consor

CITY OF FIRCREST

Comprehensive Water System Plan

September 2023

THE CITY OF FIRCREST

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Comprehensive Water System Plan

City of Fircrest

September 2023

09/13/23

Consor
(formerly Murraysmith)

1102 Broadway Plaza
Suite 401
Tacoma, WA 98402

In Association with:
Katy Isaksen & Associates

City of Fircrest

Dawn Masko, City Manager
Tyler Bemis, Public Works Director

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Chapter 1

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Chapter 1

Introduction

1.1 Authorization and Purpose

In May 2020, the City of Fircrest (City) authorized Consor (formerly Murraysmith) to prepare a comprehensive water system plan (WSP) as required by state law under Washington Administrative Code (WAC) 246-290-100. In accordance with WAC 246-290-100, the WSP shall be updated and submitted to the Washington State (State) Department of Health (DOH) every six or ten years, depending on approval type. The previous comprehensive water system plan was prepared for the City in 2014 and approved by DOH in May 2014 for six years. A 10-year approval period is desired for this Plan, and therefore the Plan analyzed 10-year and 20-year planning periods. The purpose of this updated WSP is:

- To evaluate historical growth and water usage for use in projecting future water demands.
- To inventory, describe, and analyze the existing water system to determine if it meets minimum requirements mandated by DOH and the City's own policies and design criteria.
- To prepare a capital improvement program (CIP) that identifies water system improvements which resolve existing system deficiencies and accommodate future needs of the system for at least 20 years into the future.
- To prepare an implementation schedule of improvements.
- To prepare a financing plan that meets the goals of the financial program.
- To document the operations and maintenance program.
- To comply with all other water system plan requirements of DOH.

1.2 Background

The City's existing WSP was approved by DOH in May 2014. Several changes to water system regulations, as they apply to comprehensive WSPs, have occurred since 2014. The City also has continued to improve and update their water system since 2014. This WSP addresses these changes to regulations and improvements to the City's system and outlines the City's plans for the next 10 and 20-year planning periods.

1.3 Water System Ownership and Management

The City is a municipal corporation that owns and operates a public water system within its corporate boundaries. Water system data on file at DOH for the City is shown in Table 1-1.

Table 1-1 | Water System Ownership Information

Information Type	Description
System Type	Group A – Community – Public Water System
System Name	City of Fircrest
County	Pierce County
DOH System ID Number	25150T
Owner Number	001924
Address	115 Ramsdell Street Fircrest, WA 98466
Contact	Jeff Davis, Utility Foreman
Contact Phone Number	253-564-8900

1.4 Overview of Existing System

In 2019, the City provided service to approximately 2,783 customer connections, or 3,024 equivalent residential units (ERUs). All water supply to the City is provided by five ground water wells directly connected to the High Zone. These wells then gravity feed the Low Zone. All water supplied by the City is fluoridated and chlorinated by the City. Water storage is provided by three reservoirs that have a total maximum storage capacity of 1.8 million gallons (MG). In addition, the City's water system has three pressure zones with three pressure reducing stations, one booster pump station, and 38 miles of water main. A summary of 2019 water system data for the City's system is shown in Table 1-2.

Table 1-2 | 2019 Water System Data Summary

Description	Data
Population (2019)	6,770
2020 Census Population	7,156
City Limits	1.58 sq ml
Existing Retail Water Service Area	1.60 sq ml
Future Water Service Area	1.60 sq ml
Total Connections (2019)	2,783
Total ERU's (2019)	3,024
Demand per ERU (2019)	214 gal/ERU
Demand per Capita (2019)	98.6 gal/capita
Annual Supply (2019)	244 MG
Distribution System Leakage (2017-2019)	5.2%

Description	Data
Max Day/Average Day Demand Factor	2.24
Peak Hour/Max Day Demand Factor	1.69
Number of Pressure Zones	3 Zones
Number of Wells & Total Capacity	5 Active & 1 Emergency (5,145 gpm)
Number of Pump Stations & Total Capacity	1 BPS (1,190 gpm)
Number of Reservoirs & Total Capacity	3 Res (1.8 MG)
Number of Pressure Reducing Stations	3
Total Length of Water Main	38 miles

1.5 Summary of Plan Contents

A summary of the content of the chapters in the plan is as follows.

- Chapter 1 - Introduction: Provides an overview of the City's water system, the objectives of the plan, and the plan organization.
- Chapter 2 - Water System Description: Presents the water service area, describes the existing water system, and identifies the adjacent water purveyors.
- Chapter 3 - Land Use and Population: Presents related plans, land use, and population characteristics.
- Chapter 4 - Water Demands: Presents historical water use patterns, existing water demands, and projected future demands.
- Chapter 5 - Policies and Design Criteria: Presents the City's water service policies, water system operation policies, and water system design criteria.
- Chapter 6 - Water Supply Quantity and Quality: Discusses the City's water source and the results of past water quality monitoring.
- Chapter 7 - Operations and Maintenance: Discusses the City's operations and maintenance program.
- Chapter 8 - Water System Analyses: Presents the results of the water system analyses and summarizes existing system deficiencies.
- Chapter 9 - Water System Improvements: Presents the proposed water system improvements, their estimated costs, and implementation schedule.
- Chapter 10 - Financial: Summarizes the City's water utility financial history, identifies funding sources and a plan for funding the recommended capital improvements and provides a ten-year financial plan, with the impact on rates.

- Appendices: Contains additional information and plans that supplement the chapters listed above.

1.6 Definition of Terms

The following terms are used throughout this plan.

Connection Charge: A one-time fee paid by a property owner when connecting to the City's system which is made up of both the General Facilities Charge and Connection Fee.

Connection Fee: The installation charge or hook-up fee is a fee paid by a property owner to the City for the cost incurred to make the physical connection to the water system. This cost includes both direct and indirect costs for installing the service line off the system's water main to the customer's water meter.

Consumption: The true volume of water used by the water system's customers. The volume is measured at each customer's connection to the distribution system.

Cross-Connection: A physical arrangement that connects a public water system, directly or indirectly, with anything other than another potable water system and which, therefore, presents the potential for contaminating the public water system.

Demand: The quantity of water required from a water supply source over a period necessary to meet the needs of domestic, commercial, industrial, and public uses, and to provide enough water to supply firefighting, system losses, and miscellaneous water uses. Demands are normally discussed in terms of flow rate, such as million gallons per day (MGD) or gallons per minute (gpm) and are described in terms of a volume of water delivered during a certain time. Flow rates pertinent to the analysis and design of water systems are:

- Average Day Demand (ADD): The total amount of water delivered to the system in a year divided by the number of days in the year.
- Maximum Day Demand (MDD): The maximum amount of water delivered to the system during a 24-hour time-period of a given year.
- Peak Hour Demand (PHD): The maximum amount of water delivered to the system, excluding fire flow (FF), during a one-hour time-period of a given year. A system's peak hour demand usually occurs during the same day as the peak day demand.

Distribution System Leakage (DSL): The annual amount of water calculated from the difference between the measured amount of water supplied into the system and the measured amount of water taken out of the system for consumption and other authorized uses. Authorized uses include both metered and unmetered water uses. Examples of common unmetered water uses include the use of hydrants for flushing, firefighting, and construction. The calculated DSL volume consists

primarily of water loss through leaks in the water system, but may also include meter inaccuracies, meter reading errors, water theft, and reservoir overflows.

Equivalent Residential Units (ERUs): One ERU represents the amount of water used by one single family residence for a specific water system. The demand of other customer classes can be expressed in terms of ERUs by dividing the demand of each of the other customer classes by the demand represented by one ERU.

Existing Retail Water Service Area (RWSA): Includes all areas where the water system already provides direct service, remote service, or where service connections are currently available, and may include areas where new service is proposed.

Fire Flow: The rate of flow of water required during firefighting, which is usually expressed in terms of gpm.

Future Water Service Area: Includes all areas outside of the existing retail water service area where the City has the duty to provide water service to future customers.

General Facilities Charge: A one-time fee paid by a property owner when connecting to the water system. This fee pays for the new customers' equitable share of the cost of the existing system. This fee offsets the costs of providing water to new customers and recognizes that the existing water system was largely built and paid for by the existing customers.

Head: A measure of pressure or force by water. Head is measured in feet and can be converted to pounds per square inch (psi) by dividing feet by 2.31.

Head Loss or Pressure Loss: Pressure reduction resulting from pipeline wall friction, bends, physical restrictions, or obstructions.

Hydraulic Elevation: The height of a free water surface above a defined datum; the height above the ground to which water in a pressure pipeline would rise in a vertical open-end pipe.

Maximum Contaminant Level (MCL): The maximum permissible level of contaminant in the water that the purveyor delivers to any public water system user, measured at the locations identified under WAC 246-290-310.

Potable: Water suitable for human consumption.

Pressure Zone: A portion of the water system that operates from sources at a common hydraulic elevation.

Purveyor: An agency, special purpose district, subdivision of the state, municipal corporation, firm, company, mutual or cooperative association, institution, partnership, or persons or other entity owning or operating a public water system. Purveyor also means the authorized agents of such entities.

Supply: Water that is delivered to a water system by one or more supply facilities which may consist of supply stations, booster pump stations, and wells.

Storage: Water that is "stored" in a reservoir to supplement the supply facilities of a system and provide water supply for emergency conditions. Storage is broken down into the following five components which are defined and discussed in more detail in **Chapter 7**: operational storage, equalizing storage, standby storage, FF storage, and dead storage.

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Chapter 2

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Chapter 2

Water System Description

2.1 Introduction

This chapter describes the City's existing and future water service areas, water service agreements, and existing water system components. The system components described in this chapter were analyzed to identify system deficiencies. The results of these analyses are described in Chapter 8.

2.2 History

The City was settled in the early 1900s, originally as a subdivision and residential park. It was later incorporated as a town in 1925 and eventually grew large enough to become a city in 1990. By the end of 2019, the City provided water service to 2,795 customer connections.

2.3 Water Service Area

The City's RWSA, which encompasses the Fircrest City Limits is shown in Figure 2-1. The City is in northwestern Pierce County, Washington, surrounded by Tacoma. The City Limits comprise an area of approximately 1.58 square miles. The existing RWSA is approximately 1.60 square miles and extends as far north as Columbia Avenue, west to Mildred Street West, south to approximately Fordham Street, and east to Orchard Street West. The system is mainly developed and is surrounded by Tacoma Water's service area, so future expansion of the service area is unlikely.

The City's RWSA is defined by DOH (331-432) as:

> *The Retail Service Area is the specific area, defined by the municipal supplier, where the supplier has a duty to provide service to new service connections as set forth in RCW 43.20.260.*

Per Revised Code of Washington (RCW) 43.20.260, the City has a duty to serve within its RWSA if:

> *(1) Its service can be available in a timely and reasonable manner;*
>
> *(2) the municipal water supplier has sufficient water rights to provide the service;*
>
> *(3) the municipal water supplier has sufficient capacity to serve the water in a safe and reliable manner as determined by the department of health; and*

(4) it is consistent with the requirements of any comprehensive plans or development regulations adopted under chapter 36.70A RCW or any other applicable comprehensive plan, land use plan, or development regulation adopted by a city, town, or county for the service area and, for water service by the water utility of a city or town, with the utility service extension ordinances of the city or town.

The existing RWSA boundary is generally located within the city limits, as shown in Figure 2-1. The City is responsible for providing public water service, utility management and water system development within this area. There are small areas in the northwest and southeast portions of the City Limits that are served by Tacoma Public Utilities.

The existing service area is surrounded by the Tacoma Public Utilities service area, which limits the boundary of the service area. There is no anticipated expansion of the service area.

2.3.1 Topography

The City's RWSA is situated between Tacoma and University Place. The topography of the area served by the City's water system varies greatly in elevation. Much of the City is hilly and varies between 191-410 feet in elevation. The City generally slopes downward in a southeastern direction.

2.4 Water Agreements and Contracts

The City has no water service agreements and is not considering providing water to other utilities on a wholesale basis. Aside from requests for bulk amounts of water, no formal supply agreements exist between the City and other water users. Information on the City's long-term water supply planning is presented in Chapter 6.

2.5 Satellite System Management

A Satellite Management Agency (SMA) is defined as a person or entity that is certified by the DOH to own or operate more than one public water system without the necessity for a physical connection between such systems.

The City is not currently an SMA. If the City were to consider providing SMA services, these policies would follow the requirements set by the satellite management program developed by DOH.

2.6 Existing Water Facilities

This section provides a detailed description of the existing water system and the current operation of the facilities. The analysis of the existing water facilities is presented in Chapter 8.

General water system facility data is summarized on the Water Facilities Inventory (WFI) form. A copy of this form is contained in Appendix B - Water Facilities Inventory (WFI) Form.

2.6.1 Pressure Zones

The City serves customers within an elevation range of approximately 191 feet near the Leach Creek to 410 feet in the southwestern section of the City, west of Thelma Gilmur Park. The wide elevation range requires that the water pressure is increased or reduced to maintain pressures that are safe and sufficient to meet the flow requirements of the system. To do this, the City's water system is divided into three different pressure zones, as shown in **Figure 2-1**. The pressure in each pressure zone is regulated by reservoir levels, pressure reducing valve (PRV) station settings, pump station settings, or a combination of these as illustrated in the hydraulic profile, **Figure 2-2**, and summarized in **Table 2-1**.

Table 2-1 | Pressure Zone Data Summary

Zone Name	Maximum Hydraulic Elevation (above MSL)	Storage Facilities	Supply Facilities
Low	425-ft[1]	1.0 MG Low Reservoir	(2) High/Low Zone PRVs
High	470-ft[2]	0.2 MG High Reservoir Golf Course Reservoir	Wells 4-9
Weathervane	522-ft[3]	None	Weathervane BPS

Notes:
1. The maximum hydraulic elevation for the Low Zone is set by the overflow elevation of the Low Reservoir.
2. The maximum hydraulic elevation for the High Zone is set by the overflow elevation of the High Reservoir.
3. The maximum hydraulic elevation for the Weathervane Zone is set by the pressure setting of the Weathervane BPS.

The High Zone is supplied with water from the 0.2 MG High Zone Reservoir and the five primary wells. During fire flow events or when the reservoir is out of service, the High Zone is supplied by an additional emergency well. The High Zone was originally separated as two zones: High and Golf Course. In 2008, The Golf Course Zone was consolidated into the High Zone and isolated from the Low Zone. The High Zone is located west of Alameda Avenue, north of Regents Boulevard, and west of Magnolia Drive; additionally, there is a small section along Orchard Street. The zone serves customers within an elevation range of approximately 250 to 360 feet.

The Low Zone is the lowest pressure zone and is predominately located between Alameda Avenue and Orchard Street, and south of Regents Boulevard. Elevations range from approximately 190 to 310 feet. The Low Zone is supplied from the High Zone through two PRV Stations and one PRV at the Tanks site, and stores water in the 1.0 MG Low Reservoir.

The Weathervane Zone is a closed zone (i.e., a zone without storage), which is supplied via the Weathervane Booster Pump Station, which pumps water from the High Zone to the Weathervane Zone. This zone serves customers within an elevation range between approximately 330 and 410 feet. The Zone is primarily located in the southwest corner of the service area, south of Claremont Street, and generally west of the intersection of Emerson Street and Magnolia Drive.

2.6.2 Supply Facilities

The City utilizes groundwater as its primary source of water supply. The active wells include wells FW-4, FW-6, FW-7, FW-8, and FW-9. Wells FW-1, FW-2, and FW-5 were previously abandoned. Well FW-3 is used solely as a monitoring well and does not contribute to the water supply system. All water supply to the City's system is pumped from its wells directly to the High Zone.

Well FW-4 is located south of Ramsdell Street and west of Orchard Street. Well FW-9 is located to the north between Cornell Street, Orchard Street, Ramsdell Street, and San Juan Avenue. These wells directly supply the High Zone up to 1,775 gpm and an additional 1,100 gpm in case of emergencies. Well FW-9 can directly feed the low zone through a manually actuated gate valve.

Wells FW-6 and FW-7 are located south of Claremont Street and east of Paradise Parkway. Well FW-8 is located southeast between Alameda Avenue and 60th Avenue Court West. These wells previously served the Golf Course Zone and were later incorporated into the High Zone. These wells directly supply the High Zone up to 1,450 gpm. They indirectly service the Weathervane Zone through its pump station.

Table 2-2 | Source Data Summary

Source Name	Supply Type	Capacity (gpm)	Zone Supplied
FW-1	Inactive well	n/a	Unconnected
FW-2	Inactive well	n/a	Unconnected
FW-3	Monitoring well	n/a	Unconnected
FW-4	Active well	525	High Zone
FW-5	Inactive well	1100	Unconnected
FW-6	Active well	750	High Zone
FW-7	Active well	800	High Zone
FW-8	Active well	720	High Zone
FW-9	Active well	1250	High Zone

2.6.3 Water Treatment

The City's water is chlorinated to disinfect and kill harmful bacteria that may be present in the water and fluoridated to assist in the prevention of tooth decay. The hypochlorite system includes a bulk liquid sodium hypochlorite system that injects a 12.5 percent sodium hypochlorite solution into the main water system piping at each well house. Metering pumps will then run when the well pumps turn on and will be turned off when the well pumps turn off assuring no overdosing of the system occurs. Sodium hypochlorite dosages are manually adjusted based on testing results for chlorine residual in the system. Chlorine residual analyzers monitor chlorine residuals and alert City staff in the event of a low or high chlorine residual detection. This is similar to the current operation of the City's fluoridation system.

All well houses are equipped with fluoride injection systems that inject fluoride immediately after the well casing. The injection system is automatically turned on and off in tandem with each well pump. The objective of the fluoride injection system is to provide the water system with a residual fluoride concentration of 0.5-0.9 milligrams per liter (mg/l). The system is tested daily at each water source and the injection system is adjusted as needed to achieve proper residual fluoride concentrations.

Additional information on the City's source of supply, water treatment, and water quality monitoring is contained in Chapter 6.

2.6.4 Pump Station Facilities

The City's water system has one pump station, the Weathervane Booster Pump Station, as summarized in Table 2-3. A more detailed description of the pump station is provided below.

Table 2-3 | Weathervane Booster Pump Station Pump Data Summary

Pumping Capacity	Pumps From	Pumps To	Motor (hp)	Pump Station Design Flow (gpm)	Pump Type	Variable Frequency Drive
(2) 95 gpm (2) 500 gpm	High Zone	Weathervane Zone	7.5 hp & 25 hp	1,190 gpm	(2) Horizontal & (2) Vertical Turbine	Yes

The Weathervane Booster Pump Station is located south of Emerson Street and is accessed through Evergreen Drive. The station pumps water from the High Zone to the Weathervane Zone to meet the demand requirements of the Weathervane Zone.

A concrete masonry unit (CMU) block building houses the booster pump station's mechanical and electrical equipment. The station has a total capacity of approximately 1,190 gpm, which is delivered by two 95 gpm vertical turbine pumps with 7.5 horsepower motors and two 500 gpm horizontal turbine pumps with 25 horsepower motors. All four pumps have variable frequency drives (VFDs), allowing the City to adjust the pump station to meet the needs of the Weathervane Zone more efficiently.

2.6.5 Storage Facilities

The City's water system has three active storage facilities: the 0.2 MG High Reservoir, the 0.6 MG Golf Course Reservoir, and the 1.0 MG Low Reservoir. These reservoirs are summarized in Table 2-4 and a more detailed description of each is provided below.

Table 2-4 | Tank Data Summary

Facility Name	Overflow Elevation (ft)	Zone Served	Water Storage Height (ft)	Diameter (ft)	Total Volume (MG)	Tank Type	Year Constructed
High Tank	470-ft	High	24	39	0.21	Elevated	1951
Golf Course Tank	470-ft	High	91	34	0.60	Standpipe	1966
Low Tank	425-ft	Low	48	60	1.0	Reservoir	1980

2.6.5.1 High Zone - 0.2 MG High Reservoir

The 0.2 MG High Reservoir provides water storage directly to the High Zone and can indirectly provide water to the Low Zone through the Low Reservoir. It is located at the east end of S 25th Street, a site which it shares with the Low Reservoir. The High Reservoir is an elevated six-post steel tank. The tank bowl is approximately 39 feet in diameter and 24 feet high. The base of the bowl is 60 feet above ground. The total height is 84 feet. The tank capacity is 210,000 gallons and was built in 1951. The reservoir's base elevation is at approximately 386 feet and the overflow elevation is at 470 feet.

2.6.5.2 High Zone - 0.6 MG Golf Course Reservoir

The 0.6 MG Golf Course Reservoir is located on the Fircrest Golf Club property approximately 400 feet north of 35th Street W. It provides storage for the High Zone and can provide supplemental storage to the Low Zone when supplied through the pressure reducing stations. The 91-foot tall, 34-foot in diameter standpipe was constructed in 1966. The reservoir has a base elevation of approximately 379 feet and overflow elevation of 470 feet.

2.6.5.3 Low Zone - 1.0 MG Low Reservoir

The 1.0 MG Low Reservoir is located at the east end of S 25th Street and shares a site with the High Reservoir. The Low Reservoir provides storage for the Low Zone and receives water from the High Reservoir through an altitude valve with pressure transducers. When the Low Reservoir hits the set low water level, then the High Reservoir is signaled to provide water. The 48-foot tall, 60-foot diameter reservoir was constructed in 1980. It has a base elevation of approximately 377 feet and overflow elevation of 425 feet.

2.6.6 Distribution and Transmission System

The City's water system contains more than 38 miles of water main ranging in size from 2 to 16 inches. As shown in **Table 2-5** most of the water main (approximately 30 percent) within the service area is 4-inch diameter, and over 90 percent of all water main is 4 to 16-inch diameter.

Table 2-5 | Water Main Inventory

Diameter (inches)	Total Length (feet)	% of Total
2	6,085	**3%**
3	1,385	**1%**
4	59,550	**30%**
6	45,620	**23%**
8	40,560	**20%**
12	38,205	**19%**
16	8,720	**4%**
Total Length	**200,125**	**100%**
% of Total	**100%**	

All the water main in the City's system is constructed of asbestos cement (AC), polyvinyl chloride (PVC), and ductile iron. All new water main projects are required to use ductile iron water main in accordance with the City's development and construction standards.

2.6.7 Pressure Reducing Stations

Pressure reducing stations are connections between adjacent pressure zones that allow water to flow from the higher to the lower zone by reducing the pressure of the water as it flows through the station, thereby maintaining a safe range of pressures in the lower zone. The City's water system has a total of two pressure reducing stations, as shown in **Figure 2-1** and **Figure 2-2**. These two PRV stations actively supply water from the High Zone to the Low Zone. All the City's PRV stations are in underground vaults and are not equipped with pressure relief valves.

2.6.8 Water System Interties

Water system interties are physical connections between two adjacent water systems. In 1994, the City completed an emergency intertie with Tacoma's water system. It is located on the east side of Orchard Street across from Stanford Street. It connects the City's High Zone, 330 hydraulic grade line (HGL), to Tacoma's 478-High pressure zone and is normally closed. A copy of the agreement and its amendment is contained in **Appendix A - Water Service Area Agreements**.

2.6.9 Telemetry and Supervisory Control System

Successful operation of any municipal water system requires gathering and using accurate information. A telemetry and supervisory control system efficiently controls the water system by automatically optimizing facility operations. It also provides instant alarm notification to operations personnel in the event of equipment failure, operation problems, flood, fire, or other emergency situations.

The City's telemetry system was replaced with a supervisory control and data acquisition (SCADA) system in 2009. The system consists of a new master telemetry unit (MTU) at the Fircrest Public

Works Building, existing communications equipment, and new remote telemetry units (RTU) at the wells and reservoir sites. The Reservoir RTUs transmit the reservoir levels to the MTU along with the status of the doors, hatches, valves, and ancillary alarm conditions. The SCADA RTU controls the well pump motors via setpoints input by the operator. Well levels, pump status, control settings, alarm setpoints, and station alarms can be viewed and tracked.

2.7 Water System Operation

All water supply is provided through the five active wells, as shown in Figure 2-1. Wells FW-4 and FW-9 provide water to the High Zone and fill the High Reservoir through an altitude control valve at the reservoir site. Water from these wells can also indirectly fill the Low Zone through an isolation valve. The High Reservoir fills the Low Reservoir through an altitude control valve with pressure transducers at the reservoir site, then the Low Reservoir gravity feeds the Low Zone. Wells FW-6, FW-7, and FW-8 provide water directly to the High Zone and the Golf Course Reservoir. The settings of the supply facilities and water usage throughout the system dictate the amount of water either flowing into or out of the reservoirs. The Weathervane Zone Booster Pump Station draws water from the High Zone and pumps it into the closed Weathervane Zone (i.e., no storage within the zone) to meet the zone demands.

2.8 Adjacent Water Systems

The area surrounding the City's RWSA is served by Tacoma Water's system. This large water system is adjacent to the City's system. The following provides a brief description of Tacoma Water's system.

