NO. 2023-06

AN ORDINANCE ADOPTING THE 2022 WATER SYSTEM MASTER PLAN AND THE 2016 WATER MANAGEMENT AND CONSERVATION PLAN, AND AMENDING CHAPTER 13.04 OF TITLE 13 OF THE SANDY MUNICIPAL CODE

Whereas, cities and counties are required to develop and adopt a public facilities plan for areas within an urban growth boundary containing a population greater than 2,500 persons per Oregon Statewide Planning Goal 11, Public Facilities and Services; and

Whereas, adoption of the 2022 Water System Master Plan (WSMP) complies with water system master planning requirements established under Oregon Administrative Rules (OAR) for Public Water Systems, Chapter 333, Division 61; and

Whereas, the 2016 Water Management and Conservation Plan (WMCP) will be adopted as an addendum to the 2022 WSMP in compliance with OAR 690-086; and

Whereas, the City Council wants to incorporate the 2022 Water System Master Plan and 2016 Water Management and Conservation Plan into Title 13 of the Sandy Municipal Code by reference; and

Whereas, on January 18, 2023, the City provided notice of the proposed amendments to DLCD in conformance with ORS 197.610; and

Whereas, the Planning Commission held public hearings to review the 2022 Water System Master Plan, 2016 Water Management and Conservation Plan, and proposed code amendments to Chapter 13.04 on February 27, 2023, and forwarded a recommendation to City Council to adopt the plans and approve the proposed code amendments; and

Whereas, the City Council held a public hearing to review the 2022 Water System Master Plan, 2016 Water Management and Conservation Plan, and proposed code amendments to Chapter 13.04 on April 3, 2023.

NOW, THEREFORE, THE CITY OF SANDY ORDAINS AS FOLLOWS,

Section 1: The City of Sandy Comprehensive Plan is amended to include the Water System Master Plan (WSMP) dated December 2022 and the Water Management and Conservation Plan (WMCP) dated June 2016 as an addendum to the 2022 WSMP. The 2022 WSMP is attached to this ordinance as Exhibit A and incorporated by reference. The 2016 WMCP is attached to this

ordinance as Exhibit B and incorporated by reference. The 2022 WSMP replaces and supersedes any previously adopted WSMP and the 2016 WMCP replaces and supersedes and previously adopted WMCP.

Section 2: Sandy Municipal Code Chapter 13.04 is amended as detailed in Exhibit C, attached and incorporated by reference

Section 3: The adoption of the 2022 WSMP and 2016 WMCP and amendment of the Sandy Municipal Code are supported by findings, attached as Exhibit D and incorporated by reference.

This ordinance is adopted by the Common Council of the City of Sandy and approved by the Mayor this 03 day of April 2023

_____

Stan Pulliam, Mayor

ATTEST:

_____

Jeff Aprati, City Recorder

EXHIBIT A

City of Sandy

Water System Master Plan

December 2022

PREPARED BY:

Consor

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City of Sandy, Oregon

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Water System Master Plan

City of Sandy

December 2022

RENEWS June 30, 2023

Consor

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CHAPTER 1

Existing Water System

1.1 Introduction

The purpose of the Water System Master Plan (WSMP) is to perform an analysis of the City of Sandy's (City's) water system and:

- Document the existing water system including improvements completed since the 1991 WSMP and 1999 WSMP Update.
- Develop and calibrate a new water system hydraulic model.
- Estimate future water requirements including potential water system expansion areas.
- Identify deficiencies and recommend water facility improvements that may correct system deficiencies and provide for growth.
- Recommend an updated water system capital improvement program (CIP) for the water system.
- Develop a document which will support future review of system development charges (SDCs) and water rates based on the updated CIP.
- Document the City's supply strategy and potential change to the current wholesale water supply agreement with the City of Portland.

In order to identify system deficiencies, existing water infrastructure inventoried in this section will be assessed based on the existing and future water needs summarized in Chapter 2 and water system performance criteria described in Chapter 3. The results of this analysis are presented in Chapter 4 and Chapter 5. Chapter 6 provides recommendations for system improvements and a 20-year capital improvement program. The planning and analysis efforts presented in the WSMP are intended to provide the City with the information needed to inform long-term water supply and distribution infrastructure decisions.

This plan complies with water system master planning requirements established under Oregon Administrative Rules (OAR) for Public Water Systems, Chapter 333, Division 61.

1.2 Service Area

The City is located in Clackamas County, southeast of the City of Portland. The water system provides potable water to approximately 13,000 customers within city limits and some surrounding areas through about 4,100 single-family residential, multi-family, and commercial/industrial service connections. Future growth of the water service area will encompass the current urban growth boundary (UGB). The City also sells water to three wholesale customers: Section Corner Water District (WD), Alder Creek-Barlow WD, and Skyview Acres Water Company. The City is the sole source of water for the Section Corner and Alder Creek-Barlow WDs; Skyview Acres serves part of its system through a connection to Portland Water Bureau (PWB). An overview map of the water service area can be found in Figure 1-1.

Legend

Existing Facilities:

Water Main

- <=6"
- 8" - 10"
- 12" - 16"
- >16"
- WTP
- Springs
- Pump Station
- Tank
- Control Valve

Pressure Zone Boundary

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- Zone X
- City Limits
- Urban Growth Boundary

Zone 4

Zone 5

Zone 3

Zone 2

Zone 1

Zone X

REVENUE AVE RESERVOIR & TRANSFER PUMP STATION

VISTA LOOP 1 & 2 MG RESERVOIR

SANDERCOCK LN RESERVOIR

PWB Wholesale Connection
Hudson Road Pump Station

SANDERCOCK LN RESERVOIR

TERRA FERN RD RESERVOIR

BROWNELL SPRINGS

ALDER CREEK WTP

0 1,500 3,000 Feet

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SANDY

City of Sandy
Water System Master Plan

Figure 1 - 1
Existing System

December 2022

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1.3 Supply Sources

The City's supply sources and current operation are described in the following paragraphs. Future supply options, strategy, and limitations are discussed in more detail in **Chapter 5**. The locations of all supply connections are shown in **Figure 1-1**.

The City currently receives its water from three sources: Alder Creek (a tributary of the Sandy River), Brownell Springs (a tributary of Beaver Creek), and PWB, which receives its water supply from the Bull Run Watershed. The water purchased from PWB is subject to minimum purchase requirements in accordance with the Water Supply Agreement. During fall and winter, approximately two-thirds of the City's water supply is purchased from PWB (492,000 gallons), while Alder Creek and Brownell Springs supply the remaining one-third to meet the total demand of approximately 700,000-800,000 gallons. During the summer and fall, PWB continues to supply 492,000 gallons while more water is drawn from Alder Creek and Brownell Springs, fulfilling increased warm weather demands.

1.3.1 Alder Creek WTP

Since 1971 the City has held water rights on Alder Creek. In 1977, the City constructed the Alder Creek Water Treatment Plant (WTP) to treat 1.0 million gallons per day (MGD) of water from Alder Creek. In 1998, they expanded the WTP and its capacity to 2.0 MGD. Shortly thereafter, in 2001, a more efficient system replaced the old treatment unit, increasing the WTP's capacity to 2.6 MGD. While the sustainable capacity of this source is unknown as there are no stream gauges located on Alder Creek, it is believed that at peak capacity it is capable of supplying the 2.6 MGD flow rate allowed by the City's water right.

The Alder Creek raw water intake is located approximately 4,000 feet upstream of the WTP. An intake structure directs water into a 12-inch raw water main and is pumped to the plant via an 1,800 gallon per minute (gpm) duplex booster pump station (two 20 horsepower (hp) pumps with variable frequency drives (VFDs)). Based on anecdotal information from City and Veolia staff (contract operator of the WTP), the firm capacity of the raw water pump station (capacity with the largest pump out of service) is approximately 1,800 gpm.

The WTP is a Trident MicroFloc package, direct-filtration plant. The filters are dual media (sand and anthracite) and backwash is accomplished by gravity flow from the Terra Fern Road Reservoir. The WTP does not use sedimentation or coagulation; pretreatment consists only of flocculation by hydraulic mixing, with no rapid mixing.

The WTP consists of three packaged filtration units – Filters #1 and #2 each have a capacity of approximately 0.5 MGD but have not operated in more than a decade due to control panel issues and instrumentation failures. Filter #3 operates at an approximate capacity between 1.2 MGD and 1.6 MGD.

Finished water is pumped to the distribution system via pumps at the WTP, which send water to the Terra Fern Road Reservoir and Pump Station. Filters #1 and #2 have three submersible turbine pumps with an estimated capacity of 1,050 gpm. These pumps have not been operated since Filters #1 and #2 were in operation (over a decade). Filter #3 has one vertical turbine pump with an approximate capacity of 1,100 gpm (1.6 MGD). The Filter #3 pump has a spare motor, but there is no backup pump. Additionally, this pump is oversized and does not have a VFD.

The WTP site has a standby generator, though the current transfer switch is manual. There is an ongoing project that will convert this to an automatic transfer switch (ATS) and prevent City staff from having to drive to the site to transfer the power source to the generator.

1.3.2 Brownell Springs

Approximately six miles east of Sandy, a series of eight springs, known as Brownell Springs, are located on 22 acres of City-owned land on Lenhart Butte. Water from the individual springs is collected in open-bottom concrete boxes and piped to a 1,000-gallon concrete holding tank where the spring water is disinfected with sodium hypochlorite. Turbidity, disinfectant residual monitoring, and supervisory control and data acquisition (SCADA) communications equipment are housed in a nearby building with a separate room for sodium hypochlorite storage and pumping equipment.

The Springs consistently produce between 0.3 and 0.5 MGD year-round. While peak flows from the Springs occur during the early summer, by late summer, the City is typically regulated down to 90 gpm (0.13 MGD) due to impacts on senior water rights.

From the common holding tank, the chlorinated water blends with water traveling from the Terra Fern Road Reservoir and Pump Station to the Sandercock Lane Reservoir and Vista Loop Reservoirs.

There are three customers downstream of the holding tank who have grandfathered water rights to Brownell Springs water from the City. Their usage is metered, but they do not pay the City for water usage.

1.3.3 Portland Water Bureau

Since a wholesale water supply agreement was established in 2008, the City acquires 0.5 MGD to 3.0 MGD from the PWB. The City is required to pay for at least 0.5 MGD regardless of how much water is actually used, the Guaranteed Minimum Purchase amount stipulated in the current City's wholesale water supply agreement with PWB. This interconnection allows the City to supplement their Alder Creek and Brownell Springs sources, as well as providing redundancy to the system in case of emergency. The PWB receives water from the Bull Run Watershed, located approximately 3 miles northeast of the City at the base of the Cascade Mountains. Water is supplied from Bull Run Lake and Bull Run Reservoirs No. 1 and No. 2, with a combined storage capacity of approximately 17 billion gallons. Water is delivered to the City of Portland and various wholesale customers in the Portland metro area through three large-diameter conduits. The City receives water from the PWB at the Hudson Road Intertie and through a master meter that the PWB is responsible for maintaining and calibrating. The current contract with the PWB expires in 2028 and a new long-term wholesale water supply agreement is currently being developed.

