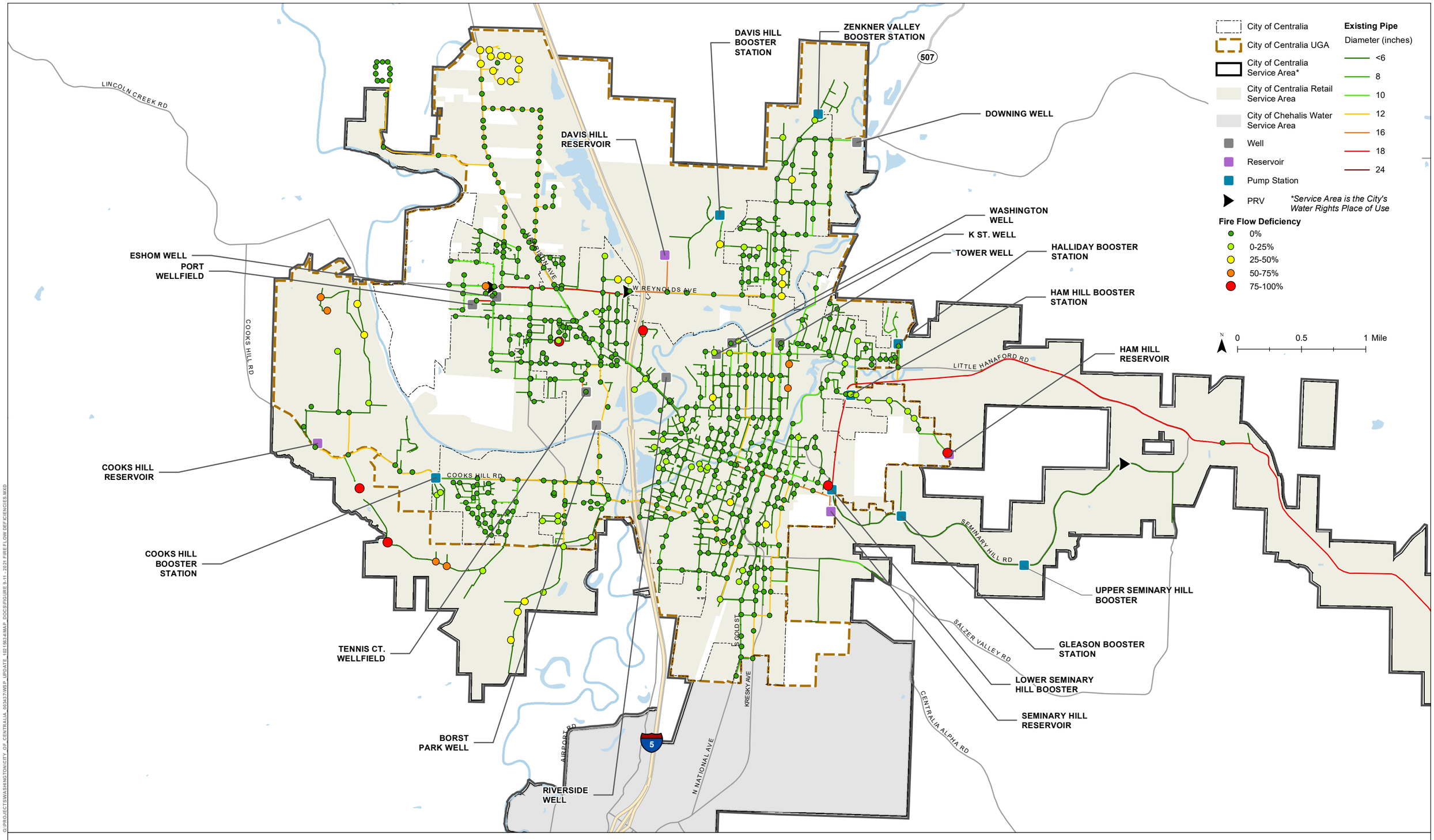


G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_102163.4\MAP_DOCS\FIGURE 9-10 - 2041 FIRE FLOW MAP WITH EXISTING INFRASTRUCTURE.MXD

2041 AVAILABLE FIRE FLOW MAP WITH EXISTING INFRASTRUCTURE

FIGURE 9-10

City of Centralia Water System Plan
September 2022

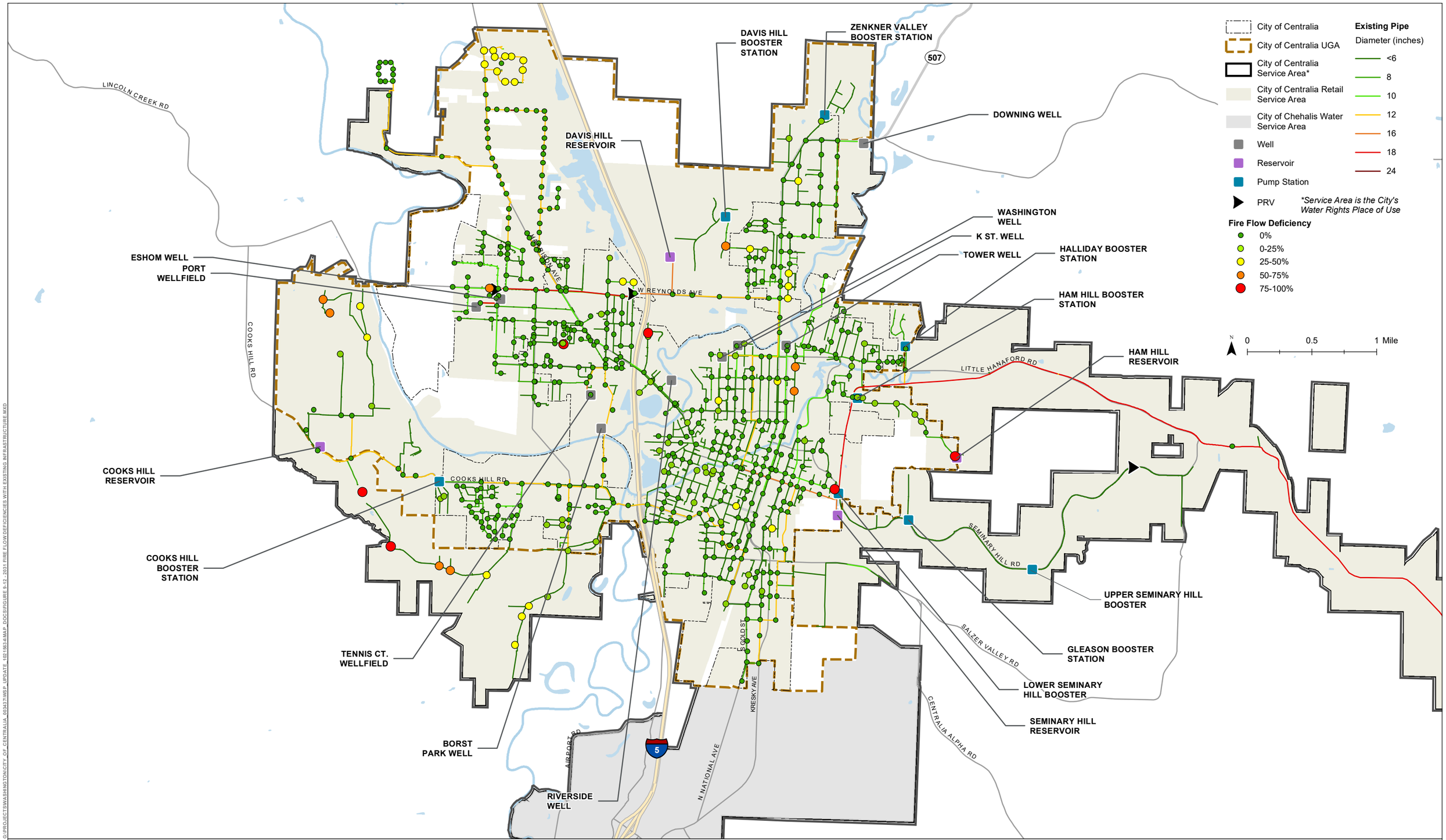


G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_00437\WSP_UPDATE_10219\GIS\MAP_DOCS\FIGURE 9-11 - 2021 FIRE FLOW DEFICIENCIES.MXD

2021 FIRE FLOW DEFICIENCIES

FIGURE 9-11

City of Centralia Water System Plan
September 2022

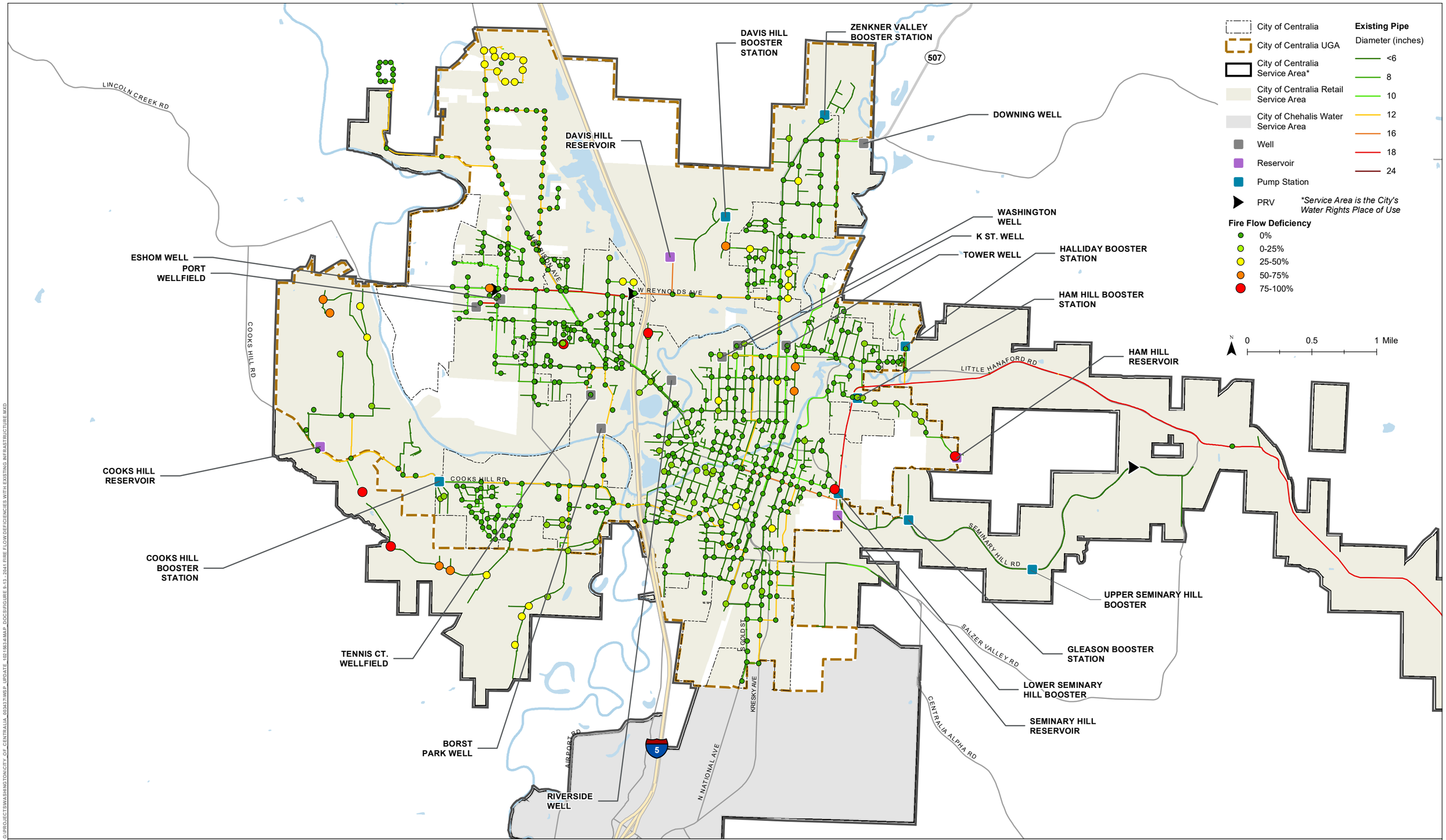


G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_10216\6.4\MAP_DOCS\FIGURE 9-12 - 2031 FIRE FLOW DEFICIENCIES WITH EXISTING INFRASTRUCTURE.MXD

2031 FIRE FLOW DEFICIENCIES WITH EXISTING INFRASTRUCTURE

FIGURE 9-12

City of Centralia Water System Plan
September 2022

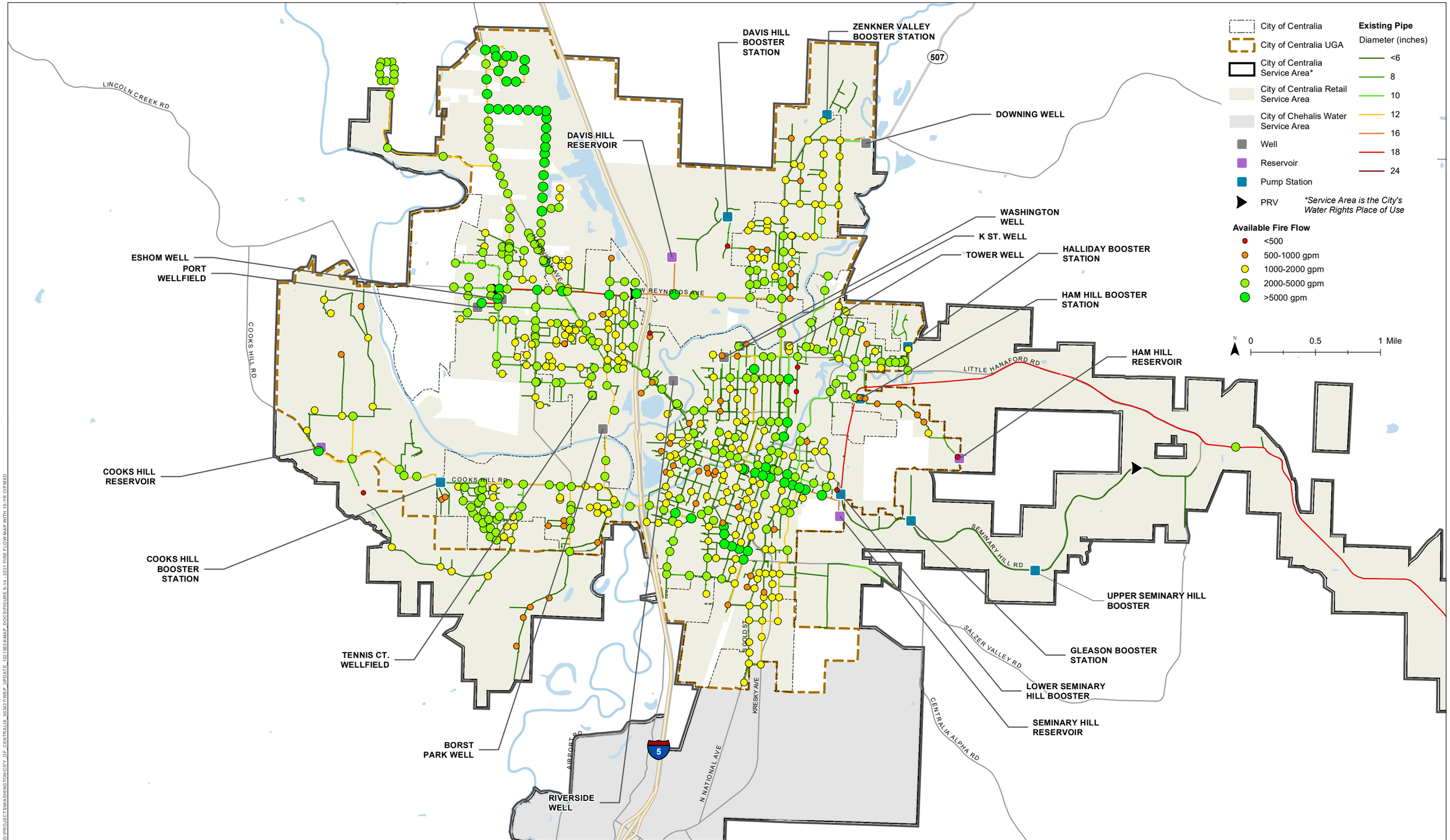


G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_102196\4-MAP_DOCS\FIGURE 9-13 - 2041 FIRE FLOW DEFICIENCIES WITH EXISTING INFRASTRUCTURE.MXD

2041 FIRE FLOW DEFICIENCIES WITH EXISTING INFRASTRUCTURE

FIGURE 9-13

City of Centralia Water System Plan
September 2022

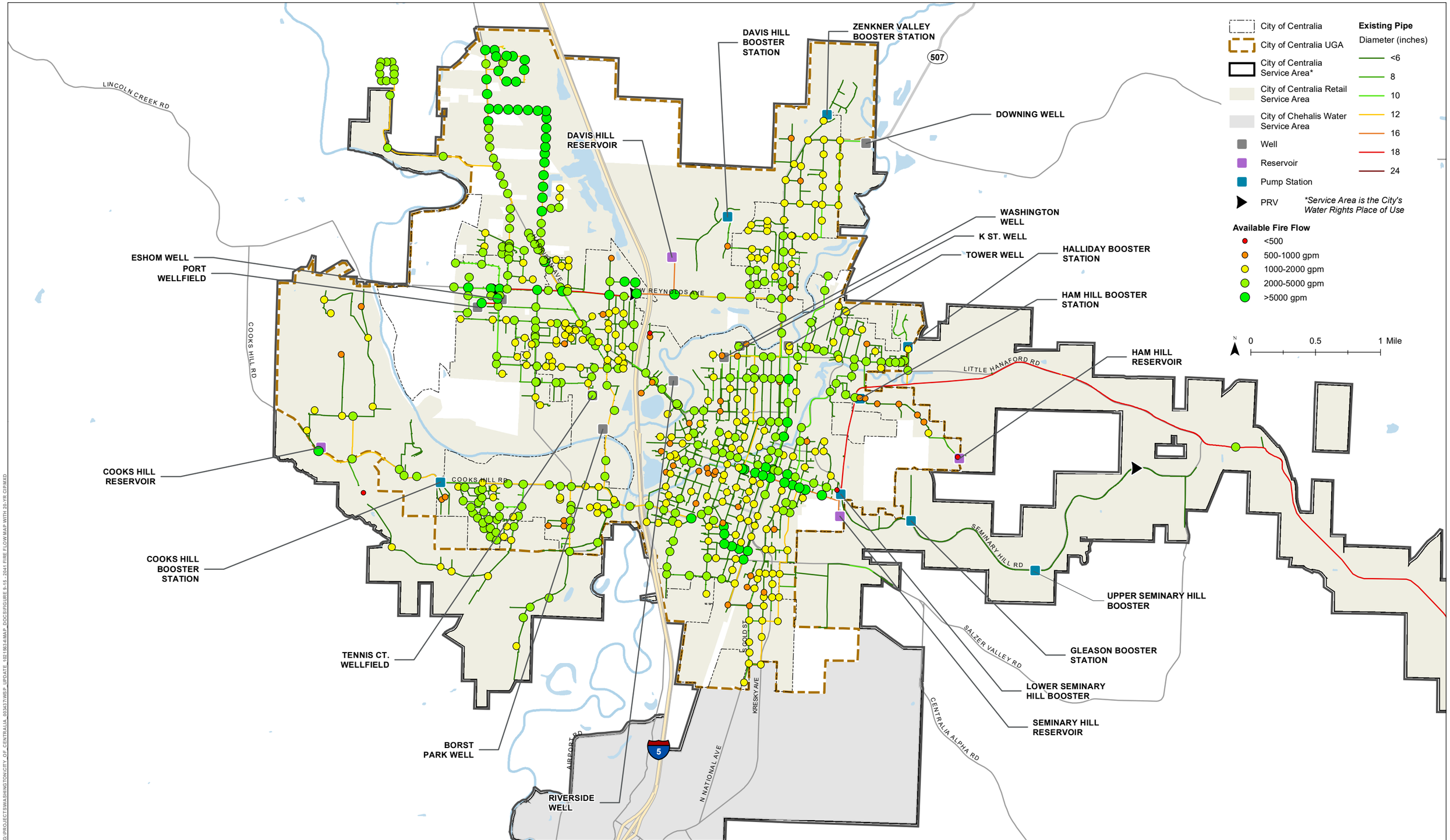


G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_102163.4\MAP_DOCS\FIGURE 9-14 - 2031 FIRE FLOW MAP WITH 10-YR CIP.MXD

2031 AVAILABLE FIRE FLOW MAP WITH 10-YEAR CIP

FIGURE 9-14

City of Centralia Water System Plan
September 2022

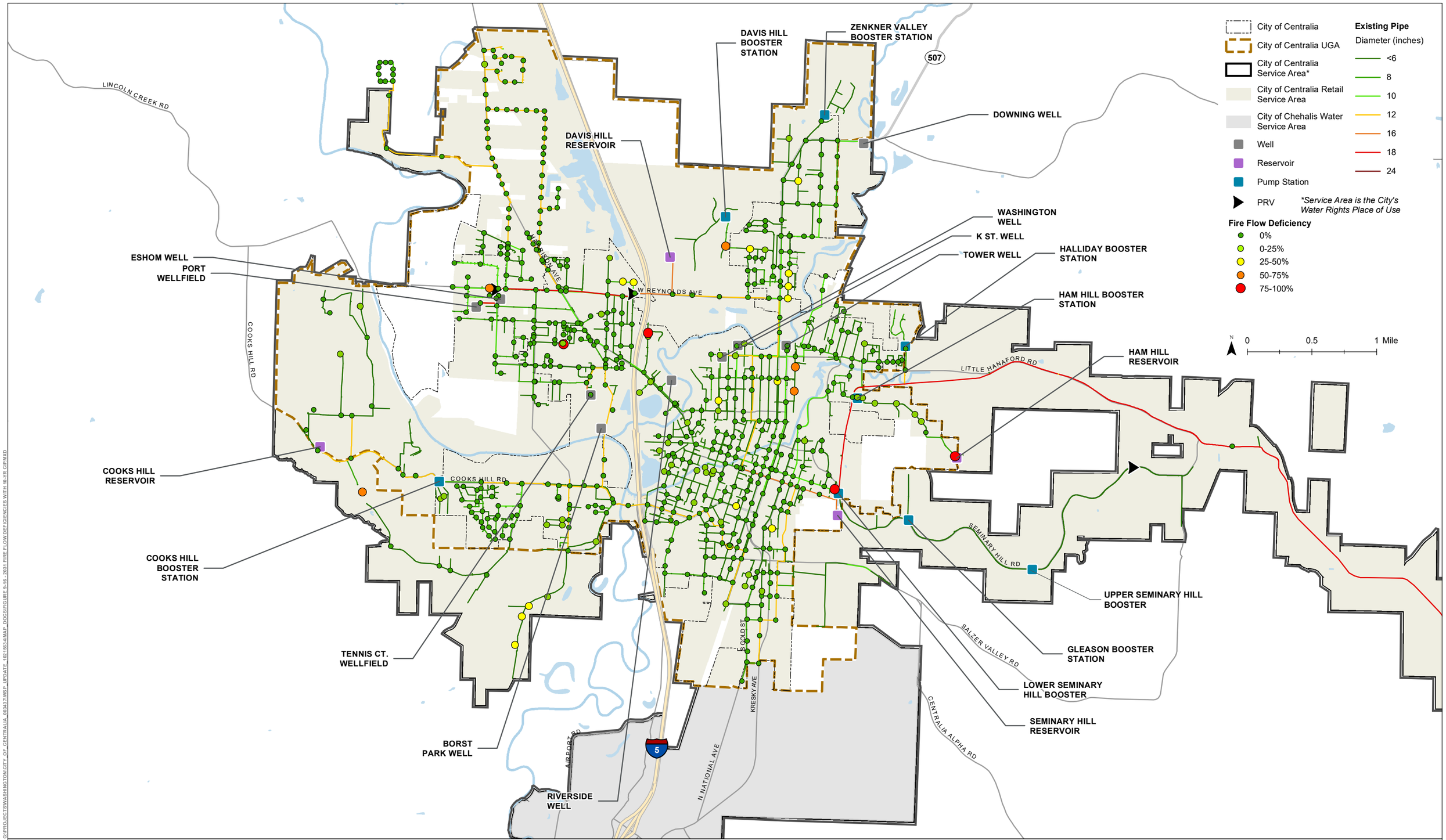


G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_102163.4\MAP_DOCS\FIGURE 9-15 - 2041 FIRE FLOW MAP WITH 20-YR CIP.MXD