2.8.1 Tacoma Public Utilities

Tacoma Water's RWSA surrounds the City's RWSA. Tacoma Water is a regional supplier that serves more than 300,000 customers in Pierce and King Counties. It also provides water to some residents within the City Limits. These areas are in the northwest and southeast portions of the City and are shown in Figure 2-1.

Tacoma's raw water supply originates in the Green River Watershed, which covers approximately 148,884 acres on the west flank of the Cascade Mountains between Chinook and Snoqualmie passes and supplies up to 167 MGD. Tacoma can supplement its Green River supply with water from seven wells located along the north fork of the Green River. This well field can produce 84 MGD in the winter and spring months. These wells are used only when the water in the river is too turbid to be used as a supply. This usually occurs in the fall and winter when rain and snow melt washes soil sediment into the river. The raw water supply for this system is stored in the Howard Hanson Reservoir which was created after the U.S. Army Corps of Engineers installed the Howard Hanson Dam in 1961. The water from the reservoir is then diverted into Tacoma's pipeline for treatment and distribution.

In 2005 Tacoma finished installing 34 miles of transmission main increasing the water supply to Tacoma and South King County. Due to this increase in supply, an expansion of the Howard Hanson Dam was required to increase storage capacity. This 2007 expansion added 6.5 billion gallons of storage capacity to the water system. Water treatment facilities were also constructed in 2005 and 2007 and include ozone disinfection.

In addition to the North Fork Wells, Tacoma has several wells in its service area that can be used to meet peak summer water demands. The South Tacoma Wells have a maximum capacity of approximately 59 MGD.

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THE CITY OF FIRCREST

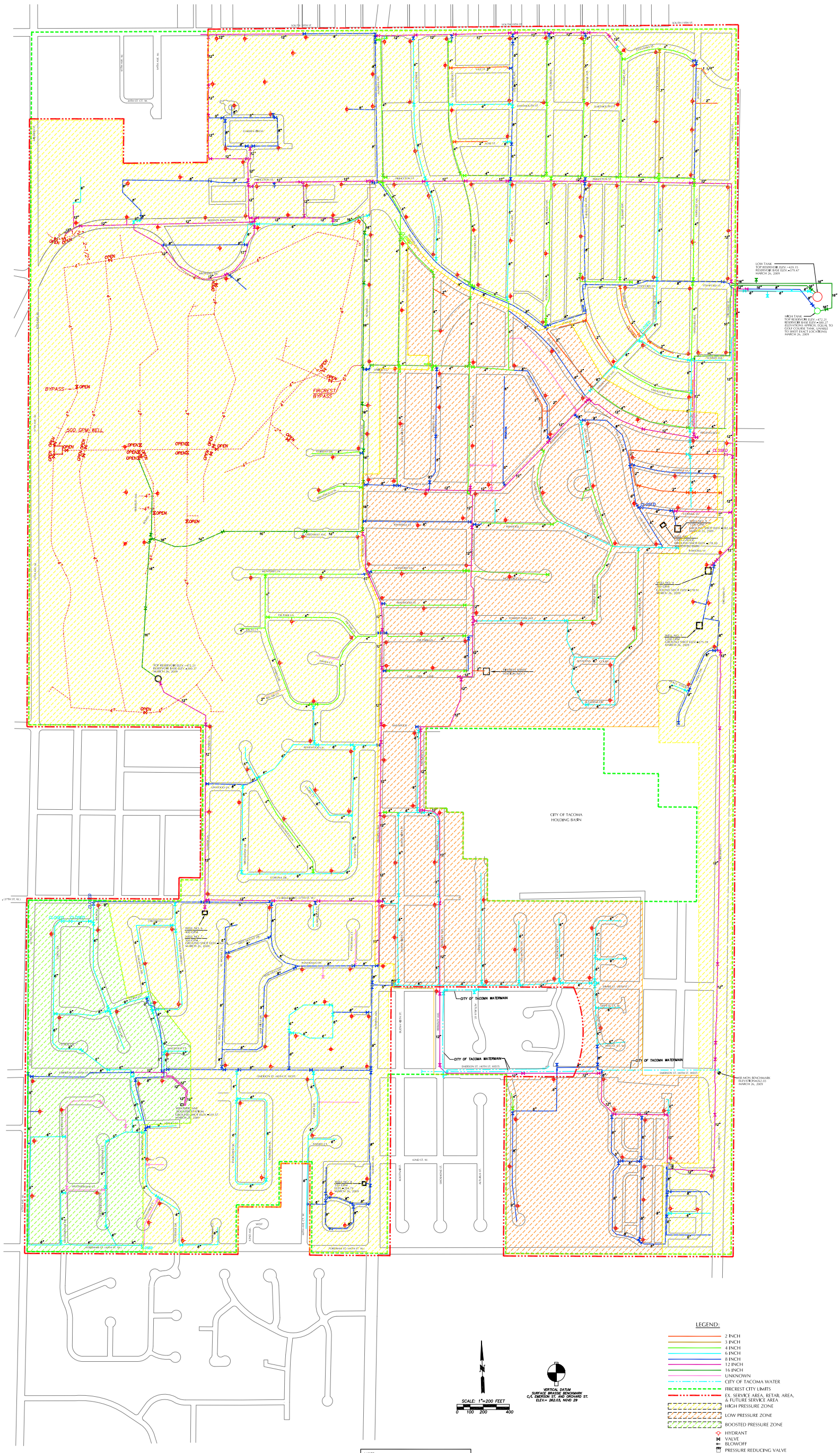

FIGURE 2-1

NO	DATE	BY	APPR	REVISIONS
1	1/28/13	R.W.	S.S.	REVISED BASE MAP PER AS-BUILT DRAWINGS
2	2/14/14	R.W.	S.S.	REVISED BASE MAP PER CITY AS-BUILT DATED 01/29/14

JWM&A Civil • Municipal • Geotechnical • Land Surveying
Jerome W. Morrissette & Associates Inc., P.S.
1700 Cooper Pt. Road S.W. #B-2, Olympia, Wa. 98502-1110 Ph 360.352.9456 Fx 360.352.9990

Approved By

DESIGNED BY DATE
S.S., P.W.
C.A.D.D. BY DATE
CHECKED BY DATE
1-23-2013
DATE PLOTTED

2014
WATER SYSTEM
BASE MAP

CITY OF FIRCREST

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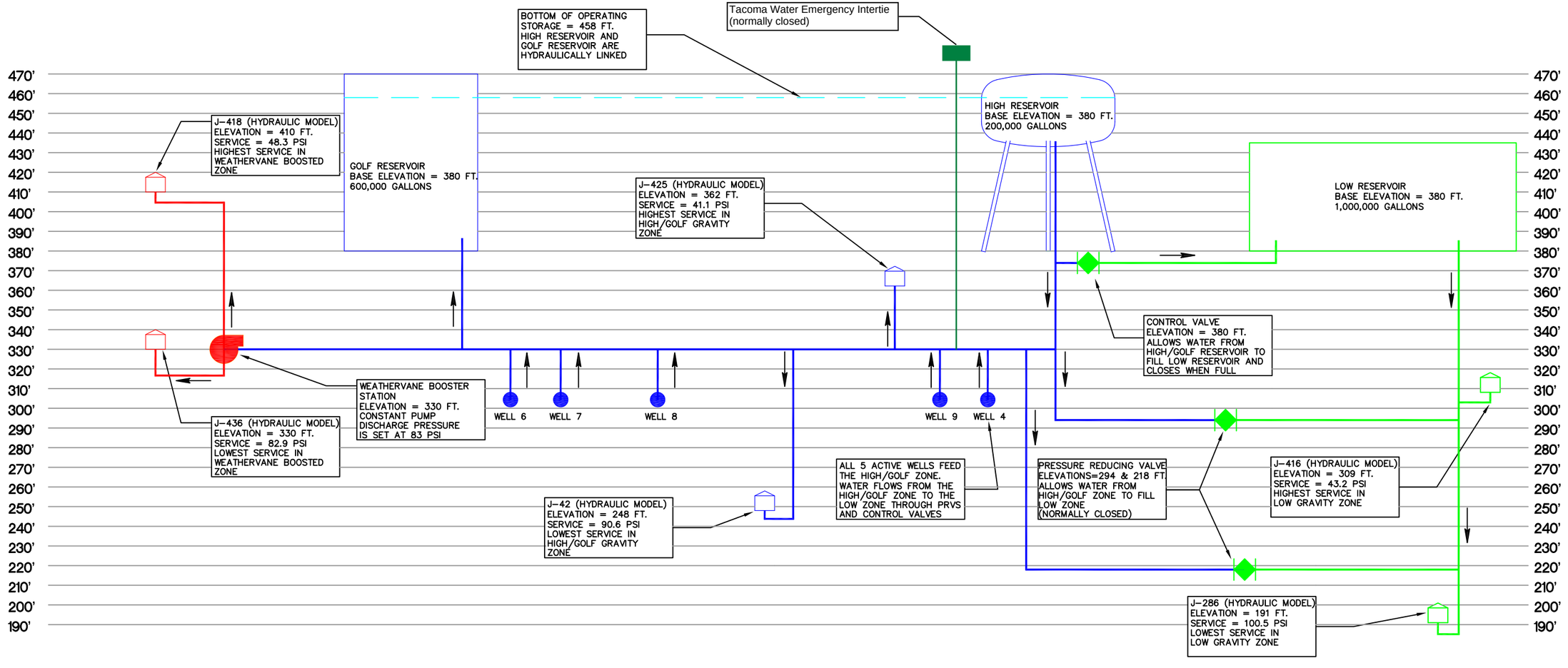
THE CITY OF FIRCREST



CONDITIONS ARE DURING PEAK HOUR DEMAND

FIGURE 2-2

NO	DATE	BY	APPR	REVISIONS

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C.D.M. 01/22/2010 DESIGNED BY DATE

C.D.M. 01/22/2010 C.A.D.D. BY DATE

02/14/2014 DATE PLOTTED

THE CITY OF FIRCREST

FIRCREST WATER SYSTEM HYDRAULIC PROFILE

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Chapter 3

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Chapter 3

Land Use and Population

3.1 Introduction

This chapter demonstrates the consistency of the WSP with the City Comprehensive Plan and other planning documents, identifies current land use designations, and presents population data. The City's Comprehensive Plan was completed in January 2016 and was last updated in December 2020. The Comprehensive Plan was developed to meet the requirements of the State Growth Management Act (GMA). The GMA requires, among other things, consistency between land use and utility plans and their implementation.

3.2 Compatibility with Other Plans

The following planning documents were examined to ensure the WSP is consistent with the City's land use policies and other related plans.

- Growth Management Act
- City of Fircrest Comprehensive Plan
- Pierce County Countywide Planning Policies
- Pierce County Coordinated Water System Plan
- Puget Sound Regional Council (PSRC) VISION 2050

3.2.1 Growth Management Act

The GMA was passed in 1990 and amended as required over the years. It defines four goals relevant to water system planning.

1. Focus growth in urban areas and reduce sprawl
2. Ensure consistency between land use and utility plans
3. Ensure adequate public facilities and services, concurrent with growth
4. Designate and protect critical areas

Through the GMA all counties, cities, and towns were required to develop comprehensive plans, which address issues of land use, transportation, housing, capital facilities, utilities, and rural lands.

3.2.1.1 Urban Growth Area

The GMA requires that Pierce County (County) and the City cooperate in designating an urban growth area (UGA). The City annexed its remaining area in 2018 and no longer has a UGA.

3.2.1.2 Consistency

The plans and policies of the City and County must be consistent in accordance with GMA, per RCW 36.70A.100. All comprehensive plans for communities within the PSRC planning area are also required to be consistent with its multi-county plan. The GMA also requires consistency with the implementation of WSPs and comprehensive plans, per RCW 36.70A.120.

The Municipal Water Law, which became effective in 2003, also requires consistency of WSPs with local plans and regulations. Confirmation of consistency under this law is achieved by means of completing the Consistency Statement Checklist, which must be included with all WSPs. A signed copy of this checklist is included in Appendix C - Consistency Statement Checklist.

3.2.1.3 Concurrency

Concurrency means that adequate public facilities and services are provided at the time growth occurs. For example, growth should not occur where schools, roads, and other public facilities are overloaded. Concurrency ensures that public dollars are used efficiently, and that quality of life is preserved. To achieve this objective, the GMA directs growth to areas already served or readily served by public facilities and services (RCW 36.70A.10). It also requires that, when public facilities and services cannot be maintained at an acceptable level of service, the new development should be prohibited (RCW 36.70A.100).

3.2.1.4 Critical Areas

The GMA requires that critical areas be designated and protected. Critical areas include areas at elevated risk for erosion, landslides, earthquakes, or flooding; coal mines; wetlands or lands adjoining streams, or rivers and other water bodies. Appendix D - SEPA Checklist and Determination of Non-Significance, contains a State Environmental Policy Act (SEPA) checklist that was prepared for this WSP and addresses environmental issues.

3.2.2 City of Fircrest Comprehensive Plan

The City's most recent Comprehensive Plan was published in 2015, adopted in January of 2016, and amended in December of 2020. The Land Use Element of this Comprehensive Plan states the City's vision of how growth and development should occur over a 20-year horizon and includes goals and policies to achieve this vision. The Future Land Use Map, which is included as Figure 3-1, shows the diverse types of land uses that are planned throughout the City.

The Land Use Element of the Comprehensive Plan articulates many of the same goals and concerns of the GMA. Like the GMA, the Land Use Element seeks to accommodate growth while maintaining the City's high quality of life, cherished natural features, distinct places, and character. It seeks to promote an attractive residential neighborhood and enhance public recreational services by focusing economic development within them and establishing development guidelines. The Transportation and Capital Facilities Elements ensure that new development will be adequately

serviced without compromising existing levels of service, similar to the principal of concurrency as defined in the GMA.

The Comprehensive Plan also states its City Limits and updates its UGA boundary. The City encompasses an area of approximately 1,011 acres (1.58 square miles). Some undeveloped lots still exist within the City and infilling is expected and encouraged. As noted in Section 3.2.1, the City annexed all its remaining UGA in 2018.

The GMA requires that the City updates its Comprehensive Plan by the middle of 2024. This update will address PSRC's and the County's newly adopted growth targets.

3.2.3 Pierce County Countywide Planning Policies

The Pierce County Regional Council, which is comprised of elected officials from the County, each of its 23 cities and towns, and the Port of Tacoma, originally adopted the Pierce County Countywide Planning Policies (CPPs) in 1992. Since this time, the plan has been amended several times with the last amendment occurring in May of 2020. The CPPs serve as the comprehensive plan framework for the County and cities within the County, including the City. Consistent with the GMA's goals, it establishes a UGA within the County to encourage growth in urban areas and to reduce urban sprawl. The CPPs also guide development in rural, unincorporated Pierce County. Similar to the City's Comprehensive Plan, the County's policy goals seek to reduce urban sprawl, protect rural areas, provide affordable housing throughout the County, and coordinate protection of environmentally sensitive areas.

The Pierce County Regional Council is in the process of updating the CPPs. The intent of the update process is threefold: 1) to ensure consistency with current state law, state agency guidance and recent hearings board decisions; 2) to align the CPPs with the newly adopted regional growth strategy found in VISION 2050; and 3) to modernize the CPP narrative to reflect the ongoing and evolving implementation of the GMA and countywide policies.

3.2.3.1 Fircrest and the Pierce County Countywide Planning Policies

The City is considered part of James Center which is a designated County Wide Growth Center. Countywide Growth Centers are chosen because they can become attractive places to live and work while being supported by effective public transportation. These growth centers are also a way to concentrate jobs, housing, and community life.

The City is located at the outskirts of six Regional Growth Centers around the Tacoma area. Regional Growth Centers are all required to create and strive for 20-year employment and household targets. Due to its proximity to these Regional Growth Centers and its designation within the Countywide Growth Center, the City is in a region with an expected rise of population.

3.2.4 Pierce County Coordinated Water System Plan

The Pierce County Coordinated Water System Plan (PCCWSP) was originally prepared in 1988 and most recently updated in 2021. The PCCWSP was prepared under the direction of the Pierce County Council and the Water Utility Coordinating Committee (WUCC). The WUCC periodically reviews and advises the County on updating the PCCWSP. The group also assesses whether the plan policies are being implemented as anticipated. Recommended revisions to the plan are forwarded to the DOH, the County Executive and County Council for review and adoption.

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

With the 2021 update to the PCCWSP, the "Water System Plan Review Requirements Guidelines" checklist was also updated. This update includes additional requirements for WSPs, specifically additional requirements associated with Accessory Dwelling Units. This updated checklist is included in Appendix C - Consistency Statement Checklist.

3.2.4.1 Fircrest and the Pierce County Coordinated Water System Plan

The most recent PCCWSP is based on estimates from Vision 2040. Within the WSP, the City is grouped with Tacoma with all household growth rates for the area falling under the Tacoma Subarea. Between 2020-2030, the Puget Sound Resource Council has predicted the Tacoma Subarea household growth rate to be 1.91 percent and decreasing slightly to 1.65 percent between 2030-2040.

3.2.5 Puget Sound Regional Council

The PSRC provides data and long-term forecasts for transportation, population, jobs, and housing to help with future planning in the Puget Sound area. It is directed by local elected leaders of King, Pierce, Snohomish, and Kitsap counties, the region's cities and towns, ports districts, transit agencies, and tribes. All these local jurisdictions work together to create a cohesive plan for the future of the Puget Sound region.

The PSRC's multi-county planning document, Vision 2050, is a policy-based growth projection that provides a planning vision for the area including King, Snohomish, Kitsap, and Pierce Counties. Vision 2050 superseded Vision 2040 after being adopted by the PSRC General Assembly in October of 2020. Vision 2050 has several goals and policies with regards to domestic water systems, such as the City. These policies and goals include:

- Ensuring residents of the region have access to high quality drinking water that meets or is better than federal and state requirements.

- Identifying and developing additional water supply sources to meet the region's long-term water needs, recognizing the potential impacts on water supply from climate change and fisheries protection.

- Promoting coordination among local and tribal governments and water providers and suppliers to meet long-term water needs in the region in a manner that supports the region's growth strategy.

- Reducing the per capita rate of water consumption through conservation, efficiency, reclamation, and reuse.

3.2.5.1 Fircrest and PSRC's VISION 2050

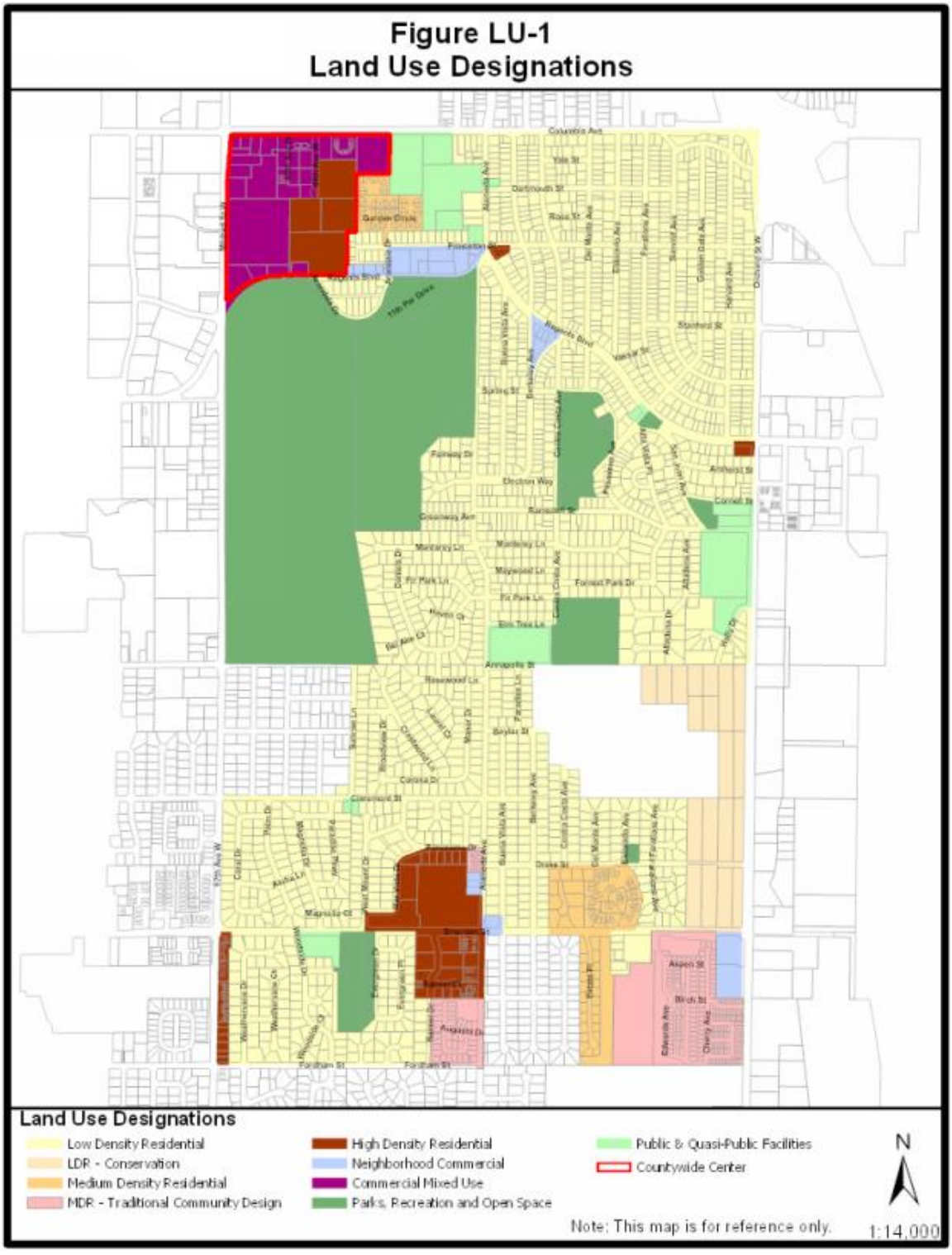
The City is one of the 34 communities listed in Vision 2050 as a High-Capacity Transit Community (HTC) under the regions transit system growth projections. The Regional Growth Strategy calls for the HTCs to accommodate population growth of 24 percent within the region as well as a 13 percent increase in employment through the region.

3.3 Land Use

The City Limits currently encompass 1,011 acres. The City's land use designations, as shown in the Future Land Use Map on Figure 3-1, guide development within the City Limits. Land use outside of the city limits is designated by the cities of Tacoma or University Place.

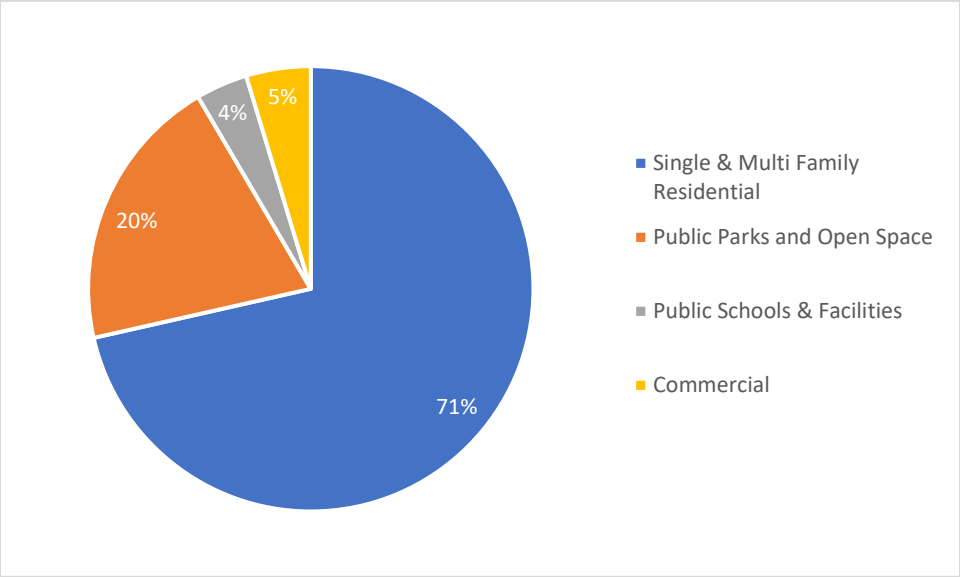
Figure 3-1 shows a 44-acre section in the northwest corner of the City (bound by Mildred Street West and 19th Street West) that is designated as part of the Countywide Center. This countywide center was created by the Pierce County Regional Council and includes land from the City, Tacoma, and University Place. This area is being rezoned from commercial (box stores) to mixed use (high-rise mixed residential and commercial). These new zones will result in a higher water demand due to the change from commercial to mixed residential and commercial buildings. Portions of the mixed-use commercial area are located within the northwest corner of the City, known as the Countywide Center area. This area may have the maximum building height increased to allow seven stories and maximum density restrictions would be removed to allow for future growth, as shown on Figure 3-1.