The Hudson Road Intertie is located between the headworks, where chlorine is added to the Bull Run surface water source, and the Lusted Hill Facility where ammonia is added to the water (to create a more stable disinfectant residual in the water, called chloramines) and the pH of the water is adjusted for corrosion control. As discussed further in Chapter 5, the Hudson Road Intertie is located upstream of the future PWB water treatment plant meaning that the water supplied to the City of Sandy at the Hudson Road Intertie will be unfiltered and untreated, and PWB will discontinue chlorination of the water at the Bull Run headworks.

The Hudson Road Intertie with the PWB was established in 2014 approximately 4 miles north of the City. The City cannot convey water back to the PWB from this interconnection. Nearby, the Hudson Pump Station pumps water through approximately 27,000 feet of 18 and 24-inch diameter pipeline to the Revenue Avenue Reservoir, which is located within city limits. On the same site, the Transfer Pump Station pumps water from the reservoir into the distribution system in Zone 2 and up to the Vista Loop Reservoirs. Customers east of Langensand Road, between the Vista Loop Reservoirs and the Alder Creek WTP, cannot currently be served by the PWB source because the pump stations are not configured to pump up to these elevations.

1.3.4 Salmon River

The City holds Permit S-48451 for use of up to 25.0 cubic feet per second (cfs) (16.1 MGD) from the Salmon River, which is currently undeveloped and has an extension of time to October 1, 2069. This water right is intended to provide a long-term water supply to accommodate the City's growth. In the *Agreement for Instream Conversion* (executed October 24, 2002) associated with Portland General Electric's decommissioning of Marmot Dam, the City voluntarily agreed to reduce this permit from 25.0 cfs to 16.3 cfs (16.1 MGD to 10.5 MGD) when the flow available in the Sandy River near Brightwood, OR is 600 cfs (387.8 MGD) or less, but can still divert up to 25.0 cfs when the flow available is more than 600 cfs. No gauge is currently operating near Marmot, OR to provide a picture of the flow in the Sandy River at that location.

1.4 Distribution System

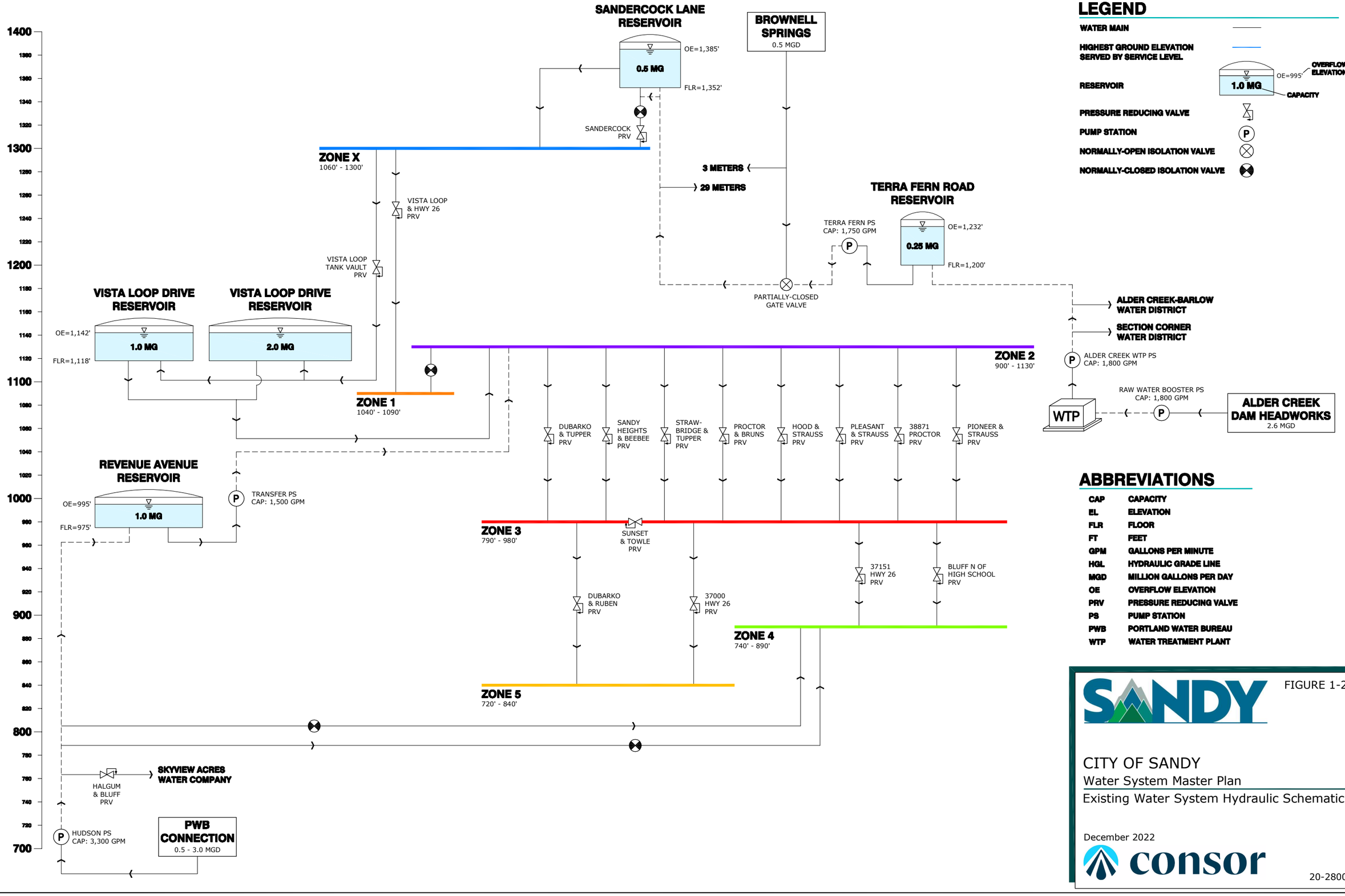
The City's existing water distribution system consists of six pressure zones, five storage reservoirs, four pump stations, and 15 pressure-reducing valve (PRV) stations throughout the City's service area. These components and the supply sources are shown in the existing water system hydraulic schematic included as **Figure 1-2**. The City's distribution system and current operational strategy are described in further detail in **Chapter 4**.

1.4.1 Pressure Zones

Pressure zones are defined by ground topography and their hydraulic grade lines (HGLs) are determined by overflow elevations of water storage reservoirs, discharge pressure at pump stations, or outlet settings of PRVs. Pressure zone boundaries are defined in order to maintain an acceptable range of service pressures to all customers and fire hydrants.

The City's water distribution system is divided into six pressure zones. They are identified simply as Zone X and Zones 1 through 5. The topography of the City's water service area generally slopes down from southeast to northwest, with Sandercock Lane Reservoir acting as the high point in the distribution system. Water from Alder Creek WTP is pumped up to the Sandercock Lane Reservoir while water from Brownell Springs flows by gravity to the reservoir. From here, water flows directly into Zone X, into Zone 1 via PRV, and into the Vista Loop Reservoirs through the Vista Loop Control Valve. From the PWB intertie, water is transmitted to the Revenue Avenue Reservoir where it is blended with Alder Creek and Brownell Springs source water to control disinfection byproduct formation. Water from the Revenue Avenue Reservoir is pumped into Zone 2 from the Transfer Pump Station. From Zone 2, water travels by gravity throughout the remaining pressure zones, passing through PRVs as necessary.

In addition to these six established and named pressure zones, the City supplies water to the three aforementioned wholesale customers, as well as 29 meters above the Sandercock Lane Reservoir, and three meters supplied by gravity between Brownell Springs and a partially-closed gate valve, located near Highway 26, that regulates the flow rate from the springs to the City's allowed water right capacity.



LEGEND

- WATER MAIN
- HIGHEST GROUND ELEVATION SERVED BY SERVICE LEVEL
- RESERVOIR (OE=995', 1.0 MG; OVERFLOW ELEVATION; CAPACITY)
- PRESSURE REDUCING VALVE
- PUMP STATION
- NORMALLY-OPEN ISOLATION VALVE
- NORMALLY-CLOSED ISOLATION VALVE

ABBREVIATIONS

CAP	CAPACITY
EL	ELEVATION
FLR	FLOOR
FT	FEET
GPM	GALLONS PER MINUTE
HGL	HYDRAULIC GRADE LINE
MGD	MILLION GALLONS PER DAY
OE	OVERFLOW ELEVATION
PRV	PRESSURE REDUCING VALVE
PS	PUMP STATION
PWB	PORTLAND WATER BUREAU
WTP	WATER TREATMENT PLANT

FIGURE 1-2

CITY OF SANDY

Water System Master Plan

Existing Water System Hydraulic Schematic

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Figure 1-1 shows the geographical locations of the pressure zones. Table 1-1 summarizes approximate ground elevations served, HGLs, and service pressures, as well as facilities supplying each pressure zone. The information included in Table 1-1 is depicted visually in Figure 1-2.

Table 1-1 | Pressure Zone Summary

Pressure Zone	Elevation Range Served (feet)[1]	Supply Source	Pressure Control (Reservoir/Pump Station/PRV)	Controlling HGL (feet)	Approximate Pressure Range (psi)
Zone X	1,060 to 1,300	Sandercock Lane Reservoir	Sandercock Lane Reservoir	1,385	37 to 141
Zone 1	1,040 to 1,090	Sandercock Lane Reservoir	Vista Loop & Hwy 26 PRV	1,206	50 to 72
Zone 2	900 to 1,130	Vista Loop Reservoirs, Revenue Avenue Reservoir/Transfer Pump Station	Vista Loop Reservoirs	1,228	42 to 142
Zone 3	790 to 980	Zone 2	Several PRVs	1,098	51 to 133
Zone 4	740 to 890	Zone 3	37151 HWY 26 PRV, Bluff Road PRV	980	39 to 104
Zone 5	720 to 840	Zone 3	Dubarko & Ruben PRV, 37000 HWY 26 PRV	987	64 to 116

[1] Individual services with pressures above 80 psi are assumed to have individual PRVs.

1.4.2 Storage Reservoirs

The City's water system includes five active storage reservoirs with a total capacity of 4.75 million gallons (MG). Key information on these reservoirs can be found in Table 1-2. See Figure 1-1 for the geographical locations of the reservoirs.