2041 AVAILABLE FIRE FLOW MAP WITH 20-YEAR CIP

FIGURE 9-15

City of Centralia Water System Plan
September 2022

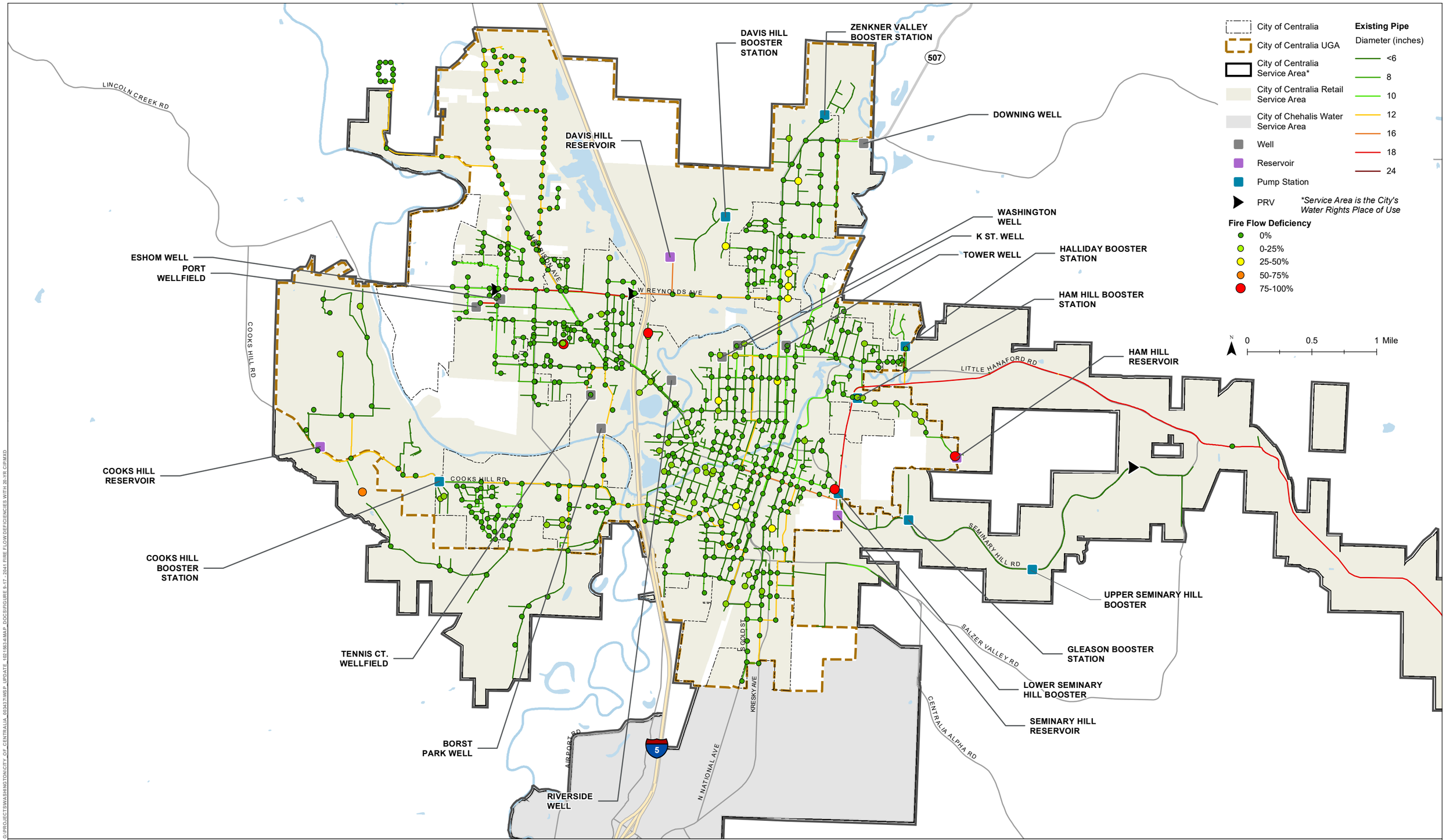


G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_102196\4-MAP_DOCS\FIGURE 9-16 - 2031 FIRE FLOW DEFICIENCIES WITH 10-YR CIP.MXD

2031 FIRE FLOW DEFICIENCIES WITH 10-YEAR CIP

FIGURE 9-16

City of Centralia Water System Plan
September 2022



G:\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_003437\WSP_UPDATE_102196\4-MAP_DOCS\FIGURE 9-17 - 2041 FIRE FLOW DEFICIENCIES WITH 20-YR CIP.MXD

2041 FIRE FLOW DEFICIENCIES WITH 20-YEAR CIP

FIGURE 9-17

City of Centralia Water System Plan
September 2022

10. Regulatory Compliance Program

This chapter provides a review of current Washington Administrative Code (WAC) 246-290 and federal drinking water regulations pursuant to the Safe Drinking Water Act (SDWA), and an assessment of the City's compliance for the period between 2013 and 2020 (referred to as "compliance period" for the remainder of this chapter). This chapter describes system components in regard to applicable regulations, monitoring practices, and compliance status. It also identifies possible future regulations and assesses the implications for the City.

10.1 Safe Drinking Water Act and Washington Administrative Code

The federal regulatory framework directing water quality is the Safe Drinking Water Act (SDWA) and its 1986 and 1996 Amendments. The SDWA and Amendments, administered by the U.S. Environmental Protection Agency (EPA), provide the framework for the operation and monitoring of public water supply systems. Washington State has incorporated these regulations into State law and has assumed primacy for administration.

Washington State law incorporates the SDWA and its amendments as Chapter 246-290 of the Washington Administrative Code (WAC 246-290). The Washington State Department of Health (DOH) administrates and enforces these WAC codes. As a Group A public water system, the City is required to meet drinking water quality regulations and conform to monitoring and reporting requirements as described by WAC 246-290.

10.2 System Overview

The City of Centralia's potable water system consists of two primary sources of supply, the Tennis Court Wellfield (two wells) and the Port District Wellfield (three wells); a seasonal peak demand source, the K Street Well; and an emergency source, the Washington Well. The City's sources of supply and operational status are summarized in Table 10-1.

Table 10-1. Water Sources and Operational Status

Source	Status	Type
Tennis Court Wellfield	Primary Source	2 wells
Port District Wellfield	Primary Source	3 wells
K Street	Seasonal	1 well
Washington	Emergency	1 well
Borst Park	Off-line	1 well
Downing	Off-line	1 well
Riverside	Off-line	1 well

Beginning in 1999 the City began to transition its source of supply. In October of that year the City brought the Tennis Court Wellfield on-line and removed the Borst Park source from service. In February 2001, the Riverside well was removed from service. Finally, in June 2003 the City

brought the Port District Wellfields on-line. Per DOH monitoring requirements, only the Tennis Court, Port District and K Street sources are identified for monitoring.

Both primary sources are treated by air stripping, to raise pH for corrosion control at the Tennis Court site, and to remove contaminants at the Port District site. Water is disinfected with chlorine in the form of sodium hypochlorite and fluoridated before entering the distribution system. As a 100% groundwater system that does not purchase water from another purveyor, the City is responsible for complying with the regulations pertaining to groundwater sources shown in Table 10-2.

Table 10-2. Applicable Safe Drinking Water Act Regulations

Rule	Description
National Primary Drinking Water Requirements (1976)	Physical and chemical
Radionuclides Rule (1976)	Gross alpha and beta emitters, radium-226, and radium-228
Phase I (VOCs) and Phase II and Phase V (IOCs and SOCs) – 1989, 1993, and 1994 respectively	Volatile organic chemicals (VOCs), inorganic chemicals (IOCs), and synthetic organic chemicals (SOCs)
Lead and Copper Rule (1992), Lead and Copper Rule Minor Revisions (2000), Lead and Copper Rule revisions (2021).	Lead and copper and treatment for corrosion control. Directives to replace lead service lines.
Consumer Confidence Rule (1998)	Water quality compliance reporting to customers
Public Notification Rule (2000)	Notification of public after water quality violation
Stage 1 Disinfectants/Disinfection By-Products Rule (2002)	Disinfectant residual, total trihalomethanes (TTHMs), and haloacetic acids (HAA5)
Radionuclides Rule (2003)	Radionuclides
Arsenic Rule (2006)	Arsenic
Stage 2 D/DBP Rule (2006)	TTHMs, HAA5
Groundwater Rule (2007)	Fecal indicators in groundwater
Revised Total Coliform Rule (2013)	Coliform Bacteria
Unregulated Monitoring Rule 4 (UCMR4) (2018)	Monitoring for contaminants included on assessment and screening lists

10.3 Summary of Effective Source Water Quality Regulations

The City conducts water quality monitoring in compliance with EPA and DOH requirements. The City annually reviews its Water Quality Monitoring Report (WQMR), as issued by DOH, and communicates any issues, or asks for clarification, with the State.

The approaches to monitoring for various parameters are outlined below, along with a summary of monitoring violations during the prior compliance period. Details regarding the City's water quality results are contained within DOH's Sentry database system, accessible online at DOH's website.

10.3.1 Source and Treatment Regulations

National Primary Drinking Water Standards

National Primary Drinking Water Standards are currently set for 87 contaminants. Maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) have been established for 77 contaminants, while the remaining ten have treatment technique requirements. A constituent's MCL is generally based on its public health goal (PHG), which is the level of a contaminant in drinking water below which there is no known or expected health risk. Regulated constituents include microbial contaminants, inorganic chemicals (IOCs), volatile organic chemicals (VOCs), synthetic organic chemicals (SOCs), radionuclides, and disinfection by-products (DBPs).

The EPA regulates most of the chemical contaminants through the rules known as Phase I, II, IIb, and V. The EPA issued the four rules regulating 69 contaminants over a five-year period as it gathered, updated, and analyzed information on each contaminant's presence in drinking water supplies and its health effects. Since the Phase V Rule, MCLs for additional contaminants have been established through new regulations, such as the Arsenic Rule, and must be adopted by DOH.

The EPA has also established secondary standards for 15 contaminants to address the aesthetic quality of drinking water. These secondary standards have also been adopted within the WAC. Because the federal standards primarily address taste and odor, rather than health issues, they are often used only as a guideline. For new community water systems, the DOH requires treatment for secondary MCL (SMCL) exceedances under WAC 246-290-320 (3)(d). For existing public water systems, the WAC stipulates that the required follow-up action be determined by DOH based on the degree of consumer acceptance of the water quality and their willingness to bear the cost of meeting the secondary standard.

Current primary and secondary MCLs for inorganic and organic constituents, respectively, are documented in the following subsections.

Phase I, II and V Regulations

Phase I, II, and V of the federal Primary Drinking Water Regulations set maximum contaminant levels (MCLs) for 15 inorganic compounds (IOCs), 33 synthetic organic compounds (SOCs), and 21 volatile organic compounds (VOCs). WAC 246-290-300 and 246-290-390 defer to the federal rules and require testing based on a "vulnerability of occurrence" assessment. WAC 246-290-300 stipulates that regulated IOCs, VOCs and SOCs are to be monitored on 12 to 36-month sampling cycles depending on the contaminant. The primary drinking water regulations apply to all the sources that are not classified as emergency sources.

As part of the Phase II Rule, systems with a significant amount of asbestos-cement (AC) pipe must conduct periodic asbestos monitoring in the distribution system. In Washington State, DOH has historically required systems that contain more than 10% AC pipe in their distribution system to comply with the monitoring requirement. These systems must collect one sample in the distribution system at a location served by AC pipe and under conditions where asbestos

contamination is most likely to occur. Approximately 21% of the City's pipes are AC pipe, therefore the City conducts asbestos monitoring.

City's Status

The City has a waiver to monitor for IOCs every nine years at all sources. The most recent samples were collected in summer 2019, and the next sampling round is due in 2028.

The City is on a standard nine year asbestos monitoring schedule. The most recent sample was collected in summer 2013, and the next sample is due in summer 2022.

The City must monitor for VOCs every three years at the Port District wellfield and K Street well, and every 6 years at the Tennis Court wellfield. Regarding SOCs, herbicide monitoring must occur once every nine years. Pesticides and soil fumigants must be monitored every three years at all sources. Nitrates are required to be sampled at each source every year.

No exceedances were observed for any Phase I, II, or V contaminants during the prior compliance period.

Arsenic Rule

The original arsenic MCL of 0.050 mg/L was established as part of the 1975 National Interim Primary Drinking Water Regulations. After years of additional health effects research and cost/benefit analysis, the EPA published the final Arsenic Rule in January 2001 with an effective date of January 2006. The Arsenic Rule revised the arsenic MCL downward to 0.010 mg/L and identified several best available treatment technologies for compliance. As with other primary MCLs, compliance with the new arsenic MCL is based on the running annual average of results collected for each entry point to the distribution system. The rule makes arsenic monitoring requirements consistent with monitoring for other IOCs regulated under the Phase II/V standardized monitoring framework. However, if arsenic is detected above the MCL in any individual sample, the system must increase the frequency of monitoring at that sampling point to quarterly.

City's Status

During the prior compliance period, there have been no MCL exceedences.

Radionuclides

The Radionuclides Rule became effective in 1978 and is part of the Primary Drinking Water Regulations. Current radionuclide MCLs include limits for radium-226, radium-228, adjusted gross alpha emitters, gross beta and photon emitters, and uranium. Monitoring for radionuclides must be conducted either annually for four years or once every four years depending on system contaminant levels. Combined radium, gross alpha, and uranium sampling is required once every three, six, or nine years, depending on a system's average contaminant levels. Table 10-3 summarizes the current radionuclide MCLs.

Under this rule, monitoring for radionuclides must be conducted at each entry point to the distribution system. Systems were required to conduct an initial round of monitoring between 2003 and 2007, unless earlier radionuclide data was accepted for use in grandfathering by DOH. Thereafter, the required monitoring frequency is determined by DOH and depends on

system contaminant levels observed during initial monitoring. The rule allows for eliminating the analysis of radium-226 and uranium for a particular source if gross alpha results are ≤ 5 pCi/L and 15 pCi/L, respectively. Similarly, monitoring for beta and photon emitters may be waived by DOH if the system is deemed not vulnerable to these contaminants.

Table 10-3. Radionuclide Rule MCLs

Contaminant	MCLs
Radium – 226, Radium – 228	5 pCi/L (Combined)
Gross Alpha Particles	15 pCi/L
Gross Beta and Photon Emitters	4 mrem/yr[1]
Uranium	30 µg/L

City's Status

The City is on a standard six-year monitoring schedule for radionuclides at all sources. During the prior compliance period, there have been no radionuclide exceedances.

Unregulated Contaminant Monitoring Rule

The EPA issued the first Unregulated Contaminant Monitoring Rule (UCMR) in 1999, with requirements that were effective from 2001 through 2006. The UCMR required public water systems to perform monitoring and reporting of specified contaminants to investigate their occurrence. The UCMR accomplished the following:

- Established three lists of contaminants, categorized by available analytical methods.
- Required that large Public Water Systems (PWSs) and some small PWSs monitor for List 1 contaminants.
- Required that selected large and small PWSs monitor List 2 contaminants.
- Required systems to submit data to the EPA and the State.
- Required systems to include detected contaminants in the Consumer Confidence Report.

The EPA did not require List 3 monitoring under the UCMR since analytical methods were not established before 2005.

Unregulated Contaminant Monitoring Rule 2

In August 2005, the EPA proposed a second Unregulated Contaminant Monitoring Rule (UCMR2) that includes two lists of contaminants; some systems are required to monitor for these contaminants. The rule became final in February 2007. According to the final rule, all PWSs serving more than 10,000 people are required to conduct assessment monitoring for 10 contaminants on the Assessment Monitoring List (i.e., List 1) at distribution system entry-points twice during a 12-month period between January 2008 and December 2010. Systems serving more than 100,000 people are required to conduct screening monitoring for 15 contaminants on

the Screening Survey List (i.e., List 2). All analyses are to be conducted by laboratories that are EPA approved for the contaminants in consideration.

Unregulated Contaminant Monitoring Rule 4

USEPA issued the UCMR4 in 2016, with requirements that were effective from 2018 through 2020. The UCMR4 required systems to conduct monitoring for specified contaminants to investigate their occurrence. All systems serving more than 10,000 persons are required to monitor for 10 List 1 cyanotoxins during a four-consecutive-month period from March 1, 2018, to November 31, 2020. All systems serving more than 10,000 persons will also be required to monitor for 20 List 1 additional contaminants during a 12-month period between January 1, 2018, and December 31, 2020. The 20 List 1 additional contaminants consist of metals, pesticides, HAA, alcohols, semivolatile chemicals, and indicators.

City's Status

The City is required to monitor only for those contaminants found on the UCMR 2's List 1, Assessment Monitoring, consisting of 10 chemical contaminants for which standard analytical methods are available. The City is in compliance with this requirement.

Groundwater Rule

The Groundwater Rule (GWR) was promulgated on November 8, 2006 and became effective in December 2009. It applies to all public water systems that use groundwater, unless the groundwater sources are under the influence of surface water or groundwater and surface water are blended prior to treatment (neither of which applies to Centralia). The GWR contains the following primary elements:

- Sanitary surveys
- Source water monitoring
- Corrective action treatment requirements
- Public notification requirements.

Systems were required to comply with all requirements except for the sanitary surveys requirement by December 1, 2009. States were required to conduct the first cycle of sanitary surveys by December 31, 2012.

Further details on each primary element are below.

Sanitary Surveys

The GWR requirement for sanitary surveys builds on existing requirements related to the SWTR and related rules. However, the GWR adds requirements for frequency, scope of surveys, survey documentation, and corrective actions. DOH must conduct sanitary surveys every three years, or five years if the system meets specified performance criteria. The sanitary survey must include eight elements:

- Source

- Treatment
- Distribution system
- Finished water storage
- Pumps, pump facilities, and controls
- Monitoring, reporting, and data verification
- System management and operation
- Operator compliance with State requirements.

If DOH identifies a significant deficiency during the course of the sanitary survey, the State must notify the system within 30 days and may specify the appropriate corrective action. The system has 120 days to take the corrective action or develop a State-approved plan for achieving compliance.

Source Water Monitoring

Systems which do not provide (and demonstrate via monitoring) 4-log treatment of viruses at groundwater sources may be required to conduct source water monitoring for fecal indicators. The GWR specifies two types of source monitoring: assessment monitoring and triggered monitoring. DOH may require systems to conduct assessment source water monitoring for fecal indicators on a case-by-case basis at each source. Groundwater systems will be required to conduct triggered source water monitoring within 24 hours of a positive distribution system total coliform sample to determine whether the coliform presence is due to fecal contamination of the source. Triggered monitoring requires systems to collect a source water sample from each groundwater source in use when the positive sample occurred (or at sources requested by DOH).

DOH will determine whether groundwater systems must conduct assessment source water monitoring and will specify the appropriate fecal indictor. The GWR indicates that States could require systems to monitor for E. coli, enterococci, or coliphage.

Corrective Action Treatment Requirements

If it is determined that a system has a significant deficiency, either through the results of a sanitary survey or source water monitoring, the system will be required to implement corrective actions. The GWR specifies that corrective actions are:

- Correct significant deficiencies
- Provide an alternative source of water
- Eliminate the source of contamination
- Provide treatment that reliably achieves at least 4-log treatment of viruses.

Public Notification Requirements

The GWR also establishes requirements for notifying the public according to the type of violation incurred by the groundwater system. This is addressed in more detail in Section 10.4.3.

City's Status

The City is in compliance with the GWR.

Both primary sources are treated by air stripping, to raise pH for corrosion control at the Tennis Court site, and to remove contaminants at the Port District site. Water is disinfected with chlorine in the form of sodium hypochlorite and fluoridated before entering the distribution system.

Source Water Protection Programs

The Safe Drinking Water Act (Section 1428) established a Wellhead Protection Program (WHPP) to protect groundwaters that contribute to public water systems. DOH has expanded those Federal source protection regulations to include all Group A community and non-community water systems, including groundwater, GUI, and filtered and non-filtered surface water sources. Accordingly, DOH has developed regulations that require all Group A water systems that maintain and operate their own sources to implement a WHPP (WAC 246-290-135(3)), or a Watershed Control Program (WCP) (WAC 246-290-135(4)), or any combination thereof, as deemed appropriate by the State. More detail is provided in Chapter 11.

Secondary National Drinking Water Regulations

In addition to the parameters listed above, the City voluntarily monitors its sources for levels of several compounds to that can impact the aesthetic quality of water. The SDWA secondary maximum contaminant levels (SMCLs) provide a guide to utilities that choose to monitor these parameters. These SMCLs are not enforceable in terms of providing safe drinking water; rather, the SMCLs address aesthetic characteristics. The City is not required to monitor the parameters listed in Table 10-4, but includes these parameters in their monitoring program as a proactive step to ensure customer satisfaction.

Table 10-4. Secondary Drinking Water Parameters

Parameter	Requirement	
	Unit	SMCL
Chloride	mg/L	250
Fluoride	mg/L	4
Iron	mg/L	0.3
Manganese	mg/L	0.05
Silver	mg/L	0.1
Sulfate	mg/L	250
Zinc	mg/L	5
Color	color units	15
Conductivity	umhos/cm[4]	700
Hardness	mg/L	NA
Sodium	mg/L	NA

10.3.2 Distribution System Regulations

Coliform Rule

Coliform bacteria describe a broad category of organisms routinely monitored in potable water supplies. Though not all coliform bacteria are pathogenic in nature, they are relatively easy to identify in laboratory analysis. If coliform bacteria are detected, then pathogenic organisms may also be present. Bacterial contamination in a water supply can cause a number of waterborne diseases, therefore these tests are strictly monitored and regulated by DOH.

The EPA published the Revised Total Coliform Rule (RTCR) in February 2013 with minor corrections in February 2014. The RTCR is the revision to the 1989 Total Coliform Rule (TCR) and is intended to improve public health protection. Provisions of the RTCR include:

- Setting a maximum contaminant level goal (MCLG) and maximum contaminant level (MCL) for E. coli for protection against potential fecal contamination.
- Setting a total coliform treatment technique (TT) requirement.
- Requirements for monitoring total coliforms and E. coli according to a sample siting plan and schedule specific to the PWS.
- Provisions allowing PWSs to transition to the RTCR using their existing TCR monitoring frequency, including PWSs on reduced monitoring under the existing TCR.
- Requirements for seasonal systems to monitor and certify the completion of state-approved start-up procedures.
- Requirements for assessments and corrective action when monitoring results show that PWSs may be vulnerable to contamination.
- Public notification (PN) requirements for violations.
- Specific language for CWSs to include their Consumer Confidence Reports (CCRs) when they must conduct an assessment or if they incur an E. coli MCL violation.