Figure 3-1 | City of Fircrest Future Land Use Map



Much of the City is low density residential and parks, comprised largely of single-family residents. The area served by the City is primarily residential. Currently single and multi-family residential make up about 71 percent of the land use. A variety of other uses make up the remaining 29 percent, as summarized in Figure 3-2.

Figure 3-2 | Existing Land Use in Fircrest City Limits



3.4 Population

Because the City's water system mostly serves customers within the City limits, the historical trends and population projections presented here are consistent with the City's 2016 Comprehensive Plan.

3.4.1 Household Trends & Historical Population

From 1980 to the late 1990s the City population was slightly declining followed by a rapid rate of growth between 1995 and 2000. Since 2000, the City population has steadily increased at a modest rate. Since its creation, the City has been primarily a residential community comprised largely of single-family residences. Most of its population commutes to nearby cities for employment.

This WSP was originally written based on the 2019 population data per the State's Office of Financial Management (OFM). Per that data, the City had approximately 2,898 residential units and a population of approximately 6,770 people. This equates to a calculated average of 2.34 residents per household. Historically, the City has seen this average household size hover around two people for the last decade Per the City's 2016 Comprehensive Plan this trend was expected to continue until the City reached its Adopted Population Target of 6,950.

The 2020 Census data was published after the original writing of this WSP but before it was fully approved and adopted. The 2020 Census data shows that the City has approximately 2,926 residential units and a population of 7,156. This data results in a calculated average resident per household of 2.45. This higher person-per-household number partially explains why the 2020 Census population is higher than the City's Adopted Population Target.

Of the residential units, approximately 76 percent were single family and 24 percent were multi-family. Since 1980, the City has experienced a slow trend towards supplying an increasing number of multi-family housing units and it is expected that this trend will continue.

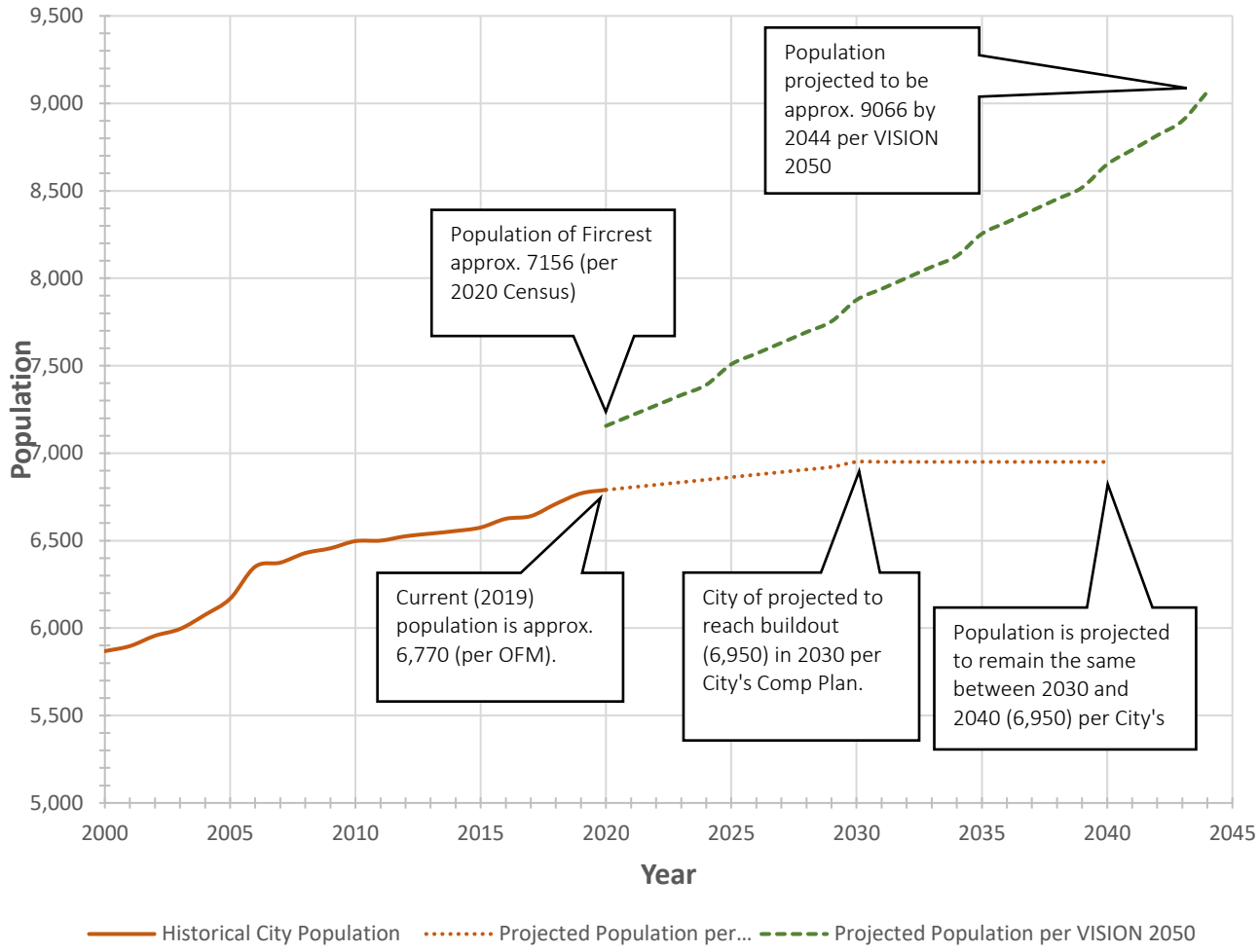
3.4.2 Population Projections

The City's Comprehensive Plan, written in 2016, provided a population projection consistent with the County's population projections. This projection estimated an average annual growth of approximately two percent. The City expected to continue at this rate until reaching full build out in 2030. After 2030, the City expected population growth to be negligible.

VISION 2050, adopted in 2020, supplied an alternative population projection. This alternative projection calls for High-Capacity Transport Communities to accommodate a population growth of 17 percent from 2020 to 2040. Based on the 2020 US Census, the population of the City was 7,516 people. With a 24 percent growth rate, the population is estimated to be around 8,651 people by 2040.

Figure 3-3 illustrates the City's historical as well as the two distinct population projections through the twenty-year planning period (2040).

Figure 3-3 | Historical Population and Future Projection



As previously mentioned, the City is largely built-out and has no existing UGA. Growth within the City will be limited to the development of the few undeveloped lots within the City Limits and increased density within the developed areas of the City. Increased density will primarily require upzoning.

Because of the limited areas currently available for development, the City expects slower growth than Vision 2050 projects. Therefore, the City has chosen to move forward with the population projected in the 2016 Comprehensive Plan. These population projections, along with the historical per capita water use data presented in **Chapter 4**, form the basis for deciding the future demands of the City's water system. However, a system capacity analysis using the VISION 2050 population projections has been provided in **Appendix P - Agency Review Comments.** The results of this analysis show that the City's system has sufficient capacity to handle VISION 2050's population projections.

3.5 Summary

This chapter reviewed relevant planning documents for the area as well as the existing land use and current planned development for the area. The City Comprehensive Plan's projection and Vision 2050 projection were both considered. Due to the limited available developable lots within the City's RWSA, the WSP will use the smaller growth projections provided in the 2016 Comprehensive Plan. This projection assumes there will be no further growth as the City will be at full build-out. This population projection will be used to estimate future water demands in Chapter 4. Despite this, an analysis of the system capacity compared to the higher growth in Vision 2050 showed that the City's water system can support any growth that may occur. That analysis is provided in Appendix P - Agency Review Comments.

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Chapter 4

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Chapter 4

Water Demands

4.1 Introduction

The City's planning efforts rely on a thorough analysis of its system's water demands. This analysis reviewed the historical water supply and demand data from 2014 to 2019. Using this data, the City's demand per ERU, the ADD, and the MDD were calculated for each year. The analysis then looked at the historical trends of these values and determined "planning" values to use in forecasting the system's future water demand.

These planning values, along with the population projections presented in Chapter 3, were used to forecast the future water supply and demand needs for the system for the next 10 and 20-year planning periods. The future water supply and demands determined by this analysis are used in Chapter 8 to analyze the water system facilities and form the basis for sizing future water system improvements described in Chapter 9.

4.2 Historical Water Demands

This section summarizes the City's historical water consumption and supply trends between 2014 and 2019. Using this data, the average ERU and daily demand values were calculated for these years.

4.2.1 Historical Water Consumption

Water consumption is the amount of water that customers use, as measured by their water meters. For planning purposes, all water customers have been combined into six groups: single-family residential, multi-family residential, commercial, and industrial, irrigation, and non-retail. The consumption analysis that follows will summarize the water use patterns of these six user groups. The average number of connections, average annual consumption, and average daily consumption per connection for each customer group between 2014 and 2019 are shown in Table 4-1.

Table 4-1 | Average Annual Metered Consumption and Service Connections

Year	Customer Group					Totals
	Single Family Residential	Multi-Family Residential	Commercial & Industrial	Irrigation	Non-retail[1]	
Number of Connections						
2014	2146	477	97	22	0	2,741
2015	2153	477	97	25	0	2,751
2016	2164	478	102	24	0	2,768
2017	2174	475	104	24	0	2,777
2018	2,179	474	104	25	0	2,782
2019	2,181	474	104	24	0	2,783
Annual Consumption (1,000 gallons)						
2014	167,786	24,948	12,871	14,283	433	220,321
2015	179,054	25,240	12,829	16,675	463	234,261
2016	176,674	26,044	13,097	15,517	331	231,663
2017	171,100	26,914	13,293	16,974	286	228,566
2018	174,807	27,639	11,764	16,232	232	230,674
2019	164,984	24,868	10,571	14,764	250	215,436
Average Daily Consumption per Connection (gal/day/connection)						
2014	214	143	363	1,774	0	219
2015	228	145	363	1,865	0	233
2016	223	149	353	1,767	0	228
2017	216	155	350	1,911	0	225
2018	219	159	309	1,798	0	226
2019	207	144	278	1,662	0	212
Average	218	149	336	1,796	0	224

Note:
1. Non-retail connections accounts for water sold at hydrants and could not be attributed to connections, so the average daily consumption per connection is not applicable and is left blank.

Most of the water consumption is from single-family residential customers. The single-family residential group accounts for approximately 78 percent of the City's customers. Commercial and Industrial and Irrigation groups have the highest consumption per connection because these customer classes serve the system's largest water users. Consumption attributed to the non-retail customer class includes water sold at hydrants for construction and other temporary uses.

4.2.2 Largest Water Users

Table 4-2 shows the City's top 20 highest demand water customers in 2019. The total water consumption of these customers is approximately 13 percent of the total consumption in 2019. The list is comprised of apartment complexes, golf course, commercial connections, schools, and a few single-family residential connections.

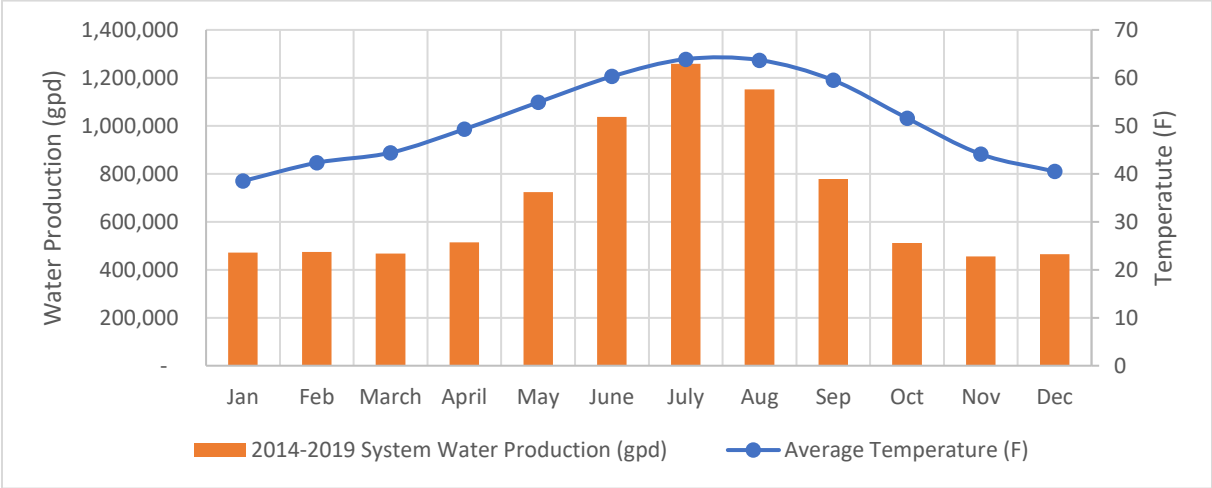
Table 4-2 | 2019 Largest Water Users

Type of Service	Service Address/Location	Consumption (gal)
Apartment Complex	Arleo Lane 1086	7,523,833
Apartment Complex	Mar Vista Drive 1303	5,030,681
Apartment Complex	Regents Boulevard 1317-1339	4,468,589
Golf Course	Regents Boulevard 1500	1,998,110
Apartment Complex	Rainier Drive 1415	929,166
Apartment Complex	Rainier Drive 1422	910,690
Apartment Complex	Rainier Drive 1442	850,177
Commercial	Orchard Street 4040	810,308
Wainwright School	Alameda Avenue 130	680,770
Apartment Complex	Rainier Court 1433	653,812
Commercial	Regents Boulevard 1019	637,954
Apartment Complex	Rainier Drive 1410	580,598
Apartment Complex	Rainier Drive 1425	478,039
Apartment Complex	Alameda Avenue 1402	439,151
Apartment Complex	Rainier Court 1461	428,679
Single Family Residential	Weathervane Drive 1432	381944
Commercial	Regents Boulevard 302	374,830
Single Family Residential	Broadview Drive 1037	368757
Single Family Residential	Panorama Drive 1103	357342
Apartment Complex	Alameda Avenue 1450	337,849
Total (gal)		**28,241,279**
% OF Total Usage		**13.1%**

4.2.3 Seasonal Variations in Consumption

Water consumption is affected by seasonal variables such as temperature and precipitation, influencing the system's peaking factors. **Figure 4-1** shows the relationship between the average monthly temperature in the City and the average system production between 2014 and 2019. In general, as temperature increases, so does system demand. The system demand shown in the chart below includes all customer demands as well as system leakage and non-revenue demands.

Figure 4-1 | Seasonal Variation on System Demand



4.2.4 Equivalent Residential Unit

The demand of each customer class can be expressed in terms of ERUs for demand forecasting and planning purposes. Rather than expressing water demand in terms of use per connection, the data is normalized by ERU which stands for a typical single-family residence.

Table 4-3 uses the annual demand and number of single-family residential connections as well as the annual DSL to calculate the system's ERU value from 2014 through 2019. The average annual demand is scaled by the system's annual DSL, to account for water loss in the system, and then divided by the total number of connections.

Table 4-3 | System Equivalent Residential Unit (ERUs) Summary

Year	Number of Single-Family Connections	Average Annual Demand (gallons per day)	Demand ERU (gpd/ERU)	Annual DSL[1]	Supply ERU (gpd/ERU)[2]
2014	2,146	458,431	214	6.0%	226.50
2015	2,153	490,558	228	4.6%	238.41
2016	2,164	482,715	223	6.2%	236.95
2017	2,174	468,767	216	5.8%	228.10
2018	2,179	477,614	219	6.4%	233.23
2019	2,181	452,010	207	3.3%	214.14
		2014 – 2019 Average	**218**	**5.4%**	**229.55**

Notes:
1. Annual DSL is described in further detail in Section 4.3
2. Supply ERU includes the demand ERU plus DSL and is used in the system capacity analysis described in **Chapter 8**.

Table 4-4 shows the number of ERUs per customer class, which is calculated by dividing the average water demand per connection, shown in **Table 4-1**, by the system's demand per ERU, shown in **Table 4-3**.

Table 4-4 | Number of Equivalent Residential Unit (ERUs) per Customer Class

Year	Supply/ ERU[1]	Single Family Residential	Multi-Family Residential	Commercial & Industrial	Irrigation	Non-Retail	Non-Billed Authorized Consumption[2, 3]	Total System ERUs
2014	227	2,024	301	155	172	5	0	2,658
2015	238	2,058	290	147	192	5	0	2,692
2016	237	2,037	300	151	179	4	0	2,671
2017	228	2,055	323	160	204	3	172	2,918
2018	233	2,048	324	138	190	3	482	3,184
2019	214	2,111	318	135	189	3	265	3,021
							2014 – 2019 Average	**2,857**

Notes:
1. These values come from the "Supply ERU" column in **Table 4-3**.
2. Non-Billed Authorized Consumption is described in further detail in **Section 4.3**.
3. Unmetered consumption was not tracked for 2014-2016, and therefore, Non-Billed Authorized Consumption is shown as zero.

4.2.5 Average Day Demand

The ADD is calculated based on water supply rather than water consumption. Water supply is the total amount of water delivered to the City's water system, as measured through the meters at both supply facilities. Water supply is different than water consumption in that water supply is the amount of water delivered into the system and water consumption is the amount of water taken out of the system. For any given year, the amount of water supply will be greater than the amount of water consumption, due to system leaks and non-metered uses, which will be further described in the next section.

Table 4-5 summarizes the total amount of water that was supplied to the City's system from 2015 through 2019, the average population within the City's RWSA, and the computed per capita demand for each year. The ADD is found from historical water use patterns of the system and can be used to project future demand within the system. The ADD data is typically used to determine standby storage and other requirements for water systems.

Table 4-5 | Average Annual System Demand

Year	Average Metered Supply (gpd)	City Population	Average Day Demand (gpd/capita)
2015	671,647	6,575	102
2016	674,259	6,625	102
2017	706,486	6,640	106
2018	795,705	6,710	119
2019	669,114	6,770	99
		Average	**106**

As shown in Table 4-5, average demand per capita fluctuates from year to year, but an overall trend shows per capita water demand has been steady despite population growth. Monthly supply from active wells is included in Appendix E - Monthly Supply Data.

4.3 Water Use Efficiency

The Water Use Efficiency (WUE) Rule, which became effective in January 2007, established a DSL standard that all public water systems were required to meet by July 1, 2010. To comply with the WUE Rule, the City implemented its first WUE Program in 2007. The program has been updated at least every six years and will be updated again as part of this WSP. A copy of the City's current WUE Program is included in Appendix F - Conservation Plan.

The City's WUE Program focuses on reducing DSL and encouraging water conservation. The goal is to reduce customer water demand by 0.2 percent per year. DSL is defined as the difference between authorized consumption and total water supply. This may include water system leaks, inaccurate supply metering, inaccurate customer metering, unknown fire hydrant usage, illegal water service connections, and unknown reservoir overflows. According to the WUE Rule, DSL must not make up than 10 percent of supply, based on a 3-year rolling average, or a water loss control action plan must be prepared and implemented.

Authorized consumption is the amount of water authorized for use. There are two types of authorized consumption: billed and non-billed. Billed authorized consumption generally includes consumption tracked by customer meters. Non-billed authorized consumption is consumption that is tracked or estimated, but not billed. Some examples of non-billed authorized consumption are firefighting activities, water main flushing, cleaning tanks and reservoirs, and street cleaning. Non-billed authorized consumption makes up a small part of the total authorized consumption.

The difference between the amount of water supplied to the City and the amount of metered water consumption from 2014 through 2019 is shown in Table 4-6.

Table 4-6 | Water Use Efficiency Analysis (1,000 gallons)

Year	Total Supply	Billed Authorized Consumption	Non-Billed Authorized Consumption	Total Authorized Consumption[1]	DSL	Percent DSL	3-Year Rolling Average
2014[1]	233,915	220,321	0	219,873	14,042	6.0%	10.6%
2015[1]	245,151	234,261	0	233,810	11,341	4.6%	6.0%
2016[1]	246,779	231,663	0	231,394	15,385	6.2%	5.6%
2017	257,867	228,566	14,342	242,908	14,959	5.8%	5.6%
2018	290,432	230,674	41,136	271,810	18,623	6.4%	6.1%
2019	244,227	215,436	20,710	236,145	8,082	3.3%	5.2%

Note:
1. 2014, 2015, and 2016 total authorized usage values differ slightly than what was reported in the City's WUE reports. These differences are minor and can be attributed to rounding and reporting differences.

The 3-year rolling average of DSL in 2019 is 5.2 percent, which is less than 10 percent of total supply. Therefore, the City does not need to implement a water loss control action plan. The City will continue to collect data, monitor all uses of water, and report annually the amount of DSL.

4.3.1 Reclaimed Water Feasibility

The City does not currently have a feasible source of reclaimed water because the City's generated wastewater is pumped to City of Tacoma Environmental Services' sewer system for treatment. For reclaimed water to be economically feasible, the cost of constructing and operating a wastewater treatment facility; constructing and operating reclaimed water storage; and distributing reclaimed water must be less than the cost of paying Tacoma Environmental Services.

The golf course has been identified as a potential opportunity of use of reclaimed water; however, it is not currently financially feasible. The City does not currently have any plans to implement a reuse system but will continue to re-evaluate periodically.

4.4 Peaking Factors

Peaking factors are used to estimate the MDD and PHD for a water system. MDD and PHD peaking factors were estimated using historical system data and equations from the DOH Water Design Manual.

The MDD is the largest amount of water consumed and used throughout the system during a 24-hour period of a given year. The MDD typically occurs on a hot summer day when outdoor water use for lawn watering and other purposes is occurring throughout much of the system. The MDD is used in FF availability reporting and in sizing supply facilities (e.g., supply stations, booster pump stations, interties) capacity analyses. The system's MDD factor was calculated from historical system data.

The PHD is the amount of water used (excluding FF) during the largest use hour of the year. In accordance with WAC 246-290-230, new public water systems or additions to existing systems shall be designed to provide domestic water at a minimum pressure of 30 psi during PHD conditions. Low pressure analysis and equalizing storage are typically based on PHD data. The system's PHD factor was estimated using Equation 3-1 in the DOH Water Design Manual, which is largely based on population size.

Table 4-7 shows the MDD and PHD factors for 2015 through 2019. The five-year average MDD/ADD and PHD/MDD peaking factors will be used in future water demand projections.

Table 4-7 | Peaking Factor Analysis

Year	Average Metered Supply (gpd)	Max Day Demand (gpd)	MDD:ADD Peaking Factor	Calculated PHD (gpm)	PHD:MDD Peaking Factor
2015	671,647	1,580,802	2.35	1,866	1.70
2016	674,259	1,593,178	2.36	1,881	1.70
2017	706,486	1,558,338	2.21	1,833	1.69
2018	795,705	1,708,557	2.15	2,000	1.69
2019	669,114	1,391,178	2.08	1,636	1.69
Five-Year Average (2015-2019)			**2.23**		**1.69**

4.5 Future Water Demands

The City's future water demands are estimated using the projected population data from **Chapter 3** and the historical water supply and demand data discussed in **Section 4.2**. The peaking factors discussed in **Section 4.4** were used to estimate future MDD and PHD.

4.5.1 Projected Demands

The projected water demands for the system were calculated from the population projections in **Chapter 3** and the planning values shown in **Table 4-8**. Future demand projections are shown with and without a further reduction in demand from WUE efforts, assuming the City meets its current WUE goal.

Table 4-8 | Planning Values for Water Demand Projections

Type	Planning Value	Reference Section
Average Day Demand	106 gpd/capita	**Table 4-5**
Maximum Day Demand Factor (MDD/ADD)	2.23	**Table 4-7**
Peak Hour Demand Factor (PHD/MDD)	1.69	**Table 4-7**
WUE Goal	0.2% reduction per year	**Section 4.3**

Table 4-9, at the end of this chapter, presents the estimated water demands of the system each year for the next 20 years. The actual 2019 demand and the estimated 2020 demand are also shown in the table for comparison purposes.

The future ADDs were projected based on the estimated per capita demand and population estimates for each given year. The future MDD and PHD were computed from the projected ADDs and the existing system peaking factors shown in **Table 4-8**. **Table 4-9** also shows the projected demands, assuming the City meets its WUE goal.

The 20-year (2040) projected demand data without conservation reductions were used for the evaluation of the planned improvements presented in **Chapter 9** to ensure that the future system will be sized properly to meet all requirements, whether or not additional water use reductions

from conservation are achieved. However, the City will pursue further water use reductions by implementing the WUE Program elements (see Appendix F - Conservation Plan).

4.6 Summary

The water consumption and use data presented in this chapter includes historical water production and consumption, DSL, and demand projections. This data will be used in Chapter 8 to analyze the effectiveness of water system facilities and procedures. In addition, this data will be used in Chapter 9 to decide the future improvements needed to meet the design criteria presented in Chapter 5.