Located outside of city limits, the easternmost reservoir, Terra Fern Road Reservoir, is of welded steel construction and has a capacity of 0.25 MG. It is filled from the Alder Creek WTP finished water pumps. Water is then boosted by the adjacent Terra Fern Pump Station to the Sandercock Lane Reservoir.

Sandercock Lane Reservoir, another steel reservoir, is the highest reservoir in the City's system and is the second reservoir located outside city limits. Access to the site is unreliable as it is steep and can be subject to downed trees and hazardous driving conditions during winter months. It has a capacity of 0.5 MG and is filled by the Terra Fern Pump Station as well as water from Brownell Springs. Sandercock Lane Reservoir serves Zone X, pressure regulated Zone 1, and supplies the Vista Loop Reservoirs.

The Vista Loop Reservoirs are an older 1.0 MG capacity steel tank and a more recently constructed 2.0 MG prestressed concrete tank. The Vista Loop Reservoirs directly serve Zone 2 and provide the supply to pressure regulated Zones 3, 4, and 5 through Zone 2 distribution piping. Neither the Sandercock Lane nor Vista Loop sites have generators, ATSs, manual transfer switches (MTSs), or back-up power available onsite.

The fifth and final tank is the newest and the lowest in the system. The concrete Revenue Avenue Reservoir receives water from the Hudson Road Intertie with the PWB. Water is pumped directly to the tank from the Hudson Pump Station located more than five miles north. The Transfer Pump Station pumps water from the reservoir to Zone 2. From here, a series of PRVs supply Zones 3, 4, and 5.

Table 1-2 | Reservoir Summary

Reservoir Name	Pressure Zone	Overflow Elevation (feet)	Volume (MG)	Diameter (feet)	Height to Overflow (feet)	Material	Year Constructed
Revenue Avenue	2	995	1.0	92	20	Concrete	2014
Vista Loop	2	1,142	1.0	86	24	Steel	1975
Vista Loop	2	1,142	2.0	122	24	Concrete	2001
Terra Fern Road	N/A	1,232	0.25	32	32	Steel	1978
Sandercock Lane	X	1,385	0.5	51	33	Steel	1966

1.4.3 Pump Stations

The City's existing water system includes four distribution system pump stations and a raw water booster pump station. **Table 1-3** presents a summary of all existing pumping facilities. See **Figure 1-1** for the geographical locations of the pump stations.

The first pump station is the raw water booster pump station which was constructed in 1996 to provide additional capacity to the Alder Creek WTP from the 12-inch diameter raw water intake pipeline. The pump station consists of two 20-hp pumps with VFDs. The pump station provides the WTP with approximately 1,800 gpm (2.6 MGD). Back-up power for the raw water booster pump station is provided from the generator at the WTP.

The WTP houses four finished water pumps. Three submersible turbine pumps operate with Filters #1 and #2. Filter #3 operates with one vertical turbine pump. If all three filter trains are operating, three of the finished water pumps can convey a total of approximately 1,800 gpm (2.6 MGD). The Filter #3 pump has a design capacity of 1,100 gpm (1.6 MGD).

From the WTP, finished water is pumped to the Terra Fern Road Reservoir. The Terra Fern Road Reservoir controls the WTP operation by pressure transducer level transmitters. There is a generator onsite at the WTP, but it does not have an ATS and requires manual override. There is an ongoing project that will install an ATS at the WTP.

The Terra Fern Pump Station shares a site with the reservoir and pumps water to the Sandercock Lane Reservoir, picking up water from Brownell Springs along the way. The pump station was constructed in 1977 and houses five submersible turbine pumps for a capacity of 1,750 gpm (2.5 MGD).

Wholesale water purchased from the PWB at the Hudson Road Intertie is pumped to the City's water system by the Hudson Pump Station. From here, three pumps, two duty and one standby, can supply up to 3,300 gpm (4.8 MGD) of water through 27,000 feet of pipe to the Revenue Avenue Reservoir, located within city limits. There are also hydrated lime chemical feed facilities to adjust the pH of the supply from PWB at this pump station, though it has never been necessary to implement the chemical equipment.

The fifth and final pump station is the Transfer Pump Station, which can convey up to 2,100 gpm (3 MGD) via three pumps, two duty and one standby, into Zone 2. The Terra Fern, Hudson, and Transfer pump stations all have a generator and ATS onsite.

Table 1-3 | Pump Station Summary

Pump Station	Pumping To	Pumping From	Pump No.	Approximate Capacity (gpm)	Emergency Back-up Power	VFD or Constant Speed	Year Constructed
Raw Water Booster	Alder Creek WTP	Alder Creek Intake	2	3,600	Manual Transfer Switch / Control Switch[1]	VFD	2018 (upgraded)
Alder Creek WTP	Terra Fern Road Reservoir	Alder Creek WTP	4	1,800	Manual Transfer Switch / Control Switch[1]	Constant Speed	1977
Terra Fern	Sandercock Lane Reservoir	Terra Fern Road Reservoir	5	1,750	Automatic Transfer Switch / Control Switch	Constant Speed	1977
Hudson	Revenue Avenue Reservoir	PWB Intertie	3	3,300	Automatic Transfer Switch / Control Switch	Constant Speed	2014
Transfer	Zone 2	Revenue Avenue Reservoir	3	2,100	Automatic Transfer Switch / Control Switch	Constant Speed	2014

[1] There is an ongoing project at the WTP that will upgrade this to an automatic transfer switch.

1.4.4 Pressure-Reducing Valves

A total of 15 pressure-reducing stations, installed throughout the distribution system, divide it into pressure zones, providing customers with appropriate water pressures. Of these, 13 PRVs are used to reduce pressure from Zone 2, directly and indirectly supplying Zones 3, 4, and 5. One PRV reduces pressure from the Sandercock Lane Reservoir, supplying Zone X. One more PRV serves Zone 1 from Zone X. The pressure zones served and settings of the PRVs are shown in **Table 1-4**. The geographic location and hydraulic configuration of these PRVs are illustrated in **Figure 1-1** and **Figure 1-2**, respectively.

Table 1-4 | Pressure Reducing Valves Summary

PRV Name	Elevation (ft)	Main Valve			Bypass Valve			Pressure Zone
		Setting (psi)	Size (in)	Grade (ft)	Setting (psi)	Size (in)	Grade (ft)	
Sandercock (Tank Bypass)	1226	75	6	1399	80	2	1411	Zone X
Vista Loop and US 26	1089	55	8	1216	60	3	1228	Zone 1
Sandy Heights South of Beebee	958	53	6	1080	64	1.5	1106	Zone 3
Pleasant and Strauss	960	55	6	1087	-	-	-	Zone 3
Pioneer and Strauss	970	50	4	1086	-	-	-	Zone 3
Towle and Sunset	824	65	6	974	68	1.5	981	Zone 3
Strawbridge and Tupper	903	60	6	1042	60	1.5	1042	Zone 3
Hood and Strauss	954	55	6	1081	-	-	-	Zone 3
Dubarko and Tupper	896	70	8	1058	80	2.5	1081	Zone 3
Proctor and Bruns	960	55	8	1087	-	-	-	Zone 3
38871 Proctor	966	50	10	1082	55	3	1093	Zone 3
37151 Hwy 26	840	56	10	969	61	3	981	Zone 4
Bluff North of High School	870	50	6	986	50	2	986	Zone 4
Dubarko East of Ruben	793	60	10	932	65	3	943	Zone 5
37000 SE Hwy 26	832	57	10	964	65	4	982	Zone 5

1.4.5 Distribution Piping

The City's water transmission and distribution system contains approximately 67 miles of piping and is composed of various pipe materials ranging in size from 2 to 24 inches in diameter. The majority of the piping is 6, 8, 12, and 16 inches in diameter. Most of the pipes are ductile iron (75 percent) or cast iron (CI) (16 percent), in addition to other materials, including steel, polyvinyl chloride (PVC), and asbestos cement. The City has exclusively been installing ductile iron since 1979. **Table 1-5** presents an inventory of existing pipes by diameter.

Table 1-5 | Distribution System Pipe Summary

Diameter (inches)	Length (feet)	Percentage of All Pipe
2	1,616	0.5%
4	9,657	2.7%
6	88,126	24.9%
8	110,865	31.3%
10	4,810	1.4%
12	61,146	17.3%
16	47,787	13.5%
18	16,067	4.5%
24	14,124	4.0%
TOTAL	**354,197**	**100%**

CHAPTER 2

Water Requirements

This chapter characterizes current water demands and summarizes future growth scenarios, population projections, and projected future water demands for the City's water service area. Water demand forecasts presented in this chapter are used with performance criteria presented in Chapter 3 to evaluate the existing water system's capacity to serve current customers and future growth. Demand forecasts are developed from historical water consumption and production records, regional planning data, current land use designations, and previous City water planning efforts.

2.1 Water Service Area

2.1.1 Existing Service Area

The existing City water service area includes approximately 80 percent of the land within the city limits. The City also provides service to three wholesale customers outside of the City's service area: Section Corner WD, Alder Creek-Barlow WD, and Skyview Acres Water Company. The service area is shown in Figure 1-1.

2.1.2 Future Service Area

Based on existing development types in the area, some re-development and densification is expected within the existing water service area, particularly in the central portion of the city. The City expects growth and expansion within its UGB, which is expected to be mostly low density residential. Subdivisions in the east are actively being developed and will affect Zone X in particular. The proposed future service area is illustrated in Figure 1-1.

2.2 Planning Period

The planning period for this WSMP is 20 years, through the year 2043, which meets the requirements for WSMPs outlined in the OAR 333-061. Water supply capacity is evaluated through 2050, to accommodate long-range supply development planning.

2.3 Water Demand Description

Water demand refers to all potable water required by the system including residential, commercial, industrial, city, and public uses. Water demands are described using three water use metrics: average daily demand (ADD), maximum (peak) day demand (MDD), and peak hour demand (PHD). Each of these metrics is stated in MGD.

- ADD is the total annual water volume used system-wide divided by 365 days per year.
- MDD is the largest 24-hour water volume for a given year. MDD typically occurs each year between July 1st and September 30th.
- PHD is estimated as the largest hour of demand on the peak water use day.

Water demand can be calculated using either water consumption or water production data. Water consumption data is taken from the City's Advanced Metering Infrastructure (AMI) data and includes all

revenue metered uses. This data can be analyzed by geographical location and customer type, which is useful for quantifying typical water use for different pressure zones and land uses. However, consumption data does not capture any water loss or unmetered uses, making it less useful in determining system-wide peak demands.