City's Status

The City performs coliform monitoring as outlined in its Coliform Monitoring Plan. A map and list of sampling locations is provided as Appendix I. The City currently collects 30 samples per month with the exception of June, July, and August, when only 20 samples per month are collected from sites throughout the distribution system. As additional sample sites are required, they are selected based on population served, system hydraulics, average and maximum residence times and adequate representation of each pressure zone.

The City is in compliance with the Total Coliform Rule and WAC 246-290-300. The City has consistently met regulatory sampling requirements and samples have not exceeded the regulatory limit of more than one positive sample per month.

Stage 1 Disinfectants/Disinfection By-Products Rule

Stage 1 of the Disinfectants/Disinfection By-Products (D/DBP) Rule was promulgated in December 1998 and revised in January 2001. The D/DBP Rule became effective in January 2002 and replaced the former Trihalomethane Rule. The D/DBP Rule sets MCLs for disinfection byproducts including total trihalomethanes (TTHMs), the sum of five haloacetic acids (HAA5), chlorite and bromate and maximum residual disinfectant levels (MRDLs) for disinfectants including chlorine, chloramine, and chlorine dioxide. It also includes monitoring, reporting and public notification requirements for these compounds and sets several MCLGs for specific DBP species. Table 10-5 summarizes the Stage 1 D/DBP Rule parameters and monitoring requirements for water systems that use both groundwater and surface water sources, and provide chlorine disinfection.

Table 10-5. Stage I D/DBP Monitoring Requirements

Chemicals	MCL or MRDL	Number of Samples	Sample Locations
TTHM	MCL 80 µg/L	4 per quarter per disinfected source.	1 at max. residence time; 3 at average residence time in distribution system.
HAA5	MCL 60 µg/L	Same as TTHM requirement.	At same location as TTHM requirement
Chlorine	MRDL 4.0 mg/L	Same as number of total coliform samples collected monthly	Same location as total coliform samples.

Stage 2 Disinfection By-Products Rule

The Stage 2 DBPR was promulgated by the EPA on January 4, 2006 and was adopted by DOH in WAC 246-290. The key provisions of the Stage 2 DBPR consist of:

- An Initial Distribution System Evaluation (IDSE) to identify distribution system locations with high DBP concentrations. Further information is provided below.
- Site-specific locational running annual averages (LRAAs) instead of system-wide RAAs to calculate compliance data. LRAAs will strengthen public health protection by eliminating the potential for groups of customers to receive elevated levels of DBPs on a consistent basis.

The MCLs for TTHM and HAA5 remain unchanged from the Stage 1 DBPR at 0.080 and 0.060 mg/L, respectively, although they will now be calculated as LRAAs.

The IDSE is the first step in Stage 2 DBPR compliance. Its intent is to identify sampling locations for Stage 2 DBPR compliance monitoring that represent distribution system sites with high TTHM and HAA5 levels. For systems serving more than 500 people, three options were available for the IDSE:

- 40/30 Waiver, which allows systems with no samples exceeding TTHM and HAA concentrations of 40 and 30 µg/L, respectively, during 8 consecutive quarters to apply to waive the IDSE requirements.

- Standard Monitoring Program (SMP), which involves a 1-year distribution system monitoring effort to determine locations that routinely show high THM4 and HAA5 concentrations.
- System-Specific Study (SSS), based on historical data and a system model.

City's Status

The City applied for a 40/30 Certificate based on their Stage 1 TTHMs and HAAs compliance monitoring results. The City was granted the certification and was not required to submit an IDSE report. The City completed its Stage 2 D/DBP Compliance Monitoring Plan on August 18, 2021. The City's D/DBP Compliance Monitoring Plan is shown in Appendix K.

The City chlorinates at the outlet of the Port District and Tennis Court Wellfields. The City currently collects annual samples at the Port District Wellfield and at 1622 Gold St representing the maximum residence time in the distribution system and test for HAAs and TTHMs. No exceedances were observed during the prior compliance period.

Lead and Copper Rule

Lead and copper are heavy metals that may be found in household plumbing materials and water service lines. Lead can cause a variety of adverse health impacts, including delaying physical and mental development in infants and children. Copper can cause aesthetic issues in addition to short-term and long-term negative health impacts. The Lead and Copper Rule (LCR) establishes monitoring requirements, action levels, and compliance requirements to control the levels of these metals at customers' taps.

Under the LCR, water systems are required to perform monitoring of standing water samples at customer taps to determine if more than 10% of homes that meet certain criteria exceed the lead and copper action levels of 0.015 mg/L and 1.3 mg/L, respectively. If these action levels cannot be met, systems must implement public education and a corrosion control treatment strategy for meeting these levels.

In 2004, the EPA initiated a review of LCR implementation across the nation. This effort was focused on determining whether national lead levels are increasing. As a result of this effort, the EPA identified several targeted changes to the existing regulation that would meet short-term goals for improving implementation of the LCR. These revisions, which were finalized in October 2007 and became effective in December 2007, are intended to enhance LCR implementation in the areas of monitoring, treatment, customer awareness, and lead service line replacement. Additionally, these revisions focus on improving compliance with public education requirements to ensure that consumers receive meaningful and timely information that assists in limiting exposure to lead in drinking water. Table 10-6 provides a summary of the LCR revisions.

Table 10-6. Lead and Copper Rule Revisions

Activity	Rule Revision
Monitoring	• Clarify language in the rule regarding the number of samples required and the number of sites from which samples should be collected. • Modify definitions for monitoring and compliance periods to make it clear that all samples must be taken in the same calendar year. • Clarify the reduced monitoring criteria that would prevent small and medium water systems above the lead action level or large systems deemed to no longer meet Optimum Corrosion Control Treatment from remaining on a reduced monitoring schedule.
Treatment or Source Water Changes	• Require water systems to provide advanced notification to the primacy agency of intended changes in treatment or source water that could impact long-term water quality. • The primacy agency must approve the planned changes using a process that will allow the states and water systems to take as much time as needed for systems and states to consult about potential problems.
Customer Awareness and Public Education	• Require utilities to provide a notification of tap water monitoring results for lead to owners and/or occupants of homes and buildings that are part of the utility's sampling program. • Changes to the content, delivery, and time frame of public education regarding lead action level exceedances. Systems must partner with additional organizations to disseminate the message to at-risk populations. • Requires educational statements about lead in drinking water to be included in all Consumer Confidence Reports.
Lead Service Line Replacement	• Require utilities to reconsider previously "tested-out" lead service lines when resuming lead service line replacement programs.

The EPA promulgated further revisions to the LCR, which were effective December 16, 2021. The goals of the final rule are:

- Provide greater and more effective protection of public health
- Better identify high levels of lead
- Improve reliability of lead tap sampling results
- Strengthen corrosion control treatment (CCT) requirements
- Expand consumer awareness
- Improve risk communication
- Accelerate lead service line replacement (LSLR)

The final rule mostly focuses on lead. The rule incorporates a trigger level for lead of 10 micrograms per liter (90th percentile). A sample at this concentration triggers additional planning, monitoring, and treatment requirements.

A key focus of the rule are lead service lines (LSLs). The rule requires water systems to inventory their LSLs and establish and LSL removal plan (or demonstrate the absence of LSLs)

within three years of rule publication. The inventory must be updated annually. The results of lead monitoring determine the rate at which the utility must replace LSLs:

- If P90 > 15 ug/L, the system must replace 3% of LSLs per year based on a 2-year rolling average for at least 4 consecutive 6-month monitoring period
- If P90 > 10 ug/L to 15 ug/L, LSL replacement goals will be developed in consultation with the regulatory agency for two consecutive 1-year monitoring periods

The rule contains guidance on how these plans should be developed. These regulations also affect priorities for sample collection.

More information about the LCR can be found on the EPA website: EPA - Lead and Copper Rule

City's Status

The City performs at-the-tap monitoring for lead and copper at 30 locations with a frequency of one sample every three years. The City has consistently maintained compliance with lead and cooper action levels and the broader monitoring and notification requirements of the LCR. The City last sampled for lead and copper in June 2020. The next sampling event is due by June 2023.

With the promulgation of the 2021 LCR revisions, the City follows the requirements. The City uses the EPA form for sampling results and is on a reduced monitoring schedule.

10.3.3 Other Regulations

Consumer Confidence Reports (CCR) and Public Notification Rule

Under the CCR Rule promulgated in 1998, community water systems are required to provide an annual Consumer Confidence Report (CCR) on the quality of their drinking water and levels of detected contaminants, if any. The annual report must be supplied to all customers and must include:

- Information on the source of drinking water;
- A brief definition of terms;
- If regulated contaminants are detected, the maximum contaminant level goal (MCLG), the maximum contaminate level (MCL), and the level detected;
- If an MCL is violated, information on health effects; and
- If EPA requires it, information on levels of unregulated contaminants.

While the CCR addresses annual "state-of-the-water" reports, the Public Notification Rule (PNR) directs utilities in notifying customers of acute violations when they occur.

The PNR was revised in May 2000 and outlines public notification requirements for violations of MCLs, treatment techniques, testing procedures, monitoring requirements, and violations of a variance or exemption. If violations have the potential for "serious adverse effect," consumers

and the State must be notified within 24 hours of the violation. The notice must explain the violation, potential health effects, corrective actions, and whether consumers need to use an alternate water source. Notice must be made by appropriate media or posted door-to-door. Less serious violations must be reported to consumers within 30 days, in an annual report, or by mail or direct delivery service within one year depending on the severity of the violation. The 2000 revisions also provide the rule Administrator the option of requiring public notification of unregulated contaminants.

City's Status

The City is in compliance with the CCR Rule. Annual CCRs have been published as required. No acute violations have occurred since the promulgation of these rules and therefore the PNR has not been implemented. A copy of Centralia's 2021 CCR is in Appendix J.

10.4 Anticipated Monitoring Requirements

Anticipated future regulatory requirements are summarized in Table 10-7. This table includes ongoing programs to introduce new regulatory requirements, under the Unregulated Contaminant Monitoring Rule and the Contaminant Candidate List, as well as specific rules and regulations currently under consideration. A brief description of anticipated requirements under each rule is provided herein.

Table 10-7. Anticipated Future Regulations

Proposed Rule	Affected Contaminants	Proposed Publication Date [(1)]
Unregulated Contaminant Monitoring Rule 5 (UCMR5)	Various parameters	December 2021
Per- and Poly-Fluroaklyl Substances (PFAS)	Monitoring requirements for PFOA and PFOS; potential future requirements for other PFAS	TBD
[(1)] Effective and compliance dates were obtained from the Federal Register and EPA's Drinking Water Website and represent the best information available as of the date of this report.		

Unregulated Contaminant Monitoring Rule 5

The EPA published the final rule in December 2021. UCMR5 will specify assessment monitoring for a list of 30 contaminants, 29 of which are under the Per- and Poly-Fluroalkyl Substances (PFAS) category. This monitoring will be required during a 12-month period between 2023 and 2025.

Per- and Poly-Fluoroalkyl Substances

PFAS are a group of man-made chemicals manufactured and used in a variety of industries since the 1940s. The EPA initially established a provisional lifetime health advisory level (HAL) for perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) in 2009. Six PFAS were included in the third Unregulated Contaminant Monitoring Rule (UCMR 3). The two most

frequently detected PFAS during UCMR 3 were PFOS and PFOA. As a result, the EPA replaced the provisional HAL with a formal HAL for these two compounds, individually or combined, of 70 nanograms per liter (ng/L) in 2016. The EPA has not yet incorporated PFAS monitoring into Safe Drinking Water Act requirements.

Washington State initiated rulemaking related to PFAS in December 2017. The State Board of Health determined that a state action level (SAL) is the best way to set a standard for PFAS. A SAL is the concentration of a contaminant or group of contaminants without a maximum contaminant level (MCL) established to protect public health. If exceeded, a SAL triggers required monitoring, follow-up actions, and public notification. There is currently a draft rule that establishes SALs for five PFAS compounds:

- PFOA – 10 nanograms/liter (ng/L)
- PFOS – 15 ng/L
- PFHxS – 70 ng/L
- PFNA – 14 ng/L
- PFBS – 860 ng/L

The draft rule will require community water systems monitor for these chemicals once every three years. The draft rule also establishes monitoring, reporting, public notice and follow-up action requirements. DOH maintains fact sheets on their webpage describing these requirements. The City will stay appraised as these requirements are formalized.

The EPA developed a PFAS Action Plan in February 2019 with seven goals:

1. Conduct the Maximum Contaminant Level (MCL) process for PFOS and PFOA, and evaluate information to determine if a broader class of PFAS should be regulated.
2. Strengthen enforcement authorities and clarify cleanup strategies by designating PFOS and PFOA as hazardous substances and develop interim groundwater cleanup recommendations.
3. Determine if PFAS should be added to the Toxics Release Inventory and if rules to prohibit the use of certain PFAS should be developed.
4. Include additional PFAS in UCMR 5 that were not previously part of UCMR 3.
5. Increase research related to PFAS, including improved detection and measurement methods.
6. Utilize EPA enforcement tools, when necessary, to address PFAS exposure in the environment and assist states in enforcement activities.
7. Develop a risk communication toolbox for federal, state, tribal, and local partners to use with the public.

In February 2020, EPA announced that it is proposing to regulate PFOS and PFOA under the Safe Drinking Water Act (SDWA). EPA is seeking information related to other PFAS and comments on potential monitoring requirements and regulatory approaches for PFAS. If a

positive regulatory determination is finalized, EPA would begin the process for establishing a National Primary Drinking Water Regulation for PFOS and PFOA. As previously noted, some of these contaminants will be required under UCMR5 monitoring. Other regulations related to these substances may come in the future at an undetermined date. The City will monitor how these regulations evolve.

10.5 Laboratory Certification

The City utilizes an independent, DOH-certified laboratory for water quality testing. The contact information for this laboratory is listed below.

Lewis County Enviro Lab - Chehalis
360 NW North St.
Chehalis, WA 98532
(360) 740-1222

10.6 Summary of Regulatory Status by Source and Component

Review of water quality data for the most recent monitoring period, 2013 - 2020, indicates that the City has been in compliance with all effective federal and State drinking water regulations. Table 10-8 summarizes applicable regulations and the City's compliance status.

10.7 Summary of Monitoring Requirements and Plans

Currently, the City is required to conduct source water monitoring at the Tennis Court and Port District wellfields and the K Street Well. Table 10-9 provides a summary of water quality monitoring requirements for the City. The table includes the parameters to be monitored, sampling location and frequency. Table 10-9 is intended to be a guide; detailed requirements are available in WAC 246-290.

Table 10-8. Summary of Applicable Regulations and Compliance Status

Regulation	Requirements	Status	Compliance Status
Phase I, Phase II, Phase V Regulations	• Written Plan • Monitoring • Waivers granted for herbicides, insecticides, inorganics, and VOCs	• Monitoring conducted per DOH directed monitoring Plan and waivers • Meets MCLs	Yes
Arsenic Rule	• Monitoring	• Monitors • Meets MCL	Yes
Radionuclides	• Monitoring	• Monitors • Meets MCLs	Yes
Unregulated Contaminant Monitoring Rule	• Monitor for listed contaminants under UCMR1 and UCMR2	• Monitors • Meets MCL	Yes
Source Water Protection Program	• Wellhead Protection Plan	• Approved plan	Yes
Groundwater Rule	• Sanitary Surveys, source water monitoring	TBD	Yes
Total Coliform Rule	• Written Plan • Monitoring	• Monitors throughout distribution system • Meets monitoring requirements • Approved plan	Yes
Lead and Copper Rule	• Monitoring • Treatment Optimization	• Monitors • Optimized for corrosion control	Yes
Stage I D/DBP Rule	• Written Plan • Monitoring	• Monitors D/DBPs throughout distribution system • Meets MCLs	Yes
Stage 2 D/DBO Rule	• Written Plan • Monitoring	• Monitor D/DBOs through distribution system • Meets MCLs	Yes
CCR and Public Notification Rules	• Annual Reports • Reporting as needed	• Consumer Confidence Reports published annually	Yes

Table 10-9. Summary of Existing Monitoring Requirements

Parameter	Regulatory Requirement	Location	Schedule/Status
Inorganic Chemicals			
Asbestos	Primary Drinking Water Regulations	Distribution system	One sample every nine years
Regulated Inorganics	Primary Drinking Water Regulations	All sources	One sample every three years
Nitrate	Primary Drinking Water Regulations	All sources	One sample annually
Lead Copper	Lead and Copper Rule	Customer taps	One set of 30 samples every three years
Radionuclides			
Gross Alpha Emitters Gross Beta Emitters Radium 226 and 228 Uranium	Radionuclides	All sources	Once every four years
Organic Chemicals			
VOCs	Phase I	K Street Tennis Court Port District	One sample every three years
SOCs (herbicides, general pesticides and insecticides)	Phase II & V	Point of entry into distribution system1	None. Waivers granted
Dioxin, endothall, Diquat, Glyphosate, EDB & other soil fumigants	Phase II & V	Point of entry into distribution system1	None. Waivers granted
Baceteriological			
Total Coliform	Total Coliform Rule	Throughout distribution system	30 samples per month
Chlorine Residual	SWTR	Throughout distribution system	Same as Total Coliform sites
Disinfection By-Products			
Total Trihalomethanes (TTHM) Haloacetic Acids (HAA5)	Stage I D/DBP Rule	4 per disinfected source: 3 at average hydraulic residence time, 1 at maximum residence time	One sample per treatment plant per year

11. Source Protection Program

This section provides a summary of the City of Centralia's (City) existing Wellhead Protection Plan (WHPP), as well as updates to some sections of the WHPP.

11.1 Summary of Existing Wellhead Protection Plan

The existing WHPP was prepared under the State of Washington Wellhead Protection Program approved by EPA in 1994. The program is administered by the Department of Health (DOH), which approved the City's plan in 1999. The WHPP has three main components: wellhead protection area delineation, pollution prevention planning, and notice to regulatory authorities, local governments, and landowners. Each component is summarized below. The existing WHPP is incorporated by reference into this Water System Plan (WSP).

As part of the wellhead protection area delineation effort, the plan includes a description of the geology and hydrogeology of the area and compilation of well characteristics. The plan also includes 6-month, 1-, 5-, and 10-year estimations of time-of-travel zones for the City's water supply wells, based upon a numerical model. The time-of-travel zones extend generally to the east of the wellfields due to the westerly direction of the regional groundwater flow.

The pollution prevention planning component of the WHPP contains an inventory of potential contaminant sources, a spill response assessment, contingency planning, and a pollution prevention plan. The list of known and potential contaminant sources was originally compiled in 1999, based on information obtained from a "windshield survey" and State and Federal databases. General categories of potential contaminants were then ranked according to relative risk. The sites posing the highest risk to ground water quality are: (1) known contaminated sites, (2) commercial and industrial facilities within the protection areas, (3) transportation and storage of hazardous materials, and (4) stormwater facilities.

The City provides notice to regulatory agencies, local governments, and landowners with interest in the wellhead protection area.

The spill response assessment provides a discussion of the organization, lines of communication, and strategies that the City employs to address spill situations. The contingency planning section describes options available to the City in the event that some well supplies become contaminated or are otherwise unavailable. One of the options discussed in the contingency plan is the expansion of pumping capacity and provision of treatment at the Eshom Well. This has taken place since the initial development of the WHPP, with the addition of the two Fords Prairie Wells and the Fords Prairie Treatment Facility.

The WHPP also presents ground water management strategies, including budgetary costs for implementation. Recommended management strategies include both regulatory and non-regulatory approaches. Examples of key strategies that the City continues to implement include:

- Implement a ground water quality monitoring program within the Wellhead Protection Management Area.

- Pursue the clean-up of known contaminated sites (e.g., the Fords Prairie Aquifer Restoration Project).
- Update the potential contaminant source inventory every two years.
- Communicate with local agencies about the nature of their wellhead protection needs, and explore improved coordination among programs which might affect land use, environmental protection, and spill response.
- Communicate regularly with property owners within the Wellhead Protection Management Area regarding their responsibility for pollution prevention, and seek their participation in all information activities.

11.1.1 Wellhead Protection Plan Update

Since the development of the 1999 WHPP, there have been changes within the City water system that impact the WHPP. The most significant changes occurred between 2000 and 2004, and were documented within the WHPP update discussion included in the 2005 WSP. No other significant changes have occurred within the system since 2004. However, key system characteristics that were described in the 2005 WSP and which are still pertinent as of this version of the WSP because they represent material updated since the original 1999 WHPP, are summarized below.

Since the prior WSP update, the City contracted with Pacific Groundwater Group (PGG) to re-delineate the groundwater time-of-travel zones in the Fords Prairie area, reviewed and updated the potential contaminant sources, and established a nitrates monitoring program for the Centralia Outwash Gravel Aquifer (COGA).