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Table 4-9 | Future Retail Water Demand Projections (gallons per day)

Description	Base Year[1] 2019	Planning Year[2] 2020	Ten-Year Planning Period										20-Yr Period 2040
			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Population in Water Service Area	6,770	6,790	6,805	6,819	6,834	6,848	6,863	6,877	6,892	6,906	6,921	6,950	6,950
Estimated Number of ERUs	2,916	3,128	3,134	3,141	3,148	3,154	3,161	3,168	3,174	3,181	3,188	3,201	3,201
Average Day Demand Projections (gpd)	669,114	719,740	721,282	722,824	724,365	725,907	727,449	728,991	730,533	732,075	733,616	736,700	736,700
w/ WUE Efforts		718,301	718,394	718,478	718,553	718,619	718,676	718,724	718,762	718,791	718,811	720,330	705,132
Maximum Day Demand Projections (gpd)	1,492,125	1,605,020	1,608,458	1,611,897	1,615,335	1,618,773	1,622,211	1,625,650	1,629,088	1,632,526	1,635,964	1,642,841	1,642,841
w/ WUE Efforts		1,601,810	1,602,018	1,602,206	1,602,373	1,602,521	1,602,647	1,602,754	1,602,839	1,602,905	1,602,949	1,606,335	1,572,444
Peak Hour Demand Projections (gpm)	1,751	1,884	1,888	1,892	1,896	1,900	1,904	1,908	1,912	1,916	1,920	1,928	1,928
w/ WUE Efforts		1,880	1,880	1,880	1,881	1,881	1,881	1,881	1,881	1,881	1,881	1,885	1,845
Annual Demand Projections (1,000 gal)	244,227	262,705	263,268	263,831	264,393	264,956	265,519	266,082	266,644	267,207	267,770	268,896	268,896
w/ WUE Efforts		262,180	262,214	262,244	262,272	262,296	262,317	262,334	262,348	262,359	262,366	262,920	257,373

Note:

1. Based Year data shows historical retail supply for that year. Maximum day and peak hour demands are estimated using the peaking factors discussed in **Section 4.4**. Water use efficiency (WUE) projections are not relevant for historical data, and therefore, not included.
2. Planning Year data represents the projected information for the current planning year

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Chapter 5

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Chapter 5

Policies and Design Criteria

5.1 Introduction

The City provides potable water service for its customers according to the laws, policies, and design criteria that originate from seven regulatory agencies, as summarized in Table 5-1. The agencies are listed in descending order from those with the broadest authority in setting laws, policies, and design criteria that guide the development of this WSP to the narrowest authority.

Table 5-1 | Regulatory Agency Summary

Agency	Origin and Type of Design Criteria, Laws, and/or Policies
U.S. Department of Health & Human Services	Federal Regulations
U.S. Environmental Protection Agency	Federal Regulations
State DOH	State Regulations
State Department of Ecology (Ecology)	State Regulations
Pierce County Council	County Regulations
Fircrest City Council	Administrative Policies
American Water Works Association	Design Criteria

These laws, policies, and design criteria guide the City's daily operation and maintenance of its system as well as the design of improvement projects and the planning for future system needs. The U.S. Government, the State, and Pierce County Council establish requirements in statutes, regulations, or ordinances to ensure high quality drinking water at sufficient quantities to meet existing and future system demands. The City Council and Mayor adopt policies in the form of ordinances, memoranda, and operation procedures that cannot be less stringent or in conflict with those established by governments above them.

Policies associated with the following categories are presented in this chapter.

- Water Service
- Water Supply
- Facilities
- Finance
- Organization

5.2 Water Service Policies

The City has created water service policies to maintain quality water supply for existing and future customers. These policies reference new water services, temporary services, emergency services, and planning boundaries.

5.2.1 New Water Service

To provide safe, reliable drinking water within its RWSA, the City has adopted the following policies.

1. Potable water service will be provided to all people within city limits and designated water service area, provided all policies related to service can be met.

2. All proposed developments within city limits and designated water service area will connect directly to the City's existing water system, unless deemed infeasible by the City at the time of the request.

3. Water system improvements required to provide water service to proposed developments must be approved by the Public Works Department and conform to the City's adopted design criteria, and construction standards and specifications, as shown in the City's Development Design Standards contained in Appendix G - Water System Construction Standards. The Applicant shall install new water main to the limits of the property. The Applicant will pay all costs of the permits and water system improvements. Recovery contracts (latecomers fees) may be recorded against adjacent frontage.

4. Requests for new water service will be processed by the City's permit coordinator in accordance with City Municipal Code. Applications must be received at least one week prior to connection of water service. Once applications are received by the permit coordinator, the location of the proposed service will be reviewed to ensure it is within the City's retail water service area and will be evaluated to determine FF availability, meter size, and other associated improvements necessary for adequate water pressure, FF, looping, or extensions. The adequacy of water system capacity to serve the applicant's property will also be evaluated at that time. New water service applications will be processed within one week of receipt of application and associated fees.

5. The City will determine whether adequate water system capacity is available to serve the applicant's property, based on available capacity from supply, storage, and transmission systems. This will be accomplished through the ongoing tracking of ERUs served by the City in comparison to the maximum number of ERUs that can be served by the system, as computed in Chapter 8 of this WSP.

6. Water service applications will expire at the time that the associated building permit expires or if the applicant has not readied water service for connection by the City within 120 days of the approval of the water service application.

7. Time extensions regarding water availability will be granted in accordance with the associated building permit requirements. When extensions are denied, a written notice of appeal, together with an appeal filing fee, may be submitted in person to the Permit Center. Appeals must be made within the time specified under the requirements of the associated permit and in accordance with City Municipal Code.

8. Delays resulting from non-technical conditions that affect the City's ability to provide new water service will be the responsibility of the Applicant. These conditions include, but are not limited to, environmental assessments and local ordinances and procedures.

5.2.2 Temporary Service

No temporary service is allowed, unless there are approved plans for permanent water service that meet all City standards.

5.2.3 Emergency Service

The City has adopted the following policies regarding emergency water service.

1. Compliance with standards may be deferred for emergency water service.
2. Policy criteria may be waived for emergency service.

5.2.4 Planning Boundaries

For planning purposes, the City will use water service boundaries established by agreement because of the PCCWSP and as has been modified or further described by the City.

5.3 Water Supply Policies

The City follows water supply policies to protect water quality and sustainability to meet the needs of all its customers.

5.3.1 Water Quality

1. The City will strive to provide high quality water while complying with all water quality regulatory requirements.

2. The City will take all reasonable measures to protect its system and customers and will promptly respond to situations that may adversely affect water quality.

5.3.2 Water Quantity

The City has adopted the following policies to ensure that it delivers high quality, safe water which meets or exceeds all local, state, and federal guidelines.

1. The City will pursue steps to meet or exceed all water quality laws and standards.
2. The City will take all reasonable measures to protect its system and customers.

5.3.3 Water Use Efficiency and Regional Participation

To promote the efficient use of water, the City has adopted the following policies.

1. The City will participate in regional supply management and planning activities to reduce the cost of service while improving reliability, water quality, and quantity.

2. The City will promote the efficient and responsible use of water and will conserve water during a shortage.

3. The City has a WUE Program and participates in regional water conservation efforts. Documentation from the City's WUE Program is contained in Appendix F - Conservation Plan.

5.3.4 Cross-Connection Control

Protecting the water system is of the utmost importance to the City. To help protect the water system from potential pollutants or contaminants which may be introduced from cross-connections, the City has adopted the following policies.

1. The City strives to protect its water system from contamination due to cross-connections. To eliminate them, it has developed a Cross-Connection Control Program. Documentation from the program is contained in Appendix H - Cross Connection Control Program.

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

3. The City has staff that are certified as Cross-Connection Control Specialists.

5.4 Facility Policies and Design Criteria

This section describes the planning policies and design criteria used to establish an acceptable hydraulic behavior level and a standard of quality for the water system. Additional criteria are contained in the City's Development Design Standards contained in Appendix G - Water System Construction Standards.

All design and construction standards comply with Pierce County Codes (PCC) 19D.130, 17C.60.160 and 165.

5.4.1 Minimum Standards

Minimum design standards ensure the City can provide a uniform and reliable water service.

1. All proposed developments within the City's existing and future service areas shall conform to the City's adopted design criteria, City Municipal Code, construction standards, and standard specifications.

2. All projects within unincorporated County right-of-way must be designed and constructed in accordance with the City's Development Design Standards. They shall also be inspected and approved by City.

3. In accordance with WAC 246-290-200 - Design Standards: (1) Purveyors shall ensure that good engineering criteria and practices are used in the design and construction of all public water systems, such as those set out in:

    a. The most recent published edition of the DOH's Water System Design Manual, International Building Code (IBC), Uniform Plumbing Code (UPC), and other national model codes adopted in the State;

    b. The most recent published edition of *Recommended Standards for Water Works, A Committee Report of the Great Lakes - Upper Mississippi River Board of State Public Health and Environmental Managers*;

    c. Standard specifications of the American Public Works Association, the American Society of Civil Engineers, AWWA, or the American Society for Testing and Materials;

    d. Design criteria, such as contained in current college texts and professional journal articles, acceptable to the City's Public Works Department;

    e. Chapter 173-160 WAC *Minimum Standards for Construction and Maintenance of Wells*;

    f. The latest edition of the PNWS-AWWA Cross-Connection Control Manual, or the University of Southern California (USC) Manual of Cross-Connection Control.

4. In accordance with WAC 246-290-220 - Drinking water materials and additives: (1) All materials shall conform to the American National Standards Institute (ANSI)/National Sanitation Foundation (NSF) Standard 61 if in substantial contact with potable water supplies.

5. In accordance with WAC 246-290-451 - Disinfection of drinking water: (1) No portion of a public water system containing potable water shall be put into service, nor shall service be resumed until the facility has been effectively disinfected.

    a. In cases of new construction, drinking water shall not be furnished to the consumer until satisfactory bacteriological samples have been analyzed by a laboratory certified by the State.

    b. In cases of existing water mains, when the integrity of the main is lost resulting in a significant loss of pressure that places the main at risk to contamination, the purveyor shall use standard industry practices to ensure adequate and safe water quality prior to the return of the line to service, including at least one of the following.

        i. Flushing
        ii. Disinfection
        iii. Bacteriological sampling

    The procedure used for disinfection shall conform to standards published by the AWWA, or other industry standards acceptable to the Public Works Department.

5.4.2 Water Pressure

Pressure criteria at service connections are summarized below. These pressure criteria are based on current City standard practices, which are based in part on industry standards, the DOH, and UPC requirements.

1. The City will supply water to all customers at a minimum pressure of 30 psi during all demand conditions, except when providing FF or during emergency situations.

2. During FF situations, the City will maintain a minimum pressure of at least 20 psi at all customer meters and throughout the system.

3. The City will provide pressure reducing stations to control pressures in the distribution system and avoid high pressures. It is the customer's responsibility to install and maintain a pressure reducing valve on their side of the water meter to reduce pressures to 80 psi or less.

4. The City will endeavor to limit the maximum pressure to 120 psi in the water mains during normal demand conditions, excluding pressure surges.

5.4.3 Pipeline Velocities

Policies regarding velocity of water flow have been created to maintain system reliability for all customers in emergency and non-emergency conditions.

1. Under normal demand conditions, all new distribution system water mains will be designed to deliver the required amount of flow at a velocity of 8 feet per second (fps) or less. Velocities greater than 8 fps are acceptable within short lengths of pipe and within water system facilities.

2. Under normal demand conditions, all new transmission mains will be designed to deliver the required amount of flow at a maximum velocity of 5 fps. Transmission mains designed with velocities greater than 5 fps will be evaluated for hydraulic surges (transient conditions) using a hydraulic model capable of surge analyses.

3. Under emergency conditions, such as a fire, all distribution and transmission system water mains will be designed to deliver the required FF and simultaneous MDD at a velocity of 10 fps or less.

5.4.4 Storage Facilities

The City has multiple types of water storage to maintain reliable service for all customers during all seasons and conditions. The following is a list of policies regarding water storage.

1. Storage within the distribution system has sufficient capacity to supplement supply when system demands are greater than the supply capacity (equalizing storage) and still maintain sufficient storage for proper pump operation (operational storage), fire suppression (FF storage), and other emergency conditions (standby storage).

2. Standby storage must be stored above the elevation that yields a 20-psi service pressure to all services in the zone that it directly serves under PHD conditions.

3. FF storage must be stored above the elevation that yields a 20-psi service pressure to all services in the zone that it directly serves under MDD conditions.

4. The City will provide sufficient standby storage for an emergency condition in which a major supply source is out of service. The volume of storage will be sufficient to maintain uninterrupted supply to the system for at least two days during the emergency condition.

5. The City will provide sufficient storage for a fire condition equal to the system's maximum fire protection water demand and the required duration.

6. The City will have high-water level and low-water level alarms for all storage facilities at the Operations and Maintenance or Engineering office.

7. Water level data will be transmitted to the Operations and Maintenance or Engineering office.

8. Storage facilities will be in areas where they will satisfy the following requirements.

    a. Minimize fluctuations in system pressure during normal demands.
    b. Maximize use of the storage facilities during fires and peak demand periods.
    c. Improve the reliability of supply to the water system.

5.4.5 Transmission and Distribution Mains

The policies regulating transmission and distribution of water are essential to the quality of water, reliability of service, and FF capacity. Consistency in policy allows for more ease in system maintenance and installation. The following is a list of policies regarding water transmission and distribution.

1. All new transmission and distribution mains will be looped to improve water quality, increase reliability, and increase FF capacity, unless the City determines that looping is not practical.

2. All new water mains will be designed under the direction of a professional engineer licensed in the State and will comply with the water quality testing and construction completion requirements of the DOH.

3. All new construction will be in accordance with the City's Development Design Standards.

4. All new water mains will be sized by a hydraulic analysis.

5. All new mains providing FF will be sized to provide the required FF at a minimum residual pressure of 20 psi and maximum pipeline velocity as dictated in Section 5.4.3 of this WSP.

6. The minimum diameter of distribution mains shall be 8 inches and may be reduced to 6 inches or less, provided FF requirements can be met. Mains with diameters smaller than 6 inches are not allowed.

7. Valve installation on water mains shall be designed based on the following.

    a. Isolation valves shall be installed at locations along the water main to allow sections to be shut down for repair or installing services. The maximum distance between isolation valves shall not exceed 1,000 feet. A minimum of three valves shall be provided per cross, and two valves per tee.

    b. Zone valves shall be located at all pressure zone boundaries when a water main crosses a pressure zone boundary without a pressure reducing station.

c. Combination air and vacuum release valves shall be placed at all high points of water main installations.

d. Blow-off assemblies shall be located at water main dead ends where there is not a fire hydrant. If a water main extension is expected in the future, the blow-off assembly shall have a valve the same size as the main with concrete thrust blocking.

e. Individual service PRVs must be installed on all new customer service lines in the City. The UPC requires them on customer service lines if pressures are greater than 80 psi. PRVs protect customers from high pressures in case a mainline pressure reducing station fails.

8. Fire hydrant installations will satisfy the following criteria.

    a. Fire hydrants serving detached single-family dwellings or duplex dwellings on individual lots will be located not more than 600 feet on center with a maximum 300-foot frontage length from any lot to a hydrant.

    b. The number of fire hydrants shall be determined on an average spacing of 300 feet computed on an imaginary line parallel to and not less than 50 feet from the structure.

    c. All hydrants are to be accessible to fire department pumpers over roads capable of supporting such fire apparatus. The City Engineer shall approve the location of the fire hydrants depending on utility, topography, and building location.

    d. Hydrants shall be a minimum of 50 feet out from the building, minor deviations may be granted.

    e. Hydrants located in dead-end areas or cul-de-sacs shall service an area of no more than 120,000 square feet.

    f. The Public Works Department will consult with the Fire Department to review all proposed fire hydrant installations to ensure the correct number, location, and spacing of fire hydrants for each project.

5.4.6 Supply and Booster Pump Stations

Well and pump station facilities are vital to the efficient and reliable operation of a water system. The City has adopted the following policies regarding well and pump station facilities.

1. Improvements to existing and all new supply and booster pump stations will be designed to comply with the following minimum standards.

    a. All structures will be non-combustible, where practical.

b. All buildings will have adequate heating, cooling, ventilation, insulation, lighting, and workspaces necessary for on-site operation and repair.

c. Each station will be equipped with a flow meter and all necessary instrumentation to assist personnel in operating and troubleshooting the facility.

d. Backup emergency power capability will be provided to at least one booster pump station supplying each pressure zone and sized to meet the firm capacity of that pump station.

2. Pumps will be operated automatically with flexibility in pump start/stop settings.

3. Stations will be operated with the provision for at least two methods of control to minimize system vulnerability.

4. Manual override of stations will be provided for and located at the Operations and Maintenance office using the City's telemetry and supervisory control system.

5. Stations will be monitored with alarms for the following conditions.

    a. Pump started automatically or manually
    b. Power phase failure
    c. Communication failure
    d. Flooding and fire
    e. Intrusion by unauthorized personnel
    f. Low suction pressure
    g. High discharge pressure

6. Stations will have the following indicators.

    a. Local flow indication and totalizing

    b. Flow indication and totalizing at the Operations and Maintenance or Engineering office

    c. Recording of combined supply to the system

7. Stations will be placed wherever necessary to fulfill the following criteria.

    a. Provide supply redundancy to a pressure zone.
    b. Improve the hydraulic characteristics of a pressure zone.
    c. Maximize storage availability and transmission capacity.
    d. Improve water quality (i.e., increase circulation) and quantity.

5.4.7 Pressure Reducing Stations

The City has adopted the following policies regarding pressure reducing stations to provide facilities which are reliable and easy to maintain.

1. All PRVs will be placed in vaults that are large enough to provide ample workspace for field inspection and valve repair.

2. Vaults will drain to daylight or be equipped with sump pumps to prevent vault flooding.

3. Additional PRVs will be provided on the low-pressure side to prevent system over-pressurizing in case of a PRV failure and will be sized by hydraulic analysis.

5.4.8 Water System Control

The City's control system must be capable of efficiently operating the water system's components in accordance with this WSP and in response to reservoir levels, system pressures, abnormal system conditions, electrical power rate structure, and water costs. The system must be reliable and kept up to date to avoid disruption of customer water service and maintain efficient use of water supplies.

5.4.9 Maintenance

The City has adopted the following policies regarding maintenance of equipment and facilities within its water system.

1. Facility and equipment breakdown are given highest maintenance priority. Emergency repairs will be made even if overtime labor is involved.

2. Equipment will be scheduled for replacement when it becomes obsolete (equipment is no longer supported by the manufacturer) and as funding is available.

3. Worn parts will be repaired, replaced, or rebuilt before they represent a high failure probability.

4. Spare parts will be stocked for all equipment items whose failure will impact the ability to meet other policy standards.

5. Equipment that is out of service will be returned to service as soon as possible.

6. A preventive maintenance schedule will be established for all facilities, equipment, and processes.

7. Tools will be obtained and maintained to repair all items whose failure will impact the ability to meet other policy standards.

8. Dry, heated shop space will be available for maintenance personnel to maintain facilities.

9. All maintenance personnel will be trained to efficiently perform their job descriptions.

10. Maintenance will be performed by the water maintenance staff and supervised by the Public Works Director.

11. Written records and reports will be maintained on each facility and item of equipment showing operation and maintenance history.

5.5 Financial Policies

To maintain financial viability and a high quality, safe, and reliable water system, the City has adopted the following financial policies.

1. The City will set rates that comply with standards established by the AWWA.

2. Rates and additional charges established for the City should be:

    a. Cost-based rates that recover current, historical, and future costs associated with the City's water system services, and support facilities,

    b. Equitable charges to recover costs from customers, commensurate with the benefits they receive, and

    c. Adequate and stable source of funds to cover the current and future cash needs of the City Public Works Department.

3. Existing customers of the City will pay the direct and indirect costs of operating and maintaining the facilities through user rates. In addition, the user rates will include debt service incurred to finance the water capital assets of the City.

4. New customers seeking to connect to the water system will be required to pay a connection charge for an equitable share of the historical cost of the system and for the system's CIP. Connection charge revenues will be used to fund the water CIP project list in conjunction with rate revenue.

5. New and existing customers will be charged for extra services through separate ancillary charges.

6. The City will maintain information systems that provide sufficient financial and statistical information to ensure conformance with rate-setting policies and objectives.

7. User charges must be sufficient to provide cash for the expenses of operating and maintaining the system. To ensure the fiscal and physical integrity of the utility, each year an amount should also be set aside and retained for capital expenditures, which will cover

some portion of the depreciation of the physical infrastructure. The amount may be transferred between the Water Fund to the Capital Fund for general or specific purposes.

8. A Working Capital Reserve will be maintained to cover unanticipated emergencies and fluctuations in cash flow. The City will maintain a cash reserve for the Water Fund.

9. Water rates will be based on either the Base-Extra Capacity Method or the Commodity-Demand Method. Both methods strive to equitably charge customers with different service requirements based on the cost of providing the water service. Service requirements relate to the total volume of water used, peak rates of use, and other factors.

10. Fees and charges are calculated for the service area as a whole. Rates will be the same regardless of service location for existing customers.

5.5.1 Connection Charges

To have an equitable method of paying for water system improvements, the City has adopted the following connection charge policies.

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

    a. Recovery Contracts (Latecomers Fees): Recovery contracts are negotiated with developers and property owners to provide for the reimbursement of a pro rata portion of the original cost of water system extensions and facilities.

    b. General Facilities Charge: The connection charge will be assessed against any property that has not participated in the development of the water system. Meter charges or other hookup fees are additional to recover the cost of meter and service line installation.

    c. Developer Extension Charges: These charges are for the administration, review, and inspection of developer extension projects.

5.6 Organizational Policies

Appropriate organizational policies are key to the continued successful operation of the City. To promote a healthy organization, the City has adopted the policies in this section regarding the City's structure and staffing.

5.6.1 Staffing

The City recognizes the paramount importance of having highly qualified staff and has adopted the following policies.

1. Personnel certification will comply with State standards.
2. The Public Works Department will promote staff training.

5.6.2 Relationship with Other Departments

The City has adopted the following policies regarding the City's Public Works Department in coordination with other City departments.

1. The Finance Department is responsible for customer billing, payment collection, project cost accounting, fund activity reporting, employee records, union labor negotiations, and salary schedules.

2. The Police Department is responsible for enforcing violations of City water ordinances.

3. The Fire Department is responsible for emergency responses to hazardous events at water system facilities. The Fire Department uses water utility facilities for fire protection and establishes FF requirements.

5.7 Summary

This chapter summarizes the City's policies on several areas of its operations and long-term viability. These policies are in accordance with all federal, state, and county regulations as well as City policies and AWWA design recommendations. These policies are in place to ensure the City continues to meet all applicable requirements and provides high quality water to all customers. Other chapters in this WSP analyze various aspects of the water system infrastructure, demands, financial and organizational elements against these policies.

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Chapter 6

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Chapter 6

Water Supply Quantity and Quality

6.1 Introduction

This chapter discusses the City's existing water sources, water rights, drinking water regulations, and water quality monitoring. This chapter also uses demand projections from Chapter 4 to determine if the current water rights meet the existing and projected demands for the City's customers. The City's ability to supply enough water is discussed in more detail in Chapter 8.

6.2 Water Rights and Supply Overview

All water supplied to the City is provided by five active groundwater wells. The City also has one emergency groundwater well. A description of each of the City's existing sources is presented in Chapter 2.

6.2.1 Water Rights

State law requires users of public water to receive approval from Ecology prior to actual use of the water. This approval is granted in the form of a water right permit with a development schedule, and after the water is put to beneficial use, a certificate is issued.

Throughout this section, water right withdrawal amounts are referenced in two ways; as instantaneous rights (Q_i) or as annual rights (Q_a). Instantaneous rights are typically referred to in terms of gpm and represent the maximum flow rate that can be withdrawn at a given time. Annual water rights represent the total amount of water use allowed per year and are typically referred to in terms of acre-feet (AF) per year. These limits are set to prevent drawdown of the aquifers.

Table 6-1 summarizes the City's municipal water. The City's water rights certificates can be found in Appendix I - Water Rights Self-Assessment and Certificates.

Table 6-1 | Existing Water Rights

DOH Source No.	Source Name	Permit or Certificate Number	Priority Date	Aquifer	Q_i (gpm)	Q_a			
						Primary		Supplemental	
						(acre-ft)	(gpm)	(acre-ft)	(gpm)
	S01, S05, & S09	876-D	4/9/1940		250	157	97	0	0
	S02	877-D	6/1/1941		500	315	195	0	0
	S03	1322-A	5/8/1950		400	123	76	0	0
	S02	G2-00862C	1/20/1971		100	65	40	0	0
	S04	G2-00863C	1/20/1971		500	200	124	0	0
	S05 & S09	3150-A	4/17/1958		1,000	193	120	595	369
	S06	4449-A	5/22/1962		750	337	209	788	489
	S07	5374	3/8/1965		500	0	0	800	496
	S08	G2-00024C	1/6/1969		720	546	338	0	0
Totals (acre-ft & gpm)					**4,720**	**1,936**	**1,200**	**2,183**	**1,353**
Totals (mgd)					**6.8**	**1.7**		**1.9**	

An evaluation of the City's existing water rights was performed to determine the sufficiency of the water rights to meet both existing and future water demands. **Table 6-2** compares the City's total maximum Q_i with the MDD of the system and the total primary Q_a with the ADD of the system.