Water production is calculated as the sum of water supplied from the Alder Creek WTP, Brownell Springs, and the PWB connection. This includes unaccounted-for water such as loss through minor leaks and unmetered, non-revenue uses such as hydrant flushing. Total water production is recorded daily, making it useful for analyzing seasonal water demand trends, supply, and storage capacity.

2.4 Historical Water Demand

For the purposes of this WSMP, daily water production data is used to calculate system-wide historical water demand in order to account for all water uses including those which are not metered by the City and to develop peaking factors. Customer consumption and water service location data are used to distribute water demands throughout the hydraulic model, to estimate demands by pressure zone, and to quantify average water use by customer type for future demand projections described later in this chapter.

2.4.1 System-Wide Water Production

System-wide historical water production is presented in **Table 2-1**. The historical ratio of MDD:ADD, or peaking factor, is used to estimate future MDD from ADD. In addition, to understand the effect of outdoor water usage during the summer, Peak Season Demand (PSD) is calculated as the ADD between July 1st and September 30th.

Table 2-1 | Historical System-Wide Water Demand

Year	ADD (MGD)	PSD (MGD)	MDD (MGD)	MDD:ADD Peaking Factor
2016	1.15	1.49	2.36	2.1
2017	1.16	1.54	2.33	2.0
2018	1.22	1.67	2.87	2.3
2019	1.09	1.42	2.49	2.3
2020	1.24	1.59	2.47	2.0
2021	1.38	1.81	2.57	1.9
Average	**1.21**	**1.59**	**2.51**	**2.1**

[1] Based on City staff observations, actual demands may be less due to routine historical overflow of Revenue Avenue Reservoir when Hudson Pump Station supplied the City system from the PWB that has since ceased occurring. Consor was unable to identify a clear quantification of the overflow volume. It is recommended that the City investigate the impact of the recurring overflow event on demand forecast at the end of the year 2022.

2.4.2 Water Consumption by Pressure Zone

As described in **Chapter 1**, water systems are divided into pressure zones to provide adequate service pressure to customers at different elevations. Each pressure zone is served by specific facilities such as reservoirs, pump stations, or PRVs, which supply water to customers within an acceptable range of service pressures. To assess the adequacy of these facilities, it is necessary to estimate demand in each pressure zone. System-wide water consumption from 2020 was distributed uniformly within the City's pressure zones and with respect to the number of meters in each pressure zone. The percentage of water

consumption by pressure zone is summarized in **Table 2-2**. The maximum day peaking factor was applied to these demands to determine MDD.

Table 2-2 | 2020 Water Consumption by Pressure Zone

Pressure Zone	Percent of Demand
Zone X	5.0%
Zone 1	2.7%
Zone 2	46.5%
Zone 3	25.3%
Zone 4	13.4%
Zone 5	7.1%

2.4.3 Water Consumption by Customer Type

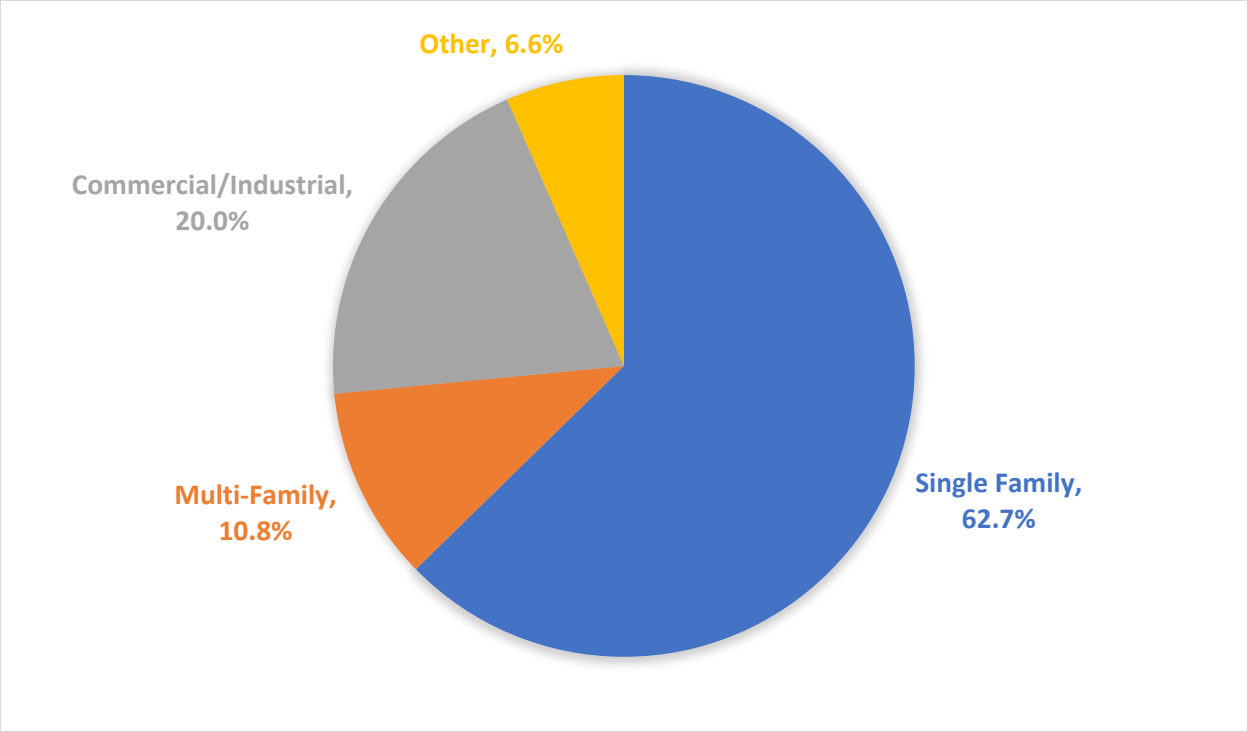
City AMI data provided historical average daily water consumption by customer type including single-family residential, multi-family residential, residential outside of city limits, commercial, industrial, and other (wholesale and public use). Historical use by customer type is presented in **Table 2-3**. The percentage of total 2020 average daily water consumption for each major customer type is presented in **Figure 2-1**.

Residential customer use makes up the majority of demand in the City. This category is assumed to be predominantly comprised of single-family homes, duplexes, and triplexes. Multi-family residential and industrial/commercial customer use also contribute significantly to overall demand. Combined (Other) wholesale, outside city limits residential, public, and City use constitutes approximately 6.6 percent of the total customer use.

Table 2-3 | Historical Water Consumption by Customer Type

Year	Water Consumption by Customer Type (MGD)				
	Single-family	Multi-family	Commercial/Industrial	Other (Wholesale, Outside City Limits Res. Public, etc.)	Total
2017	0.62	0.10	0.22	0.06	1.00
2018	0.62	0.10	0.23	0.06	1.02
2019	0.56	0.09	0.22	0.05	0.92
2020	0.61	0.10	0.19	0.07	0.98

Figure 2-1 | 2020 Water Consumption by Customer Type



2.4.4 Equivalent Dwelling Units (EDUs)

Sandy's public water system serves a significant number of single-family residential customers as well as multifamily housing developments and commercial customers. Single-family residential water services generally have a consistent daily and seasonal pattern of water use or demand. Water demands for multifamily residential, commercial, and industrial users may vary significantly from service to service depending on the number of multifamily units per service or the type of commercial enterprise. When projecting future water demands based on population change, the water needs of non-residential and multi-family residential customers are represented by comparing their water use volume to the average single-family residential unit. The number of single-family residential units that could be served by the water demand of these other types of customers is referred to as the number of "equivalent dwelling units" (EDUs). EDUs differ from actual metered service connections in that they relate all water services to an equivalent number of representative single-family residential services based on typical annual consumption.

In order to establish the average consumption per EDU, the total number of single-family residential service connections is compared to the total consumption by single-family residential customers. Residential ADD divided by the number of base size meters is the average demand per EDU (ADD/EDU in gpd/EDU). Average consumption per EDU (ADD/EDU) is anticipated to remain constant through time and based on the calculations using 2017 to 2020 water consumption records, assumed to be 182 gpd/EDU.

2.5 Future Water Demand Forecast

Future water demands were projected based on historical data, population forecasts, and growth trends. Projections take into account anticipated growth in new development areas and estimated water loss. Specific criteria used to forecast future water demands are listed below.

Actual demands may be less than projected. At one time, Hudson Pump Station supplied the City system from the PWB. During this time, City staff observed routine overflow of Revenue Avenue Reservoir. This overflow has since ceased occurring. Consor was unable to identify a clear quantification of the overflow volume. It is recommended that the City investigate the impact of the recurring overflow event on demand forecast at the end of the year 2022.

2.5.1 Residential Water Demand

Population projections were the basis for estimated residential water demand. The Coordinated Population Forecast for Clackamas County published by the Portland State University (PSU) Population Research Center (PRC, June 2020) includes US census population data from 2010 and estimated populations and growth rates for 2020 through 2070 for the City. Historical and projected populations are summarized in Table 2-4. The population projections do not include areas served by the Alder Creek Barlow WD, Section Corner WD, or Skyview Acres Water Company.

Table 2-4 | Historical and Projected Populations

Year	Population	Source
2010	9,980	U.S. Census
2022	12,991	PSU-PRC Population Estimate
2023	13,415	Projected using 2.1% AAGR (PSU PRC)
2025	13,985	Projected using 2.1% AAGR (PSU PRC)
2030	15,516	Projected using 2.1% AAGR (PSU PRC)
2035	17,215	Projected using 2.1% AAGR (PSU PRC)
2040	19,100	Projected using 2.1% AAGR (PSU PRC)
2043	20,329	Projected using 2.1% AAGR (PSU PRC)
2045	21,192	Projected using 2.1% AAGR (PSU PRC)
2050	22,942	Projected using 1.6% AAGR (PSU PRC)

Using the 2020 city-wide population estimate and residential water consumption data provided by the City for 2017 through 2020, the average use per capita per day was calculated. Note that this is for single- and multi-family consumption combined. The average per capita use was 65 gallons per capita per day (gpcd) between 2017 and 2020. The same value of 65 gpcd is used to estimate future residential water demand.

2.5.2 Non-Residential Water Demand

Commercial, industrial, wholesale, outside city limit residential, public, and City water use projections are based on consumption data from 2017 through 2020. Average 2020 consumption data for Commercial/Industrial and Other were used as basis of demands for 2023. Commercial and industrial demands are expected to increase proportional to residential demand as described in Section 2.5.1. Other (wholesale, outside city limit residential, and public and City water) usage is expected to remain constant through the planning period.