11.2 Well Pumping Characteristics and Wellhead Protection Management Area

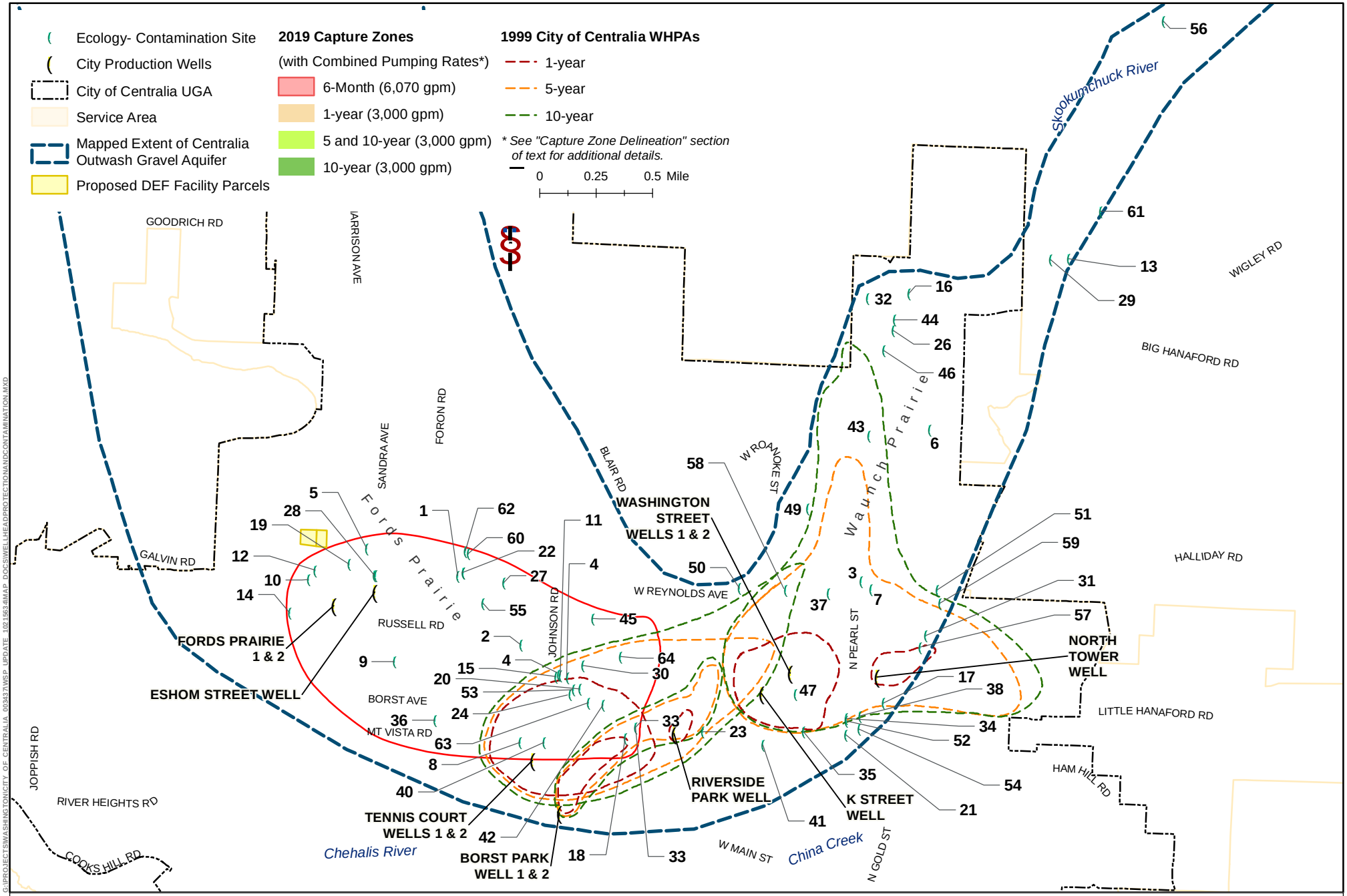
The original Wellhead Protection Management Area, or buffer zone, was created based upon the delineated time-of-travel zones for all wells used by the City at the time the WHPP was developed (i.e., in 1999). This included pumping by the North Tower, Washington, and K Street Wells (located in the eastern portion of the City). The buffer zone was then modified in the WHPP (i.e., expanded to the west) to reflect anticipated future conditions (i.e., assuming pumping of Eshom and Tennis Court Wells, and reduced pumping of the easterly wells mentioned above). However, the upgradient (i.e., northeasterly) portion of the buffer zone remained unchanged, although the City anticipated significantly reduced pumping of the easterly wells. Even though this portion of the buffer zone is far beyond the 10-year time-of-travel zone for the westerly wells that are currently utilized, it was retained so as to reflect a conservative approach in terms of managing the City's wellhead area.

The majority of the City's supply is currently obtained from the two Tennis Court Wells and the three wells in the Fords Prairie area. Information about the City's source water pumping facilities is contained in Table 5-1.

As part of a recent SEPA review process for a diesel emission fluid (DEF) manufacturing facility, it was noted that the proposed facility is located within the one-year Wellhead Protection Area

(WHPA) delineated by the Washington State Department of Health (DOH) for Fords Prairie Wells 1 and 2. Additionally, a perchloroethylene (PCE) plume is known to exist downgradient of the Trailer Village Laundromat within the Eshom Well's WHPA. The Eshom Well has had a few detections of PCE in the past. The addition of the Fords Prairie Wellfield to the supply profile influences the groundwater mechanics of the Eshom Well, rendering the prior delineated WHPA inaccurate.

For these reasons, the City requested that PGG update the capture zones using recent groundwater elevation data and methods that take groundwater flow and aquifer properties into account to assess whether the proposed DEF facility is within the capture zone. Additionally, the City requested that the 1999 Eshom well WHPA be re-delineated due to concerns about its accuracy. The updated capture zones, or Wellhead Protection Management Area, is shown on Figure 11-1.



HDR

WELLHEAD PROTECTION AREA AND POTENTIAL CONTAMINATION SITES
FIGURE 11-1

City of Centralia Water System Plan
September 2022

11.3 Inventory of Potential Contaminant Sources

Section B1 of the original 1999 WHPP contains an inventory of potential contaminant sources. Within this discussion are summary results of a “windshield survey” of the Wellhead Protection Management Area, and information obtained from State and Federal contaminant site databases. This information becomes outdated as activities change within the City. Therefore, updates are required every two years.

The information presented below represents an update to the database search, current as of 2021.

Database Search

For the 1999 WHPP, several data sets were reviewed to obtain information on known and potential sources of contamination. These included Department of Ecology (Ecology) databases (those available in July 1998) for:

- Confirmed and Suspected Contaminated Sites
- Leaking Underground Storage Tanks
- Underground Storage Tanks
- Hazardous Waste Generators (RCRA generators)

Since that time, Ecology has changed the way it maintains these databases. All information of this nature is now compiled into a single database (i.e., the Facility Site Identification Database), accessible via the Internet. This database was searched in April 2021 and data were downloaded and mapped alongside the updated WHPAs to determine the list of potential contaminant sources. This includes sites such as underground storage tanks, leaking underground storage tanks, hazardous waste generators, hazardous waste management activities, and State clean-up sites.

The database search identified 83 sites located within the management area. Figure 11-1 provides the locations of these sites, and Table 11-1 provides details regarding each site.

Table 11-1. Inventory of Potential Contaminant Sources

FID	DOE Facility ID	Site name	Type of Point Source	Ecology Program	Within 1-Yr Travel Zone	Within 5-Yr Travel Zone	Within 10-Yr Travel Zone
1	1155	Northwest Hardwoods Inc Fill	Air Qual Local Authority Reg	Air Quality	Y		
			Emergency/Haz Chem Rpt TIER2	HAZARDOUS WASTE	Y		
			State Cleanup Site	TOXICS	Y		
			Underground Storage Tank	TOXICS	Y		
			Landfill	SOLIDWASTE	Y		
			Industrial SW GP	WATER QUALITY	Y		
2	1169	TRAILER VILLAGE	Voluntary Cleanup Sites	TOXICS	Y		
			State Cleanup Site	TOXICS	Y		
3	1178	TRI COUNTY TRUCK & DIESEL	Underground Storage Tank	TOXICS		Y	
4	1179	Pacific Pride Tiger Town	Underground Storage Tank	Toxics	Y		
5	4445	CCP Composites US LLC Centralia Northpark	Industrial SW GP	WATER QUALITY	Y		
6	4857	S & S Mobile Salvage	Revised Site Visit Program	HAZARDOUS WASTE		Y	
7	5133	Dan Hull Dist Inc	Industrial Sw Gp	Water Quality		Y	
			Emergency/Haz Chem Rpt TIER2	Hazardous Waste		Y	
8	5828	Centralia Sports Fields	Construction Sw Gp	Water Quality	Y		
9	9077	Lewis County Alberta Dr	Underground Injection Control	WATER QUALITY	Y		
10	11554	The Chronicle Print Shop	Revised Site Visit Program	HAZARDOUS WASTE	Y		
11	15431	Rite Aid 5284	Hazardous Waste Generator	HAZARDOUS WASTE	Y		

FID	DOE Facility ID	Site name	Type of Point Source	Ecology Program	Within 1-Yr Travel Zone	Within 5-Yr Travel Zone	Within 10-Yr Travel Zone
12	15476	FERRELLGAS DBA BLUE RHINO NW CENTRALIA	Emergency/Haz Chem Rpt TIER2	HAZARDOUS WASTE	Y		
13	18316	LEWIS COUNTY PW BIG HANAFORD PIT	Sand and Gravel GP	WATER QUALITY			Y
14	34876	UNFI Incorporated Centralia	Industrial SW GP	WATER QUALITY	Y		
			Hazardous Waste Generator	HAZARDOUS WASTE	Y		
15	58132	TIME OIL CO JACKPOT FOOD MART CENTRALIA	Emergency/Haz Chem Rpt TIER2	HAZARDOUS WASTE	Y		
16	NA	Northwest Hardwoods Landfill	State Cleanup Site	TOXICS		Y	
17	94602	City of Centralia Light Department	State Cleanup Site	TOXICS		Y	
			LUST Facility	TOXICS		Y	
			Underground Storage Tank	TOXICS		Y	
18	150947	Jiffy Lube Store 2050	Emergency/Haz Chem Rpt Tier2	Hazardous Waste	Y		
19	NA	Rogers Machinery	Underground Storage Tank	TOXICS	N		
20	3904592	Safeway Fuel 1495	Underground Storage Tank	Toxics	Y		
21	4949613	DR ZIGS RADIATOR SHOP	Underground Storage Tank	TOXICS		Y	
22	6114444	AT&T WIRELESS CENTRALIA	Emergency/Haz Chem Rpt TIER2	HAZARDOUS WASTE	Y		
23	6337826	At&T Centralia	Emergency/Haz Chem Rpt Tier2	Hazardous Waste		Y	
24	6436724	Borst Park Bp	Underground Storage Tank	Toxics	Y		
25	7435285	I5 Foodmart	Underground Storage Tank	Toxics	Y		
26	7504507	Grassers Auto Wrecking	State Cleanup Site	Toxics		Y	
27	7629299	CENTRALIA STREET SHOP	Underground Storage Tank	TOXICS	Y		
28	7999433	Centralia Port Northpark Dr	Enforcement Final	Hazardous Waste	Y		

FID	DOE Facility ID	Site name	Type of Point Source	Ecology Program	Within 1-Yr Travel Zone	Within 5-Yr Travel Zone	Within 10-Yr Travel Zone
29	9497073	STERLING BREEN CRUSHING	Enforcement Final	WATER QUALITY			Y
			Sand and Gravel GP	WATER QUALITY			Y
30	10759868	American Pacific Industries	Hazardous Waste Generator	HAZARDOUS WASTE	Y		
31	11411147	Qwest Communications Co Centralia	Emergency/Haz Chem Rpt Tier2	Hazardous Waste		Y	
32	14253896	KIWANIS VOCATIONAL HOMES FOR YOUTH	Underground Storage Tank	TOXICS		Y	
33	16317171	Arco 6184	Underground Storage Tank	Toxics	Y		
34	24541718	CASCADE HAULING & CONSTRUCTION	Underground Storage Tank	TOXICS		Y	
35	25117314	Symons Frozen Foods Inc F St	Emergency/Haz Chem Rpt Tier2	Hazardous Waste		Y	
36	33637331	Providence Centralia Hospital Centralia	Non Enforcement Final	Ecology Action Site	Y		
37	43722518	Napavine Drug Lab 2	Hazardous Waste Generator	HAZARDOUS WASTE		Y	
38	49314784	Kellys Body Shop	Revised Site Visit Program	Hazardous Waste		Y	
39	51251146	DULIN CONSTRUCTION INC	Underground Storage Tank	TOXICS	Y		
40	51864166	CENTRALIA PARKS & RECREATION	Underground Storage Tank	TOXICS	Y		
41	52768442	Precision Laboratory Plastics LLC	Hazardous Waste Generator	HAZARDOUS WASTE		Y	
42	54295862	Chevron 93124	LUST Facility	Toxics	Y		
			Underground Storage Tank	Toxics	Y		
			Voluntary Cleanup Sites	Toxics	Y		
			Hazardous Waste Generator	Hazardous Waste	Y		
43	56646196	Reliance Food Center Inc	Underground Storage Tank	Toxics		Y	
			LUST Facility	Toxics		Y	

FID	DOE Facility ID	Site name	Type of Point Source	Ecology Program	Within 1-Yr Travel Zone	Within 5-Yr Travel Zone	Within 10-Yr Travel Zone
			Emergency/Haz Chem Rpt TIER2	HAZARDOUS WASTE		Y	
44	58139141	MINKS COUNTRY MARKET	Underground Storage Tank	TOXICS		Y	
45	62917955	RELIABLE ENTERPRISES	Underground Storage Tank	TOXICS	Y		
46	63264888	Elan Painting Inc	Hazardous Waste Generator	Hazardous Waste		Y	
			Underground Storage Tank	TOXICS		Y	
			Industrial SW GP	WATER QUALITY		Y	
47	73886322	TOLEDO TELEPHONE CO INC	Underground Storage Tank	TOXICS	Y		
48	77567317	SUPERIOR MUFFLER PARKWAY ENTERP	Underground Storage Tank	TOXICS	Y		
49	77889162	DARRELL PRICE	Underground Storage Tank	TOXICS		Y	
			Revised Site Visit Program	HAZARDOUS WASTE		Y	
50	77975549	Qwest Corporation W00832	Hazardous Waste Generator	Hazardous Waste		Y	
			Haz Waste Management Activity	Hazardous Waste		Y	
			Underground Storage Tank	TOXICS		Y	
51	83676636	Gold Beach Investment Properties Inc	Hazardous Waste Generator	HAZARDOUS WASTE		Y	
52	84673392	LEWIS COUNTY DISTRIBUTORS INC	Underground Storage Tank	TOXICS		Y	
53	87285554	Texaco 638021033	Lust Facility	Toxics	Y		
			Voluntary Cleanup Sites	Toxics	Y		
54	91259769	Toads Auto Machine	Hazardous Waste Generator	HAZARDOUS WASTE		Y	
55	NA	Lincoln Creek Lumber	Underground Storage Tank	TOXICS	Y		
56	93874971	JC OCONNOR CONSTRUCTION INC	Underground Storage Tank	TOXICS			Y

FID	DOE Facility ID	Site name	Type of Point Source	Ecology Program	Within 1-Yr Travel Zone	Within 5-Yr Travel Zone	Within 10-Yr Travel Zone
57	94628852	Crescent Ave Drug Lab	Hazardous Waste Generator	HAZARDOUS WASTE	Y		
58	96441174	CONRAD MOVING & STORAGE	Underground Storage Tank	TOXICS	Y		
59	96829392	Willamette Valley Company	Emergency/Haz Chem Rpt Tier2	Hazardous Waste		Y	
			Industrial SW GP	Water Quality		Y	
60	3084551	Parkway Mobile Home Park	Underground Storage Tank	Toxics	Y		
61	97749373	Lian Kenneth Residence	Hazardous Waste Generator	HAZARDOUS WASTE			Y
62	98895788	Lewis Cnty Fire Dist 12 Centralia	Underground Storage Tank	TOXICS	Y		
			Hazardous Waste Generator	HAZARDOUS WASTE	Y		
63	99386131	Unocal SS 4722	LUST Facility	Toxics	Y		
			Underground Storage Tank	Toxics	Y		
			Voluntary Cleanup Sites	Toxics	Y		
			Emergency/Haz Chem Rpt TIER2	HAZARDOUS WASTE	Y		
64	99996974	WA DOT I-5 Blakeslee To Grand Mound Widening	401CZM Project Site	Ecology Action Site	Y		
			Non Enforcement Final	Ecology Action Site	Y		

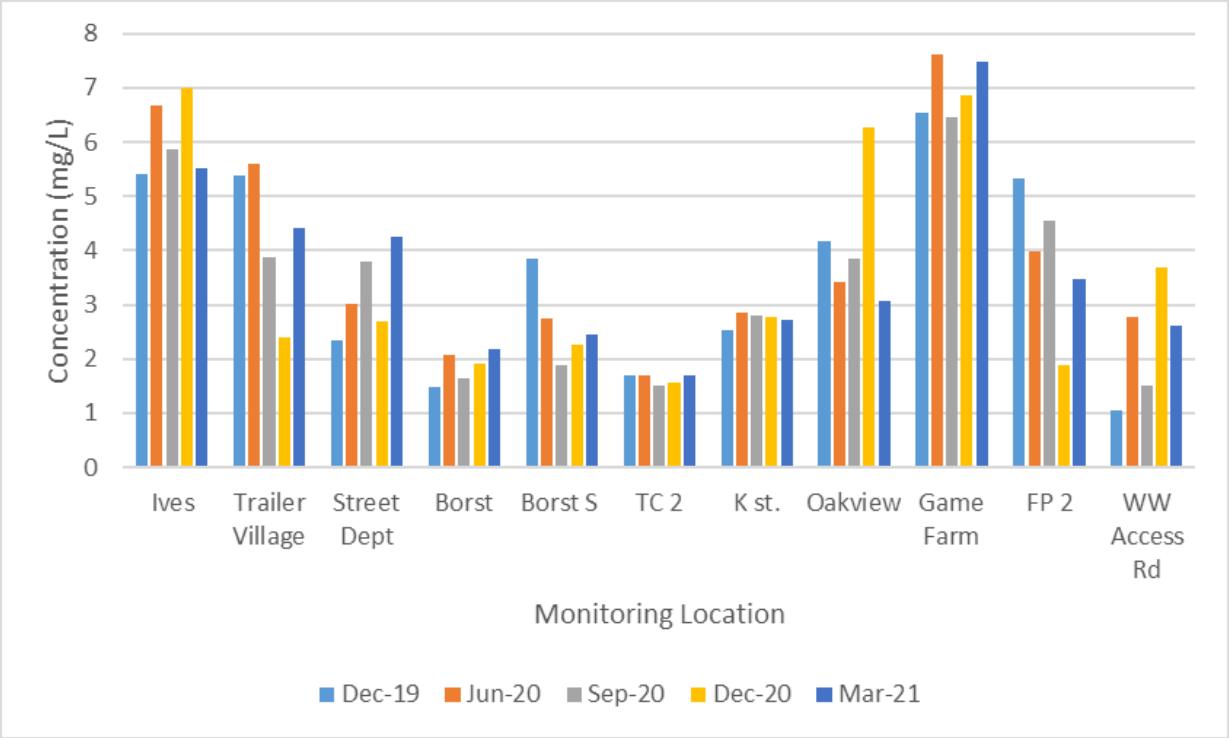
11.4 Nitrate Monitoring Program

The City has concerns about the potential for nitrate contamination in the COGA. The recharge area for the COGA is designated a Critical Aquifer Recharge Area (CARA), and encompasses much of the City to the north and west of the Skookumchuck River and Chehalis River confluence. Septic systems within the City limits and in unincorporated areas of the Urban Growth Area (UGA) overlie the CARA and may cause nitrate contamination within the shallow aquifer. Most septic systems overlying the CARA are in the Fords Prairie and Waunch Prairie areas. Most of the City's active production wells are in the Fords Prairie area, so nitrogen loading in this part of the City is of greatest concern. Other point sources of nitrate contamination, such as livestock facilities, stormwater infiltration features, and wastewater facilities, can contribute nitrates to the COGA as well.

To address this concern the City worked with PGG to characterize the presence of nitrates in the COGA and develop a nitrogen monitoring program. The City installed six monitoring wells in July 2019 and will use several other existing wells to monitor for nitrates. The first nitrate monitoring program sample was taken in December 2019, with quarterly monitoring beginning in June 2020.

The City is creating a baseline dataset so seasonal concentration variability may be observed. Monitoring data as of March 2021 are presented in Figure 11-2. The data show nitrate concentrations at monitoring sites relative to each other. There is no clearly observed seasonal nitrate trend. The City will continue to collect and review this data to look for trends in nitrate concentrations in the COGA.

Figure 11-2: Nitrate concentrations at monitoring program sites, December 2019 – March 2021



12. Operations and Maintenance Program

12.1 Organizational Structure

The City of Centralia (City) uses a Council/Manager form of government. Elected positions include those for the Mayor and each of the six Council members. The City Manager and directors of each administrative department are filled by appointment. Of these departments, the Public Works Department has responsibility for the management and operation of the City's water system.

The Public Works Department is located at 1100 North Tower Avenue and is headed by the Public Works Director. Responsibilities of this position include overall management of all operations including implementation of City policy and contractual commitments of the City.

A Water Operations Manager, under the direction of the Public Works Director, organizes and administers the day-to-day operations and maintenance of the water system. Figure 12-1 provides a diagram of the organizational structure of the Public Works Department staff involved in water system operations.

12.2 Personnel Certification

Pursuant to Chapter 246-292 WAC, the City is required to have certified operators. Certified personnel are required for positions that are in direct charge of a public water system or major segments of the system and are responsible for monitoring or improving water quality.

A minimum certification of Water Treatment Plan Operator-1 (WTPO-1) is required for most City water system operator positions. All certified personnel must renew their certificates annually. They must demonstrate their continued professional growth in the field by accumulating three related college credits or continuing education units (CEUs) every three years. The City will continue training and assistance for all staff in obtaining their certification and in meeting the three-year CEU requirements. This will assist both the operators and the City in maintaining an efficient level of water system operations. A listing of Water System Operations Personnel and their level of certification as of March 2021 is included in Table 12-1.

Figure 12-1. City of Centralia Organizational Chart

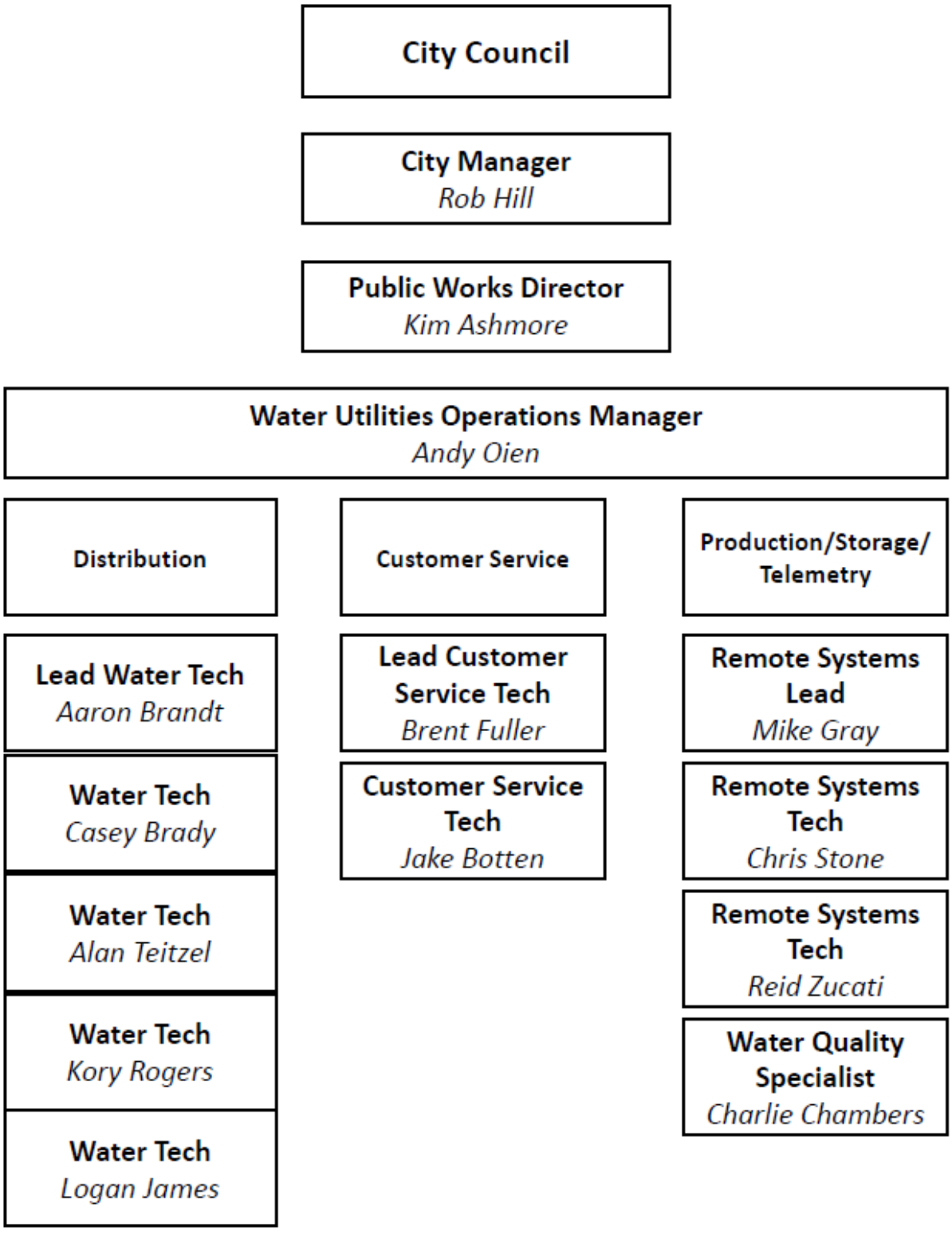


Table 12-1. Personnel Certification

Staff Person	Title	Certification
Andy Oien	Water Operations Manager	WDS; WTPO-3; CCS; WDM-3
Aaron Brandt	Lead Water Technician	WDS; WTPO-2; WDM-2
Logan James	Water Technician	CCS; WDS
Kory Rogers	Water Technician	WDM-2; CCS; WDS
Casey Brady	Water Technician	WDS; CCS; WDM-2
Alan Teitzel	Water Technician	WDS; CCS; WTPO-2; WDM-2
Brent Fuller	Lead Water Customer Service Technician	WDS; CCS
Jake Botten	Customer Service Technician	WDM-1
Mike Gray	Remote Systems Lead Technician	WDS; WDM-2; WTPO-2
Chris Stone	Remote Systems Technician	CCS; WDM-2; WTPO-2
Reid Zucati	Remote Systems Technician	WTPO-1; WDS
Charlie Chambers	Water Quality Technician	CCS; WDS; WDM-2

Notes

WDS: Water Distribution Specialist
WDM: Water Distribution Manager
CCS: Cross Connection Specialist
WTPO: Water Treatment Plant Operator
WTPOIT: Water Treatment Plant Operator-In-Training
BAT: Backflow Assembly Tester

12.3 Daily Operations

12.3.1 General

Centralia has a well-organized system of day-to-day monitoring and inspection to ensure that the water system is kept in good operating condition. Daily operations and maintenance are carried out by Water Utility staff under the direction of the Water Operations Manager. Troubleshooting, adjustments, and repairs are also a part of the daily operations program. Routine operations procedures for various system components are described below.