Table 6-2 | Water Rights Evaluation

Description	Q_i / Maximum Day Demand		Q_a / Average Day Demand		
	(gpm)	(mgd)	(acre-ft)	(mgd)	(gpm)
Total Primary Water Rights	**4,720**	**6.8**	**1,936**	**1.7**	**1,200**
Total Supplemental Water Rights			**2,183**	**1.9**	**1,353**
Existing (2019) City Water Demands	966	1.4	750	0.6	465
Surplus (or Deficient) Rights	3,754	5.4	1,186	1.1	735
Planning Year (2020) City Water Demands	1,342	1.9	814	0.7	505
Surplus (or Deficient) Rights	3,378	4.9	1,122	1.0	695
Projected (2030) City Water Demands	1,374	2.0	833	0.7	516
Surplus (or Deficient) Rights	3,346	4.8	1,103	1.0	684
Projected (2040) City Water Demands	1,374	2.0	833	0.7	516
Surplus (or Deficient) Rights	3,346	4.8	1,103	1.0	684

As shown in **Table 6-2**, the City has sufficient water to meet its projected demands through 2040. An analysis of the City's physical supply capacity is presented in detail in **Chapter 8**.

Consistent with the Memorandum of Understanding between DOH and Ecology, Ecology found several inconsistencies with information in the city's Water Rights Self-Assessment. The City, over

the planning horizon, will address the inconsistencies by performing a "Water Rights Analysis and Options" study. Once the study is complete the City will work with Ecology and Health to ensure there are no discrepancies in their information as it pertains to the city's Water Rights Self-Assessment. Ecology responded to the Water Rights Self-Assessment summarizing a list of wells that do not have water rights associated with them. The letter with a memorandum recommending that over the planning horizon a "Water Rights Analysis and Options" study be performed to address the items raised in the Ecology letter is included as Appendix R – Ecology Letter and Response. The study does not need to be included in the Capital Improvement Plan.

6.3 Drinking Water Regulations

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

6.3.1 Safe Drinking Water Act

The SDWA, enacted in 1974, sets standards for the quality of drinking water and requires water treatment if these standards are not met. The SDWA also sets water testing schedules and methods that water systems must follow. In 1986 the SDWA was amended to include the regulation of a total of 83 contaminants.

In response to the 1986 SDWA Amendments, the EPA established six rules, known as the Phase I Rule, Phase II and IIb Rules, Phase V Rule, Surface Water Treatment Rule, Total Coliform Rule (TCR), and Lead and Copper Rule. After these rules were established, some were also amended. The EPA regulates most chemical contaminants through the Phase I, II, IIb, and V Rules.

The SDWA was amended again and re-authorized in August of 1996. As part of this amendment and re-authorization, more recognition was given to source water protection, public information, water system improvement funding, and operator training in the SDWA. In response to the 1996 SDWA amendments, the EPA developed several rules including Stage 1 and Stage 2 Disinfectants and Disinfectant By-Products Rules, and the Interim, Long Term 1 and Long Term 2 Enhanced Surface Water Treatment Rules.

The EPA set two limits for each contaminant regulated under these rules. The first limit is a health goal, referred to as the Maximum Contaminant Level Goal (MCLG). The MCLG is zero for many contaminants; especially known cancer-causing agents, or carcinogens. The second limit is a legal limit, referred to as the MCL. The MCLs are equal to or higher than the MCLGs.

6.3.1.1 Phase I Rule

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

6.3.1.2 Phase II & IIb Rules

The Phase II and IIb Rules were published in the Federal Register on January 30, 1991 and July 1, 1991, and became effective on July 20, 1992 and January 1, 1993, respectively. These rules established new regulations for 27 contaminants and updated regulation of 11 additional contaminants. Organic, animal or plant produced substances containing carbon and other elements such as hydrogen and oxygen, and inorganic chemicals of mineral origin that are naturally occurring elements were included. Some of the contaminants are frequently applied agricultural chemicals, such as nitrate, while others are more obscure industrial chemicals.

6.3.1.3 Phase V Rule

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

6.3.2 Primary and Secondary Drinking Water Regulations

There are currently 92 contaminants included in the *National Primary Drinking Water Regulations*. Of these 92 contaminants, 83 have established MCLs and MCLGs, while the remaining nine have treatment technique requirements. Monitoring of these contaminants within the State is addressed under WAC 246-290-300, WAC 246-290-310, and WAC 246-290-320.

The EPA has also established secondary standards for 15 contaminants, which generally address aesthetic quality of drinking water. These federal standards are generally used as a guideline since they primarily address taste and odor issues rather than health concerns. Monitoring of these secondary contaminants within the State is addressed under WAC 246-290-300, WAC 246-290-310. Per WAC 246-290-320, secondary contaminant MCL exceedances require treatment for new community water systems, while other public water systems are required to take follow-up action as determined by DOH.

6.3.3 Source Water Quality Regulations

The City's groundwater wells are the only source of water supply in the City. The City does not have any surface water sources or groundwater sources considered under the influence of surface water (GWI). Since the City does not have any surface water or GWI sources, several surface water supply regulations are not discussed in this chapter. These regulations include Surface Water Treatment Rule; the Interim, Long Term 1 and Long Term 2 Enhanced Surface Water Treatment Rules; and the Filter Backwash Recycling Rule.

6.3.3.1 Radionuclides Rule

The EPA established the final Radionuclides rule on December 7, 2000 and it became effective on December 8, 2003. The rule established an MCLG of zero for the four regulated contaminants and MCLs of 5 picocuries per liter (pCi/L) for combined radium-226 and radium-228, 15 pCi/L for gross alpha, excluding radon and uranium, 4 millirems per year (mrem/yr) for beta particle and photon radioactivity, and 30 micrograms per liter (μg/L) for uranium. All community water systems were required to complete initial monitoring and integrate all monitoring requirements of the rule between December 8, 2003 and December 30, 2007. The rule requires utilities to undergo four consecutive quarters of monitoring for gross alpha, combined radium-225/228, and uranium. Additionally, systems considered vulnerable were required to monitor for gross beta, tritium, and strontium-90. Initial monitoring is used by the enforcing agency to determine if a water system is vulnerable and whether a system must perform reduced or increased monitoring in the future.

Based on the initial monitoring, the City is required to test for radionuclides every six years. The City last tested for radionuclides in June 2017 with less than 1 pCi/L.

6.3.3.2 Arsenic

Arsenic is highly toxic, affects the skin and nervous system, and may cause cancer. The EPA promulgated the Arsenic rule on January 22, 2001 and it became effective on January 23, 2006. The rule sets the MCLG of arsenic at zero and sets the MCL at 0.01 mg/L which is equivalent to 10 parts per billion (ppb). Community water systems with arsenic levels greater than 10 ppb must include the arsenic sampling results, along with a statement on health risks, in the annual Consumer Confidence Report (CCR). Water systems that have arsenic levels of 5 to 10 ppb must include an educational statement about arsenic in their CCRs.

The City last tested for arsenic in June 2015 with 0.0010 mg/L or 1 ppb. The testing schedule for arsenic is different for each source and is determined by the State who communicates that information to the City via a yearly Water Quality Monitoring Schedule.

6.3.3.3 Ground Water Rule

In accordance with the 1986 SDWA Amendments, the EPA developed a Ground Water Rule (GWR) that specifies the use of disinfectants for groundwater systems, as necessary. The proposed rule

was published May 10, 2000 in the Federal Register and the final rule was enacted on January 8, 2007. The rule is aimed at increasing the protection of groundwater sources against microbial pathogens in public water systems that use untreated groundwater. The GWR applies to any system which uses groundwater or a mixture of surface and groundwater if the groundwater is supplied to the customers without treatment.

The basic requirements of the GWR, adopted by DOH on October 1, 2010 include source water monitoring, compliance monitoring, sanitary surveys, corrective actions, and public notification. The rule builds upon the TCR by addressing the health risks of fecal contamination in groundwater sources used by public water systems. Elements of the GWR include the following.

- *Assessment Source Water Monitoring* may be required by DOH on a case-by-case basis to evaluate sources that may be at risk for fecal contamination.

- *Triggered Source Water Monitoring* is required when a system's routine distribution samples collected under the TCR is total coliform positive. Within 24 hours of notification of the total coliform positive result, a water system must collect samples at each source that was in operation at the time the routine sample was collected. These samples must be taken prior to treatment. Systems with more than one groundwater source, like the City, can submit a triggered source water monitoring plan for approval by DOH. This plan may allow a reduction in the number of source samples required. A copy of the City's 2012 Triggered Source Water Monitoring Plan is included in Appendix J - Water Quality Monitoring Plan.

- *Compliance Monitoring* confirms the effectiveness and reliability of a water system's treatment systems and requires daily monitoring of chemical disinfection residual before the first customer during peak flow for smaller systems and continuous monitoring of disinfection residual for systems serving more than 3,300 people. If a system provides 4-log treatment of viruses and performs compliance monitoring, it does not have to meet the triggered source water monitoring requirements.

The GWR also changes the required frequency of sanitary surveys for community water systems from once every 5 years to once every 3 years. A community water system may be allowed to stay on a 5-year schedule if it meets one of the following criteria.

1. Provides 4-log treatment of viruses for all groundwater sources

2. Has no total coliform MCL violations, has no more than one total coliform monitoring violation since the last survey, and has no unresolved significant deficiencies in the current survey.

The GWR requires a water system to take corrective action when it has a significant deficiency or when a source water sample is *E. coli* positive. The DOH defines a significant deficiency as "a defect in the design, operation, or maintenance, or a failure or malfunction of the sources, treatment,

storage, or distribution system that the department determines to be causing, or have the potential for causing, the introduction of contamination into the water delivered to consumers."

Corrective actions can involve one or more of the following, as directed by DOH.

- Correct all significant deficiencies.
- Provide an alternative source of water.
- Eliminate the source of contamination.
- Provide 4-log treatment.

There are several situations and violations in the GWR that require public notification (PN) either within the system's CCR or otherwise. Table 6-3, shown later in this chapter, summarizes these violations and the type of notification required. The varying tiers of PN required are defined in 40 CFR Section 141, Subpart Q. Each tier has different notification methods and requirements of timing associated. Tier 1 PN must be provided within 24 hours after the violation is discovered, Tier 2 PN must be provided within 30 days after the violation is discovered, and Tier 3 PN must be provided within 1 year after the violation is discovered.

6.3.4 Future PFOA and PFOS Regulations

The EPA issued health advisories for perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) in the spring of 2016. The PFOA, PFOS, and other per- and polyfluoroalkyl substances (PFASs) are a family of chemicals used since the 1950s to manufacture stain-resistant, water-resistant, and non-stick products. Certain types of firefighting foam contain PFAS. These firefighting foams were historically used by the U.S. military, local fire departments, and airports.

Over time, PFASs leach into groundwater and contaminate drinking water. Exposure to PFAS over certain levels may result in adverse health effects. The current EPA health advisory level is at 70 parts per trillion. In 2021 the EPA announced that it will develop enforceable drinking water standards for two of the most commonly detected PFASs, PFOA and PFOS. This process can take years to complete.

The State Board of Health began rulemaking for PFASs in drinking water in late 2017. In November 2019, draft State Action Levels (SALs) were published. These draft SALs test for five PFASs as indicators to identify PFAS contamination in public drinking water supplies. Draft SALs are 10 nanograms per liter (ng/L) for PFOA, 15 ng/L for PFOS, 14 ng/L for perfluorononanoic acid (PFNA), 70 ng/L for perfluorohexanesulfonate acid (PFHxS), and 1,300 ng/L for perfluorobutanesulfonic acid (PFBS).

The City does not expect the regulations to affect the City's groundwater source.

6.3.5 Distribution System Water Quality

In addition to source water quality monitoring, the City regularly monitors the water quality throughout the distribution system for several contaminants which are described below.

6.3.5.1 Revised Total Coliform Rule

The TCR was published in the Federal Register on June 29, 1989 and became effective on December 31, 1990. The rule set both MCLGs and MCLs for total coliform levels in drinking water, and the type and frequency of testing that is required for water systems. The rule was revised in April of 2016.

The Revised Total Coliform Rule (RTCR), as with the TCR, requires every public water system to develop a coliform monitoring plan, subject to approval by DOH. The RTCR adds a "find and fix" approach to any microbial contamination using assessment reports. The RCTR also adds violations to any water system that fails to complete the required tasks. The City's Coliform Monitoring Plan is part of the Water Quality Monitoring Plan. A copy is included in **Appendix K - Annual Water Quality Schedule and Reports**.

Table 6-3 | Ground Water Rule Notification Requirements Summary

Situation	Notification Required
E. coli positive groundwater source sample[1]	Tier 1 PN, CCR, Special Notification
Failure to take corrective action within 120 days of notification	Tier 2 PN, CCR, Special Notification
Failure to maintain at least 4-log treatment of viruses	Tier 2 PN, CCR
Failure to meet monitoring requirements	Tier 3 PN, CCR
Uncorrected significant deficiency[2]	Special Notice in CCR
Unaddressed *E. coli p*ositive groundwater source sample[3]	Special Notice in CCR

Notes:
1. Consecutive systems served by the groundwater source must also notify the public.
2. Systems must continue to notify the public annually until they correct the significant deficiency.
3. Community systems must put a notice in the CCR annually until the positive source water sample has been addressed.

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

The rule establishes the MCLG for total coliforms at zero. To comply with the MCL, systems must not find coliforms in more than five percent of the samples taken each month.

6.3.5.2 Lead and Copper Rule

The Lead and Copper Rule was published in the Federal Register on June 7, 1991 and became effective on December 7, 1992. On January 12, 2000, the EPA published some minor revisions to the rule in the Federal Register, intended to improve the implementation of the rule. In December 2007, additional revisions to the Lead and Copper Rule became effective, intended to enhance implementation of the rule in the areas of monitoring, treatment, customer awareness, and lead service line replacement.

The rule identifies "action levels" for both lead and copper. An action level is different from an MCL in that an MCL is a legal limit for a contaminant, and an action level is a trigger for additional prevention or removal steps. The action level for lead is 0.015 mg/L. The action level for copper is 1.3 mg/L. If the 90th percentile concentration of either lead or copper from the group of samples exceeds these action levels, a corrosion control study must be undertaken to evaluate strategies and make recommendations for reducing the lead or copper concentration below the action levels.

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

The City is required to test for lead and copper every three years. Lead and copper levels were last tested in September 2019 and all results met the 90th percentile compliance rule. The next round of testing is scheduled for August 2022.

6.3.5.2.1 Proposed Revisions to the Lead and Copper Rule

In October 2019, the EPA published proposed changes to the Lead and Copper Rule. These proposed changes include identifying the most impacted areas, strengthening treatment requirements, replacing lead service lines, increasing drinking water sampling reliability and improving risk communication to customers.

The City does not have corrosive water, and therefore, does not expect this revision to change its water treatment procedures. However, the revision will most likely require additional sampling and reporting by the City.

6.3.5.3 Stage 1 Disinfectants/Disinfection By-products Rule

Disinfection by-products (DBPs) are formed when free chlorine reacts with organic substances called precursors, most of which occur naturally. Formation of DBPs is dependent on factors such as the amount and type of chlorine used, water temperature, concentration of precursors, pH, and chlorine contact time. The DBPs have been found to cause cancer in laboratory animals and are suspected to be human carcinogens.

The EPA proposed the Stage I Disinfectants/Disinfection By-products Rule (D/DBPR) on July 29, 1994. The final rule was published in the Federal Register on December 16, 1998 and became effective on February 16, 1999. The rule applies to Lakewood Water, City, and most other water systems, including systems serving fewer than 10,000 people, which add a chemical disinfectant to the drinking water during any part of the treatment process.

The rule set the MCL for total trihalomethanes (TTHM), which are a composite measure of four individual trihalomethanes (THMs), at 0.08 mg/L. The rule established MCLs and requires monitoring of three additional categories of disinfectant byproducts as follows.

- Five haloacetic acids (HAA5), 0.06 mg/L
- Bromate, 0.01 mg/L
- Chlorite, 1.0 mg/L

The rule also established maximum residual disinfectant levels (MRDLs) as follows.

- Chlorine, 4.0 mg/L
- Chloramines, 4.0 mg/L
- Chlorine dioxide, 0.8 mg/L

6.3.5.4 Stage 2 Disinfectants/Disinfection By-products Rule

Stage 2 of the D/DBPR was promulgated by the EPA on January 4, 2006. This rule is the second part of the D/DBPR, of which the Stage 1 D/DBPR became effective in February 1999. The Stage 2 D/DBPR focuses on monitoring and reducing concentrations of two classes of DBPs, TTHM and HAA5, and applies to water systems that add chemical disinfectants. The key requirements of the Stage 2 D/DBPR include:

1. An Initial Distribution System Evaluation (IDSE) to identify distribution system locations with high DBP concentrations.

2. Site specific locational running annual averages instead of system-wide running annual averages to calculate compliance data.

The MCLs for TTHM and HAA5 are 0.080 mg/L and 0.060 mg/L, respectively, which are calculated as locational running annual averages. Per the DOH, the City tests for DBPs once a year at two locations within its distribution system.

6.4 Water Quality Monitoring Results

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

6.4.1 Source Monitoring Requirements and Waivers

The City is required to perform water quality monitoring at each of the active sources for inorganic chemical and physical substances, organic chemicals, and radionuclides. The monitoring requirements that the City must comply with are specified in *WAC 246-290-300*. In 1994, the DOH developed the Susceptibility Assessment Survey Form for water purveyors to use in determining

a drinking water source's potential for contamination. The results of the susceptibility assessment may provide for monitoring waivers that allow reduced source water quality monitoring.

6.4.2 Source Monitoring Results

The water quality of the City's sources meets or exceeds all drinking water standards. A copy of the City's Water Quality Monitoring schedule is included in **Appendix K - Annual Water Quality Schedule and Reports**.

6.4.3 Distribution System Monitoring Requirements and Results

The City is required to perform water quality monitoring within the distribution system for coliform bacteria, disinfectant or chlorine residual concentration, lead and copper, and asbestos in accordance with *WAC 246-290*. The City has been in compliance with all monitoring requirements for the past several years. A summary of the results of water quality monitoring within the City's distribution system is presented below. Annual water quality reports are included in **Appendix K - Annual Water Quality Schedule and Reports**.

6.4.3.1 Coliform Monitoring

The City is required to collect a minimum of seven coliform samples per month from various locations throughout the system, based on a population served of 6,770 in 2019. The City has not collected a positive sample since August 2016.

6.4.3.2 Disinfectant Residual Concentration Monitoring

Disinfection requirements for groundwater sources are contained in *WAC 246-290-451*, which states that a disinfectant residual concentration shall be detectable in all active parts of the distribution system. The City has set a chlorination target to maintain a residual disinfectant concentration of at least 0.2 mg/L. The water samples collected by the City for coliform analysis are also tested for residual disinfectant concentration.

6.4.3.3 Disinfectant By-Products

The City is required to perform water quality monitoring in the distribution system for DBPs in accordance with *WAC 246-290-310.* The MCLs for THMs and HAA5 are 80µg/L and 60 µg/L, respectively.

Water samples collected in 2019 were tested for DBP concentration. The results of these tests in 2018 resulted in non-detection of HAA5 and a range of less than 0.5 to 2.79µg/L of TTHMs.

6.4.3.4 Lead and Copper Monitoring

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

The results of the tests from the most recent monitoring period during 2019 indicate a range of <0.001 mg/L to 0.0015 mg/L for lead and a range of <0.05 mg/L to 0.513 mg/L for copper. These results indicate the 90th percentile. Concentration of lead and copper from each group of samples has never exceeded the action level. Monitoring currently must be completed every three years.

6.4.3.5 Asbestos Monitoring

Asbestos monitoring is required if the sources are vulnerable to asbestos contamination or if the distribution system contains more than ten percent of AC pipe. Although none of the City's sources are susceptible to asbestos contamination, AC pipe composes more than ten percent of the City's distribution system. Therefore, the City must monitor for asbestos in the distribution system.

The current MCL for asbestos is seven million fibers per liter and greater than ten microns in length. The water sample must be taken at a tap that is served by an AC pipe under conditions where asbestos contamination is most likely to occur.

Currently, the City is required to test for asbestos once every nine years. The City's most recent sample in 2020 contained less than 0.116 million asbestos fibers per liter.

6.5 Water Treatment

All water produced from the City's wells is chlorinated and fluoridated before it enters the distribution system. A detailed description of each technique and where it is implemented is included in Chapter 2 of this WSP.

6.6 Water Quality Programs

In addition to the above listed water quality requirements, the City follows several water-quality programs that are used to report and protect the City's water quality.

6.6.1 Consumer Confidence Report

The CCR is a report on the quality of water that was delivered to the system during the previous 12 months in accordance with WAC 246-290-72001. The annual report must be updated and re-issued to all customers by July 1st of each year. The report contains information on the quality of the water delivered by the systems and characterize the risks (if any) from exposure to contaminants detected in the drinking water in an accurate and understandable manner. A copy of City's latest CCR at the time of this writing is included in Appendix L - Consumer Confidence Report.

6.6.2 Wellhead Protection Program

Section 1428 of the 1986 SDWA Amendments mandates that each state develops a wellhead protection program. The State mandate for wellhead protection and the required elements of a

wellhead protection program are contained in WAC 246-290-135 Source Water Protection, which became effective in 1994. In the State, DOH is the lead agency for the development and administration of the State's wellhead protection program.

A wellhead protection program is a proactive and ongoing effort of a water purveyor to protect the health of its customers by preventing contamination of the groundwater that it supplies for drinking water. All federally defined Group A public water systems that use groundwater as their source are required to develop and implement a wellhead protection program. A copy of the City's Wellhead Protection Program is contained in Appendix M - Wellhead Protection Program.

6.7 Summary

The City is currently in compliance with all applicable water quality regulations and is performing the necessary regulated water quality testing. The City is forecasted to have sufficient water rights to meet water system demands for at least the next 20 years. Chapter 8 will further analyze the physical source capacity of the system.

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Chapter 7

Operations and Maintenance

7.1 Introduction

The City's operations and maintenance program has been developed in accordance with WAC 246-290-415. This chapter consists of the following elements: Water System Management and Personnel, Routine System Operations, Recordkeeping and Reporting, and Emergency Operations.

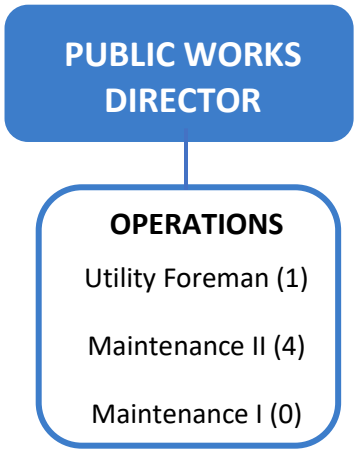
7.2 Water System Management and Personnel

The Public Works Department is responsible for various projects within the City. This section reviews the management structure, personnel responsibilities, and personnel certifications of the Public Works Department as they relate to the water system.

7.2.1 Management Structure

Figure 7-1 shows the City's management structure, as it relates to the water system.

Figure 7-1 | Organization Chart



7.2.2 Personnel Responsibilities

The key responsibilities of the water operations and maintenance staff are summarized below.

Public Works Director: Ultimate responsibility for the water system. Directs the activities of all divisions of the Public Works Department. Represents the City at regional activities.

Utility Foreman: Responsible for the day-to-day operation of the water system including adjusting the water system supply and storage facilities to meet daily demands. Assists in planning the construction, maintenance, and operations activities of the water system.

Maintenance Staff: Assists the Utility Foreman in in operation and maintenance activities, including on-call and emergency duties. These activities also include water system inspection, repair, hydrant exercising, and valve exercising.

7.2.3 Personnel Certifications

The WAC 246-292 requires the City's system to be operated by one or more certified operators. In addition, a specialty certification is required for backflow device testing. Table 7-1 shows the current certifications of the City's operations and maintenance staff.

Table 7-1 | Personnel Certification

Name	Position	Certification
Jeff Davis	Utility Foreman	WDM2, CCS
Russ Parsons	Maintenance Worker II	WDM2, CCS
Jim Marzano	Maintenance Worker II	WDM2
Certificate Definitions: WDM2: Water Distribution Manager CCS: Cross-Connection Control Specialist		

7.3 Routine System Operations

As described in Chapter 2, the City's system includes five wells, three reservoirs, one pump station, and three pressure reducing stations. Routine operations include visually checking all systems facilities, monitoring flows and reservoir levels, responding to customer inquiries and complaints, and performing customer meter readings.

7.3.1 Supplies and Equipment

Spare parts and repair equipment are stored at the City's Public Works Facility for water system operation and maintenance. The following list summarizes the City's status and protocol regarding supplies and equipment.