2.5.3 Non-Revenue Water Demand

Non-revenue water is the amount of water produced that is not billed to a customer. This generally includes water losses in the distribution system, unauthorized use, and authorized unbilled use such as hydrant flushing for water quality. This water must be accounted for in demand projections to ensure proper

infrastructure sizing. Non-revenue water is estimated as the difference between billed consumption and production.

Non-revenue water is projected using historical data, based on the difference between billed consumption and production data from 2017 through 2020. Average annual non-revenue demand was estimated at 15 percent of system production volume. This is on the high end of typical system-wide non-revenue water. It is expected that the City could decrease water loss as they continue to update and repair water system infrastructure. Additionally, water loss will be reduced in newly constructed water system infrastructure. For these reasons, non-revenue water demand is not expected to increase over the planning period proportional to growth. A constant, average non-revenue water demand was applied to the demand projections in **Table 2-5**. The demand is based on 15 percent of 2020 annual production (equivalent to 0.184 MGD).

2.5.4 Water Demand Projections

Table 2-5 presents future demand projections by customer type, as well as total ADD and MDD through 2050. A peaking factor of 2.3 (maximum peaking factor from 2017-2020 historical data, **Table 2-1**) was used to estimate MDD from ADD projections.

Table 2-5 | Future Water Demand Projections by Customer Type (MGD)

	Single-family Residential	Multi-family Residential	Commercial/ Industrial	Other (Wholesale, Outside City Limits Res., Public, etc.)	Total ADD	MDD
2023	0.74	0.12	0.22	0.07	1.33	2.59
2025	0.77	0.13	0.21	0.07	1.38	2.69
2030	0.86	0.14	0.24	0.07	1.50	2.95
2035	0.95	0.16	0.26	0.07	1.64	3.23
2040	1.06	0.18	0.29	0.07	1.79	3.55
2043	1.13	0.19	0.31	0.07	1.88	3.75
2045	1.17	0.20	0.33	0.07	1.95	3.90
2050	1.27	0.21	0.36	0.07	2.10	4.21

[1] Accounts for 0.184 MGD constant, average non-revenue water demand through projections. Historical data shows average system non-revenue water demand as 15 percent of production volume. 2020 production volume used to estimate 0.184 MGD average non-revenue demand.

[2] Based on City staff observations, actual demands may be less due to routine historical overflow of Revenue Avenue Reservoir when Hudson Pump Station supplied the City system from the PWB that has since ceased occurring. Consor was unable to identify a clear quantification of the overflow volume. It is recommended that the City investigate the impact of the recurring overflow event on demand forecast at the end of the year 2022.

2.6 Future Water Demand by Pressure Zone

Due to the limited available water consumption data, projected future water demand by pressure zone cannot be accurately forecast without a reliable spatial allocation of current water usage. As presented in **Chapter 5**, future water demands by pressure zone will be estimated using an estimate of developable land by land use type (residential – single-family or multi-family, commercial/industrial, and other uses). While the Oregon House Bill 2001 Middle Housing implementation rules could result in increased residential housing density in some areas, the increase is anticipated to be minimal. The City should review housing density increases on a case-by-case basis during the plan development process. If a situation arises where increased housing density would be limited by available fire flow in the area, the City may require additional sprinkling requirements on structures to meet fire codes and allow for development. This methodology will

provide a rough forecast by pressure zone to support capacity analyses and future water system facility sizing.

It is recommended that the City work with their AMI provider to extract detailed records of annual usage by customer, to support future refinement of hydraulic model demand distribution and pressure zone demand allocation.

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CHAPTER 3

Planning and Analysis Criteria

3.1 Introduction

This chapter documents the performance criteria used for analyses of the City's water supply and distribution system presented in Chapter 4 and Chapter 5. Criteria are established for evaluating water supply, distribution system piping, service pressures, storage and pumping capacity, and fire flow availability. These criteria are used in conjunction with the water demand forecasts presented in Chapter 2 to complete the water system analysis.

3.2 Performance Criteria

The water distribution system should be capable of operating within certain performance limits under varying customer demand and operational conditions. The recommendations of this plan are based on the performance criteria developed in this chapter and summarized in Table 3-1 at the end of this chapter. These criteria have been developed through a review of City design standards, State of Oregon requirements, American Water Works Association (AWWA) acceptable practice guidelines, the *Ten States Standards*, the *State of Washington Water System Design Manual*, and practices of other water providers in the region.

3.2.1 Supply

Supply adequacy is measured based on firm capacity. For a treatment plant, this is the total plant capacity with the largest single treatment train out of service. For wholesale supply, it is based on the wholesale supply agreement and the firm capacity of the City facilities transmitting supply to the water system. For a pump station, such as the Hudson Road Intertie, this is the capacity with the largest pump out of service.

The City's total firm supply capacity must equal, or exceed, the MDD of the water system.

3.2.2 Service Pressure

Water distribution systems must provide water to customers within a limited pressure range, generally 40 to 80 pounds per square inch (psi). To do this, systems are divided into pressure zones which provide water to customers within a band of ground elevations. Pressure zones are typically served by one or more reservoirs with the same overflow elevation. The ground elevation band is limited by the pressure available from the HGL within each level. The HGL in each pressure zone is set by the water level in the reservoirs or settings of PRVs serving the level. Areas of the system can also be hydraulically connected to another pressure zone by a PRV or pump station.

The City's acceptable service pressure range under normal operating conditions, or ADD, is 40 to 80 psi. However, due to ground elevations in some pressure zones, some customers receive service pressures outside this range. Where mainline pressures exceed 80 psi, services are equipped with individual PRVs to maintain their static pressures at no more than 80 psi in compliance with the Oregon Plumbing Specialty Code. During a fire flow event or emergency, the minimum service pressure is 20 psi as required by Oregon Health Authority, Drinking Water Program (OHA) regulations.

3.2.2.1 Distribution System Evaluation

The distribution system is evaluated for adequacy under two key demand scenarios: MDD plus fire flow and PHD. The distribution system should provide the required fire flow to a given location under MDD conditions while maintaining a minimum residual service pressure of 20 psi at any customer meter in the system as required by OHA regulations.

3.2.2.2 Main Size

Typically, new water mains should be no smaller than 8 inches in diameter. However, 8-inch mains may cause water quality concerns in areas with small, non-emergency demands and minimal looping. Pipe may be 6 inches in diameter if it is directly connected to an 8-inch or larger loop and as long as no hydrants are connected to the 6-inch diameter pipe. For areas with commercial or industrial use or fire flows exceeding 1,000 gpm, a minimum of 12-inch diameter pipe is recommended.

3.2.3 Storage Capacity

Water storage reservoirs should provide capacity for four purposes: operational storage, equalization storage, fire storage, and standby or emergency storage. A brief discussion of each storage element is provided below. Adequate storage capacity must be provided for each set of hydraulically connected pressure zones. Storage volume for closed pressure zones served through PRVs or by constant pressure pumping is provided by the upstream pressure zone supplying the PRV or pump station. The City does not currently have any constant pressure pumped pressure zones but has four PRV-fed constant pressure zones.

3.2.3.1 Operational Storage

Operational storage is the storage in reservoirs between the on and off set points for the supply sources under normal operating conditions. It is calculated by actual reservoir geometries; a typical variation in reservoir level is 3 to 5 feet. An operational range of 5 feet is recommended.

3.2.3.2 Equalization Storage

Equalization storage is the volume of water dedicated to supplying demand fluctuations throughout the day. Per the *Washington Water System Design Manual,* water systems must provide equalization storage when source pumping capacity cannot meet the PHD. It is recommended that the City plan for equalization storage equal to approximately 25 percent of MDD. This is consistent with the practices of similar water utilities in the region.

3.2.3.3 Fire Storage

Water stored for fire suppression is typically provided to meet the single most severe fire flow demand within each pressure zone. Fire services in the City's water service area are provided by Sandy Fire District No. 72, which uses the Oregon Fire Code (OFC) as a standard for addressing general requirements by building construction and development type.

Required fire flows vary depending on the type of development and building construction. Zoning is used as an analog for development type when evaluating required fire flows for planning within the City's water service area as discussed in Section 3.2.5. According to the 2019 OFC, the largest required fire flow for buildings in areas with adequate and reliable water systems, like the City, is 3,000 gpm for a recommended

duration of 3 hours. The recommended fire storage volume is determined by multiplying the fire flow rate by the duration of that flow.

3.2.3.4 Emergency Storage

Emergency storage is provided to supply water during emergencies such as pipeline failures, equipment failures, power outages, or natural disasters. The amount of emergency storage provided can be highly variable depending upon an assessment of risk and the desired degree of system reliability. An emergency storage volume of twice the ADD is recommended and is consistent with practices of other utilities in the region.

3.2.4 Pump Stations

Pumping capacity requirements vary depending on the water demand, volume of available storage, and the number of pumping facilities serving a particular pressure zone.

3.2.4.1 Pumping to Storage

When pumping to storage reservoirs, a firm pumping capacity equal to the pressure zone's MDD is recommended. Firm pumping capacity is defined as a pump station's pumping capacity with the largest pump out of service.

3.2.4.2 Backup Power

It is recommended that pump stations supplying gravity storage reservoirs include, at a minimum, MTSs and connections for a portable back-up generator. The emergency storage volume in each reservoir will provide short term water service reliability in case of a power outage at the pump station. On-site back-up generators with ATSs are recommended for pump stations critical to the operation of the system.

3.2.5 Required Fire Flow

The water distribution system provides water for domestic use and fire suppression. The amount of water required for fire suppression purposes at a specific location is associated with the local building size and construction type. Zoning and land use are used as analogs for building size when evaluating required fire flows for planning within the City's water service area.

Fire flow requirements are typically much greater in magnitude than the MDD in any local area. Therefore, fire flow must be considered when sizing pipes to ensure adequate hydraulic capacity is available for these potentially large demands. Sandy Fire District No. 72 has generally adopted the 2019 OFC as its own standard.

3.2.5.1 Single-Family and Two-Family Dwellings

The 2019 OFC guidelines specify a minimum fire flow of 1,000 gpm for single-family and two-family dwellings with square footage 3,600 square feet or less. For residential structures larger than 3,600 square feet, the minimum fire flow requirement is 1,500 gpm. The actual fire flow requirement is based on building construction and size and can be found in Table B105.1(2) in Appendix B of the OFC.

For the purposes of this WSMP, distribution piping fire flow capacity will be tested in the water system hydraulic model with a minimum requirement of 1,500 gpm to accommodate the range of potential future residential development in the City. Where deficiencies are identified in the existing system based on this

1,500 gpm requirement, existing homes that are less than 3,600 square feet will be evaluated at a 1,000 gpm fire flow to confirm if a potential deficiency exists for current customers.