12.3.2 Sources

Each well, while in operation, is visited daily by a service technician, who observes conditions, checks pump status, and observes water level in the well.

12.3.3 Storage

Daily reservoir checks are carried out to monitor water levels, chlorine residuals, pH, and provide security. Operators check fences, gates, and locks for evidence of intrusion. Reservoirs are drained, cleaned, and inspected once per year.

12.3.4 Booster Facilities

Each booster pump station is inspected weekly. This includes a check of the pumps, flow meters, pressure gauges, and controls as well as overall physical condition of the station.

12.3.5 Service Meters

Water service meters are inspected in response to customer requests or when other evidence suggests a meter has become inoperative.

12.3.6 Dead-end Lines

Dead-end lines have blow-offs operated weekly to maintain chlorine residual.

12.4 Emergency Response Plan

State Department of Health (DOH) requirements for a Water System Plan (WSP) specify that an Emergency Response Plan (ERP) be included in the Operations Program. The purpose of an ERP is to guide personnel through system malfunctions, natural disasters, and other events affecting routine system operation.

The major elements in this ERP include a description of system vulnerability, contingency plan, and emergency response procedures. Since potential emergency situations are varied, a response plan that is flexible enough to adapt to most conditions is important. Proper staffing, training, and communication, as well as a suitable inventory of maintenance and repair parts, are also basic to the ERP.

12.4.1 Vulnerability Overview

In January 2004, the City of Centralia performed a Vulnerability Assessment in accordance with the Environmental Protection Agency (EPA) Bio-Terrorism Preparedness and Response Act of 2002. All Utility facilities were assessed and rated with regard to acts of bio-terrorism. Results were sent to the EPA and integrated into this Emergency Response Plan. As a result of the Vulnerability Assessment, the City added active alarm systems to the Fords Prairie Wellfield, the Seminary Hill and Davis Hill Reservoirs, and the North End Shop.

12.4.2 America's Water Infrastructure Act (AWIA)

AWIA requires that all community water systems serving populations greater than 3,300 persons conduct a Risk and Resilience Assessment (RRA) of the risks to, and resilience of, their system, and update their Emergency Response Plan accordingly. The RRA is required to include the following elements:

- Risk to the system from malevolent acts and natural hazards
- Resilience of the infrastructure, including supervisory control and data acquisition (SCADA)/cyber resilience
- Monitoring practices of the system
- Financial infrastructure of the system
- Use, storage, or handling of various chemicals by the system
- Operation and maintenance of the system

The RRA provides a review of the vulnerability of the City's critical assets, which incorporates risks caused by both natural hazards and human-caused threats. This RRA summary report documents the process and results of the RRA, providing the City with an understanding of which assets in the system are most critical, along with potential mitigation measures that can be considered to address the identified risk in the water system. The City certified its RRA to the administrator of the U.S. Environmental Protection Agency (EPA) by the deadline (June 30, 2021).

The RRA must be reviewed at least every 5 years to determine if revisions are required because of changes to the water system. Upon review, the water system must recertify the RRA if there are no revisions or certify a revision to the RRA. The City is also required to update its Emergency Response Plan (ERP) within 6 months of each RRA certification so that the revised ERP includes information from the latest RRA. The ERP update must also be certified to the EPA. As of publication of this plan, the City is updating its ERP, which must be certified by December 31, 2021.

12.4.3 Contingency Plan

The contingency plan presented herein is intended to serve as a guide to City personnel for developing response procedures. It provides an emergency roster, gives guidelines for determining priority service customers, describes DOH notification procedures, suggests methods for organizing repair parts and materials, sets water service priorities, establishes basic personnel responsibilities, and presents a general field response procedure.

Emergency Roster

An up-to-date Emergency Call Up Roster is provided in Table 12-2. It has been prepared containing personnel and suppliers' names and phone numbers. A copy of this list is displayed at the Utility Office, City Hall, and Fire and Police Departments. In the event of an emergency, additional personnel should be assigned as deemed necessary by supervision.

Table 12-2. City of Centralia Emergency Contacts

Contact	Phone Number
Fire/Police/Medical	911
DOH Regional Engineer	360-236-3030
DOH Emergency Contact (after hours)	1-877-481-4901
Department of Ecology Spill Response	800-258-5990
Water Management Laboratories	253-531-3121
County Environmental Services	360-740-1217
County Environmental Health	360-740-1135
Electric Utility	360-330-7512
Pump Service	888-644-6686
Electrician	360-736-9907
Media Contact (KELA)	360-736-3321
Media Contact (KITI)	360-736-1355

Call Before You Dig	811
Engineering Consultant (HDR)	(360) 570-4400

Priority Service List

The City plans to develop a Priority Service List, to protect individuals and/or organizations who are dependent upon an uninterrupted supply of water and/or strict water quality requirements. Public information and education concerning this service is important to encourage those in need of special water service to contact the City for inclusion on the list. Possible candidates for this service might include individuals on home-care kidney dialysis equipment or other medical facilities and organizations requiring uninterrupted water for specialized commercial or industrial processes.

DOH Notification

The Public Works Director, or their designee, will immediately notify the DOH District Engineer in the event that water shutdown is threatened or required for more than 24 hours, water quality is determined to be unacceptable, or whenever a public health risk associated with the water system is detected.

Material Supplies

The City maintains a computerized inventory of repair and replacement parts that permits an immediate determination of readiness to respond to an emergency. The inventory is updated monthly as purchase invoices and crew reports are received. The quantity and type of materials in storage are checked periodically against the computer printout to ensure accuracy.

Priorities

When used for drinking, water quality should meet all applicable State and federal drinking water quality standards. Furthermore, priorities of water usage are rated in the following order.

- Fire Fighting (Life Threatening)
- Drinking
- Fire Fighting (Property Threatening)
- Sanitary
- Industrial
- Commercial

This usage priority rating is a general guideline only. Decisions by City officials regarding water allocation during emergencies may vary from this on the basis of prevailing conditions.

Responsibilities

The following are responsibilities for administrative and technical personnel in the event of an emergency.

- Mayor and City Manager

    - Keep public informed.
- Public Works Director
    - Keep Mayor, Manager, and public informed.
    - Maintain contact with Water Operations Manager.
    - Assess disaster/damage.
    - Determine or authorize emergency response.
    - Prepare warning information for users.
    - Oversee operations.
- Water Operations Manager
    - Keep Public Works Director informed.
    - Maintain contact with crew(s).
    - Assess available equipment and resources.
    - Formulate plan for corrective action.
    - Execute response action.
    - Document incident and response action.
- Field Staff
    - Take immediate action to protect life.
    - Note damage and apparent cause.
    - Notify Water Utility office.
    - Keep Water Supervisor informed.
    - Assist in taking corrective action.
- Office Staff
    - Contact emergency services, as appropriate.
    - Answer incoming phone calls.
    - Maintain radio contact with crews.
- Police Chief
    - Maintain crowd and traffic control.
    - Provide security.
- Fire Chief
    - Provide fire control.
    - Provide emergency aid.

General Field Response

The initial reaction by City personnel to an emergency is to take prompt action to remove any immediate threat to public health or safety. Where appropriate, bystanders may be warned,

traffic diverted, valves shut off, dangerous materials removed, or other necessary action taken, provided it can be done without further risk to the public or City staff.

Next, the Water Operations Manager is contacted and informed as to the damage and apparent cause. This individual can then dispatch a crew to isolate the problem or damaged facility. Meanwhile, the damage is more thoroughly assessed and a determination made as to the materials and equipment necessary for correction. It may be necessary to decide between a temporary solution that can be accomplished quickly and a permanent one that may take more time. It is essential that the City's repair supplies inventory and a list of materials suppliers are kept up-to-date and readily accessible to avoid unnecessary delay in restoration of service.

Throughout the emergency, radio contact is maintained between work crews, the Water Operations Manager, and other key participants to enhance coordination of the corrective effort. It is important that City administrators are kept appraised of the emergency to permit proper public notification.

12.4.3 Emergency Response Actions

A summary of system components potentially impacted by various types of emergencies is shown in Table 12-3. Actions to be taken in response to several of these situations are described below.

Table 12-3. Potential Disaster Effects

Disaster Type	Storage	Wells	Transmission Network	Distribution System	Telemetry and Control System	Power Supply System
Earthquake	X	X	X	X	X	X
Severe windstorm	X	X			X	X
Ice/snow storm (freezing conditions)	X	X		X	X	X
Flooding		X	X	X		X
Fire	X	X			X	X
Volcanic eruption	X	X	X	X	X	X
Drought		X				
Contamination of water supply	X	X		X		
Water main break	X	X	X	X	X	X
Vandalism	X	X	X	X	X	X
Explosion/bomb blast	X	X	X	X	X	X
Nuclear warfare	X	X	X	X	X	X
Bio-Terrorism	X	X	X	X	X	X

Emergency: Earthquake

Description - A major earthquake, with a magnitude of 5.0 or greater on the Richter scale, and intensity of 9 or greater on the Modified Mercalli scale, could disrupt the source, transmission,

pumping, storage, and distribution components of the water system. In addition, power failures and interruption to conventional transportation and communication systems may occur.

Response - Water personnel will anticipate critical water use needs for fire fighting and medical facilities resulting from an earthquake. These should be given due priority in assessing the emergency, preparing damage reports, and organizing repair efforts. Crews are equipped to maintain constant radio contact, barricade hazardous areas, shut off valves to isolate broken mains, move soil and debris, turn off water services, and make repairs. They are also prepared to help residents secure a safe supply of drinking water.

Since they are hidden from view and at least as susceptible to ground movement as above-ground structures, pipelines, wells, and other buried facilities require closer attention in the event of an earthquake. The water system will be checked thoroughly for any unexplained drop in line pressure, reduction in flow rate, pump failure, leakage, or other signs of damage.

Emergency: Flooding

Description - Centralia's location at the confluence of the Chehalis and Skookumchuck Rivers makes it vulnerable to floods in either drainage basin. The largest potential flood impacts on Centralia's water system are inundation and contamination of wells, loss of power, and washed out mains. Other important impacts include overload of the wastewater plant, inundation of other structures, transportation disruptions, and competing demands on City resources.

Response - Water personnel will anticipate the facilities that will most likely be impaired by flooding. All major system components, however, must be checked thoroughly to assess physical damage as well as evidence of contamination. Particular attention should be given to wells in low-lying areas and all locations where mains cross flooded streams. Once collected, damage reports can be evaluated to determine the items that need immediate attention to assure continued water service.

Crews are equipped to maintain constant radio contact, construct temporary diversion dams, barricade hazardous areas, shut off valves to isolate broken mains, pump or bail flooded facilities, move soil and debris, turn off water services, and make repairs. They are also prepared to help residents secure a safe supply of drinking water. The City's ample water storage capacity is an important resource that can be utilized until sources, that have been inactivated by flooding or other natural disasters, can be returned to service.

Emergency: Power Failure

Description - Short- and long-term interruptions in power supply can occur for a variety of reasons and may or may not be associated with emergencies which would otherwise affect the water system. In addition, power outages may be localized to one or more blocks or may affect the entire region. Facilities most affected by this type of emergency include source and booster pumping, telemetry equipment, and communications systems.

Response - In addition to their field response, water personnel will immediately contact the City Light Department to determine the nature, extent, and expected duration of the power outage. Reservoirs would enable several days of uninterrupted water service to the Central, Cooks Hill, and Ham Hill zones, under moderate demand conditions. The Davis Hill, Zenkner, and

Seminary Hill zones, however, rely on continuous pumping and would require backup power to serve water to customers while electrical service was down.

Emergency: Contamination of Source of Supply

Description - Contamination can occur in the groundwater supplies and may be the result of man-made practices or natural occurrences. The system's wells tap into open, relatively shallow aquifers in and near the City which can be susceptible to contamination from various land uses. Should a chemical spill or severe erosional condition contaminate a supply during the peak demand period, some curtailment of service may be necessary.

Response - Initial response will be to isolate the affected source from the rest of the system. Next, it will be necessary to determine the specific cause and remove it as quickly as possible. This may be a simple matter such as in the event of a minor spill or may require a long period of time, resources, and specialized assistance for larger, more complicated problems. Appropriate measures for source removal and site cleanup should be determined according to the type, location, nature, and entry path of the contaminant.

In addition to their field response, City personnel will ensure that appropriate health authorities are contacted. At a minimum, this includes the Lewis County Environmental Health Director and the DOH Regional Engineer. Staff need to determine, if possible, the extent of contamination in the system and prepare an appropriate public information program.

Emergency: Emergency Bio-Terrorism

Description – An act of bio-terrorism could affect the entire water system, from production to storage and distribution. In addition, power supply and facilities control could be interrupted, causing additional failures.

Response – Personnel will respond to alarms in place for power control and intrusion. They will notify the proper individuals who will re-establish control, isolate the system, test as needed, and notify customers of outage. Utility managers will notify the proper authorities and ensure support to affected areas until safe return to service is assured.

12.4.4 Public/Press Information

As a public water supplier, the City has an obligation to properly inform its customers of emergencies which may affect water service. Wherever possible, press releases and other public statements will be prepared in advance and delivered through a designated spokesperson. According to the extent and type of emergency, the Mayor, City Manager, Public Works Director, or Water Operations Manager may be an appropriate choice for this role. This individual must have a good understanding of the water system and the emergency at hand. In addition, she/he must be trained in public information and liability issues in order to provide assurance that essential information is presented in a manner which best serves the public interest.

12.5 Routine and Preventive Maintenance

Good preventive maintenance is both cost-effective and a deterrent to emergency conditions. By following a set schedule of maintenance activities, the City can ensure efficient and reliable system operation, extend life of equipment, and provide an early warning of mechanical breakdown. The City follows a schedule of monitoring and maintaining facilities throughout the distribution system. The maintenance reporting procedures for the system are included in Appendix L. Also in Appendix L are sample notification letters used for cross-connection control as well as customer complaint forms.

Records of maintenance activities are kept on separate forms for wells, treatment facilities, reservoirs, valves, hydrants, pump, meters, and cross connection control devices.

Preventive maintenance also requires adequate security to prevent or discourage unauthorized use, theft, or vandalism to City facilities. All major equipment is securely locked while unattended. This includes all buildings, vaults, sources, reservoirs, material storage areas, and fences designed to secure such facilities. Brush, tall grass, and trees are trimmed back from security fences to improve surveillance and thus discourage potential trespassers. The major facilities are also included in routine police and sheriff's department security patrols, and nearby residents are be encouraged to report suspicious activities.

12.6 Water Quality Public Notification, Record Keeping, and Customer Complaint Procedures

12.6.1 Public Notification

The City is required to provide periodic reports to DOH which summarize the results of water quality testing. If any MCLs are exceeded, both DOH and the public must be notified in accordance with methods specified in WAC 246-290-71001 through 246-290-71007.

DOH, through WAC 246-290-71001 (which in turn references 40 CFR 141.201 through 208) has defined situations that require water purveyors to notify customers of what the circumstances are and what actions are being taken to address certain acute issues. Violations and other situations are categorized into three tiers, based upon the degree of potential adverse impacts to human health. The most common situations listed in the three tiers are as follows:

Tier 1 (details found in Table 1 of 40 CFR 141.202 (a))

a) Violation of the MCL for total coliforms when fecal coliform or E. coli are present in the system, or when there is a failure to test for fecal coliform or E. coli when required.

b) Violation of the MCL for nitrate, nitrite, or total nitrate and nitrite, or failure to perform required confirmation sampling.

c) Certain situations when there is a violation of the MRDL for chlorine dioxide.

d) Certain situations when there is a violation of the turbidity MCL.

e) Certain situations when there is a violation of the Surface Water Treatment Rule, Interim Enhanced Surface Water Treatment Rule, or Long Term 1 Enhanced Surface Water Treatment Rule treatment technique requirement.

f) Occurrence of a waterborne disease outbreak or other waterborne emergency.

g) Other violations or situations with significant potential to have serious adverse effects on human health.

Tier 2 (details found in Table 1 of 40 CFR 141.203 (a))

a) All MCL, MRDL, and treatment technique requirement violations, except those classified as Tier 1.

b) Violations of the monitoring and testing procedure requirements, where DOH determines that a Tier 2 notice is required rather than a Tier 3 notice.

c) Failure to comply with the terms and conditions of any variance or exemption in place.

Tier 3 (details found in Table 1 of 40 CFR 141.204 (a))

a) Monitoring violations that do not fall under Tiers 1 or 2.

b) Failure to comply with a testing procedure that does not fall under Tiers 1 or 2.

c) Operation under a variance or exemption.

d) Availability of unregulated contaminant monitoring results.

e) Exceedance of the fluoride secondary MCL.

In addition, WAC 246-290-71001 requires that purveyors notify customers when the system is issued a departmental order, fails to comply with a departmental order, or is issued a category red operating permit.

Public notification distribution requirements are set forth according to the Tier system. In general, the timing and manner of public notifications are as follows:

Tier 1 (details found in 40 CFR 141.202 (b) and (c))

a) Public notice shall be provided as soon as possible but no later than 24 hours after the system learns of the violation.

b) DOH shall be contacted as soon as possible but no later than 24 hours after the system learns of the violation.

c) At a minimum, one of the following forms of delivery is to be used:

   a. Broadcast media (radio, television).

   b. Conspicuous posting.

   c. Hand delivery of notice.

   d. Another method approved by DOH.

Tier 2 (details found in 40 CFR 141.203 (b) and (c))

a) Public notice shall be provided as soon as possible but no later than 30 days after the system learns of the violation.

b) The public notice must be repeated every three months as long as the violation or situation persists, unless DOH determines that another frequency is warranted.

c) At a minimum, the form of delivery must meet the following:

   a. Mail or direct delivery.

   b. Any other method reasonably calculated to reach other persons regularly served by the system, such as publication in a local newspaper, posting in public places, etc.

Tier 3 (details found in 40 CFR 141.204 (b) and (c))

a) Public notice shall be provided no later than one year after the system learns of the violation or situation.

b) The public notice must be repeated every year as long as the violation or situation persists.

c) Instead of individual Tier 3 notices, an annual report may be used to detail all violations and situations that occurred during the year.

d) The form of delivery is to meet the same requirements as that for Tier 2 notices.

12.6.2 Recordkeeping

The City is also responsible for maintaining certain records for specified periods. These requirements are listed in Table 12-4.

Table 12-4. Retention of Records of Operation and Analysis

Event	Period of Retention
Bacteriological Analysis	5 years
Turbidity Analysis	5 years
Chemical Analysis	10 years
Records of Action Taken to Correct MCL Violations	3 years after last violation.
Records Regarding a Variance or Exemption	10 years following expiration of Variance or Exemption.
Records Concerning Public Notification	3 years after Date of Notification.
Chlorine Residual	3 years (copies sent to DOH monthly)

12.6.3 Customer Complaints

All customer complaints are reviewed and addressed in a timely manner. Most water utility related complaints are associated with leaks that are fixed as quickly as the utility can respond to them. The City maintains a log of all customer complaints related to water quality.

12.7 Cross Connection Control Program

As stipulated by WAC 246-290-490, all cross connections between the City's water system and a non-potable supply of water are prohibited. It is the purveyor's responsibility to prevent contamination of the public water system by cross connections. An effective program requires coordination between the purveyor, customer, building inspector, and health department. Basic to an effective program is enabling local ordinances and trained personnel to enforce and monitor the elimination of cross connections.

Centralia's cross connection control regulations are established by City Ordinance No. 2123, passed by the City Council in March 2004. The Ordinance prohibits the presence of cross connections and directs that water service be discontinued or refused to customers which fail to comply.

The City's Cross Connection Control Program is provided in Appendix M. This document contains the details regarding how the cross connection program is implemented.

12.8 System Reliability

12.8.1 Summary of Water System Reliability Characteristics

Water Right Adequacy

As discussed in Section 7, the City's water rights are more than adequate to meet water demands within the 20-year planning horizon and beyond.

Source Reliability

The City utilizes multiple groundwater sources; thus, if one of their primary wellfields is unavailable for maintenance purposes or other reasons, the other sources can be relied upon to meet demands.

During an emergency, the City also has an intertie with the City of Chehalis that can be opened to provide an additional supply.

The City will be increasing its source reliability by developing additional groundwater sources, using water rights acquired from TransAlta.

Facility Reliability

Analyses of the City's source, pumping and storage facilities are provided in Sections 7 and 8. As noted in those portions of this WSP, the City's distribution storage reservoirs provide sufficient standby storage to meet more than two days of average day demand. Pump stations serving boosted pressure zones contain two pumps, with each capable of meeting maximum day (and where necessary in closed pressure zones, peak hour) demands.

12.8.2 Water Shortage Response Planning

Emergency response planning is a key component of overall water system reliability. Part of emergency response is the development of a Water Shortage Response Plan (WSRP) that details actions taken during various levels of water shortages. During minor water shortages, only public information and voluntary conservation measures may be necessary to ensure adequate water supply. During extreme shortages, mandatory curtailment and rationing may be required.

Having a WSRP plan in place provides the City with an established plan on how to address shortages. It assists customers in understanding what they can do to reduce water usage and what to expect if the shortages become more severe.

The City's WSRP is contained within Chapter 15.05 of the Centralia Municipal Code (see Appendix C). The plan provides a three-stage approach to addressing a water supply shortfall event. Each stage provides an increasingly aggressive set of actions to be implemented as drought conditions become more severe.