- Spare parts, such as valves, pipe, fittings, electrical, and electronic parts, are kept in good supply. Most critical systems can be repaired from in-house stores.
- Common tools and equipment, such as hand tools, power tools, pumps, and shoring, are kept in the inventory. Accounts are maintained with vendors so that tools and equipment not on hand can be quickly purchased.
- Heavy equipment, such as backhoes, dump trucks, graders, and bulldozers, are either owned by the City or leased from local suppliers.

7.3.2 Preventative Maintenance

Routine preventive maintenance is conducted throughout the water system including the wells, storage facilities, water mains, PRVs, and hydrants. Maintenance schedules that meet or exceed manufacturer's recommendations have been established for all critical components in the water system. Table 7-2 shows the schedule used for preventive maintenance:

Table 7-2 | Preventative Maintenance

Storage Facilities	
As Needed	Detailed inspection of interior and exterior of reservoirs. Clean, repaint, and repair interior and exterior as needed on tanks.
Water Mains	
Annually or Bi-Annually	Leak survey.
Annually	Directional Flush.
Well House or Pump Stations	
Bi-Annually	Operate and exercise all valves. Inspection should include completely opening, closing, reopening, and re-closing the valve until it seats properly.
As Needed	Calibrate flow meter; maintain electrical and mechanical equipment; paint structures and piping.
Pressure Reducing & Relief Stations	
Bi-annually	Flush and check all valves and screens; check pressure settings; rebuild and paint every three years, or as necessary.
Isolation & Hydrant Valves	
Annually	Operate full open/closed; uncover where buried; clean out valve boxes and repair, as necessary. Half exercised in the fall and the other half in the spring.
Air & Vacuum Release Valve Assemblies and Blow-Off Assemblies	
Annually	Operate full open/closed and flushed; continuously operating valves should be opened/flushed more frequently.

7.3.3 Routine Water Quality Sampling

The DOH has adopted federal regulations that specify minimum monitoring requirements for water systems. The sampling requirements depend on the population served, source type, and treatment provided. The specific requirements are contained in WAC 246-290-300 and the City's practices are described in Chapter 6.

7.3.4 Staffing Analysis

The City successfully operates its water system with four maintenance employees whose time is divided up with other City departments. The operating budget has two full-time employees for the maintenance and operations of the water system. The City's system has not grown significantly since the 2014 WSP and is not expected to experience significant growth in the near future. Therefore, the City should be able to continue to successfully operate its system with its current maintenance employees throughout the planning period.

7.4 Recordkeeping and Reporting

The City must comply with all recordkeeping and report requirements stated in WAC 246-290-480. Per these requirements, the City submits the following reports to DOH.

- Any reports or communications related to monitoring waivers
- Daily source meter readings and total annual source meter readings, as requested
- Any significant changes to the WFI form
- Bacteriological test results
- DPBs information
- Certification that the system complied with public notification regulations when such notification is required

In addition to these reports, the City reports to DOH on the status on its various programs, as described below.

- Cross-connection control program summary is reported annually. The City must notify DOH as soon as possible, but no later than the end of the next business day, when a backflow incident is known by the City to have contaminated the public water system or occurred within the premises of a consumer served by the City.
- The WUE report is submitted by July 1st of each year. This report calculates the annual and three-year rolling average distribution system loss for the water system and describes progress made on WUE goals.

- The CCR is delivered to customers and DOH by July 1st of each year. This report provides information on the system's water source and water quality. The City's 2018 CCR is provided in Appendix L - Consumer Confidence Report.

Several other reports are required for state agencies, including the Department of Revenue, Department of Labor and Industries, Department of Social and Health Services, Ecology, and the Employment Security Department. All these reports are completed according to their instructions. If the City is unable to satisfactorily address departmental concerns or consumer complaints regarding the level of reliability associated with normal or abnormal operating conditions, the purveyor may be required to prepare a project report pursuant to WAC 246-290-110.

The WAC 246-290-480 also requires the City to retain critical records dealing with facilities and water quality issues. Table 7-3 provides a summary of these records and their required retention periods.

Table 7-3 | Recordkeeping Summary

Record Type	Required Retention
Bacteriological analysis results	5 years
Chemical analysis results	If the system is in operation
Daily source meter readings	10 years
Other records of operation and analyses as may be required by DOH	3 years
Chlorine residual analysis results	3 years
Documentation of actions to correct violations or primary drinking water standards	3 years after last corrective action
Records of sanitary surveys	10 years
Project reports, construction documents and drawings, inspection reports, and approvals	Life of the facility
Public Notices and Certifications associated with the water system	3 years
Cross-Connection Control program	
Records pertaining to the overview list of service connections and/or consumer's premises	If the premises pose a cross-connection hazard
Records regarding inventory information	5 years or life of backflow preventer, whichever is shorter
Records regarding backflow incidents and annual summary reports	5 years
Other records, including fluoride levels, treatment plant performance, and other source characteristics are maintained in accordance with DOH.	Varies

7.4.1 Recordkeeping Procedures

The City's recordkeeping procedures are as follows.

- All records include the date, place, time of sample, and name of person collecting the sample. Electronic data with these attributes are retained as opposed to signature as required in WAC 246-290-480.1.a.
- All sample analysis records include the identification of sample type, date of analysis, laboratory, and person responsible for performing the analysis, analytical method used, and results of the analysis.
- All water quality and quantity data are kept in spreadsheet format saved on the City computer server and back-up data tapes.
- Maintenance workers, inspectors, or other staff provides information to the Public Works Utility Foreman, who must review the information prior to it being filed.
- Project reports, construction documents and drawings, inspection reports, and approvals are saved both in electronic format and Mylar or paper format.

7.4.2 Operations and Maintenance Records

Operations and maintenance manuals are available for staff members' reference. The City requires complete operation and maintenance manuals for all new equipment.

7.4.3 Customer Service Request Records

Customer service requests are made by either contacting City Hall to initiate a maintenance request or reporting a concern through the City's website. All service requests are dealt with in a timely manner. The City Clerk maintain records of these requests.

7.5 Emergency Operations

The City has a reliable system with adequate emergency response and operations capabilities in accordance with WAC 246-290-420. The City system is designed to provide reliable service under normal operating conditions and is also well equipped to accommodate short-term system failures and abnormalities. Its capabilities are summarized in the following sections.

7.5.1 Water Service Reliability

As a municipality, the City has the structure, stability, authority, and responsibility to assure that water service will be continuous. It has developed a resilient system to provide reliable water service. These resiliencies are described below.

Multiple Supply Wells: Operational loss of one supply well would not adversely affect the City's ability to meet the water demands of its customers. Water could be routed throughout the City from the other wells and, if needed, the emergency well could be activated.

Multiple Reservoirs: Water storage is provided by three active reservoirs that are located at different sites. The duplication of reservoirs in separate pressure zones, coupled with the system's ability to transfer water between zones through a series of pressure reducing stations and a booster pump station, provides sufficient redundancy to prevent service disruption when one of the reservoirs is out of service for cleaning, painting, or repairs.

Distribution System: The City has attempted to loop water mains, wherever possible, to improve water circulation (i.e., water quality) and minimize impacts to the system if a portion of the distribution system must be taken out of service for maintenance or repairs.

Security Measures: The City maintains security measures at all City water system facilities. These measures include fencing and gates surrounding all water storage reservoir tanks and pumping facilities, screening of all reservoir tank vents and openings, locking of all reservoir tank hatches, and locking of all water system vaults.

7.5.2 Water Shortage Plan

During a water shortage, the City has an agreement with Tacoma Public Utilities to utilize an intertie at Lowes for water supply.

7.5.3 Emergency Response Plan

The City's Emergency Response Plan (ERP) identifies procedures that would be conducted in the event of a serious emergency or disaster situation. The ERP also contains a list of water personnel responsible for making decisions in emergency situations. A copy of this ERP is stored securely at the Public Works Facility but is not available for public review.

7.6 Cross-Connection Control Program

The City has adopted a cross-connection control program to comply with WAC 246-290-490 pertaining to contamination of potable water due to cross-connections. Backflow prevention devices are required at service connections where a potential for contamination exists. Appendix H - Cross Connection Control Program, includes a copy of the City's Cross-Connection Control Plan. As shown in Table 7-2, the City employs several certified Cross-Connection Control Specialists.

7.7 Sanitary Survey Findings

The City's most recent sanitary survey was performed by DOH on May 8, 2019. The City promptly responded to DOH's findings, making changes to its system were recommended.

7.8 Summary

The City has procedures and policies in place to operate and maintain its water system. It has an organizational structure that ensures each component of the system is managed and overseen by those with the appropriate certification. Routine operation items include things like making daily rounds to visually check system facilities, monitor flow and reservoir level recordings, and respond to customer inquiries and complaints. Preventive maintenance consists of regularly servicing pumps and motors, exercising valves, cleaning, and painting reservoirs, and flushing dead-end pipelines. The City has performed a staffing analysis to assure that it has enough staff to properly operate and maintain its existing system.

The City has system reliability and emergency management plans in place to address circumstances that could require increased levels of management under emergency conditions. It maintains a cross-connection control program through municipal code and reports on its status annually. Finally, the City has projects identified to maintain the system and address areas requiring improvements as identified through system operations and as discussed in further detail in Chapter 9.

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Chapter 8

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Chapter 8

Water System Analyses

8.1 Introduction

This chapter presents an analysis of the City's existing water system and evaluates its ability to meet the design criteria and policies presented in Chapter 5. Any deficiencies identified in this analysis will be addressed in the Capital Improvement Plan presented in Chapter 9.

8.2 Evaluation Criteria

The DOH requirements used to evaluate the water system are summarized in Table 8-2.

8.3 Pressure Zones

Pressure zones are designed to maintain pressures between 40 and 120 psi at demand meters. To do this, pressure zone boundaries are typically determined according to topography, and an HGL is maintained by tank overflow elevations, pump curves, and pressure reducing settings. All new water services with pressures greater than 80 psi must have individual PRVs, in accordance with the plumbing code. The minimum and maximum static pressures for each pressure zone are shown in Table 8-1.

Table 8-1 | Minimum and Maximum Distribution System Pressures

Pressure Zone	Highest Elevation Served		Lowest Elevation Served	
	Elevation (ft)	Static Pressure (psi)	Elevation (ft)	Static Pressure (psi)
High	362	47	248	96
Low	309	50	191	101
Weathervane	410	48	330	82

Table 8-2 | Evaluation Criteria

System Element	Evaluation Criteria	DOH Requirements
Water Supply	Firm Supply Capacity	Replenish depleted fire suppression storage (FSS) within 72-hr while supplying MDD *(DOH Manual Section 5.4 & WAC 246-290-222(4))*
	Well Sources - Firm Yield	Recommend providing MDD in a period of 20hrs or less of pumping. *(DOH Manual Section 5.4)*
Storage Facilities	Total Storage Capacity	Sum of operational, equalization, emergency (fire & standby), and dead. *(DOH Manual Section 7.1.1 & WAC 246-290-235(3))*
	Operational (OS)	The volume of water before sources turns on. *(DOH Manual Section 7.1.1.1)*
	Equalizing (ES)	= (peak hour demand [PHD]-maximum supply capacity) *150 min *Min pressure 30 psi.* *(DOH Manual Section 7.1.1.2)*
	Standby (SB)	= (no. of ERU_{MDD}) x (Locally adopted SB flow in gpd/ERU) x (Adopted no. of days) If multiple sources, SB may be reduced so that Volume can supply PHD with largest source out of service. Min recommended = 200 gallons per ERU *Min pressure 20 psi* *(DOH Manual Section 7.1.1.3)*
	Fire Suppression (FSS)	= (Maximum FF) x (duration) *Min pressure 20 psi* *(DOH Manual Section 7.1.1.4)*
	Dead (DS)	Volume that cannot provide minimum design pressure to all customers. *(DOH Manual Section 7.1.1.5)*
Pump Stations	Firm Capacity when pumping to storage	Average day demand (ADD) with largest pump out of service *(DOH Manual Section 8.1.1)*
	Total Capacity when pumping to storage	MDD *(DOH Manual Section 8.1.1 & WAC 246-290-230)*
	Firm Capacity when pump to system (no storage)	PHD with largest pump out of service *(DOH Manual Section 8.1.2 & WAC 246-290-230(5))*
	Reliable Capacity when pump to system (no storage)	MDD + FF with largest pump out of service *(DOH Manual Section 8.1.2 & WAC 246-290-230(6))*
Service Pressure	Minimum during MDD plus FF	20 psi *(DOH Manual Section 6.2.5 & WAC 246-290-230(6))*
	Minimum during PHD	30 psi *(DOH Manual Section 6.2.5 & WAC 246-290-230(5))*
	Maximum	Recommend 80 psi. If over 80 psi, recommend customers get an individual PRV. *(DOH Manual Section 6.2.7)*

8.4 Supply Capacity Evaluation

This section evaluates the City's groundwater wells to determine if their capacity is sufficient to provide water supply to the system at a rate that meets existing and future demands.

8.4.1 Analysis Criteria

Per WAC 246-290-222(4), the City's wells are required to provide sufficient supply to replenish depleted fire suppression storage while also supplying the system's MDD. This approach assumes that demands more than the MDD will be supplied using equalizing storage. The fire storage flow rate is based on the system fire storage calculation in **Section 8.6.** DOH also recommends that well sources have sufficient capacity to provide MDD in a period of 20 hours or less of pumping to avoid overtaxing the groundwater aquifers.

8.4.2 Analysis Results

The combined supply capacity of the system was compared to the existing and projected demand of the system. This comparison is summarized in **Table 8-3**. The results shown in the table indicate that the City's wells have sufficient capacity to meet the existing and future supply requirements of the system through the year 2040 and beyond.

Table 8-3 | Supply Capacity Evaluation

Description	Existing (gpm) 2019	Projected (gpm)[1]	
		2030	2040
Max Day Demand	1,036	1,141	1,141
Fire Storage Replenish Rate	69	69	69
Total Supply (Required)	***1,106***	***1,210***	***1,210***
Well no. 4 Capacity	400	400	400
Well no. 6 Capacity	100	100	100
Well no. 7 Capacity	600	600	600
Well no. 8 Capacity	600	600	600
Well no. 9 Capacity	1,250	1,250	1,250
Total Supply (Available)	***3,000***	***3,000***	***3,000***
Surplus/Deficiency	**1,894**	**1,790**	**1,790**

Note:
1. Maximum projections are based on City growth projections extrapolated from developer plans within the City's UGA.

8.5 Supply Capacity Evaluation: Weathervane Booster Pump Station

This section evaluates the capacity of the Weathervane Booster Pump Station to meet the existing and future demands of the Weathervane Zone, which it serves.

8.5.1 Analysis Criteria

The primary purpose of the booster pump station is to meet the demand and pressure needs of the customers located in the Weathervane Zone. This zone has no storage and therefore is a closed system. The existing booster pump station was designed and constructed to meet the DOH criteria at the time of installation in 2001. In 2019, DOH published an updated Water Design Manual, in which it revised its definition of a pump station's firm capacity when pumping to a closed zone. With this revision, pump stations pumping to closed zones must provide MDD plus FF or PHD, whichever is greater, with the largest pump out of service.

8.5.2 Analysis Results

Table 8-4 evaluates the total supply capacity of the booster pump station against existing and projected 2040 demands. Because PHD is smaller than MDD plus FF, the Weathervane Zone is evaluated using MDD plus FF (conservative) criteria.

Table 8-4 | Weathervane Zone Booster Pump Station Capacity Evaluation

Description	Existing (gpm) 2019	Projected (gpm)	
		2020	2040
Weathervane Zone MDD	62	67	69
Max FF Demand	1,000	1,000	1,000
Total Required Supply	132	136	138
Booster Pump Station (Firm Capacity)[1]	690	690	690
Surplus/Deficiency	**(372)**	**(377)**	**(378)**

1. The firm capacity of the pump station is the total capacity with the largest pump out of service.

The results of the analysis indicate that the booster pump station does not have sufficient capacity to meet new design manual criteria. This is due to a change in the DOH requirements for capacity evaluations of pump stations. Capacity evaluations of pump stations now must assume the largest pump is out of service, even if it is not regularly used. **Chapter 9** includes recommendations on how to meet the new criteria.

8.5.3 Supply Reliability

The booster pump station houses four pumps, which provide resiliency in case a single pump needs to be offline for maintenance or repair. The pump station has an emergency engine generator set equipped with an automatic transfer switch to enable operation of the station in the event of a power outage.

8.6 Storage Facilities

This section evaluates the City's existing water storage facilities to determine if they have sufficient capacity to meet the existing and future storage requirements of the system.

8.6.1 Analysis Criteria

Water storage requirements are typically defined by the following components: operational storage, equalizing storage, standby storage, FF storage, and dead storage (see Table 8-2). A description of each storage component and the criteria used to evaluate the capacity of the City's tanks is provided below.

Operational Storage: Operational storage is used to supply the water system under normal demand conditions. The operational storage in all the City's reservoirs is the volume of storage between the average water level of the reservoirs which signal a supply source to operate and the maximum water level (i.e., overflow elevation) of the reservoirs. The operational storage volume shown in Table 8-4 is based on an operating range of 3 feet for the 0.2 MG High tank and the 0.6 MG Golf Course tank.

Equalizing Storage: When the source pumping capacity cannot meet the periodic daily (or longer) peak demands placed on the water system, equalizing storage must be provided as a part of the total storage for the system and must be available at 30 psi to all service connections. The criteria for determining the equalizing storage requirements for the City's system is based on the equalizing calculation in the DOH equalizing storage equation shown in Table 8-2. The City's PHD is less than the supply firm capacity, so there is no equalization storage requirement.

Standby Storage: Standby storage is the portion of the reservoir used to supply the water system under emergency conditions when supply facilities are out of service. As shown in Table 8-2, the DOH allows water systems with multiple sources to require that standby volume supply PHD with the largest supply source out of service but recommends a minimum standby storage of 200 gallons per ERU in the system. Table 8-4 calculates standby as the maximum of either the volume required to supply PHD for one day with the Well 9 out of service or the volume required to supply all ERUs at least 200 gallons.

Fire Flow Storage: The FF storage is the portion of the reservoir with sufficient volume to supply water to the system at the maximum rate and duration required to extinguish a fire at the building with the highest FF requirement. The volume of the FF storage is the product of the FF rate and duration of the system's maximum FF requirement. The required volume of FF storage shown in Table 8-4 is the product of the maximum FF requirement of 2,500 gpm and its 2-hour duration.

Both standby storage and FF storage are considered emergency storage components. The City has elected to nest these two storage components, which results in only the larger of the two individual components being used in the required storage computation.

Dead Storage: Dead storage is the bottom portion of the reservoir that cannot be used because water is stored at an elevation that is too low to provide sufficient pressure. This unusable storage occupies the lower portion of many ground-level standpipe-type reservoirs. The High tank and Golf Course tank combined have approximately 0.2 MG of dead storage.

8.6.2 Analysis Approach

Since water from either tank may be utilized by all zones in the system through pressure reducing stations or the booster pump station, the storage analysis evaluates the capacity of the existing tanks to provide water to the system.

8.6.3 Existing and Future Storage Analysis Results

The results of the storage analysis are summarized in **Table 8-5**. The analysis results indicate that the existing storage facilities have sufficient capacity to meet existing and projected future demands of the system.

Table 8-5 | Storage Capacity Evaluation

Description	Existing System (2020)	Future System (2030)	Future System (2040)
Usable Storage (MG)			
Maximum Storage Capacity	1.85	1.85	1.85
Dead (Non-usable) Storage	0.21	0.21	0.21
Total Usable Storage	**1.64**	**1.64**	**1.64**
Required Storage (MG)			
Operational Storage	0.11	0.11	0.11
Equalizing Storage	0	0	0
Standby Storage	0.63	0.64	0.64
Fire Suppression Storage	0.6	0.6	0.6
Total Required Storage	**0.87**	**0.88**	**0.88**
Surplus Storage (MG)	**0.77**	**0.76**	**0.76**

8.7 Distribution and Transmission System Capacity Analysis

This section evaluates the City's existing distribution and transmission mains to determine if the water pipelines are sized and looped adequately to provide the necessary flow rates and pressures to meet the existing and future requirements of the system.

8.7.1 Hydraulic Model

Since the 2014 WSP was completed, the City has experienced minimal growth with no new developments and limited changes to demand. The FF requirements have also remained the same; the Tacoma Fire Department serves the City and has set the FF requirements of 1,000 gpm for

residential areas and 2,500 gpm for commercial areas. Therefore, the previous hydraulic analysis and results are carried forward to this WSP. A summary of this analysis can be found in Appendix N - Hydraulic Analysis Summary (from 2014 WSP).

The analysis was developed using Bently's WaterCAD Version 8, and the model was calibrated using field pressure and flow tests. The analysis includes scenarios for full build-out for each zone under PHD and MDD with FF conditions.

8.7.2 Hydraulic Analyses Results

The results of the hydraulic analysis showed no low-pressure deficiencies under PHD conditions but a few FF deficiencies in the Low and Weathervane pressure zones. The results of the FF analyses were used to propose improvements for water mains that are undersized or not looped adequately to provide sufficient FF. These improvements are discussed in more detail in Chapter 9.

8.8 System Capacity

System capacity analysis was performed to determine the maximum number of ERUs that the system can serve, based on an independent evaluation of each component of the City's water system (supply, storage, transmission). A separate analysis was performed for the existing system with 2019 demand levels and the future system with the year 2040 maximum projection demand levels. The results of these analyses provide the City with information to ensure sufficient capacity is available when reviewing applications for new connections to the water system and to assist in the scheduling of planned improvements that will increase supply, storage, or transmission capacity.

8.8.1 Analysis Criteria

The physical capacity of the City's water system and ability to serve additional customers is based on the limiting capacity of supply, storage, or distribution, whichever facility has the least capacity. The capacity analysis for supply was computed from the well capacities and the system's MDD per ERU. The capacity analysis for storage was computed from the total usable capacity of the storage facilities and the storage requirement per ERU. The storage requirement per ERU was determined from the existing storage requirement presented in this chapter and existing ERUs presented in Chapter 4. The capacity analysis for distribution was computed from the total capacity of the transmission mains sizes for the wells and the system's MDD per ERU. The ERU-based demand data was derived from the ADD of the system and demand peaking factors from Chapter 4.

8.8.2 System Capacity Analysis Results

The results of the system capacity analysis, as shown in Table 8-6, indicate that the existing system has sufficient capacity to serve an additional 1,521 ERUs and the future system in the year 2040

with maximum demand projections will have sufficient capacity to serve an additional 1,448 ERUs. Storage capacity is the limiting factor of the system for both years, as shown in the table.

Table 8-6 | System Capacity Analysis

Description of Capacity Parameter	Year	
Demands per ERU Basis	**2020**	**2040**
ADD per ERU (gpd/ERU)	230	230
MDD per ERU (gpd/ERU)	513	513
PHD per ERU (gpd/ERU)	867	867
Water Rights Capacity	**2020**	**2040**
Water Rights (Total, MGD)	4.38	4.38
MDD per ERU (gpd/ERU)	513	513
Maximum Supply Capacity (ERUs)	8,536	8,536
Source Capacity	**2020**	**2040**
Supply Capacity (Total, MGD)	4.32	4.32
MDD per ERU (gpd/ERU)	513	513
Maximum Supply Capacity (ERUs)	**8,418**	**8,418**
Storage Capacity	**2020**	**2040**
Maximum Usable Storage Capacity (MG)	1.6	1.6
Available Standby and Equalization Storage Capacity (MG)	0.9	0.9
Standby Storage Requirement per ERU (gal/ERU)	200	200
Equalizing Storage Requirement per ERU (gal/ERU)	0	0
Maximum Storage Capacity (ERUs)	**4,649**	**4,649**
Distribution System Capacity	**2020**	**2040**
MDD (gpm)	1,077	1,141
Maximum Fire Flow Requirement (gpm)	2,500	2,500
Capacity of 12" Main @ Velocity of 10 fps (gpm)	3,500	3,500
Capacity of 8" Main @ Velocity of 10 fps (gpm)	1,400	1,400
Remaining System Capacity (gpm)	1,323	1,259
Maximum Distribution Capacity (ERUs)	**10,448**	**10,268**
Maximum System Capacity	**2020**	**2040**
Based on Limiting Facility (ERUs)	4,649	4,649
Available System Capacity	**2020**	**2040**
Maximum System Capacity (ERUs)	4,649	4,649
Projected Average Day Demand (MGD)	0.72	0.74
Projected ERUs (ERUs)	3,128	3,201
Remaining System Capacity (ERUs)	**1,521**	**1,448**

Note:
1. Note that distribution system leakage is included in the demand estimates.