3.2.5.2 Other Dwelling Types

For buildings that are not single- and two-family residential dwellings, the fire flow requirement is based on building type and size and can be found in Table B105.1(2) in Appendix B of the OFC. The fire flow rate and duration requirements are reduced if a building has an automatic sprinkler system. Section B106.1 of the OFC sets the maximum fire flow requirement at 3,000 gpm. This applies to any new, altered, moved, enlarged, or repaired building. Buildings that require more than 3,000 gpm need approval from the fire code official.

Table 3-1 | Performance Criteria Summary

Water System Component	Evaluation Criterion	Value	Design Standard/Guideline
Water Supply	Primary Source Capacities	Firm Capacity >= MDD[3]	Ten States Standards, Washington Water System Design Manual
Service Pressure	Normal Range, during ADD[1]	40-80 psi	AWWA M32
	Maximum (without PRV)	80 psi	AWWA M32, Oregon Plumbing Specialty Code Section 608.2
	Minimum, PHD[2]	30 psi	Consor Recommended
	Minimum, during fire flow	20 psi	AWWA M32, OAR 333-061
Distribution Mains	Maximum Pipe Velocity	Not to exceed 12 fps	Consor Recommended
	Minimum Pipe Diameter	8-inch unless specific criteria is met	City Standard
Storage	Operational Storage	Tank level set points	Consor Recommended and Washington Water System Design Manual
	Equalization Storage	25% of MDD[3]	
	Fire Storage	Required fire flow x flow duration	
	Emergency Storage	2 x ADD	
Pump Stations	Firm Capacity Pump to Storage	MDD	Consor recommended
	Backup Power	Automatic transfer switch and on-site generator	
Required Fire Flow and Duration	Single- or Two-Family Residential <=3,600 square feet	1,000 gpm for 2 hours	2019 Oregon Fire Code
	Residential >3,600 square feet and other Buildings	Use OFC criteria for building size and type up to a maximum of 3,000 gpm for 3 hours	
	Commercial and Industrial	Use OFC criteria for building size and type up to a maximum of 3,000 gpm for 3 hours	

[1] ADD: Average daily demand, defined as the average volume of water delivered to the system or service area during a 24-hour period.

[2] PHD: Peak hour demand, defined as the maximum volume of water delivered to the system or service area during any single hour of the MDD.

[3] MDD: Maximum day demand, defined as the maximum volume of water delivered to the system or service area during any single day.

CHAPTER 4

Distribution System Analysis

4.1 Introduction

This chapter provides an evaluation of the City's water service distribution system, including storage reservoirs, pump stations, control valves, and distribution system piping. As discussed in **Chapter 1**, the City's distribution system consists of six pressure zones, five storage reservoirs, four pump stations, and 15 PRV stations. System facilities are analyzed for adequacy in both existing (2023) and near-term (2030) conditions within the 20-year planning horizon (2043), as well as build-out (2050) conditions beyond the planning period. These analyses inform the City's recommended CIP, presented in **Chapter 6**.

This section documents the distribution system analysis according to the performance criteria outlined in **Chapter 3** and water demand forecasts summarized in **Chapter 2**. The analysis assesses overall system performance including service pressures, pipeline velocities, storage and pumping capacities, and emergency fire flow availability. An analysis of the City's existing water supply system is presented in **Chapter 4**.

4.2 Pressure Zone Analysis

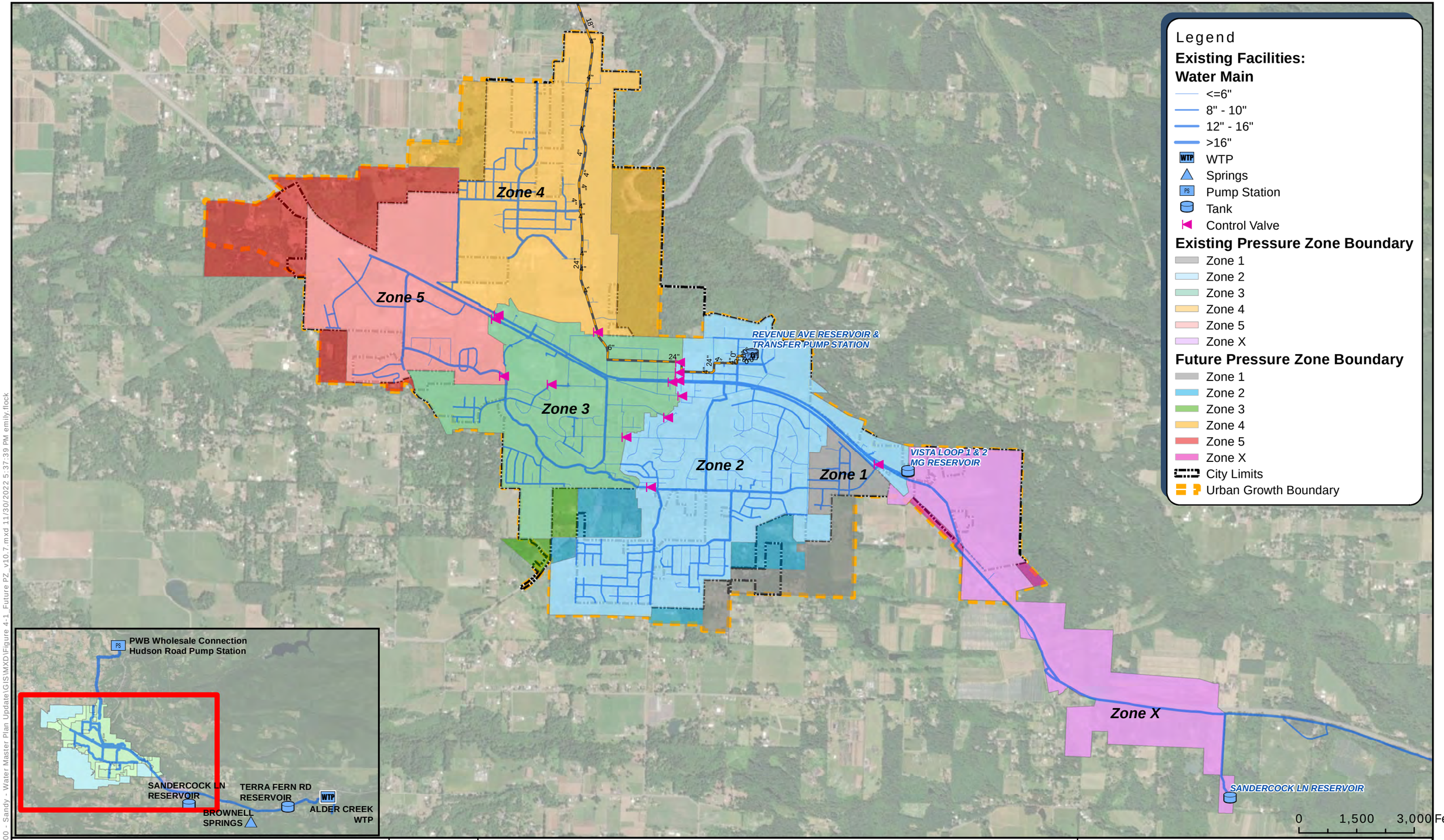
4.2.1 Existing Pressure Zones

As presented in **Chapter 1**, the City's current water service area includes all properties within city limits and some surrounding areas, including three wholesale customers. The City's distribution system is divided into six pressure zones. In addition to customers within zone boundaries, the City provides water to the three wholesale customers, 29 meters above Zone X and the Sandercock Lane Reservoir, and three meters supplied by gravity from Brownell Springs. Zones 1, 3, 4, and 5 are currently served by 14 PRVs. The Sandercock Lane and Vista Loop Reservoirs serve Zones X and 2, respectively.

4.2.2 Pressure Zone Findings

Under existing PHD conditions, the City's six pressures zones provide adequate minimum services pressures of at least 30 psi throughout the system. The maximum acceptable pressure at a water main within the system is 80 psi. Where water main pressure exceeds 80 psi, PRVs are required on individual service connections.

As discussed in **Chapter 2**, future development and densification is expected within the City's UGB. New customers are anticipated to be served primarily by expansion of the existing six pressure zones. Future pressure zone boundaries are illustrated in **Figure 4-1**. Boundaries were developed based on contour and tax lot data.



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City of Sandy
Water System Master Plan

Figure 4 - 1
Future Pressure Zone Boundary

December 2022

20-2800

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4.3 Storage Capacity Analysis

4.3.1 Existing Storage Facilities

This section details the City's existing and future storage capacity needs. Storage projects are identified to accommodate long-term demand projections and improve overall resiliency, reliability, and operational efficiency. As discussed in **Chapter 3**, required storage capacity is calculated as a sum of operational, equalization, fire, and emergency storage. **Table 4-1** summarizes current and projected storage capacity analyses performed for each of the City's pressure zones.

For these analyses, the existing reservoir storage volumes were summed and associated with pressure zones accordingly. The Terra Fern Road and Sandercock Lane Reservoirs provide storage to Zone X, which supplies Zone 1 via a PRV. The two Vista Loop Reservoirs and the Revenue Avenue Reservoir supply Zone 2. Zone 3 is served from Zone 2 by a system of eight PRVs. Zone 3 then serves Zones 4 and 5 via two PRVs per zone. In summary, the Terra Fern Road and Sandercock Lane Reservoirs are associated with Zones X and 1, while the Vista Loop and Revenue Avenue Reservoirs are associated with Zones 2, 3, 4, and 5.

The existing Sandercock Lane Reservoir and the Vista Loop Reservoirs serve customers in Zone X and Zone 2, respectively, by gravity. The City's remaining pressure zones are supplied by PRVs. There must be adequate storage volume to meet customer demands in the zones served directly from reservoirs, as well as smaller zones served through PRVs from the higher level zones with reservoirs.