13. Capital Improvement Program

This chapter describes the methodology used in developing the City's water system Capital Improvement Program (CIP) and presents the costs and schedules for projects planned for implementation between 2022 and 2042.

13.1 Development of CIP

The CIP was prepared by first identifying projects that address water system needs or deficiencies, as documented in earlier chapters of the WSP. In addition, recurring or annual capital projects related to system maintenance (e.g., water main replacement programs) have also been included in the list of improvements.

A 20-year implementation schedule of the projects was then developed. Generally, projects of higher priority (i.e., those that address current system needs) were scheduled for implementation within the 10-year planning horizon (2022-2032). Projects that serve anticipated future needs associated with system growth, or are less critical to system operation, were scheduled for implementation between 2032 and 2042. Detailed scheduling of the higher priority projects was based primarily upon the City's existing forecast of project implementation timelines. Where applicable, the timing of water system projects has been coordinated with sewer and street improvements planned for the same locations.

Planning-level (AACE[1] Class 5) cost estimates have been developed for each capital project included in the 2022-2042 CIP. Generally, each project cost includes the following components:

- **Base construction cost.** Includes all labor and material costs needed to construct a project. For pipeline and valving projects, construction costs were estimated based upon unit construction costs derived from bid tabulations for recent and similar Lewis and Thurston County water distribution projects.
- **Sales tax.** Calculated as 8.2 percent (the 2021 local tax rate) of the base construction cost.
- **Construction contingency.** Takes into account the uncertainties associated with estimating project costs at this planning level. Calculated as 30 percent of the total of base construction plus sales tax.
- **Design engineering.** Includes City and consultant design costs, and other related cost items, such as permitting and construction administration. For most projects, this is calculated as 25 percent of the base construction cost. However, a higher percentage of the base construction cost is used for projects with more complex design or permitting needs.

These elements are summed to determine the total project-level cost estimate for a project, as expressed in 2021 dollars. Planning-level cost estimates are summarized in Table 13-1 and project locations are indicated in Figure 13-1.

[1] Association for the Advancement of Cost Engineering.

Table 13-1. Capital Improvement Program (2022-2042)

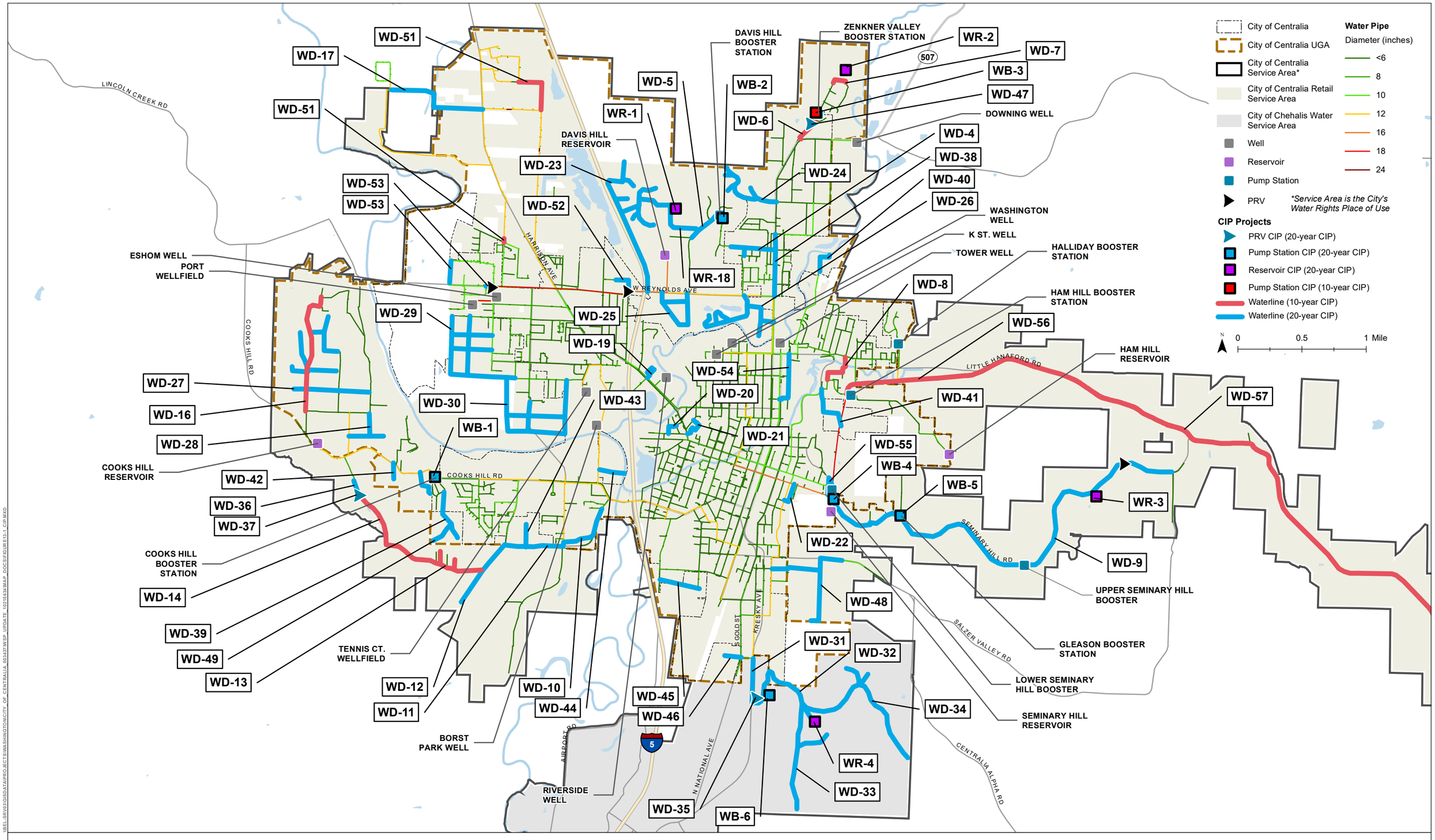
Project No.	Description	Purpose of Project [2]	Financing Source[3]	Base Project Cost (2021 Dollars)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	10-yr CIP TOTAL	2033-2042 [4]	20-yr CIP TOTAL
Water System Projects																		
Water Supply																		
WS-1	Borst Park Groundwater Treatment Facility	Growth/Improve	LT	17,600	721	1,061	8,687	8,948								19,417	17,600	37,017
Water Storage																		
WR-1	Upper Davis Hill Reservoir (0.25 MG)	Growth	Dev	566												0	760	760
WR-2	Zenkner Hill Reservoir (0.175 MG)	Growth	Dev	393												0	529	529
WR-3	Upper Seminary Hill Reservoir (0.30 MG)	Growth	Dev	676												0	908	908
WR-4	Widgeon Hill Reservoir (0.30 MG)	Growth	Dev	676												0	908	908
Water Pump Stations																		
WB-1	Upgrade Cooks Hill Booster PS (110 gpm)	Deficiency	OI	376												0	505	505
WB-2	Upgrade Davis Hill Booster PS (300 gpm and 1,000 gpm Fire Pump)	Deficiency	OI	376												0	505	505
WB-3	Upgrade Zenkner Valley Booster PS (1,000 gpm Fire Pump)	Deficiency	OI	333												0	447	447
WB-4	Upgrade Seminary Hill Booster PS (1,000 gpm Fire Pump)	Deficiency	OI	548												0	737	737
WB-5	Upgrade Gleason Booster PS (1,000 gpm Fire Pump)	Deficiency	OI	548												0	737	737
WB-6	New Widgeon Hill Booster PS (320 gpm)	Growth	Dev	771												0	1,036	1,036
Water Distribution System (Piping)																		
WD-1	Annual Piping Renewal and Replacement (Annual Cost)	Improve	OI	80	83	85	88	90	93	96	99	102	105	108	111	840	840	1,680
WD-2	(Number not Used)																	
WD-3	Leak Detection	Improve	OI	15	15	16	16	17	17	18	18	19	20	20	21	157	157	314
WD-4	Upsize Lines from 6" to 8" on Roanoke St (2,200 LF)	Deficiency	OI	787												0	1,057	1,057
WD-5	Upsize Lines from 6" to 8" in Davis Hill Zone (1,500 LF)	Deficiency	OI	535												0	719	719
WD-6	Upsize Lines from 6" to 8" on Zenkner Valley Rd (1,900 LF)	Deficiency	OI	677	697											697	0	697
WD-7	Complete Loop with 6" in Zenkner Valley Zone (500 LF)	Deficiency	OI	142	146											146	0	146
WD-8	Upsize Lines from 4" to 8" on Logan, Yakima, And Madrona (800 LF)	Deficiency	OI	284	292											292	0	292
WD-9	Upsize Lines from 6" to 8" on Seminary Hill Rd (19,000 LF)	Deficiency	OI	6,729												0	9,043	9,043
WD-10	Upsize Lines from 4" to 8" on Military Rd (2,350 LF)	Deficiency	OI	835												0	1,122	1,122
WD-11	Upsize Lines to 12" and install new 12" loop in Graf Rd area (2,700 LF)	Deficiency	OI	1,149												0	1,544	1,544
WD-12	Upsize Lines from 2" to 10" on Scammon Creek Rd (1,600 LF)	Deficiency	OI	567												0	762	762
WD-13	Upsize Lines from 4" to 8" on Blanchard Rd (3,900 LF)	Deficiency	OI	1,386	1,427											1,427	0	1,427
WD-14	Upsize Lines from 2" to 8" on Blanchard Rd (3,000 LF)	Improve	OI	1,070	1,102											1,102	0	1,102
WD-15	(Number not Used)																	
WD-16	Add 8" on Joppish Rd (5,300 LF)	Deficiency	OI	1,889	1,946											1,946	0	1,946
WD-17	Complete Loop with 12" on Goodrich Rd (4,500 LF)	Growth	Dev	1,905												0	2,560	2,560
WD-18	Add 8" Line to connect to reservoir (1,500 LF)	Growth	Dev	645												0	867	867
WD-19	Upsize Lines from 2" to 6" on High Street (860 LF)	Improve	OI	250												0	336	336
WD-20	Upsize Lines to 6" on Latona, Aurora and Denny (1,260 LF)	Improve	OI	361												0	485	485
WD-21	Upsize Lines from 2" to 6" on Orton Street (1,090 LF)	Improve	OI	314												0	422	422
WD-22	Upsize Lines from 2" to 6" on Buckner (1,550 LF)	Improve	OI	440												0	591	591
WD-23	Add 12" Lines on Blair and 8" lines on Delano and Padrick (9,520 LF)	Growth	Dev	3,688												0	4,956	4,956
WD-24	Add 6" Lines on Delano and Padrick Roads, and 6" and 8" lines in UGA (6,290 LF)	Growth	Dev	2,237												0	3,006	3,006
WD-25	Add 6" Lines off Reynolds (West side of UGA) (4,280 LF)	Growth	Dev	1,196												0	1,607	1,607
WD-26	Add 6" and 8" Lines off Reynolds (East side of UGA) (6,630 LF)	Growth	Dev	2,349												0	3,157	3,157
WD-27	Add 8" Lines in Cooks Hill area (North and West Portions of UGA) (10,000 LF)	Growth	Dev	3,545												0	4,764	4,764
WD-28	Add 8" Lines in Cooks Hill area (South Portions of UGA) (3,000 LF)	Growth	Dev	1,070												0	1,438	1,438
WD-29	Add 6" Lines in Game Farm UGA area (West portion) (10,510 LF)	Growth	Dev	2,915												0	3,917	3,917
WD-30	Add 6" Lines in Game Farm UGA area (South portion) (11,360 LF)	Growth	Dev	3,150												0	4,234	4,234
WD-31	Add 12" Lines (upstream of new Widgeon Hill booster station) (2,100 LF)	Growth	Dev	896												0	1,205	1,205
WD-32	Add 12" Lines (from Widgeon Hill booster station to new reservoir) (3,540 LF)	Growth	Dev	1,497												0	2,012	2,012
WD-33	Add 8" and 12" Lines (Widgeon Hill transmission to South) (5,800 LF)	Growth	Dev	2,316												0	3,112	3,112
WD-34	Add 8" and 12" Lines (Widgeon Hill transmission to East) (8,240 LF)	Growth	Dev	3,292												0	4,424	4,424
WD-35	Widgeon Hill 8" PRV	Growth	Dev	110												0	147	147

Table 13-1. Capital Improvement Program (2022-2042)

Project No.	Description	Purpose of Project [2]	Financing Source[3]	Base Project Cost (2021 Dollars)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	10-yr CIP TOTAL	2033-2042 [4]	20-yr CIP TOTAL
WD-36	Extend 8" Lines on Blanchard (1,740 LF)	Improve	OI	629												0	845	845
WD-37	Cooks Hill 8" PRV	Improve	OI	110												0	147	147
WD-38	Upsize Lines from 10" to 12" on Reynolds and Pearl Street (2,360 LF)	Improve	OI	994												0	1,336	1,336
WD-39	Upsize lines from 4" and 6" to 8" on Spring Lane (1,410 LF)	Improve	OI	504												0	678	678
WD-40	Add 6" Lines on Central Blvd (900 LF)	Growth	Dev	253												0	340	340
WD-41	Add 6" Lines on Roswell Road and upsize 2" to 8" (2,070 LF)	Growth	Dev	582												0	782	782
WD-42	Add 6" Lines South of Summerside (1,750 LF)	Growth	Dev	488												0	656	656
WD-43	Add 6" Lines West of Scammon Creek (890 LF)	Growth	Dev	251												0	338	338
WD-44	Add 6" Lines on Nick Road (840 LF)	Growth	Dev	237												0	318	318
WD-45	Add 8" Lines South of South Street (1,660 LF)	Growth	Dev	598												0	804	804
WD-46	Add 8" Lines on Scott-Johnson Road (680 LF)	Growth	Dev	251												0	338	338
WD-47	Zenkner 8" PRV	Improve	OI	110												0	147	147
WD-48	Upsize lines from 6" to 8" on State, 2" and 4" to 8" on Alvord (5,250 LF)	Improve	OI	2,033												0	2,733	2,733
WD-49	Add 8" lines on Spring Lane (2,430 LF)	Growth	Dev	946												0	1,271	1,271
WD-50	Upsize lines from 6" to 10" on S Scheuber Rd (6,200 LF)	Deficiency	OI	2,217												0	2,979	2,979
WD-51	New 12" loop from Kuper Rd (2,100 LF) and upsize 10" to 12"on Sandra Ave (100 LF)	Deficiency	OI	936	964											964	0	964
WD-52	Upsize lines from 10" to 14" on Industrial Dr (1,000 LF)	Deficiency	OI	426												0	572	572
WD-53	Install new 12" on Gallaher Rd (1,000 LF) and upsize 10" to 14" on Galvin Rd (300 LF)	Deficiency	OI	553												0	744	744
WD-54	Upsize pipes to 6" on E 2nd St and B St (2,300 LF)	Deficiency	OI	663												0	891	891
WD-55	Install new 8" piping on Seiminary Hill Rd and S Baker St (1300 LF)	Deficiency	OI	465												0	625	625
WD-56	Replace 18" Gravity Line Phase 1 (16"; Ham Hill to McAtee; 3,915 LF)	Improve	OI	898	925											925	0	925
WD-57	Replace 18" Gravity Line Phase 2 (8"; McAtee to east; 31,600 LF)	Improve	OI	6,320									8,246			8,246	0	8,246
Water Operations and Management [5]																		
WM-1	Wellhead Protection Plan Updates	O&M	OI	13	14				16				17			47	47	93
WM-2	Water System Plan Updates	O&M	OI	94									164			164	221	385
WM-3	Conservation Plan Implementation	O&M	OI	13	14			15	16			17	17			79	79	157
WM-4	(Number not Used)																	
WM-5	Water Rate Study	O&M	OI	40				45								45	61	106
Total Costs of Water System Improvements				**91,806**	**8,347**	**1,162**	**8,791**	**9,115**	**141**	**114**	**117**	**138**	**8,570**	**128**	**132**	**36,495**	**100,107**	**136,602**

Notes:

(1) Costs are escalated from Base Project Cost (2021 dollars) to stated year of construction, assuming a 3% annual increase in costs.
(2) Purpose of Project: Deficiency = Addresses deficiencies identified in the Water System Plan; Improve = Does not address a deficiency, but improves overall system operation/reliability; Growth = Required to address growth/expansion of the distribution system; O&M = Necessary for proper system maintenance.
(3) Source of Funding: OI = Operating Income; Dev = Developer Funded/Contributed; LT = Long Term Debt.
(4) Total costs associated with projects implemented in 2031 through 2041. Specific years of project implementation are noted where applicable.
(5) One-time O&M expenditures that are covered by O&M funds, not through the capital budget.



\\BEL-SRV03\GIS\DATA\PROJECTS\WASHINGTON\CITY_OF_CENTRALIA_00343T\WSP_UPDATE_102165X\MAP_DOCS\FIGURE13-1_CIP.MXD

CAPITAL IMPROVMENT PROGRAM (2021-2041)
FIGURE 13-1
City of Centralia Water System Plan
September 2022

To account for inflation and the increase of construction costs over time, the base project-level costs have been escalated to their anticipated year of construction. It is impossible to predict accurately the rate at which construction costs will increase over the 2022-2042 period; however, a conventional method to estimate such increases is to examine cost index trends of past years.

The City used the Engineering News Record Construction Cost Index history to determine the appropriate rate of cost increase throughout the planning horizon. The national indices indicate construction costs increased at an annual average of approximately 3% from 2013-2019. The timeframe excludes 2020 due to the potential effects of the COVID-19 pandemic on cost increases. Therefore, 3% annual cost growth was used to determine costs of projects in future years.

Where applicable, design costs are scheduled one year in advance of construction costs, to reflect the phasing typically used for larger projects.

13.1.1 Source and Treatment (WS) Improvements

Borst Park Groundwater Treatment Facility (WS-1, 10-year CIP): This item refers to the development of a new groundwater treatment facility, to be located at Borst Park. Using water rights acquired from TransAlta, this project will involve the rehabilitation of the two existing wells, development of new groundwater wells, and design/construction of a new treatment facility similar in nature to the Tennis Court treatment facility, providing for chlorination, corrosion control (via air stripping), and fluoridation. This will be an on-going project, consisting of many phases, from planning to design and then construction. The project cost included in Table 13-1 is based on preliminary, conceptual-level engineering that was conducted in 2021, and includes costs related to new wells, a treatment facility, connection to the distribution system, and associated design and permitting costs.

13.1.2 Water Reservoir (WR) Improvements

The following improvements consist of new reservoirs. While projects WR-1 through WR-3 would increase reliability and fire flow availability in specific existing areas of the distribution system, they likely will be implemented only when triggered by growth or development pressures in each specific area. This is most certainly true of WR-4, which will not be implemented if the Widgeon Hill area is not developed. As such, all reservoir projects are planned for implementation after the 10-year planning horizon, as growth pressures in these areas are assumed to be minimal during the near term.

Upper Davis Hill Reservoir (WR-1, 20-year CIP): This project consists of the construction of a new 250,000 gallon storage reservoir to serve the Davis Hill pressure zone. The tank will provide an additional level of reliability to the pressure zone, address existing fire flow deficiencies, and support anticipated growth. This improvement is not needed solely to address existing fire flow deficiencies if the pump station upgrade project (WB-2) and associated pipeline projects (WD-4 and WD-5) are implemented. Therefore, it is assumed this project will be implemented only if triggered by growth needs.

Zenkner Hill Reservoir (WR-2, 20-year CIP): This project consists of the construction of a new 175,000 gallon storage reservoir to serve the Zenkner Valley pressure zone. The tank will

provide an additional level of reliability to the pressure zone, and will address existing fire flow deficiencies. This improvement is not needed solely to address existing fire flow deficiencies if the pump station upgrade project (WB-3) and associated pipeline project (WD-7) is implemented.

Upper Seminary Hill Reservoir (WR-3, 20-year CIP): This project consists of the construction of a new 300,000 gallon storage reservoir to serve the Seminary Hill pressure zone. The tank will provide an additional level of reliability to the pressure zone, and will address existing fire flow deficiencies. This improvement is not needed solely to address existing fire flow deficiencies if the pump station upgrade projects (WB-4 and WB-5) and associated pipeline project (WD-9) is implemented, or if it is determined that existing available fire flows are sufficient to meet needs in this area.

Widgeon Hill Reservoir (WR-4, 20-year CIP): This project consists of the construction of a new 325,000 gallon storage reservoir to serve the Widgeon Hill pressure zone. The tank will support anticipated growth in this area that was previously within the City's Urban Growth Area (UGA) area, but which has been recently transferred to the City of Chehalis' water service area.

13.1.3 Water Booster Pump Station (WB) Improvements

The following projects consist of improvements to existing booster pump stations or construction of new pump stations. Similar to the reservoir projects described in the previous section, the implementation of these improvements will likely be triggered by growth or development pressures in their respective portions of the distribution system. As such, they are planned for beyond the 10-year planning horizon.

Cooks Hill Booster Pump Station Upgrade (WB-1, 20-year CIP): This project consists of an upgrade to the existing Cooks Hill pump station. The station will be modified to provide 110 gpm of additional pumping capacity, in order to meet projected 20-year supply deficiencies (as discussed in Section 7.2.3).

Davis Hill Booster Pump Station Upgrade (WB-2, 20-year CIP): This project consists of an upgrade to the existing Davis Hill pump station. The station will be modified to provide 325 gpm of pumping capacity, in order to meet projected 20-year peak hour demand (as discussed in Section 7.2.5) and increase fire flow pumping capacity to 1,000 gpm. If the Upper Davis Hill Reservoir is installed, the peak hour demand deficiencies are eliminated without upgrading the pump station and fire flow is supplied by the reservoir.

Zenkner Valley Booster Pump Station Upgrade (WB-3, 20-year CIP): This project consists of an upgrade to the existing Zenkner Valley pump station. The station will be modified to increase the fire flow pumping capacity. If the Zenkner Hill Reservoir is installed, no improvement is necessary to the pump station as fire flow will be provided by the reservoir.

Seminary Hill Booster Pump Station Upgrade (WB-4, 20-year CIP): This project consists of an upgrade to the existing Seminary Hill pump station. The station will be modified to provide 1,000 gpm of fire flow pumping capacity. If the Upper Seminary Hill reservoir is installed, no improvement is necessary to the pump station as fire flow will be provided by the reservoir.

Gleason Booster Pump Station Upgrade (WB-5, 20-year CIP): This project consists of an upgrade to the existing Gleason pump station. The station will be modified to provide 1,000 gpm

of fire flow pumping capacity. If the Upper Seminary Hill reservoir is installed, no improvement is necessary to the pump station as fire flow will be provided by the reservoir.

Widgeon Hill Booster Pump Station (WB-6, 20-year CIP): This involves construction of a 500 gpm pump station to serve anticipated growth in the Widgeon Hill area. The station will be designed to operate in conjunction with the Widgeon Hill Reservoir (see note above about this area now being in the City of Chehalis UGA).

13.1.4 Water Distribution System (WD) Improvements

Annual Piping Renewal and Replacement (WD-1, 10-year CIP): This item refers to the continuation of the City's existing water main replacement program. The goal of the program is to reduce the City's amount of unaccounted-for water by the replacement of aging and deteriorated pipelines. This program is a component of the City's conservation program, as discussed in Section 4.

Leak Detection (WD-3, 10-year CIP): This consists of annual investigations by leak detection specialists to identify leaks in the water distribution system. This City typically conducts leak detection over a two-three week period each year, with the goal of investigating the entire system every four years. This aids in prioritizing projects in the renewal and replacement program.