As shown in the FF analysis (**Section 8.7**), required FF is not available at all points in the system due to undersized pipes; however, storage is the limiting system capacity factor for the system. Improvements to address system deficiencies are outlined in **Chapter 9.**

8.9 Asset Management

The City actively assesses and plans for the maintenance, repair, and replacement of its major assets. In November of 2020, the City's Public Works Department rolled out its Asset Management Program. Brightly Software, formerly known as Dude Solutions, was selected as the Computerized Maintenance Management System (CMMS) provider. The utilization of a CMMS plays a tremendous role in effectively providing safe drinking water to the residents of Fircrest. The City is able to mitigate risk by identifying historic maintenance and setting preventative maintenance schedules. Initial Water System data collection included wells, water mains, valves, hydrants, and meters. Future asset collection and water main data updates will include main size, direction of flow, material type, installation timeframe, and remaining useful life expectancy.

An inventory of the City's existing critical water system assets was compiled for an asset condition assessment, which informed the development of the City's 20-year CIP plan. A summary of that assessment is shown in **Table 8-7.** It reviews each asset's estimated age, general condition, and estimated remaining life expectancy.

Table 8-7 | Asset Condition Assessment Summary

Critical Assets	Construction Year	Age[1]	Expected Lifespan	Condition Rating	Remaining Useful Life
Well 4	1971	49	100	Good	51
Well 6	1962	58	100	Good	42
Well 7	1965	55	100	Good	45
Well 8	1969	51	100	Good	49
Well 9	1958	62	100	Good	38
Disinfection Facilities	2016	4	50	Excellent	46
Weathervane BPS	2003	17	50	Good	33
High Tank	1951	69	100	Acceptable	31
Golf Course Tank	1966	54	100	Acceptable	46
Low Tank	1980	40	100	Acceptable	60

Age of facility is listed per the year this WSP as written (2020).

As the table shows, no major facility is expected to need replacement during this planning period. The City will continue to build its asset management program, allowing it to ensure adequate time for planning the replacement of any major assets.

8.10 Summary

The City's water system is supplied by a reliable source and includes redundancy and storage which further improves reliability. The results of the water system analyses presented in this chapter indicate that the overall water system is in good operating condition and will require some improvements to ensure that a high level of service is maintained. Recommended improvements are presented in **Chapter 9**.

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Chapter 9

Water System Improvements

9.1 Introduction

This chapter presents water system improvements that the City plans to implement within the 20-year planning period. These improvements will resolve existing system deficiencies and meet the future demands of the water system. The improvements recommended in this chapter consider system deficiencies described in Chapter 8 as well as the City's knowledge of what facilities need to be maintained, renovated, or replaced. Recommended improvements have been sized to accommodate the projected demands shown in Chapter 4 and to meet the design standards and policies described in Chapter 5.

This chapter compiles the list of improvements into a CIP with planning-level project cost estimates and an implementation schedule. The CIP will help guide the City project planning efforts and its annual budgeting process.

9.2 Water System Improvements Completed Since 2014

Since the last WSP was prepared in 2014, the City has spent considerable time and expense improving their water system. In addition to facility improvements, approximately 4,500 linear feet of water main was installed. Consultants were hired to conduct a rate study and design disinfection facilities in 2016. The City also continued several programs including its conservation and leak detection program, cross-connection control program, and updated its comprehensive water system plan.

A more detailed summary of the water system improvements completed since 2014 is presented in Table 9-1.

Table 9-1 | Water System Improvements Completed Since 2014

2014 CWSP CIP No.	Project Description
1	Installed air gaps or soft starts at each well site
2	Installed fluoride monitors at each well site
3	Installed 1,000 linear feet of 8-inch piping on Golden Gate Avenue, from Princeton Street to Columbia Street
4	Installed 1,150 linear feet of 12-inch piping on Farallone Avenue, from Columbia Street to Princeton Street
6	Recoated the exterior of the High Tank reservoir
7	Installed 1,712 linear feet of 8-inch piping on Ramsdell Avenue, from Tot Lot to San Juan
8	Installed 700 linear feet of piping on Farallone Avenue, from Vassar Street to Golden Gate Avenue

9.2.1 New Water System Improvements

The water system improvements identified from the results of the distribution and transmission system analyses in Chapter 8 are listed in Table 9-2. The table also includes a brief description of each improvement and the deficiency it resolves. Most of the improvements are necessary to resolve existing system deficiencies.

The water system improvements are grouped into the following project type categories: Water Main Replacements (CIP R1), Fire Flow (CIP L1 – L2), Facility Improvements (CIP F1- F3), and City-wide Programs (CIP CW1).

Table 9-2 | Capital Improvement Program Projects

ID Num	Project Location or Name	Project Limits	Existing Deficiency	Proposed Improvement	Est Length (ft)	Estimated Cost
WATERMAIN REPLACEMENT					**5,165**	**$1,950,000**
R1	8" Watermain Replacement of Old & Undersized Mains	Citywide	On-going required watermain replacements	This project involves replacing old, leaking, or undersized mains to improve water quality, pressure, or fire flow capacity for deficient watermains.	5,165	$1,950,000
FIRE FLOW					**2,100**	**$843,000**
L1	12" Watermain on Summit Avenue	Princeton St to Columbia St	Undersized water mains with insufficient fire flow	This project will install 12-inch DI mains to improve flow and water quality to the area.	950	$408,000
L2	8" Watermain on Eldorado Avenue	Princeton St to Columbia St	Undersized water mains with insufficient fire flow	This project will install 8-inch DI mains to improve flow and water quality to the area.	1,150	$435,000
FACILITIES						**$1,250,000**
F1	Golf Course 0.6 MG Tank Recoating	0.6 MG Reservoir	On-going water tank maintenance	This project involves repainting the existing Golf Course Tank to protect against corrosion, repair any lost paint due to aging, and beautify the tank.		$150,000
F2	Water Meter Upgrades and Software for Meter Reading Changes	Citywide		This project involves replacing existing water meters and the new software for reading meter changes.		$450,000
F3	Weathervane Zone Pump Station Firm Capacity Improvements	Weathervane Zone Pump Station	No longer meets DOH requirement for firm capacity	This project involves providing two additional 500 gpm pumps to the weathervane zone.		$650,000
CITYWIDE PROGRAM						**$140,000**
CW1	Comprehensive Plan	System Wide, every 10 years	On-going required comprehensive plan updates	This task involves the update of the Comprehensive WSP every ten years to meet the requirements that are in effect at the time of the update. WAC 246-290-100 requires the City to update its Comprehensive WSP every ten years and submit to the Department of Health for review and approval. Drinking water regulations are continuously changing and must be addressed in the City's Comprehensive WSP.		$140,000

9.3 Project Cost Estimates

Project costs were estimated for each of the planned improvements and are presented in 2020 dollars. The planning-level project cost estimates include the estimated construction cost and indirect costs. The construction cost estimate portion includes all construction related costs, sales tax, and a 20 percent construction cost contingency. The indirect cost portion is estimated at 35 percent of the construction cost and is included to provide a budget amount for engineering (preliminary design, final design, and construction management services), surveying, permitting, legal, and administrative services.

9.3.1 Weathervane Pump Station Firm Capacity Improvement Options

Based on the capacity analysis in Chapter 8, the Weathervane Pump Station no longer meets the DOH revised firm capacity requirements. There are several possible alternatives to meet the requirement, including installing an additional high demand pump, upsizing the existing high demand pumps, or upsizing one of the low flow pumps. Since the pump station currently serves the Weathervane Pressure Zone with no issues, the firm capacity improvement is expected to occur within the 10 to 20-year planning period. However, should population growth occur within Weathervane Pressure Zone or other major infrastructure improvements be required, this project would occur sooner in the planning timeline, as discussed in Section 9.5.

9.3.1.1 Option 1 – Additional High Demand Pump

One option to address the firm capacity deficiency is to add a third 500 gpm pump. However, the existing pump station space is limited, so the additional pump and appurtenances would reduce the limited space and make maintenance more difficult to perform. To accommodate the additional pump, the pump station would have to increase in size, which increases the project cost. Overall, this option is estimated to be $1,100,000, but does not include possible generator upsizing or power service required improvements. To avoid structural and architectural improvements, other options include upsizing existing pumps.

9.3.1.2 Option 2 – Upsizing Existing High Demand Pumps

Currently the pump station has two 500 gpm pumps to meet high demand conditions. If these two pumps were upsized to 880 gpm each, the station would meet the firm capacity requirement. This option would require more expensive pumps and appurtenances. The price of these pumps as well as the electrical improvements needed is estimated to be $650,000.

9.3.1.3 Option 3 – Upsizing an Existing Low Flow Pump

The pump station has two 95 gpm pumps for low flow operations. One of these pumps could be upsized to 500 gpm to meet the firm capacity requirements. However, that would reduce the existing redundancy of having two low flow pumps. This option's estimated costs are about $250,000 for a new pump, pump appurtenances, and electrical improvements.

For future planning, Table 9-4 shows the estimated cost for Option 2.

9.4 Water Main Cost Estimates

The water main costs were estimated based on pricing on RSMeans. Construction costs were added to the cost per linear foot to account for traffic and erosion control, valves and fittings, service line costs, restoration, and contractor profit. Indirect costs were added for engineering, sales tax, contingency, legal, and administrative services. Table 9-3 shows the estimated project cost per linear foot used for the water main project construction cost estimates.

9.5 Prioritizing Improvements

The planned improvements were prioritized based on project need, maintenance requirements, existing deficiencies, capacity requirements, and reliability considerations. The results of the priority ranking were used to schedule the improvements, as presented below.

9.6 Schedule of Improvements

The implementation schedule shown in Table 9-4 includes the previously described water main improvements and all other improvements described earlier in this chapter that are planned in the next 20 years. This schedule is a useful planning tool for the City, but it cannot account for real-time or real-world changes which may create opportunities for projects to be constructed out of order. Some examples of this include funding opportunities like grants or loans, developer potential, property ownership changes or acquisitions, and other capital needs of the City and its related utilities or departments. Staff and managers of the water system should carefully review opportunities and adjust as deemed appropriate.

The project cost estimates shown in the table are based on 2020 dollars for all years shown. The City will adjust these cost estimates at the time of project implementation to include an escalation factor that represents inflation and the construction market conditions anticipated at the actual time of construction. The financial program in Chapter 10 describes in more detail the escalation factor to be used for future project cost adjustments.

Table 9-3 | Water Main Unit Costs for Construction

Pipe Dia (in)	Basic Cost ($/LF)	Mobilization 8% of Total	Traffic Control 2%	Erosion Control 2%	Valve & Fittings 25%	Service Lines ($/LF)	Restoration Cost ($/LF)	Contractor Overhead & Profit 10% of Total	Construction Value	Eng Design 20% of Total	Legal/ Admin 10% of Total	Sales Tax 9.9% of Total	Contingency 20% of Total	Planning Value
4	$47	$8	$1	$1	$12	$40	$80	$19	**$208**	$42	$21	$27	$59	**$356**
6	$44	$8	$1	$1	$11	$40	$81	$19	**$204**	$41	$20	$26	$58	**$350**
8	$54	$9	$1	$1	$14	$40	$82	$20	**$220**	$44	$22	$28	$63	**$378**
10	$62	$10	$1	$1	$16	$40	$83	$21	**$234**	$47	$23	$30	$67	**$401**
12	$72	$11	$1	$1	$18	$40	$84	$23	**$250**	$50	$25	$32	$72	**$429**
14	$85	$12	$2	$2	$21	$40	$85	$25	**$271**	$54	$27	$35	$78	**$465**
16	$96	$13	$2	$2	$24	$40	$86	$26	**$289**	$58	$29	$37	$83	**$496**

Table 9-4 | Planned Improvements Implementation Schedule

ID Num	Description	Estimated Project Cost	20-Year Schedule of Improvements Planned Year of Project and Estimated Cost in 2020 (x$1,000)										
WATERMAIN REPLACEMENT		**(2020 x$1,000)**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031-2040**
R1	8" Watermain Replacement of Old & Undersized Mains	$1,950			$200	$200	$160	$160	$160		$160	$160	$750
FIRE FLOW													
L1	12" Watermain on Summit Avenue	$408							$122	$286			
L2	8" Watermain on Eldorado Avenue	$435											$435
FACILITIES													
F1	Golf Course 0.6 MG Tank Recoating	$150			$60	$90							
F2	Water Meter Upgrades and Software for Meter Reading Changes	$450	$250	$200									
F3	Weathervane Zone Pump Station Firm Capacity Improvements	$650											$650
CITYWIDE PROGRAM													
CW1	Comprehensive Plan	$140										$70	$70
Total Annual Cost (note - average cost per year is shown for years beyond 2030)		**$4,183**	**$250**	**$200**	**$260**	**$290**	**$160**	**$160**	**$282**	**$286**	**$160**	**$230**	**$1,905**

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Chapter 10

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Chapter 10

Financial

10.1 Introduction

This chapter summarizes the City's water utility financial history, identifies funding sources and a plan for funding the recommended capital improvements and provides a ten-year financial plan, with the impact on rates. This chapter was prepared by Katy Isaksen & Associates.

10.2 Financial Viability

Financial viability is the ability for the water system to meet financial needs to operate, meet debt obligations, repair/replace/improve the system components, and maintain reserves, as necessary. Financial viability is important to make sure the water utility remains in a position to provide safe and reliable drinking water for years into the future. The City has shown its commitment to financial viability with a recent rate study, establishing a capital fund to save for planned improvements, making adjustments to the rate structure to charge all customers for water used in an inclining three-tier rate system (each tier gets more expensive as customers use more water), adopting multi-year rate increases, and reducing the distribution system leakage. Since the submittal of this draft WSP, the City Council adopted the recommended 2022 rates and will review annually during the budget process to continue providing the level of maintenance and planned capital improvements within a balanced budget. (See Appendix Q - Public Meeting Documentation.)

10.3 Financial History

The City owns and operates a water system along with sewer conveyance and stormwater systems. The self-supporting water utility is accounted for separately in Water Fund 425 that includes water operating expenses and transfers to the water capital fund to carry out the capital improvement projects. The ending fund balance remains to provide for future use of the water utility. Table 10-1 provides a three-year financial history of the water operating fund based on the City's financial reports.

Table 10-1 | Three Year Financial History

Water Operating Fund 425	2018	2019	2020
Operating Revenue			
Sale Of Water	1,019,251	1,030,557	1,046,111
Service Connections	360	11,665	16,111
Setup Fees - Water	1,658	1,385	1,287
Penalties - Water	10,351	11,421	3,470
Backflow	270	450	225
Investment Interest - Water	3,994	4,927	1,917
Rent City Property/High Tank	51,103	53,088	54,591
Rent City Prop/Golf Crse Tank	30,460	29,996	34,768
Court Ordered Judgments - Water	340	-	-
Other Misc Revenue - Water	1,279	1,174	375
Subtotal W Revenue	**1,119,066**	**1,144,662**	**1,158,856**
Expenses			
Sal & Wages - Water Admin	159,412	159,681	168,227
Overtime - Water - Admin	320	170	-
Casual Labor - Water Admin	-	130	-
Sal & Wages - Water Maint	112,740	137,937	112,590
Overtime - Water Maint	1,686	2,626	2,933
Casual Labor - Wtr Maint	-	520	1,150
Sal & Wages - Water Gen Op	19,781	21,767	28,674
Overtime - Water Gen Op	539	430	452
Personnel Benefits - Wtr Admin	75,236	71,732	71,487
Contract Benefits - Wtr Admin	391	843	568
Personnel Benefits-Wtr Maint	59,306	70,085	56,094
Personnel Benefits - Gen Op	8,685	9,203	13,352
Office Supplies - Water	215	139	321
Small Tools & Equip - Water	68	107	198
Oper Supplies - Water Maint	11,091	18,028	17,684
Fluoride	8,049	2,927	3,035
Oper Supplies - Water	1,601	1,781	330
Oper Supplies - Chlorine	4,246	4,309	4,909
Small Tools & Equip - Water Gen	2113.41	3331.97	594
Prof Svcs - Water	2,100	3,250	36,194
Advertising - Water	28	28	107
Communication - Water	2,522	2,737	2,741
Postage - Water	1,354	1,664	1,601
Travel - Water	75	340	520
Land Rental/Water Tank	15,150	15,377	15,608
Oper Rentals - Copier - Water	658	644	543
Interfd Land Rental	18,220	18,875	19,200

Water Operating Fund 425	2018	2019	2020
Utility Services/Building - Water	2,993	3,124	2,787
Rep & Maint - Water Admin	53	3,010	1,611
Interfd ERR Replace - Water	19,340	18,860	27,027
Miscellaneous - Water	347	395	546
State Operating Permit	3,578	3,578	3,578
Reg & Tuition - Water	699	18	-
Dues,Member,Sub - Water	1,019	993	1,374
Printing & Binding - Water	1,478	1,364	1,533
Mailing Service - Water	2,287	3,319	2,811
Rep & Maint - Water Maint	11,485	13,256	19,776
Interfd ERR R & M - Water	8,199	7,896	18,961
Water Testing	4,769	8,698	5,536
Utility Services/Pumping	70,799	68,087	67,560
Dumping Fees – Water	386	-	526
Public Utility Services/Meter	44	161	88
Excise Tax – Water	49,454	49,913	20,644
City Utility Tax	78,506	80,074	82,209
Interfd Service Charges	155,973	190,221	180,749
Overtime - Water Conservation	191	-	-
Personnel Benefits-Wtr Consv	130	-	-
Office/Operating Supplies - Wtr Consrv	-	1,706	-
Principal Loan Payment - Water	44,218	44,218	44,218
Interest - Water	5,527	4,422	3,316
Transfer Out to Water Capital Fund	621,000	108,160	108,160
Subtotal W Expenses	**1,588,060**	**1,160,135**	**1,152,121**
Annual Increase/(Use) of Reserves	**(468,994)**	**(15,473)**	**6,735**

At the bottom of Table 10-1, the Annual Increase/(Use) of Reserves line provides a quick view of whether the water revenue was sufficient to meet the expenditures in each year. If revenue is greater than expenses, the reserve levels are increased. If revenues are less than expenditures, the reserves are used to balance the budget for the year. This may work for a couple of years if capital improvement funding is higher than typical but is not sustainable in the long run.

The water utility was in balance for 2020, with a positive $6,700, after the prior two years of reducing reserves. Year 2018 was negative due to a one-time transfer to set up the water capital fund, and 2019 was negative by $15,500.

In 2018, the City established the Water Capital Fund 426 to set aside funds for capital improvements instead of having one combined ending fund balance for both operations and improvements. A transfer from the water operating fund was made for the initial funding, and annual transfers continue to fund system replacement from rates. A multi-year rate schedule was adopted by the City Council for 2017-2019.

Table 10-2 summarizes the annual operating expenses for the water utility that are supported by water rates, including operations, equipment repair and replacement, debt repayment, and the transfer to Water Capital Fund 426 for water system improvements.

Table 10-2 | Three Year Expense Summary

Water Operating Fund 425	2018	2019	2020
Operations	889,777	976,579	950,439
ERR Replacement	27,539	26,756	45,988
Debt	49,745	48,640	47,534
Transfer To Water Capital	621,000	108,160	108,160
Subtotal W Expenses	**1,588,060**	**1,160,135**	**1,152,121**

Monthly water service charges are the primary source of ongoing revenue for the water utility, including the sale of water. Other revenue includes service connections which reimburse for staff and equipment, setup fees for new water accounts, penalties, backflow charges, investment interest, rent for use of the water tank properties, and other miscellaneous revenue. The general facilities charges collected from new or upsized water connections are deposited directly into Water Capital Fund 426.

10.3.1 Water Utility Funds

The water operating fund balance at the beginning of 2021 was $296,000 as shown in Table 10-3. The model estimates $315,000 will be available, primarily from rates, after meeting operating expenses and debt payments at the end of 2020. The City's enterprise funds goal is to maintain reserves equal to at least three months of adopted operating expenditures, including equipment replacement ERR and debt payments. After subtracting a three-month cash flow reserve of $257,000, the remaining $58,000 is available for future system investment or water fund use.

Table 10-3 | Water Fund Balance – 425

Water Operating Fund 425	2021	Comments
Beginning Fund Balance	296,000	2020 actual year end
Annual Increase/(Use) of ending fund balance (EFB)	19,000	
Undesignated Ending Fund Balance	315,000	
Target Minimum Balance		
Cash Flow Reserve	257,000	90 days operations, ERR, debt
Available Balance	58,000	for future investment

The water capital fund balance at the beginning of 2021 was $337,000 as shown in Table 10-4. Anticipated 2020 income includes capital contributions/general facilities charges of $65,000, grant reimbursement of $75,000 for 2020 expenditures, a grant from State Legislature for $171,000 for water meter replacement, and an operating transfer from rates for capital improvements of

$108,000. The estimated water capital sources for 2021 of $756,000 is available for water system improvements and emergencies. Additional grants from the federal American Rescue Plan are anticipated for $500,000 in future years (see Table 10-9).

Table 10-4 | Water Capital Fund – 426

Water Operating Fund 426	2021	Comments
Beginning Balance	337,000	2020 actual year end
Capital Contributions/GFC	65,000	one time
Grant - 2020 grant received in 2021	75,000	
Grants - WA State Legislature	171,000	American Rescue Plan $500k, 2022-24
Transfer - Rate-Funded CIP	108,000	
Estimated W Capital Sources	756,000	Available for Improvements

10.4 Outstanding Debt

The water utility has one outstanding debt issue in the form of a Drinking Water State Revolving Fund (DWSRF) low-interest loan from the DOH.

The 2001 DWSRF loan was for $840,141 in water supply improvements and is scheduled to be paid off in October 2022. The loan has an interest rate of 2.5%. The remaining payments are $46,429 in October 2021 and $45,323 in October 2022, including principal and interest.

Debt reserves are held as appropriate and necessary to meet covenants on outstanding debt. The current loan does not require a separate reserve fund, and the City budgets for annual principal and interest payments to be sure it can meet its obligations.

The State designed the DWSRF program to be junior in lien to outstanding parity debt, typically revenue bonds. The City does not currently have any revenue bonds outstanding that pledge the revenue of the combined waterworks utility.

10.5 Current Rates and Charges

The City Council has authority to set rates and charges for the water utility to ensure it remains self-sufficient and meets all covenants on outstanding debt. The rates are reviewed annually during the budget process. Current water rates and fees are included in the City Municipal Code, Chapter 21.04.

10.5.1 Monthly Water Rates

The City reads meters and bills customers every two months (bimonthly) for water service. All customers pay a ready to serve charge (base rate) per dwelling unit or water meter, plus a consumption charge based on metered water use in three inclining tiers (water rate). The water rate is charged per cubic foot and the customers that use more, pay more. Residential and

commercial customer classes have different tier definitions and rates, with commercial being higher to meet additional fire flow requirements. Water from separate irrigation meters is charged at the second tier. This rate structure gives customers control over their bill, promotes conservation, and provides incentive to correct leaks as quickly as possible.

The current 2022 residential base rate is $37.74 for two months. Residential water tiers range from $0.0111 for up to 1,000 cubic feet to $0.0282 for greater than 4,000 cubic feet, on a per cubic foot basis. The typical single-family residence uses 843 cubic feet per month (see **Table 4-1**) or 1,700 cubic feet with rounding per two-month bill. This typical residence pays $60.46 per two-month bill. Current water rates are shown in **Table 10-5**.

Table 10-5 | Current Water Rates

Water Rates, Bi-Monthly	Base + Water	2021	2022
Ready to Serve Charge			
Residential (Single & Multiple)	per dwelling unit	$37.00	$37.74
Single-family with ADU	1 dwelling unit	$37.00	$37.74
Commercial/Industrial Meter	per unit	$37.00	$37.74
Irrigation Meter		no base	no base
Commodity Charge, 2-Month Usage			
Residential (Single & Multiple)			
Tier 1 (0 - 1,000 cubic feet)	per cubic foot	$0.0109	$0.0111
Tier 2 (1,001 - 4,000 cubic feet)	per cubic foot	$0.0163	$0.0166
Tier 3 (4,001+ cubic feet)	per cubic foot	$0.0272	$0.0282
Commercial/Industrial			
Tier 1 (0 - 2,000 cubic feet)	per cubic foot	$0.0129	$0.0132
Tier 2 (2,001 - 4,200 cubic feet)	per cubic foot	$0.0183	$0.0187
Tier 3 (4,201+ cubic feet)	per cubic foot	$0.0292	$0.0302
Irrigation (Separate Meter)			
Residential (at Tier 2)	per cubic foot	$0.0163	$0.0166
Commercial (at Tier 2)	per cubic foot	$0.0183	$0.0187

10.5.2 Water General Facilities Charges

Water general facilities charges (also referred to as system development fees, capital facilities charges, connection charges or participation fees) are collected from each new or upgraded connection to the water system. These charges are for the right to connect into and make use of the system. All connections must obtain a water permit, pay water meter and service connection fees for installation and inspection as appropriate and described in City Municipal Code, Chapter 21.01 and 21.04. The 2021 Water General Facilities Charge for a new single-family residence with a ¾-inch meter inside the city limits is currently $4,400. **Table 10-6** summarizes the current water general facilities charge.