Table 4-1 | Storage Capacity Analysis

Scenario	Pressure Zone	Required Storage Volume (MG)					Existing Storage Available (MG)	Storage Deficit (MG)
		Operational	Equalization	Fire Flow	Emergency	Total		
2023	Zone X	0.05	0.03	0.54	0.13	0.76	0.75	0.69
	Zone 1	0.05	0.02	0.54	0.07	0.68		
	Zone 2	0.23	0.30	0.54	1.24	2.30	4	2.12
	Zone 3	0.23	0.16	0.54	0.67	1.60		
	Zone 4	0.23	0.09	0.54	0.36	1.21		
	Zone 5	0.23	0.05	0.54	0.19	1.00		
	System	**1.01**	**0.65**	**3.24**	**2.66**	**7.56**	**4.75**	**2.81**
2030	Zone X	0.05	0.04	0.54	0.15	0.78	0.75	0.77
	Zone 1	0.05	0.03	0.54	0.12	0.75		
	Zone 2	0.23	0.31	0.54	1.29	2.37	4	2.46
	Zone 3	0.23	0.17	0.54	0.70	1.64		
	Zone 4	0.23	0.11	0.54	0.44	1.31		
	Zone 5	0.23	0.08	0.54	0.30	1.14		
	System	**1.01**	**0.74**	**3.24**	**3.00**	**7.99**	**4.75**	**3.24**
2043	Zone X	0.05	0.05	0.54	0.18	0.82	0.75	0.96
	Zone 1	0.05	0.06	0.54	0.23	0.89		
	Zone 2	0.23	0.34	0.54	1.40	2.51	4	3.24
	Zone 3	0.23	0.19	0.54	0.76	1.71		
	Zone 4	0.23	0.16	0.54	0.62	1.55		
	Zone 5	0.23	0.14	0.54	0.56	1.47		

Scenario	Pressure Zone	Required Storage Volume (MG)					Existing Storage Available (MG)	Storage Deficit (MG)
		Operational	Equalization	Fire Flow	Emergency	Total		
	System	**1.01**	**0.94**	**3.24**	**3.76**	**8.95**	**4.75**	**4.20**
2050	Zone X	0.05	0.05	0.54	0.20	0.85	0.75	1.07
	Zone 1	0.05	0.08	0.54	0.30	0.97		
	Zone 2	0.23	0.36	0.54	1.47	2.59	4	3.69
	Zone 3	0.23	0.20	0.54	0.79	1.76		
	Zone 4	0.23	0.19	0.54	0.73	1.68		
	Zone 5	0.23	0.18	0.54	0.70	1.65		
	System	**1.01**	**1.05**	**3.24**	**4.20**	**9.50**	**4.75**	**4.75**

4.3.2 Storage Capacity Findings

As shown in **Table 4-1**, the existing water distribution system is lacking in storage for the current 2023 scenario by approximately 2.81 MG, system wide. By the build-out scenario in 2050, the system has a storage deficit of about 4.75 MG.

The City identified three City-owned tax lots that could serve as potential reservoir sites: 24E13BD00101 (Site 2), 24E14DA00700 (Site 1A), and 24E14DB07300 (Site 1B). A summary of these sites and their potential uses is provided in **Table 4-2**.

Site 1A is located at a ground elevation of approximately 850 feet. On Site 1A, the City could construct a buried tank to serve Zone 5 at its current HGL. They also have the option of constructing a tank that would raise the HGL of Zone 5. For the purposes of this WSMP, a reservoir with a floor elevation of 802 feet and a volume of 1.7 MG was modeled at this site to serve Zone 5 at its current HGL. A reservoir at this site would require approximately 1,200 feet of supply piping and 2,000 feet of outlet piping.

With a ground elevation of approximately 900 feet, Site 1B is too high to serve Zone 5 and too low to serve Zone 3. This site could be utilized to provide storage for Zone 4. This would require approximately 3,000 feet of transmission main. Use of this site would be limited by its small size.

Site 2 is the largest by area and has the widest range of ground elevations. One potential use for this site is to construct an elevated storage tank to supply Zone 3. The site could also be used to supply storage to Zone 4 by raising the zone's HGL, which would allow it to be tied directly into the PWB transmission main. For this WSMP, a reservoir was modeled on this site to supply Zone 4, with a floor elevation of 882 feet and a volume of 1.7 MG. This reservoir would require about 300 feet of supply piping and 3,200 feet of transmission main.

In addition to the undeveloped potential reservoir sites, the Sandercock Lane site could be utilized to increase available storage for Zones X and 1 and provide gravity supply to lower elevation pressure zones. An additional reservoir could be constructed on the site or the existing reservoir removed and replaced with a larger one.

Table 4-2 | Potential Reservoir Sites

Tax Lot ID (Address)	Site Name	Ground Elevation Range (feet)	Potential Uses for Site
24E13BD00101 (17255 Smith Ave)	Site 2	890 to 970	➢ Construct an elevated reservoir to provide storage for Zone 3 ➢ Raise the HGL of Zone 4 by providing storage from this site; Zone 4 could then be directly tied in to the PWB transmission main ➢ Construct a ground-level reservoir and pump station to supply the system where needed
24E14DA00700 (Sunset St and University Ave)	Site 1A	840 to 860	➢ Construct a buried reservoir to serve Zone 5 ➢ Raise the HGL of Zone 5 by providing storage from this site ➢ Construct a ground-level reservoir and pump station to supply the system where needed
24E14DB07300 (37615 Sandy heights St)	Site 1B	895 to 905	➢ Construct a reservoir to serve Zone 4

4.4 Pumping Capacity Analysis

4.4.1 Existing Pumping Facilities

As described in **Section 1.4.3**, the existing distribution system includes four pump stations. The Alder Creek WTP, Terra Fern, and Hudson Pump Stations pump directly to the Terra Fern Road, Sandercock Lane, and Revenue Avenue Reservoirs, respectively. Aside from a handful of customers served above Zone X from the Terra Fern pump station discharge piping, the Revenue Transfer pump station is the only one that pumps directly into the distribution system piping.

Pressure zones with the benefit of gravity storage are also referred to as open zones. All six of the City's pressure zones are open. Operational and fire storage supplied by open zone reservoirs make it unnecessary to plan for fire flow or peak hour capacity from pump stations or other supplies, assuming adequate storage is available. Open zone pump stations must have sufficient firm capacity to meet the MDD for all customers in the zone.

4.4.2 Pumping Capacity Findings

The pumping capacity analysis was completed for the entire system, rather than by pressure zone, and accounted the capacities of the Terra Fern and Transfer Pump Stations. **Table 4-3** summarizes the analysis of the City's existing and future pumping requirements. The existing pump stations provide adequate capacity to supply existing and future demands.

Table 4-3 | Pumping Capacity Analysis

Scenario	Existing Total Capacity (MGD)	Required Capacity, MDD (MGD)	Pumping Deficit (MGD)
2023	4.68	2.59	-2.09
2030	4.68	2.95	-1.73
2043	4.68	3.75	-0.93
2050	4.68	4.21	-0.47

Though the system's existing pumping capacity is sufficient to meet existing and future demands, adequate fire flow is not being provided for the system above the Sandercock Lane Reservoir. In order to meet MDD

plus fire flow demands, it is recommended that upgrades be completed at the Terra Fern Pump Station. A 1,000 gpm fire flow pump should be added to supply current and future demands.

In addition to upgrades at the Terra Fern Pump Station, a pump station should be constructed at the Vista Loop site to provide redundancy to the system. Currently, if the Alder Creek WTP supply is unavailable, Brownell Springs may not supply sufficient capacity to customers above Zone 2 that the Transfer pump station cannot serve. A Vista Loop Pump Station would be able to supply Zones X and 1 as well as customers above Sandercock Lane Reservoir in case of an emergency. The Vista Loop Pump Station should be sized to provide 400 gpm, which will meet Zone X plus Zone 1 demands. It should provide 310 feet of head so that it can pump up to Sandercock Lane Reservoir, which is the highest point in the system.

4.5 Distribution System Analysis

4.5.1 Hydraulic Model

A hydraulic model was developed using the City's GIS data. This included utilizing shapefiles provided by the City. Table 4-4 presents the shapefiles used to create the hydraulic model.

Table 4-4 | City GIS Data

File Name	Model Element	Notes
Water_Mainlines(1).shx	Pipes	Determined pipe length, diameter, material, and pressure zone from shapefile
PRV_Valves(1).shx	Valves	Determined PRV location and size from shapefile

In addition to the model build, the meter shapefile and tax lot shapefile were utilized to allocate demands to the system. The Demand Allocation used the 2020 consumption data to allocate the demand based on meter type and meter size. Table 4-5 presents the demand allocation by meter type and meter size.

Table 4-5 | Demand Allocation

Land Use	Meter Size	Number of Meters	Total Demand (gpm)	Demand per Meter (gpm)
Single Family	¾ and 1-inch	3,623	435.37	0.12
Single Family	2-inch	4	2.17	0.54
Multi Family	¾, 1, 1½, 2, and 4-inch	47	72.85	1.55
Commercial/Industrial	¾, 1, 1½, and 2-inch	253	136.76	0.54

[1] Meter data was obtained from December 2020 billing data provided by the City.

Once the demand was spatially allocated per the known meter locations, it could be scaled to simulate ADD, MDD, and PHD. Table 4-6 presents the demands within the system scaled to meet the required simulation conditions.

Table 4-6 | Demand Scenarios

Scenario	System-Wide Water Demand (MGD)		
	ADD	MDD	PHD
Existing (2023)	1.33	2.59	4.26
Near-Term (2030)	1.50	2.95	4.83
Build-Out (2050)	2.10	4.21	6.85

4.5.2 Model Calibration

4.5.2.1 Fire Flow Testing

Consor provided the City with the proposed locations for hydrant testing to be conducted for the purpose of hydraulic model verification and calibration. Some of the test locations provided static pressure to verify the HGL of specific areas of the system. At the majority of locations, fire hydrants were operated to stress the system to calibrate the model. The data obtained when the system is stressed can be used to determine required changes to the boundary conditions and pipe roughness factors within the hydraulic model. The City provided fire flow test results conducted over the course of three days. **Table 4-7** presents an overview of the fire flow test locations and purpose of the test. **Figure 4-2**, **Figure 4-3**, and **Figure 4-4** provide maps of the fire flow test locations.