Upsize Waterlines on Roanoke St (WD-4, 20-year CIP): This project involves the upsizing of 6" main on Roanoke Street and a 2" between Prairie Rose Street and Roanoke Street with approximately 2,200 LF of 8" pipe to address fire flow deficiencies.

Upsize Waterlines in Davis Hill Zone (WD-5, 20-year CIP): This project involves the upsize of the 6" waterline in Roanoke Street within the Davis Hill zone with approximately 1,500 LF of 8' pipe to address fire flow deficiencies.

Upsize Waterlines on Zenkner Valley Rd (WD-6, 10-year CIP): This project involves increasing the existing unlooped 6" AC waterline on Zenkner Valley Road from Pearl St to Northridge Dr with approximately 1,900 LF of 8" pipe to address fire flow deficiencies.

Complete Loop in Zenkner Valley Zone (WD-7, 10-year CIP): This project creates a loop between Zenkner Valley Road and Northridge Drive with approximately 500 LF of 6" pipe to address fire flow deficiencies.

Upsize Waterlines on Logan, Yakima, and Madrona (WD-8, 10-year CIP): This project increases the existing 4" waterline on Logan Street with approximately 800 LF of 8" pipe to address fire flow deficiencies.

Upsize Waterlines on Seminary Hill Road (WD-9, 20-year CIP): This project increases the existing 6" waterline on Seminary Hill Road in the Seminary Hill zone with approximately 19,000 LF of 8" pipe to address fire flow deficiencies.

Upsize Waterlines on Military Road (WD-10, 20-year CIP): This project increases the existing 4" waterline on Military Road with approximately 2,350 LF of 8" pipe to address fire flow deficiencies.

Upsize Waterlines on Graf Road (WD-11, 20-year CIP): To address fire flow deficiencies, this project upsizes 200 LF of 6" AC pipe on Scheuber Rd north of the Graf Rd intersection to 12" pipe. The project also upsizes 1,100 LF of 4" AC pipe on Graf Rd to 12" pipe. The project also extends the Graf Rd piping to tie in with piping on Scammon Creek Rd by adding 1,400 LF of new 12" pipe.

Upsize Waterlines on Scammon Creek Road (WD-12, 20-year CIP): This project increases the existing 2" waterline on Scammon Creek Road with approximately 1,600 LF of 10" pipe to address fire flow deficiencies.

Upsize Waterlines on Blanchard Road (WD-13, 10-year CIP): This project increases the existing 4" waterline on Blanchard Road with approximately 3,900 LF of 8" pipe to address fire flow deficiencies.

Upsize Waterlines on Blanchard Road (WD-14, 10-year CIP): This project increases the existing 2" waterline continuing west on Blanchard Road with approximately 3,000 LF of 8" pipe.

8" Waterline on Joppish Road (WD-16, 10-year CIP): This project installs approximately 5,300 LF of 8" waterline on Joppish Road to create a loop to River Heights Road and increase fire flow in the Cooks Hill zone.

Create Loop on Goodrich Road (WD-17, 20-year CIP): This project installs approximately 4,500 LF of 12" waterline from Harrison Avenue along Goodrich Road to create a loop to a dead end 6" waterline to allow for future growth.

Upper Davis Hill Reservoir 8" waterline Connection (WD-18, 20-year CIP): This project installs approximately 1,500 LF of 8" waterline in the Davis Hill zone to connect to the Upper Davis Hill Reservoir.

Upsize Small Diameter Waterlines in Central Part of City (WD-19 through WD-22, 20-year CIP): These projects increase small diameter piping in the central part of the City with 6" waterlines.

New Pipes to Serve Growth in Northern Part of City (WD-23 through WD-26, 20-year CIP): These projects involve the construction of new distribution mains in the northern portion of the City to extend water service to newly developed areas.

New Pipes to Serve Growth in Cooks Hill Area (WD-27 through WD-30, 20-year CIP): These projects involve the construction of new distribution mains to extend water service to newly developed areas in the Cooks Hill pressure zone as well as the Game Farm area (i.e., near the high school).

New Pipes to Serve Growth in Widgeon Hill Area (WD-31 through WD-34, 20-year CIP): These projects involve the construction of new distribution mains in and around the Widgeon Hill pressure zone to extend water service to areas of potential new development.

Widgeon Hill PRV (WD-35, 20-year CIP): This project involves the construction of a pressure reducing valve (PRV) to allow water from the Widgeon Hill pressure zone to flow into the Central Zone, to aid in maintaining pressures (i.e., during fire fighting or other high flow events).

8" Waterline on Blanchard Road (WD-36, 20-year CIP): This project installs approximately 1,750 LF of 8" waterline on Blanchard Road to create a connection to the existing waterline on Blanchard for the installation of the Cooks Hill PRV (WD-37).

Cooks Hill PRV (WD-37, 20-year CIP): This project involves the construction of a PRV to allow water from the Cooks Hill pressure zone to flow into the Central Zone, to aid in maintaining pressures (i.e., during fire fighting or other high flow events). The PRV station should be located at an elevation below the highest service connections in the Central Zone along Blanchard Road to allow these high elevation (low pressure) connections to shift to the Cooks Hill Zone.

New and Upsized Pipes to Serve Growth throughout the City (WD-38 through WD-46 and WD-49, 20-year CIP): These projects involve the upsizing of some existing lines and construction of new distribution mains in various areas to be developed throughout the Central pressure zone.

Zenkner Hill PRV (WD-47, 20-year CIP): This project involves the construction of a PRV to allow water from the Zenkner Valley pressure zone to flow into the Central Zone, to aid in maintaining pressures (i.e., during fire fighting or other high flow events). This project should only be completed if the Zenkner Hill Reservoir (WR-2) is completed.

Address Fire Flow Deficiencies on State and Alvord Streets (WD-48, 20-year CIP): This project involves the upsizing of distribution mains in State and Alvord Streets to address fire flow requirements.

Address Fire Flow Deficiencies on S Scheuber Rd (WD-50, 20-year CIP): This project involves the upsizing of the existing 6" PVC distribution main on S Scheuber Rd south of the Graf Rd intersection with 6,200 LF of 10" pipe to allow for fire flow goals to be reached for the full stretch of piping along S Scheuber Rd.

Port of Centralia Park II Fire Flow Improvements (WD-51, 10-year CIP): The current available fire flow for the Port of Centralia Park II is approximately 3,500 gpm but has a fire flow goal of 5,000 gpm. This project includes several distribution improvements to reach the fire flow goal for the area.

- Extend the waterline on Robert Thompson Rd to the east and then south to Kuper Rd with 2,100 LF of 12" pipe to create a loop to feed the Port of Centralia Park II.
- Upsize approximately 100 LF of 10" CI pipe on Sandra Ave just north of the intersection with Ives Rd with 12" to eliminate a bottleneck of 10" pipe.
- Adjust the PRV settings of the Eshom Rd PRV (located at the intersection of Eshom Rd and Galvin Rd) with a 100 psi setting.

Industrial Drive Fire Flow Improvements (WD-52, 20-year CIP): The current available fire flow for the Industrial Dr area is approximately 3,000 gpm but has a fire flow goal of 5,000 gpm. This project upsizes the existing 10" CI pipe (1,000 LF) on Industrial Dr to 14" to reach the fire flow goal for the area.

Galvin Rd Industrial Area Fire Flow Improvements (WD-53, 20-year CIP): The current available fire flow for the industrial area along Galvin Rd is approximately 2,500 gpm but has a fire flow goal of 5,000 gpm. This project adds approximately 1,000 LF of 12" along Gallaher Rd

between Galvin Rd and Northpark Dr to create a new pipe loop. The project also upsizes 300 LF of 10" DI with 14" on Galvin Rd between Steelhamer Ln and Eshom Rd to remove a bottleneck in the system.

Address Fire Flow Deficiency on B Street (WD-54, 20-year CIP): This project would upsize the existing 6" CI and 2" GI pipe on E 2nd St from N Tower Ave to B St, and the existing 2" PVC, 6" CI, and 4" AC pipe on B St from E 2nd St to E 6th St with 2,300 LF of 6" pipe to improve fire flows.

Address Low Pressure Area around Baker Street (WD-55, 20-year CIP): This project would shift a portion of the Central zone to the Seminary Hill zone along Baker Street and Seminary Hill Road that currently experience low pressures and limit available fire flow to the rest of the Central zone. This would be done by installing approximately 1,300 LF of 8" from the discharge side of the Seminary Hill Pump Station along Seminary Hill Road and Baker Street.

Replace 18" Gravity Main from Ham Hill to McAtee – Phase 1 (WD-56, 10-year CIP): This project will replace approximately 3,915 linear feet of existing 18-inch water main with 16-inch pipe from Ham Hill Road to McAtee Road, abandon an existing water main, and install valves and two fire hydrants. The existing water main is old and prone to leaks. Due to the location of the line it is difficult to find and repair the leaks. Replacing the line using pipe bursting technology allows the City to replace the main without excavating on steep hillsides, private property and the China Creek Phase 1 property. This method saves time, money and reduces construction impacts to area residents. The addition of two fire hydrants improves fire protection for area residents.

Replace 18" Gravity Main from Ham Hill to McAtee – Phase 2 (WD-57, 10-year CIP): This project will replace approximately 31,600 linear feet of existing 18-inch water main with 8-inch pipe from McAtee Road to the east. The City will replace the difficult to access and wetland sections as a matter of priority, then replace the remaining pipes in multiple stages.

13.2 Operational and Management Improvements

Operational and management (O&M) improvements are listed in Table 13-1 and are summarized below. These represent one-time O&M expenditures that are paid for through O&M funds, not through the capital budget.

Wellhead Protection Plan Updates (WM-1): This item refers to the periodic updates and implementation actions associated with the wellhead protection plan (e.g., updates to the inventory of potential contaminant sources). Budget is provided every four years to address this need.

Water System Plan Updates (WM-2): This consists of the periodic (i.e., every ten years) update to the water system plan.

Conservation Plan Implementation (WM-3): This includes annual costs associated with implementation of the conservation plan. This covers items such as public education (e.g., mailed and distributed brochures), consumer assistance, etc. Other, more costly conservation activities are considered separately, such as annual pipeline renewal and replacement (WD-1) and leak detection (WD-3).

Water Rate Study (WM-5): This item refers to periodic rate studies. For budgeting purposes, it is assumed a rate study is conducted once every 5-10 years.

14. Financial Plan

14.1 Introduction

The effective implementation of a Water System Plan (WSP) is dependent upon accurately developing a document that can be financially supported by the utility, will meet State and local regulatory requirements, and provides the flexibility to deal with unforeseen changes. Requirements from the Department of Health (DOH) are outlined in WAC 246-290-654, which include:

(j) Financial program, including demonstration of financial viability by providing:

(i) A summary of past income and expenses;

(ii) A one-year balanced operational budget for systems serving one thousand or more connections or six-year balanced operations budge for systems serving less than one thousand connections;

(iii) A plan for collecting the revenue necessary to maintain cashflow stability and to fund the capital improvement program and emergency improvements; and

(iv) An evaluation that has considered:

a. The affordability of water rates; and

b. The feasibility of adopting and implementing a rate structure that encourages water demand efficiency.

The discussion below presents elements of this WSP which address each of these issues. It is important to note that the financial plan presented herein is an overview of the water system financial position.

A crucial component of the review is how the water system Capital Improvement Plan (CIP) will be reflected in the analysis. Identifying both the cost and timing of CIP projects to be pursued, as well as how they will be funded (Bonds, Grants, Rate Revenue, Loans and/or combinations of each), can significantly impact the water utility's rate revenue requirement.

Based on how these projects are approached from a financial perspective, the review takes an in-depth look at financial performance measures such as the debt service coverage ratio, as well as any existing obligations to fund reserves or renewal and replacements.

This chapter also projects the utility's financial position over time to gauge the relative merits or consequences of specific CIP financing strategies. Monitoring actual changes in financial performance over time will also help indicate when and where actions may be needed to maintain or improve the utility's financial health throughout the process.

The City completed a rate study in 2019. The rate study was used as a basis for developing the financial forecast for this chapter along with the City's updated budget.

14.2 Past Period Financial History

The past five years of financial information for the water utility (Table 14-1) were examined to gain an understanding of the past performance of the utility, and at the same time, gain perspective on its current financial status.

Table 14-1. Historical Revenues and Expenses FY 2015-2019 ($1,000s)

Account Name	2015 Actual	2016 Actual	2017 Actual	2018 Actual	2019 Actual
Operating Revenue					
Charges for Services	$5,095	$5,039	$5,189	$5,431	$5,597
Interest Earnings	11	29	46	134	164
Interfund Loan Repayment	75	225	0	0	0
Capital Facility Charges	96	151	257	220	218
Miscellaneous	37	21	173	34	935
Total Operating Revenue	$5,314	$5,465	$5,664	$5,819	$6,914
Operating Expenses					
Salaries	$1,212	$1,220	$1,318	$1,257	$1,286
Benefits	577	535	580	585	607
Supplies	257	228	215	231	220
Other Services & Charges	687	812	797	941	956
Intergovernmental	0	5	5	33	0
Interfund	741	733	759	791	812
Total Operating Expenses	$3,474	$3,532	$3,674	$3,838	$3,881
Debt Service					
Debt Principal	$440	$435	$436	$436	$379
Debt Interest & Amortization	44	39	33	28	22
Total Debt Service	$484	$475	$469	$463	$402
Capital Outlay					
Total Capital Outlay	$1,290	$881	$1,339	$1,230	$1,596
Fund Balance Used	$0	$0	$0	$0	$0
Operating Revenues Less Expenses, Debt, & Capital Outlay	**$66**	**$578**	**$182**	**$287**	**$1,035**

As can be seen from Table 14-1, the City has been able to fund both O&M and capital costs with rate revenue. During the FY 2015 through FY 2019 period, the City's capital costs have averaged $1.3 million per year. The amount of revenue remaining after all costs is largely dependent on the level of capital spending that year. Excess revenue remaining at the end of the year are held in reserve to be used for future capital needs. The City has a policy to increase their water rates at inflationary levels on an annual basis.

14.3 Development of the Financial Plan

The development of the six-year financial plan is intended to demonstrate the City's ability to meet its capital improvement needs, while maintaining sufficient rate levels to support those needs. The financial plan was developed to review the projected revenues and expenses of the

water system for Fiscal Years (FY) 2022-2032. The City's FY 2020 water system budget was used as a starting point. Cost projections for future years were obtained by applying annual escalation factors to the City's 2020 budget in addition to the capital plan proposed in this WSP. The escalation factors used to project the financials were obtained from the 2019 rate study.

14.3.1 Water Utility Revenues

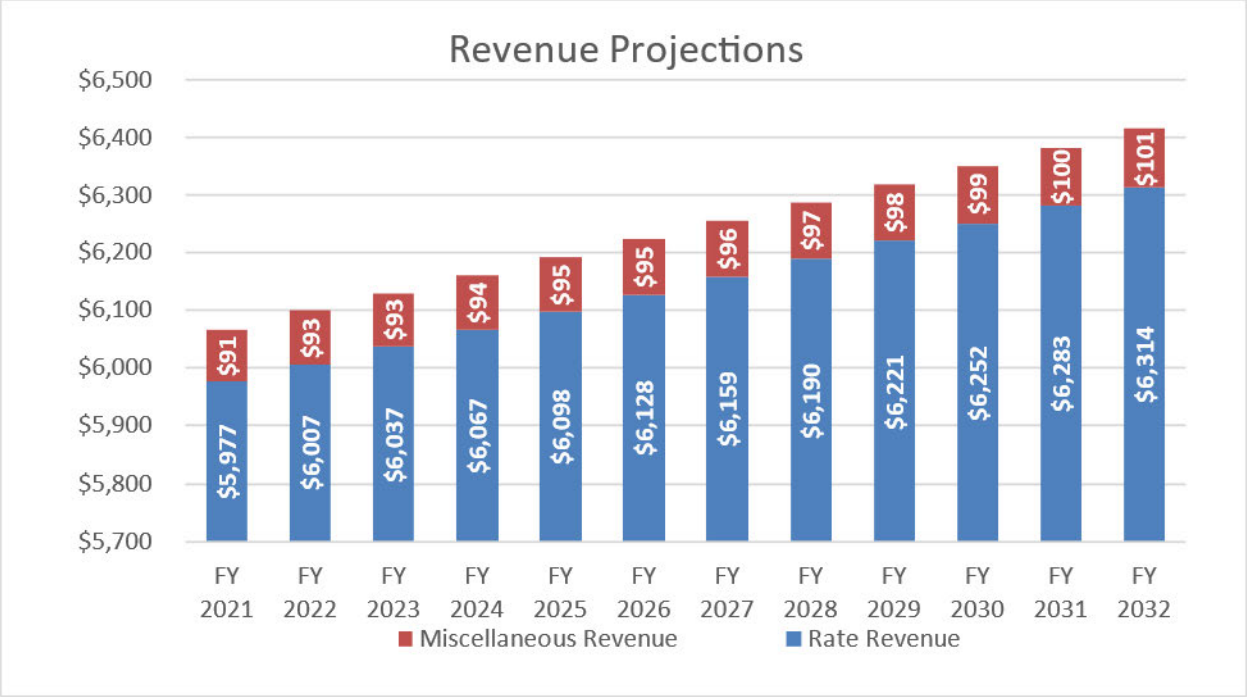
The first component of the financial plan reviews the revenues of the water system. There are two primary types of revenues received from operations: rate revenues and miscellaneous revenues. Rate revenues are projected to be $5,977,234 in FY 2020. While the demand forecast in Chapter 3 of this WSP uses a growth rate of approximately 1.76 percent for residential customer categories, the financial plan assumes revenue growth from water rates will be lower than this, at 0.5% (see Table 14-2). Using the lower growth rate was consistent with the 2019 rate study and it is generally a good approach when forecasting revenue to be conservative with revenue estimates.

Table 14-2. Escalation Factors

	Budget	Projected		
	FY 2020	FY 2021	FY 2022	FY 2023 Through 2032
Revenues:				
Customer Growth	Budget	0.50%	0.50%	0.50%
Expenses:				
Labor	Budget	3.50%	3.50%	2.25%
Benefits	Budget	7.50%	7.50%	7.50%
General Inflation	Budget	2.00%	2.00%	2.00%
Interest:	1.00%	1.00%	1.00%	1.00%
New Debt Service:				
Low Interest Loan				
Term in Years	20	20	20	20
Rate	1.58%	1.58%	1.58%	1.58%
Issuance Cost	1.00%	1.00%	1.00%	1.00%

With these assumed growth rates, rate revenues are anticipated to increase to approximately $6,314,325 by FY 2032. The City also receives several types of Other Miscellaneous revenue such as investment interest, customer penalties, and other non-water sales. Miscellaneous revenues total $90,000 in FY 2020 and increase to approximately $100,000 in FY 2032. Total revenues available to offset the operating and capital needs of the water system total $5,967,285 in FY 2020, increasing to $6,414,908 by FY 2032.

Figure 14-1. Revenue Projections



14.3.2 Water Utility Expenses

The second part of the financial plan is a review of the expenses of the utility. These include operating & maintenance expenses, capital outlays funded from rates, taxes/transfer payments, and debt service. These items are summarized below.

Operation & Maintenance Expenses. The FY 2020 budget was used as a starting point for the O&M expenses of the water system. O&M expenses were categorized into salaries, benefits, supplies, and other services and charges. Annual escalation factors (Table 14-2) were applied to the FY 2020 costs to obtain projected costs. It should be noted that no extraordinary costs were assumed as part of the projected costs. O&M expenses begin at $3,796,356 in FY 2020 and are projected to rise to $5,812,695 in FY 2032.

Capital Improvement Projects from Rates. Capital improvement projects are related to the infrastructure of the water utility. Capital improvement projects are of an ongoing basis and are generally divided into three types or categories. These categories are capital improvements which are related to renewal and replacements, growth related facilities, and regulatory related improvements. Renewal and replacements are, as the name suggests, the replacement of existing and worn out (depreciated) facilities. Growth related facilities, on the other hand, are those related to system expansion, system upgrades and new customers. Regulatory improvements are those mandated by State or Federal agencies for items like water quality.

One goal of the analysis developed herein is to generally fund capital projects from rates in an amount equal to or greater than the annual depreciation expense for the water utility. Depreciation expense was $747,000 per the 2018 financial statement. The City has been funding an average of $1.26 million per year from current rate revenue exceeding the 2018 annual depreciation of $747,000. It should be noted that depreciation expense will not cover the cost of renewal and replacement of existing infrastructure due to the impacts of inflation.

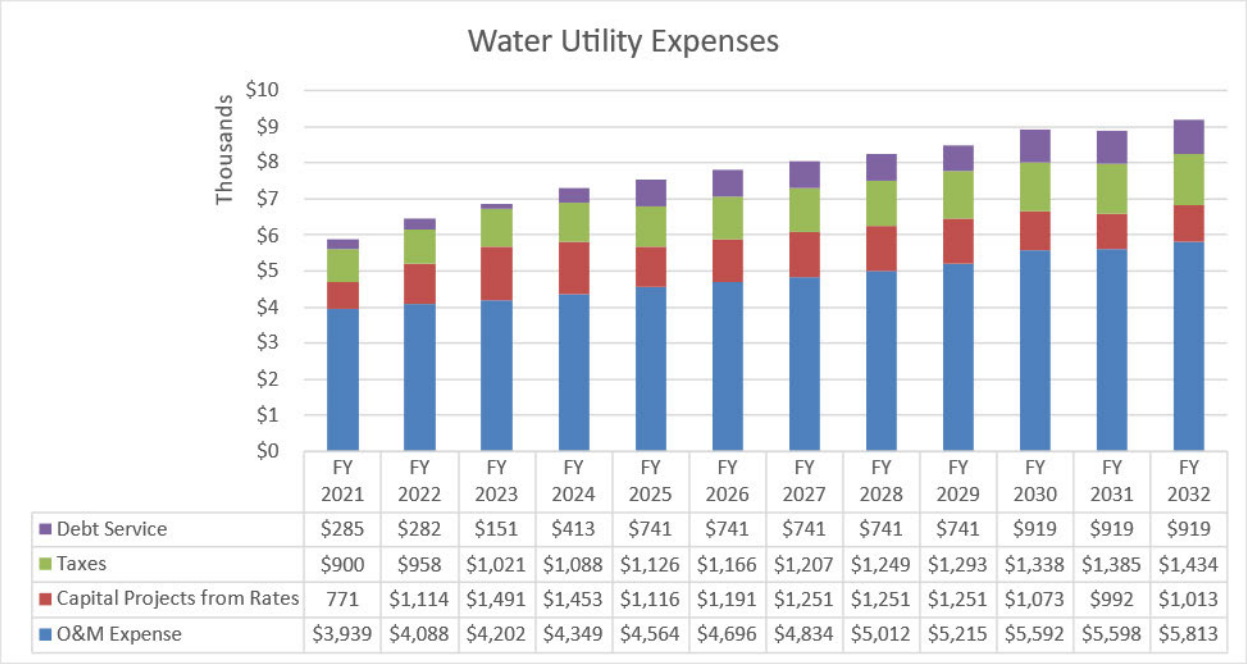
The capital projects outlined in Section 13 of this WSP document are incorporated as a part of this financial plan (see Table 14-3). Capital project costs for the six-year period 2021-2026 range from $93,000 to $9.1 million per year. The funding for these projects is provided from a combination of rate revenue, capital facility charges, and new debt beginning in 2024

Taxes. The water system has two tax obligations. First, the state utility excise tax is calculated as 5.029% of the rate revenues of the utility. Second, interfund taxes are calculated as 10% of the rate revenue. Total taxes for the time period range from $867,000 in FY 2020 to $1,464,044 in FY 2030. The projected tax payments for the period assumes no tax rate change over time.