Table 10-6 | Current Water General Facilities Charge

Water General Facilities Charge	2021
Water Meter Size	Amount
3/4"	$4,400
1"	$11,000
1-1/2"	$22,000
2"	$35,200
3"	$70,400
4”	$110,000

10.6 Capital Improvement Funding

10.6.1 Capital Funding Sources

The City has preferred to avoid taking on new utility debt when possible and has relied on low interest loan programs from the State when necessary, including DWSRF and Public Works Trust Fund (PWTF). Other local sources of capital funding include connection fees, developer extensions with latecomer agreements, monthly rates, and capital reserves. These are the primary sources of capital funding available for water. The following discussion outlines the City’s major water funding source opportunities.

The State legislature adopted the 2021-23 Capital Budget with an appropriation for the City for $171,000 grant for water meter replacement with the Infrastructure Projects to be funded from the federal coronavirus state fiscal recovery fund. The City is also seeking a grant from the federal American Rescue Plan to step up replacement of old and undersized water mains.

The DOH typically has four DWSRF funding opportunities each year: grants for preconstruction or consolidation in April and May, loans for preconstruction are open year-round, construction loans in October and November, and emergency loans open year-round. The opportunities require funding from the State capital budget and federal capital budget. Specific information is available on the DOH website (www.doh.wa.gov, DWSRF page). A 1-percent loan fee is included in a successful construction application and the standard interest rate is currently 1.75 percent for a 20-year loan term. Disadvantaged systems and consolidation projects qualify for 1.25 percent interest rate, up to 50 percent principal forgiveness (subsidy), and up to 30-year loan term. The interest rates and terms can be adjusted for each new application window. This is partially a federally funded program under the EPA (partially State funded) and there are a number of federal requirements that must be met. The EPA has a new focus on asset management. Bonus points are available for attending asset management training and for submitting a completed asset inventory. The DWSRF program scores all project applications based on the health risk being addressed. The goal is to provide loans for capital improvements that increase public health protection and compliance with drinking water regulations and protect the health of people throughout the State by ensuring safe and reliable drinking water.

The Public Works Board, operating with the State Department of Commerce, offers the PWTF program. The program is focused on completing necessary infrastructure projects to recirculate the funds to the next round of projects. This requires that projects be ready to proceed and thus the loans must be drawn within 36 months of approval. The program has been on hold or had limited funds for several years with the State education budget crisis. The program relies on a State capital budget appropriation. The program will accept applications when funds are available. The legislative session in 2021 will be the next opportunity for funding into the Public Works Assistance Account. If successful, the first-round submittal deadline may be in July 2021 for construction or preconstruction loans, with interest rates potentially around 1.5 percent for standard 6–20-year loans. Emergency loans are offered year-round as long as funds are available. More detailed information is available on the Public Works Board website (www.pwb.wa.gov).

Other funding sources include the State Department of Commerce energy efficiency grants and the Community Economic Revitalization Board (CERB) program geared to infrastructure improvements for job creation.

On the federal assistance side, there is the US Department of Agriculture-Rural Development Program (USDA-RD) that provides low-interest loans with potential grant subsidy for water systems in communities up to 25,000. There is also a federal Economic Development Administration (USEDA) with a Public Works grant and loan program available. Community Development Block Grant (CDBG) is another federal program, managed at the State Department of Commerce, with limited grants for improvements that benefit low to moderate income customers.

To keep current with infrastructure funding programs, a database is provided by the Infrastructure Assistance Coordinating Council (IACC). The City can use this database to monitor available funding and contact information. The database can be accessed on the web directly on the IACC website (www.infrafunding.wa.gov).

10.6.2 Local Funding Sources

Monthly water rates can provide an on-going level of funds for planned capital repairs, system replacement, and improvements. These funds are appropriate for repair and replacement of the water system to serve existing customers. General facilities charges from new connections are also available to fund improvements to the water system. The water utility is able to borrow from the above-mentioned financial assistance programs and any loans will need to be repaid by monthly rates and connection charges. The water utility is able to sell revenue bonds and/or general obligation bonds to fund planned system improvements. Revenue bonds will be repaid by water rates and connection fees. General obligation bonds can be repaid by water rates and charges or general City tax revenue.

Some of the projects will be the responsibility of developers to connect their property to the system. When developers' complete projects that are approved by the City, the infrastructure is deeded over to the City. The developer can negotiate a latecomer or recovery agreement with the

City to be reimbursed by new development making use of the facilities constructed by the developer for a specified period of time allowed by state law. In certain instances, on a case-by-case basis, such as when additional capacity is provided by a developer-funded project, the City may opt to participate in a cost sharing mechanism.

The City has the option to complete area-specific projects and be reimbursed as new development occurs in that area through a special connection charge. The City also has the option to establish a local improvement district (LID), where the properties specially benefiting from an infrastructure investment would pay their share through an assessment.

10.6.3 Affordability

The EPA requires DOH to award subsidy, or principal forgiveness, of at least 20 percent of the EPA capitalization grant award. To determine how best to award the subsidy, communities are evaluated on affordability of water compared to the median household income (MHI). The EPA defines affordable water rates as 2 percent of MHI for a community. This also reflects the test applied by DOH to determine the level of hardship in a community when applying for grants (subsidy) and loans for water improvement projects. The level of hardship can influence the financial assistance offer. If the cost of water service is higher, the community will be considered in hardship and could be eligible for some financial assistance in the offer, resulting in a grant (subsidy), a lower interest rate loan, or a combination of the two.

The Census Bureau operates a Quick Facts portal of data (census.gov) that provides information for a community, including MHI. For the City, the current MHI is $80,839, in 2019 dollars based on 2015-2019 American Community Survey. The threshold for affordability at 2.0 percent of MHI would be residential water rates of $134.73 per month, or $269 per two-month bill. A lower threshold of 1.5 percent of MHI, with residential bill of $202 per month could result in a 0.5 percent reduction in the interest rate. A typical residence in Fircrest currently pays $59.31 per two-month bill for water service. This level is considered affordable and would not be eligible for subsidy.

Another measure of affordability is what residents in local jurisdictions are paying. Table 10-7 compares 2021 water rates for a typical single-family residence, 3/4-inch meter using 850 cubic feet of water per month, or 1,700 cubic of water per two-month bill. Using this measure, the City currently is in the lower tier compared to other local communities. The average cost of water in the communities listed is $88.00 per two-month bill which is higher than current City rates. The comparison will vary depending on the amount of water used in a home, the season of the year, the rate structure (base fee and usage tiers), and timing of the next rate adjustment.

Table 10-7 | Residential Water Rates Comparison 2021

Residential Water Service	2-Month Bill @ 1,700 cf	Per Month @ 850 cf
University Place – summer	$113	$55
University Place – winter	$105	$53
Steilacoom	$101	$51
Tacoma – summer	$94	$46
Tacoma – winter	$87	$44
Fircrest	$59	$46
Lakewood	$52	$39
1 cubic foot equals 7,48 gallons.		

10.7 Water Capital Improvements

Chapter 9 of this WSP identifies $4.2 million in recommended capital improvements for the water system during the 20-year planning horizon, $2.3 million are recommended for the first 10 years (2021-2030) and $1.9 million for the second 10 years (2031-2040). These cost estimates are in 2020 dollars. This financial chapter addresses the first 10-year period.

It is reasonable to assume that the costs will be higher in the future when projects are scheduled for completion. The estimated costs will be escalated in this financial chapter to make sure the funding is appropriate to match the anticipated cost. The financial projections include construction cost escalation of 4.0 percent per year.

10.7.1 Ten-Year Capital Improvements

The 10-year projects are displayed by year over the planning period as shown in Table 10-8. The main replacement program provides funding for the highest priority replacement of old and undersized mains. The individual project estimated costs in this table have been escalated from 2020 dollars to the scheduled year at 4 percent per year in the Total Ten-Year CIP (Escalated) amounts by year. The total estimated planning level cost for the ten-year CIP is $2.8 million including construction cost escalation. The average annual cost for the 10-year CIP is $287,000. The City's budget currently shows a different amount for 2021 water meter upgrade program and will be adjusted, as necessary. Table 10-8 reflects the cost to complete and the timing is tied to the anticipated grant funding sources.

Table 10-8 | Water 10-Year Capital Improvement Program (CIP), 2021-2030

CIP No.	Project	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
The individual 2020 cost estimates shown by project are escalated at the bottom of the table to the scheduled year at 4% per year.											
R1	8" Main Replacement Old & Undersized Mains			200,000	200,000	160,000	160,000	160,000		160,000	160,000
L1	12" Main on Summit Ave							122,000	286,000		
F1	Golf Course 0.6 MG Tank recoating			60,000	90,000						
F2	Water Meter Upgrades & Software*	250,000	200,000								
CW1	Comprehensive Plan										70,000
Total Ten-Year CIP - W ($2020)		250,000	200,000	260,000	290,000	160,000	160,000	282,000	286,000	160,000	230,000
Total Ten-Year CIP W (Escalated)		250,000	216,300	292,500	339,300	194,700	202,500	371,100	391,400	227,700	340,500
Total 10-Year CIP (Escalated)		2,826,000									
Average Annual 2022-2030 (Escalated)		287,000									

10.7.2 Ten-Year Capital Improvement Funding

The 10-year CIP projects have been reviewed for potential funding sources, such as general facilities charges from new connections, grants and appropriations, developer funding, borrowing, reserves and rates. The City plans to schedule the projects as necessary to balance the engineering need, system capacity and the ability to fund the CIP without borrowing in the next 10 years. Grants will always be reviewed and pursued when appropriate.

Table 10-9 summarizes the funding sources to support the planned CIP projects. With the conservative growth scenario of 1 new ERU per year, general facilities charges are projected to bring in $109,000. Anticipated grants include a legislative appropriation for $171,000 and $500,000 from the American Rescue Plan toward meter and main replacement. The remaining $2,046,000 will be funded with a combination of rates and reserves already set aside.

Table 10-9 | Water 10-Year CIP Funding Sources, 2021-2030

CIP Funding Sources	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
New ERU's	16.2	1	1	1	1	1	1	1	1	1
W GFC Connection Charges	64,800[2]	4,488	4,578	4,669	4,763	4,858	4,955	5,054	5,155	5,258
Grants - Legislative Appropriation	171,000									
Grants - American Rescue Plan		200,000	200,000	100,000						
Funded by Rates[1]	14,200	11,812	87,922	234,631	189,937	197,642	366,145	386,346	222,545	335,242
Total 10-Year CIP Funding Sources	**$250,000**	**$216,300**	**$292,500**	**$339,300**	**$194,700**	**$202,500**	**$371,100**	**$391,400**	**$227,700**	**$340,500**

Note

1. The total funded by rates varies by year, but the financial plan is for regular annual transfers into the water capital fund to build up the reserve for higher years. (See Transfer in **Table 10-12**)
2. 2021 GFC Connection Charges includes meter connection for new community center.

10.8 Ten-Year Financial Plan

The 10-year financial plan to support the recommend capital improvements was developed and discussed with Public Works, Finance, City Manager and presented to the City Council. The adopted 2021 budget is the base year for projections in the model.

10.8.1 Key Assumptions

Several key assumptions were used in making the 10-year projections and are shown in **Table 10-10**. These include the number of new connection ERUs per year, cost escalation factors, other revenue escalation factors and the bimonthly single family base rate.

Table 10-10 | Key Financial Assumptions

Assumptions	Amount
New Customer ERU's	1 ERU per year
General Cost Escalation	3% per year
Construction Cost Escalation	4% per year
Rent Received for Property/Tanks	2% per year
Water Service Connection Fee, 3/4"	2% per year
Water General Facilities Charge	2% per year
Single Family Base Rate	$37.00 per 2-Month Bill

The financial outlook assumes the bimonthly water rate is held constant at $37.00 for a single-family residence to calculate the impact on existing water rates to carry out the plan. Other revenue for rent received for water tanks, connection fees and general facilities charges are escalated at 2 percent per year to reflect the estimated impact on monthly rates.

10.8.2 Ten-Year Outlook

The 10-year rate outlook for Water Fund 425 was developed and is summarized in **Table 10-11**. In order to fund the recommended level of maintenance and CIP with a combination of rates, water capital reserves, general facilities charges, and grants, the 2021 residential bimonthly base rate of $37.00 ($18.50 per month) will need to increase to $45.20 ($22.60 per month) by 2030. This represents an increase of $8.20 per bimonthly bill ($4.10 per month) for the 10-year period. With annual rate increases of 2 percent per year, the planned CIP would be funded along with the planned level of operations to continue to provide reliable, safe drinking water into the future.

The percentage rate impact is assumed to be applied to all customer classes and water rates, as well as other fees for rent, new connections, and general facilities charges. The impact on a typical single-family residence using 1,700 cubic feet of water per two months would be an increase from the current bill of $59.00 to $72.00 by 2030, an increase of $13.00 over ten years ($6.50 per month). This would be an average increase of approximately $1.50 each year. After reviewing the affordability index described in **Section 10.6.3**, these rates continue to be “affordable”, or less than 2 percent of median household income.

Table 10-11 | Summary 10-Year Residential Rate Outlook

Water Utility 10-Yr Outlook	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Subtotal Water Revenues	1,154,400	1,178,606	1,202,648	1,228,691	1,255,635	1,283,280	1,311,826	1,341,172	1,371,419	1,402,568
Transfer to Capital Improvements for CIP	108,160	160,000	200,123	196,127	192,011	187,771	183,404	178,906	174,274	169,502
Subtotal Expenditures	1,135,531	1,178,623	1,202,623	1,228,627	1,255,511	1,283,171	1,311,704	1,341,006	1,371,274	1,402,402
Increase/(use) of EFB	18,869	(17)	25	64	124	109	121	166	146	166
Estimated Monthly Base Rate	$18.50	$18.95	$19.34	$19.76	$20.20	$20.65	$21.12	$21.60	$22.09	$22.60
Estimated Increase in Monthly Base		$0.45	$0.39	$0.42	$0.44	$0.45	$0.47	$0.48	$0.50	$0.51
Estimated Percentage Change		2%	2%	2%	2%	2%	2%	2%	2%	2%
2-Month Base Rate	$37.00	$37.90	$38.68	$39.52	$40.40	$41.30	$42.24	$43.20	$44.18	$45.20
Typical SF 2-Mo Bill @ 1,700 cf/mo	$59.31	$60.75	$62.00	$63.35	$64.76	$66.20	$67.71	$69.25	$70.82	$72.45
Typical SF Increase per 2-Mo Bill		$1.44	$1.25	$1.35	$1.41	$1.44	$1.51	$1.54	$1.57	$1.64

The City will manage the financial plan through the budget process and understands the need for an annual rate increase to fund the recommended level of maintenance and capital improvements to provide safe, reliable water service to ratepayers for years to come. The current City Council prefers annual rate adjustments in the rate ordinance compared to a multi-year rate ordinance. See Appendix Q - Public Meeting Documentation, for the December 14, 2021 agenda packet and Appendix O - Water Ordinances, for the adopted Ordinance No. 1681.

10.8.3 Water Fund 425 Revenue

The water revenue is based on the 2021 budget, including a conservative estimate for water sales and growth. It is assumed that one new residential customer is added each year and the water rates and other revenues are increased 2 percent per year throughout the 10-year outlook. Additional new customers will positively impact the water bottom line and will provide increased revenue available to fund CIP. If water tank leases or other revenue sources change, substitute revenue will be needed or there will be an additional impact on rates.

10.8.4 Water Fund 425 Expenditures

The operating expenses reflect 2021 budget and are generally projected to increase 3.0 percent per year for cost escalation. The expenditures include water operating expenses, equipment repair and replacement (ERR), existing debt payments on the DWSRF loan (ends in 2022), and a transfer to Water Capital Fund 426 for rate-funded CIP. Note that the capital improvement activity takes place within the water capital fund, and the annual rate contribution is transferred to make sure it is available for the recommended CIP.

10.8.5 Detailed 10-Year Outlook

A revenue sufficiency test was applied to make sure that the estimated water revenue met or exceeded the projected water expenditures. Using existing rates, the net income available for capital was not sufficient. However, by increasing rates annually by 2 percent as shown, the bottom yellow line is in balance for each year between 2021 and 2030. An out of balance situation for capital in one year could be addressed by applying reserves but with multiple on-going years, the model estimates the annual impact on rates to be 2 percent. The City has the choice to address annual deficits by reducing expenses, increasing rates and fees, and/or new customer growth exceeding expectations.

Table 10-12 provides the detailed 10-year outlook. Additional connections would provide additional funding for capital improvements, and additional ratepayers to share in the operating costs and contributions to fund CIP.

Table 10-12 | Water 10-Year Financial Outlook

Water Utility 10-Year Outlook	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Operating Revenue										
Water Sales	1,050,000	1,075,800	1,098,200	1,122,300	1,147,500	1,173,300	1,200,300	1,227,800	1,255,900	1,285,200
Service Connections	5,000	2,106	2,148	2,191	2,235	2,280	2,326	2,372	2,419	2,468
Rent Property/Tanks	80,000	81,600	83,320	84,900	86,600	88,300	90,100	91,900	93,700	95,600
Miscellaneous Revenue	19,400	19,400	19,400	19,400	19,400	19,400	19,400	19,400	19,400	19,400
Subtotal Water Revenues	**1,154,400**	**1,178,906**	**1,202,948**	**1,228,791**	**1,255,735**	**1,283,280**	**1,312,126**	**1,341,472**	**1,371,419**	**1,402,668**
Expenses										
Water Operating Expenses	935,870	926,900	954,700	983,300	1,012,800	1,043,200	1,074,500	1,106,700	1,139,900	1,174,100
ERR Replacement	45,072	46,400	47,800	49,200	50,700	52,200	53,800	55,400	57,100	58,800
Existing Debt: DW SRF	46,429	45,323								
Transfer to Capital Improvements for CIP	108,160	160,000	200,123	196,127	192,011	187,771	183,404	178,906	174,274	169,502
Subtotal Expenditures	**1,135,531**	**1,178,623**	**1,202,623**	**1,228,627**	**1,255,511**	**1,283,171**	**1,311,704**	**1,341,006**	**1,371,274**	**1,402,402**
Increase/(Use) of EFB	**18,869**	**283**	**325**	**164**	**224**	**109**	**421**	**466**	**146**	**266**
Estimated Percentage Change to Balance		*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*	*2%*
Estimated Monthly Residential Rate	**$18.5**	**$18.95**	**$19.34**	**$19.76**	**$20.20**	**$20.65**	**$21.12**	**$21.60**	**$22.09**	**$22.60**
Estimated 2-Month Residential Base	$37.00	$37.90	$38.68	$39.52	$40.40	$41.30	$42.24	$43.20	$44.18	$45.20
Typical SF 2-Mo Bill @ 1,700 cf/bill	**$59.31**	**$60.75**	**$62.00**	**$63.35**	**$64.76**	**$66.20**	**$67.71**	**$69.25**	**$70.82**	**$72.45**
Typical SF Increase per 2-Mo Bill		***$1.44***	***$1.25***	***$1.35***	***$1.41***	***$1.44***	***$1.51***	***$1.54***	***$1.57***	***$1.64***

10.8.6 Water Fund 425 Balance and Cash Flow Reserve

The 2021 beginning balance is based on the utility's actual year end 2020 balance. The projected increase or (use) of EFB, or yellow line from above, is used in estimating the ending fund balance for each year. Table 10-13 assumes that the rate increases of 2 percent per year have been applied to result in balanced revenue and expenditures for each year, thus the ending fund balance remains at $315,000 for the 10 years. If rates are not adjusted, this fund balance would be drawn down.

The ending fund balance includes an amount set aside for reserves. The target minimum cash flow reserve of 90 days (3 months) of operating expense, including ERR and debt, is set aside within the fund balance. This matches the City's goal for enterprise fund reserves. The remainder of the funds are available to water.

10.8.7 Water Capital Fund 426 Outlook

The 2021 water capital resources begin with the actual 2020 ending balance. The model assumes this fund collects revenue for future system improvements from several sources, including the water general facilities charges, grants and appropriations for meter and main replacement CIP, and an annual transfer from Water Fund 425 for the rate-funded portion to complete the CIP. The projects funded are then shown in the Water CIP Program line as the funds are expended.

In

Table 10-14, after accounting for the revenue sources and spending on the CIP, the ending balance is estimated to decrease from $506,000 to $116,000 over the 10 years as the City completes the scheduled CIP projects. At the end of 2030, this financial plan estimates $123,000 will be available for emergencies (in addition to the 90 days of operating expenses in the cash flow reserve) in Water Funds 425 and 426.

Table 10-13 | Water Fund 425 Balance and Cash Flow Reserve

Water Operating Fund 425	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Comments
Beginning Balance	**296,083**	314,952	314,952	314,952	314,952	314,952	314,952	314,952	314,952	314,952	actual 2020 end bal
Increase/(Use) of EFB	18,869	assumes estimated rates are in place for balanced program									
Ending Fund Balance	**314,952**	**314,952**	**314,952**	**314,952**	**314,952**	**314,952**	**314,952**	**314,952**	**314,952**	**314,952**	
Target Minimum Balance											
Cash Flow Reserve	257,000	255,000	251,000	258,000	266,000	274,000	282,000	291,000	299,000	308,000	3 mos x operation, ERR, debt
Available Balance	**57,952**	**59,952**	**63,952**	**56,952**	**48,952**	**40,952**	**32,952**	**23,952**	**15,952**	**6,952**	+ Cash Flow Reserve

Table 10-14 | Water Fund 426 Balance

Water Capital Fund 426	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Comments
Resources											
Beginning Balance	337,324	506,284	654,472	766,673	728,169	730,243	720,372	537,632	330,192	281,921	actual 2020 end bal
Capital Contributions/GFC	64,800	4,488	4,578	4,669	4,763	4,858	4,955	5,054	5,155	5,258	GFC x new homes/ERU
Grant - 2020 grant rec'd in 2021	75,000										
Grants (Amer. Rescue, WA St. Leg.)	171,000	200,000	200,000	100,000							see CIP Funding Sources
Transfer - Rate-Funded CIP	108,160	160,000	200,123	196,127	192,011	187,771	183,404	178,906	174,274	169,502	
Subtotal Capital Resources	756,284	870,772	1,059,173	1,067,469	924,943	922,872	908,732	721,592	509,621	456,682	
Expense											
Capital Improvement Projects (Escalated)	250,000	216,300	292,500	339,300	194,700	202,500	371,100	391,400	227,700	340,500	
Subtotal Capital Expense	**250,000**	**216,300**	**292,500**	**339,300**	**194,700**	**202,500**	**371,100**	**391,400**	**227,700**	**340,500**	
Estimated Ending Capital Balance	**506,284**	**654,472**	**766,673**	**728,169**	**730,243**	**720,372**	**537,632**	**330,192**	**281,921**	**116,182**	Available for Emergencies
Estimated Total Emergency Reserve										123,133	Funds 425 & 426

10.9 Financial Conclusion

There are not sufficient funds available at the existing water rates to pay for the recommended 10-year capital improvements. The CIP list has been prioritized and planned for annual investment in system repair/replacement/improvement to continue to provide safe, reliable water service for future generations. The goal is to do so in an affordable manner with annual investment funded by water rates, and general facilities charges from new connections. Developer contributions will be considered where appropriate. Of course, the City will seek grants to assist where appropriate.

The financial model estimates the impact on residential monthly water rates (base and water usage) to complete the 10-year CIP. No borrowing is anticipated during this period. The impact on the base rate and typical single-family residence are summarized below:

- Impact on Ready to Serve Charge (Base Rate) - In order to fund the CIP with a combination of rates, water capital reserves, general facilities charges, and grants, the current residential bimonthly base rate of $37.00 would need to increase 2 percent per year to $45.20 by 2030. On a monthly basis, the current base rate of $18.50 would need to increase to $22.60 by 2030. This represents an increase of $8.20 per bimonthly bill ($4.10 per month) for the 10-year period.

- Impact on Commodity Charge (Water Usage) – The water usage charge is assumed to increase the same percentage as the base rate, the 2 percent per year increase would apply to the 3-tiers of water usage rates.

- Impact on Typical Single-Family Residence - The model assumes that all water rates would be impacted on a similar percentage basis. A typical single-family residence using 1,700 cubic feet of water per two months would need an increase from the current bill of $59.00 to $72.00 by 2030, an increase of $13.00 over ten years ($6.50 per month).

- Impact on Reserves – The reserves remain fully funded in the 10-year financial plan. The annual rate increase at 2 percent is near the assumed cost escalation of 3 percent after using $390,000 in capital reserves. If the assumed grants are not realized, the utility will need to reschedule projects or rates and fees will need to be further increased.

These water rates continue to be considered affordable when compared to the median household income of Fircrest, which is the measure specified by DOH and EPA.

The City will manage the budget and improvements to fit as necessary and will adjust rates as needed to complete the recommended improvements to provide safe, reliable water service to ratepayers for many years to come. The City discussed and adopted the necessary rates for 2022 and will continue to do so on an annual basis (See Appendix O - Water Ordinances).

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