Debt Service. There are currently three outstanding debt issues related to the water system. One issue is from the Washington State Drinking Water Revolving Fund (SRF) and two are from the Washington State Public Works Trust Fund (PWTF). The total debt obligations for all three loans combined are approximately $400,000 in FY 2020. Each of the debt issues currently outstanding are set to mature during the analysis period. The PWTF loan is scheduled to mature in FY 2022 while the remaining two SRF loans are scheduled to mature in FY 2023 and FY 2024.

Low interest loans totaling $15 million in FY 2024, $5 million, FY 2025 for $7.5 million and $3 million in FY 2030 (see Table 14-3). An interest rate of 1.58 percent, 1 percent issuance fee and term of 20 years was assumed for the projected low interest loan.

Figure 14-2. Water Utility Expenses



	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
Debt Service	$285	$282	$151	$413	$741	$741	$741	$741	$741	$919	$919	$919
Taxes	$900	$958	$1,021	$1,088	$1,126	$1,166	$1,207	$1,249	$1,293	$1,338	$1,385	$1,434
Capital Projects from Rates	771	$1,114	$1,491	$1,453	$1,116	$1,191	$1,251	$1,251	$1,251	$1,073	$992	$1,013
O&M Expense	$3,939	$4,088	$4,202	$4,349	$4,564	$4,696	$4,834	$5,012	$5,215	$5,592	$5,598	$5,813

Table 14-3. Summary of Capital Construction Fund ($1,000s)

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
Beginning Fund Balance	$7,086	$8,316	$9,187	$2,185	$2,654	$464	$155	$1,399	$2,749	$4,170	$5,648	$1,571	$3,023
Plus:													
Rate Funded System Reinvestment	3,812	771	1,114	1,491	1,453	1,116	1,191	1,251	1,251	1,251	1,073	992	1,013
Grants	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest Income	0	83	92	22	27	5	2	14	27	42	56	16	30
Total Beginning Fund Balance	**$10,898**	**$9,170**	**$10,393**	**$3,698**	**$4,133**	**$1,584**	**$1,348**	**$2,663**	**$4,027**	**$5,462**	**$6,778**	**$2,578**	**$4,066**
Less: Capital Projects													
Budgeted Capital Projects	2,582	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water Supply	0	0	721	1,061	8,687	8,948	0	0	0	0	0	0	0
Water Storage	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Pump Stations	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Distribution System	0	93	7,600	102	105	108	111	114	118	121	8,371	129	133
Total Capital Outlays	**$2,582**	**$93**	**$8,321**	**$1,162**	**$8,792**	**$9,056**	**$111**	**$114**	**$118**	**$121**	**$8,371**	**$129**	**$133**
Plus: Outside Funding Sources													
Excess Operational Fund Balance	$0	$0	$0	$1	$1	$1	$31	$65	$121	$163	$14	$418	$423
Capital Facility Charges	0	110	114	118	122	126	130	135	140	145	150	155	160
Revenue Bond Proceeds	0	0	0	0	0	0	0	0	0	0	0	0	0
New Low-Interest Loan Proceeds	0	0	0	0	5,000	7,500	0	0	0	0	3,000	0	0
Total Outside Funding Sources	0	110	114	119	5,123	7,627	161	199	261	307	3,164	573	583
Ending Fund Balance	**$8,316**	**$9,187**	**$2,185**	**$2,654**	**$464**	**$155**	**$1,399**	**$2,749**	**$4,170**	**$5,648**	**$1,571**	**$3,023**	**$4,517**

The capital improvement financing plan above assume that all the projects outlined in the master plan will be completed. The major funding sources for the capital projects are assumed to be a combination of rates, Capital Facility Charges (CFCs) and low-interest loans. It is helpful that the City's current debt is set to mature within the analysis period rather than issuing new debt on top of existing debt service. A result of using revenue bonds and low interest loans for financing purposes will be an increase in debt service which will have a direct impact on rates because the level of new debt exceeds the amount of debt that is scheduled to mature. This combination of financing capital is appropriate and prudent for purposes of reviewing the financial/rate viability of the proposed plan. It should be noted that the City has other funding sources available for capital improvements such as grants and loan programs. These other funding sources are discussed in more detail below.

It should be noted that the City has significant capital improvement projects outside of the time period reviewed. It is important during the development of rates that these future projects be included in the rate setting discussion as they can have significant impacts.

14.3.3 External Sources of Funds

There are outside agency grants and loan funding programs that can be used to fund a portion of the City's Capital Improvement Plan (CIP). The City has in the past been effective at securing these grant and loan funds and should continue to closely monitor future opportunities to obtain these potential funding sources which allow the City to minimize rate impacts. It is important to note that these sources rarely provide full funding of a construction project. The City will need to supplement these funds with other sources of revenue to ensure that implementation of the recommended capital improvement projects occurs. Provided below is a summary of potential funding sources that may be applicable to the City's upcoming capital improvement projects.

- Drinking Water State Revolving Fund
- Public Works Trust Fund
- Rural Development
- Water Infrastructure Finance and Innovation Act
- Other External Funding Sources

A brief description of these funding sources is provided below.

Drinking Water State Revolving Fund (DWSRF). DOH manages these funds. Under the reauthorized Safe Drinking Water Act (SDWA), funding is appropriated to states to develop their Drinking Water State Revolving Fund (DWSRF) loan programs. Each state receives annual allocations in the form of a Capitalization Grant. DWSRF loans are available to all community public water systems, and non-profit, non-community public water systems, except federally owned and state-owned systems. Loans are provided to water systems for capital improvements that increase public health protection and compliance with regulations. Additionally, loans are intended to protect the health of the people of Washington by ensuring safe and reliable drinking water.

Loans ranked and awarded to communities based on an established scoring criterion. As of 2014 US steel and iron products are required for projects fully or partially funded by the DWSRF. Loans must focus on construction and address a single identified problem or need. If multiple areas are applicable and in need of funding separate loan applications must be submitted. A few notable ineligible projects and activities include projects that focus on future population growth and water systems expansion and purchase of water rights.

Subsidized loans are granted to communities based on affordability determined by an affordability index based on the community's median household income and the water systems water rates. Subsidized loans are awarded based on available funds with a maximum subsidy of 50% principal forgiveness.

The interest rates of the loan are generally 1.0 to 1.5 percent based on a community affordability index calculation. Non-subsidized loans are also assessed a 1.0 percent loan fee. interest rate, with a 1.0 percent loan fee, for a term of up to 20 years and a maximum of $5 million. No local match is necessary for the loan.

Public Works Board Loan (Public Works Trust Fund). The Public Works Board (PWB) Loan program is a loan program set up by the Legislature to assist cities, towns, counties, or special districts with funding for different types of public works projects. The program is administered by the Washington State Department of Commerce. Eligible projects include repair, replacement or creation of domestic water systems, sanitary sewer systems storm water sewer systems roads, streets, solid waste and recycling facilities and bridges. Eligible project must meet policy objectives which include:

- Efficient use of State Resources
- Preservation and enhancement of health and safety
- Abatement of pollution and protection of the environment
- Creation of new, family wage jobs, and avoidance of shifting existing jobs from one Washington State community to another
- Foster economic development
- Efficiency in delivery of goods and services transportation
- Reduce the overall cost of public infrastructure.

There are three types of loans available, construction, pre-construction and emergency. Projects are awarded based on a scoring method that is then ranked against all other applicants. PWB Loans are awarded to communities by scoring applications based on a set of predetermined criteria then funding the highest scores until budgeted funds are exhausted.

The maximum loans per biennial budget are $10 million for construction, $1 million for both pre-construction and emergency loans. The terms are variable based on need but can range from 1 to 20 years for construction and emergency loans and a maximum of 5 years for pre-construction loans. No local match is required for PWBL loans. Debt service coverage is not imposed on the PWBL loan. The interest rates for non-distressed communities are established by multiplying the average of 11 general obligation bond index rates by 50%.

Communities that are determined to be distressed, as measured by an affordability index similar to the DWSRF, may receive loan forgiveness of up to 5% of principal for construction loans.

U.S. Department of Agriculture, Rural Development (RD). Loan monies are available to rural areas with less than 10,000 population. This program is funded RD for the preliminary engineering, design, construction, and start-up of new water system facility projects. The application process allows for a thorough review of the engineering, environmental, and financial impacts of proposed projects before extending a loan offer. The RD loan program offers interest rates lower than municipal bonds and up to a 40-year term. The RD loan program requires some form of interim financing, as loan monies are made available after completion of the construction activity.

U.S. Environmental Protection Agency, Water Infrastructure Finance and Innovation Act (WIFIA). The program is eligible for a broad range of water and wastewater infrastructure projects. Interest rates are set at U.S. Treasury rates and can be financed over a maximum of 35 years from substantial completion of the project. The program is limited to a minimum of $20 million for large communities and $5 million for communities with a population less than 25,000. A key limitation to the program is that the loan amount cannot exceed 49 percent (%) of the total project costs and the project cannot exceed 80 percent (%) of federal funding.

Provided below are additional funding sources available to the City for funding capital improvements.

Other External Funding Sources

Revenue Bonds. Revenue bonds are another external source of funding for capital projects. The sale of revenue bonds is the most common source of funds for construction of major utility improvements. Water rate revenue and charges are the main source of funds for debt service (principal and interest) payments. A key benefit of revenue bonds is the exemption of federal income tax.

A determination of the utility's ability to repay debt is an important consideration. A debt service coverage ratio (total revenue, less O&M and tax expenses, divided by the debt service payments requiring a coverage ratio) is calculated and the utility's finances are reviewed in order to verify debt payments will be feasible. Coverage ratios of 1.25 (25 percent more than the debt payment) are typical, but coverage of 1.5 is a more prudent financial target for financial planning purposes.

Utility Local Improvement Districts/Special Assessment Districts. Similar to revenue bonds, other bond financing approaches include utility local improvement districts (ULIDs), special assessment districts (SADs) and other funding for projects that serve and benefit a limited service area within the City's total service area. The costs of those improvements are shared only by those customers benefiting from those improvements.

Developer Contributions. Some projects are identified in the capital improvement program with an expectation to be funded through developer projects. Where possible, the City attempts to leverage development related projects to lower costs of City funded capital projects.

While the above list of possible funding opportunities for the City is not exhaustive, it does highlight the most probable outside funding sources available to the City for its capital

improvement program. Provided below is a summary of a key resource that may be helpful for the City to identify possible funding opportunities.

Infrastructure Assistance Coordinating Council. One key resource in identifying other funding programs is the Infrastructure Assistance Coordinating Council (Council). The Council is a non-profit organization comprised of state and local agencies whose function is to provide assistance in securing funding for infrastructure repair and development. The purpose of the Council is to assist local governments in coordinating funding efforts for infrastructure improvements. This is an important resource as the Council will be aware of any new funding opportunities that may arise.

14.4 Summary of the Financial Projections

A summary of the financial plan and resulting financial status of the water system is provided in Table 14-4. This is an abbreviated summary of the detailed analysis that was developed for the City, summarizing the major elements of the City's analysis, along with its findings.

As can be seen from Table 14-4, in order for the City to fund the full capital plan (as detailed in Table 14-3), new low interest loans and rate adjustments will be required. The plan shown in Table 14-4 uses potential additional rate adjustments of 6 percent (%) for FY 2022 through FY 2024 and 3 percent (%) per year thereafter. The rate adjustments shown are cumulative in each year. Therefore, the total cumulative adjustment required to rates over the six-year period is projected to be 26.08 percent (%).

Two additional indicators of financial viability are reserve levels and debt service coverage ratios. As can be seen in Table 14-4, the debt service coverage ratio is currently 4.53. This indicates strong financial results and will remain above 2.70 during the analysis period after rate adjustments are incorporated.

Table 14-5 shows that the minimum balance for the working capital reserve is 60 days of O&M expenses and taxes. This equates to a minimum reserve of $792,000 in FY 2020, rising to $1,112,000 in FY 2032. The working capital reserve target is projected to be met in all years of the forecast period.

Table 14-4. Summary of the Revenue Requirements FY 2020 to 2032 ($1,000s)

	Budget	Projected											
	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
Revenue													
Rate Revenue	$5,877	$5,977	$6,007	$6,037	$6,067	$6,098	$6,128	$6,159	$6,190	$6,221	$6,252	$6,283	$6,314
Miscellaneous Revenue	90	91	93	93	94	95	95	96	97	98	99	100	101
Total Sources of Funds	**$5,967**	**$6,068**	**$6,100**	**$6,131**	**$6,161**	**$6,192**	**$6,224**	**$6,255**	**$6,287**	**$6,318**	**$6,350**	**$6,383**	**$6,415**
Expenses													
O&M Expenses	$3,796	$3,926	$4,060	$4,202	$4,349	$4,503	$4,665	$4,834	$5,012	$5,198	$5,393	$5,598	$5,813
Additional O&M to Support CIP	156	13	28	0	0	60	31	0	0	17	199	0	0
Capital Outlays from Rates	393	771	1,114	1,491	1,453	1,116	1,191	1,251	1,251	1,251	1,073	992	1,013
Taxes	867	900	958	1,021	1,088	1,126	1,166	1,207	1,249	1,293	1,338	1,385	1,434
Debt Service	288	285	282	151	117	0	0	0	0	0	0	0	0
New Debt Service	0	0	0	0	296	741	741	741	741	741	919	919	919
Total Revenue Requirements	**$5,501**	**$5,894**	**$6,443**	**$6,865**	**$7,303**	**$7,547**	**$7,794**	**$8,033**	**$8,253**	**$8,499**	**$8,922**	**$8,894**	**$9,179**
Balance/(Deficiency) of Funds	**$466**	**$174**	**($343)**	**($734)**	**($1,142)**	**($1,354)**	**($1,570)**	**($1,778)**	**($1,966)**	**($2,181)**	**($2,572)**	**($2,511)**	**($2,764)**
Total + / (-) as a % of Rates	**-7.9%**	**-2.9%**	**5.7%**	**12.2%**	**18.8%**	**22.2%**	**25.6%**	**28.9%**	**31.8%**	**35.1%**	**41.1%**	**40.0%**	**43.8%**
Proposed Rate Adjustment		**0.0%(1)**	**6.0%**	**6.0%**	**6.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**
Additional Revenue / Rate Adjustment		**$0**	**$360**	**$746**	**$1,159**	**$1,383**	**$1,615**	**$1,857**	**$2,108**	**$2,368**	**$2,639**	**$2,920**	**$3,212**
Net Balance/(Deficiency) of Funds	**$466**	**$174**	**$17**	**$12**	**$17**	**$28**	**$45**	**$79**	**$142**	**$187**	**$67**	**$409**	**$448**
Additional Rate Adjustment After Proposed	**-7.9%**	**-2.9%**	**-0.3%**	**-0.2%**	**-0.3%**	**-0.5%**	**-0.7%**	**-1.3%**	**-2.3%**	**-3.0%**	**-1.1%**	**-6.5%**	**-7.1%**
Average Residential Bill Comparison													
After Proposed Rate Adjustment	$58.37	$59.03	$62.57	$66.33	$70.31	$72.41	$74.59	$76.82	$79.13	$81.50	$83.95	$86.47	$89.06
Monthly Bill Difference	$0.00	$0.66	$3.54	$3.75	$3.98	$2.11	$2.17	$2.24	$2.30	$2.37	$2.45	$2.52	$2.59
Cumulative Bill Difference	$0.00	$0.66	$4.20	$7.96	$11.94	$14.04	$16.22	$18.45	$20.76	$23.13	$25.58	$28.10	$30.69
Debt Service Coverage Ratio - All Debt													
Before Rate Increase	4.53	4.36	3.83	6.01	1.75	0.76	0.53	0.29	0.03	-0.23	-0.41	-0.65	-0.91
After Proposed Rate Increase	4.53	4.36	5.11	10.94	4.56	2.62	2.71	2.79	2.88	2.96	2.46	2.52	2.59

(1) FY 2021 is a scheduled consumer price index adjustment (CPI) of 1.13%, no additional adjustment proposed.

Table 14-5. Summary of Reserves FY 2020 to FY 2032 ($1,000)

	Budget	Projected											
	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032
Operating Reserve													
Beginning Reserve Fund Balance	$608	$615	$795	$821	$840	$865	$901	$924	$947	$977	$1,011	$1,074	$1,076
Plus: Balance of Funds	8,603	180	25	20	26	37	54	88	151	197	77	420	459
less: Transfer of Surplus to Capital Fund	(8,596)	(0)	(0)	(1)	(1)	(1)	(31)	(65)	(121)	(163)	(14)	(418)	(423)
Ending Fund Balance	**$615**	**$795**	**$821**	**$840**	**$865**	**$901**	**$924**	**$947**	**$977**	**$1,011**	**$1,074**	**$1,076**	**$1,112**
Minimum 60 Days (O&M + Transfers)	***$792***	***$795***	***$821***	***$840***	***$865***	***$901***	***$924***	***$947***	***$977***	***$1,011***	***$1,074***	***$1,076***	***$1,112***
Capital Reserves													
Beginning Reserve Fund Balance	$7,086	$8,316	$9,187	$2,185	$2,654	$464	$155	$1,399	$2,749	$4,170	$5,648	$1,571	$3,023
plus: Rate Funded System Reinvestment	3,812	771	1,114	1,491	1,453	1,116	1,191	1,251	1,251	1,251	1,073	992	1,013
plus: Capital Facility Charges	0	110	114	118	122	126	130	135	140	145	150	155	160
plus: Loan Proceeds	0	0	0	0	5,000	7,500	0	0	0	0	3,000	0	0
plus: Interest Earnings	0	83	92	22	27	5	2	14	27	42	56	16	30
less: Funds Used For Capital Projects	(2,582)	(93)	(8,321)	(1,162)	(8,792)	(9,056)	(111)	(114)	(118)	(121)	(8,371)	(129)	(133)
Ending Fund Balance	**$8,316**	**$9,187**	**$2,185**	**$2,653**	**$463**	**$155**	**$1,368**	**$2,684**	**$4,049**	**$5,485**	**$1,556**	**$2,605**	**$4,094**
Target Ending Fund Balance (1.5% of Plant in Service)	***$465***	***$466***	***$468***	***$468***	***$474***	***$474***	***$474***	***$474***	***$474***	***$474***	***$475***	***$475***	***$481***
Equipment Replacement Reserve													
Beginning Reserve Fund Balance	$855	$862	$832	$880	$788	$887	$988	$1,093	$1,200	$1,310	$1,423	$1,540	$1,659
Plus: Balance of Funds	87	94	96	98	99	101	104	107	110	113	116	120	123
less: Transfer of Surplus to Capital Fund	(80)	(124)	(47)	(190)	0	0	0	0	0	0	0	0	0
Ending Fund Balance	**$862**	**$832**	**$880**	**$788**	**$887**	**$988**	**$1,093**	**$1,200**	**$1,310**	**$1,423**	**$1,540**	**$1,659**	**$1,782**

14.5 Review of the City's Current Water Rates

The City has adopted water rates to meet their financial requirements. Table 14-6 shows the current adopted water rates of the City for one customer category: single-family residential customers inside City limits. For this category of water use the rate structure includes a minimum monthly charge, plus an "inclined block" structure that applies higher rates at higher levels of consumption. This type of rate structure encourages customers to manage their water consumption. The typical monthly bill for an Inside-City residential customer with a 3/4" meter and 10 CCF usage would be $59.03 per month. Customers outside City limits have a similar rate structure but with higher rate levels.

Table 14-6. Overview of the City's Current (2021) Water Rates for Single-Family Residential Customers

	Category	Charge
2021 Minimum Monthly Charge		
Inside City Limits - Single Family Residential	¾ inch meter	$21.53/month
	1 inch meter	$29.27/month
	1 ½ inch meter	$45.60/month
	2 inch meter	$68.24/month
2021 Consumption Charge		
Inside City Limits - Single Family Residential		
Block One	(0-5 ccf)	$3.20/ ccf
Block Two	(6-15 ccf)	$4.30/ ccf
Block Three	(Over 15 ccf)	$5.33/ ccf

CCF = One Hundred Cubic Feet

Rates for customer categories other than single-family residential also include a minimum monthly charge, but apply uniform rates instead of inclined block rates. These rate structures apply to multi-family residential, commercial/industrial and irrigation customers. These categories are also broken down into Inside-City and Outside-City categories, with differing rates for each.

Another aspect of the water systems water rates that should be considered is affordability to the customers. A common method of determining if water rates are affordable is to calculate the water rates as a percentage of median household income. The Environmental Protection Agency (EPA) has historically stated that the annual water cost billed to customers that is in excess of 2 percent of Median Household Income (MHI) is considered unaffordable. Table 14-7 summarizes the affordability calculation where the average annual single-family bill with 10 CCF of consumption is shown as a percent of MHI.

Table 14-7. EPA Affordability Calculation

	2017	2018	2019	2020	2021
Median Household Income (MHI)	$39,324	$40,815	$42,449	$43,595	$44,772
Estimated Annual Single Family Water Bill	$656	$671	$686	$700	$708
Water Costs as % of MHI	1.7%	1.6%	1.6%	1.6%	1.6%

For table 14-7 above, MHI was taken from the US Census Bureau for the City of Centralia. 2020 and 2021 MHI were estimated using the 10-year average MHI annual growth of 2.7%. For the City of Centralia water rates to exceed the EPA 2% affordability threshold, Rates would have to increase in excess of 126%.

In 2026 the affordability threshold is estimated to be 1.7% after adjusting MHI by 2.7% per year and the potential water rate adjustments. Table 14-8 summarizes the single-family water rates with the assumed rate adjustments proposed in 14-4.

Table 14-8. Overview of the City's Potential Future Water Rates for Single-Family Residential Customers

		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Minimum Monthly Charge Inside City Limits - Single Family Residential												
¾ inch meter		$22.82	$24.19	$25.64	$26.41	$27.20	$28.02	$28.86	$29.73	$30.62	$31.54	$32.48
1 inch meter		31.03	32.89	34.86	35.91	36.98	38.09	39.24	40.41	41.63	42.87	44.16
1 ½ inch meter		48.34	51.24	54.31	55.94	57.62	59.35	61.13	62.96	64.85	66.79	68.80
2 inch meter		72.33	76.67	81.27	83.71	86.22	88.81	91.48	94.22	97.05	99.96	102.96
Consumption Charge Inside City Limits - Single Family Residential												
Block One	(0-5 ccf)	$3.39	$3.60	$3.81	$3.93	$4.04	$4.16	$4.29	$4.42	$4.55	$ 4.69	$ 4.83
Block Two	(6-15 ccf)	4.56	4.83	5.12	5.28	5.43	5.60	5.76	5.94	6.12	6.30	6.49
Block Three	(Over 15 ccf)	5.65	5.99	6.35	6.54	6.73	6.94	7.14	7.36	7.58	7.81	8.04

14.6 Conclusion

Potential rate increases are needed to cover the capital projects in this plan. The City has successfully acquired low interest loans in the past and this plan assumes they will fund portions of the capital plan with new low interest loans which will allow for rates to remain as low as possible.