Table 4-7 | Fire Flow Test Location Overview

Date of Test	Test #	Pressure Zone	Approximate Test Location	Time of Test
01/20/2022	1	X	Mt Hood Hwy & SE Wagoneer Loop	10:25
	2	X	Mt Hood Hwy & SE Rainbow Hill Rd	10:35
	3	X	SE Vista Loop Dr & SE 412th Ave	10:51
	4	1	Antler Ave & Dubarko Dr	11:00
	5a	2	Langensand Rd & McCormick Dr	11:31
	6a	2	Pacific Ave & Dubarko Dr	13:55
	7a	2	Cork Ave & Cascadia Dr	14:13
	8a	2	Revenue Ave & Idleman St	15:00
	9	3	Sandy Heights St & Nettie Connett Dr	15:31
	10a	3	37695 HWY 26	15:52
	14	5	36535 Industrial Way	16:10
	15	5	Skogan Rd & Aubin St	16:26
01/24/2022	11	4	Coralburst St & Jewelberry Ave	14:05
	12	4	Jefferson Ave & Olson St	14:21
	13	5	Kelso Rd & Shalimar Dr	14:38
	16	PWB	SE Bluff Rd & SE Hauglum Rd	15:06
	17	PWB	SE Bluff Rd & SE Hudson Rd	15:23
	18	PWB	39175 SE Hudson Rd	15:32
01/25/2022	5b	2	Langensand Rd & McCormick Dr	14:13
	6b	2	Pacific Ave & Dubarko Dr	15:02
	7b	2	Cork Ave & Cascadia Dr	15:37
	8b	2	Revenue Ave & Idleman St	16:10
	10b	3	37695 HWY 26	16:37

VISTA LOOP 1 & 2
MG RESERVOIR

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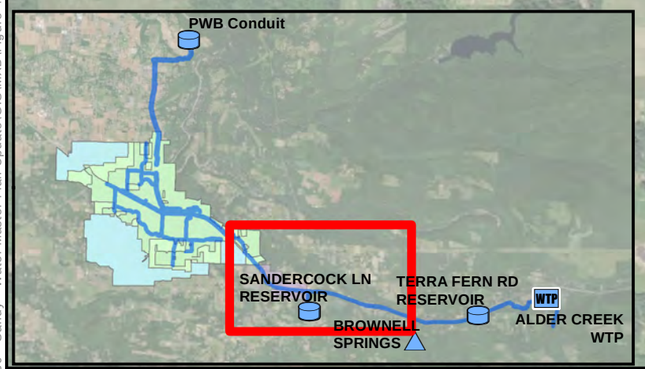

Legend

Existing Facilities:

Water Main

- <=6"
- 8" - 10"
- 12" - 16"
- >16"
- PWB Transmission Main
- WTP
- Springs
- Pump
- Tank
- Control Valve

Fire Flow Test Hydrants

- Flush
- Pressure

Pressure Zone Boundary

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- Zone X
- City Limits
- Urban Growth Boundary

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Figure 4-2
Field Fire Pressure and Flow
Test Locations 1-3

December 2022

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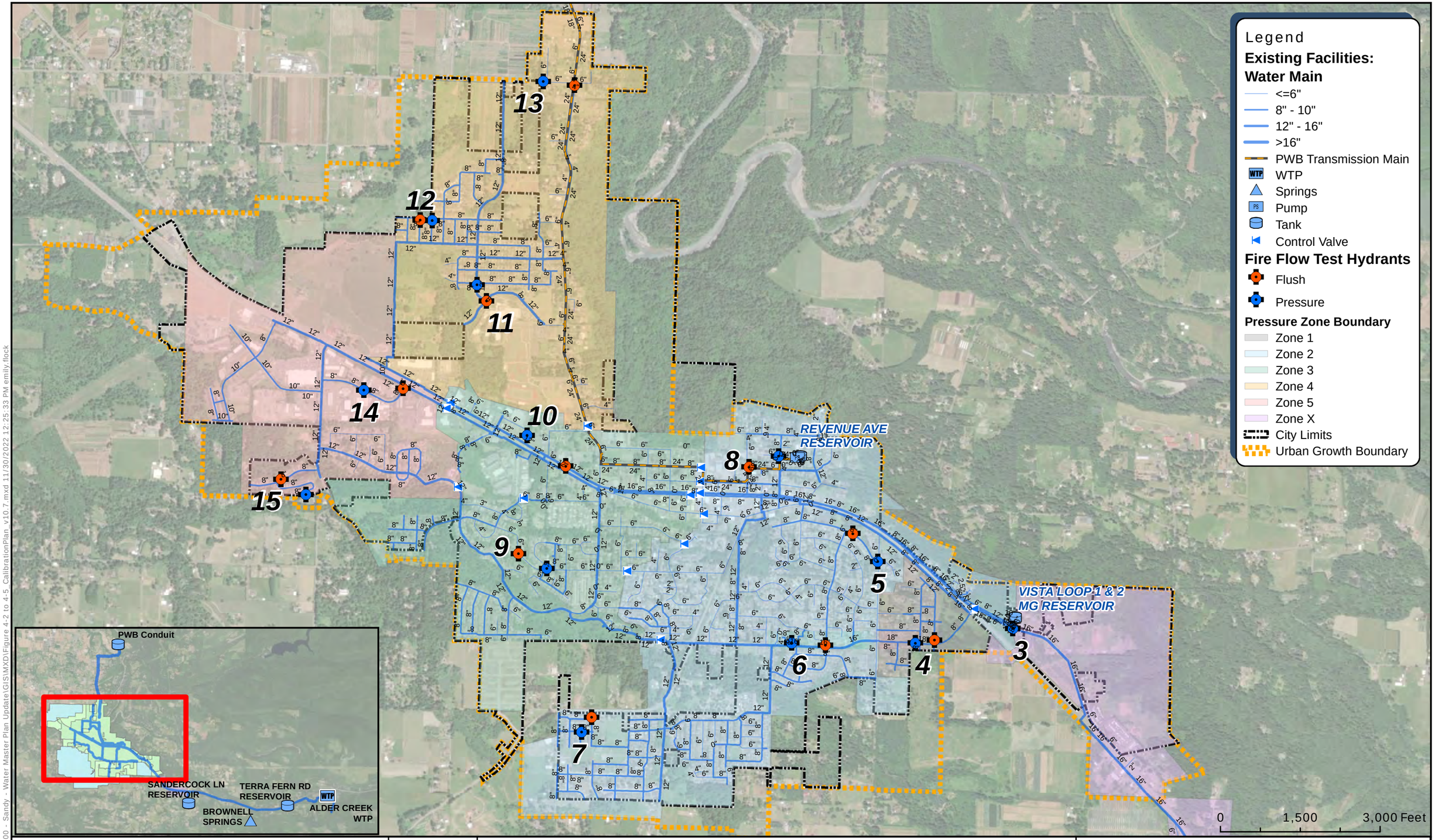

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Figure 4-3
Field Fire Pressure and Flow Test Locations 3-15

December 2022

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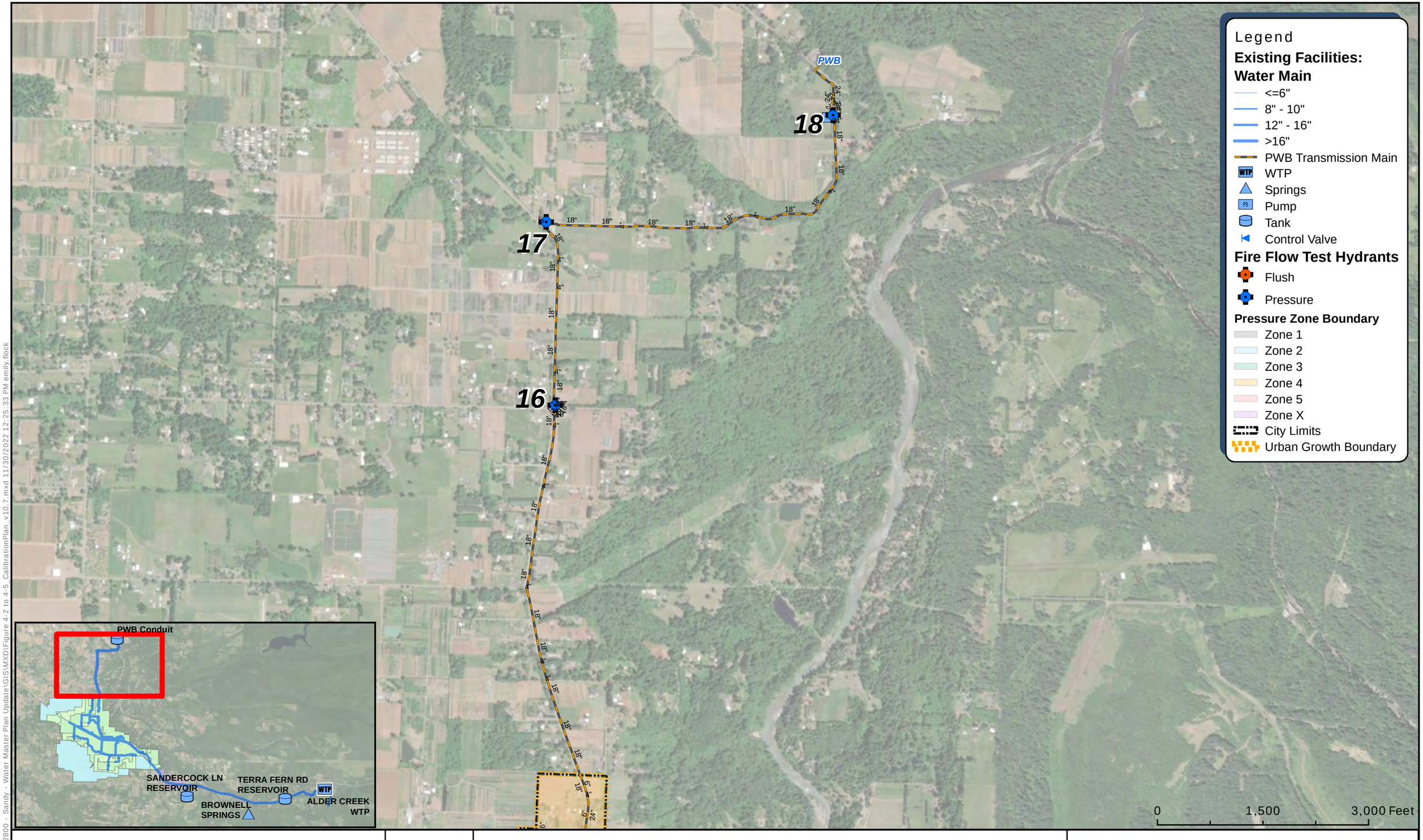

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Figure 4-4
Field Fire Pressure and Flow
Test Locations 16-18

December 2022

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4.5.2.2 Calibration Results

In addition to providing the results of the hydrant tests, the City provided the boundary conditions of water system facilities at the time of each test. The boundary conditions were used to calculate the demand observed during each test. The boundary conditions were also input into the model for each hydrant test to accurately simulate the conditions of the test. **Table 4-8** presents the boundary conditions for each hydrant test.

Table 4-8 | Fire Flow Test Boundary Conditions

Date of Test	Test #	Reservoir Water Level (feet)			
		Terra Fern Road	Sandercock Lane	Vista Loop	Revenue Avenue
01/20/2022	1	8.8	19.6	19.9	12.49
	2	8.8	19.7	20	12.07
	3	8.7	19.7	20.1	11.64
	4	8.6	19.7	20.3	11.2
	5a	8.6	19.6	20.5	10.34
	6a	14	20.1	21.5	6.56
	7a	17.5	20.1	21.7	5.91
	8a	22.7	20.4	22	4.5
	9	26.1	20.5	21.8	4.5
	10a	29.4	20.6	21.7	4.5
	14	29.4	20.6	21.6	4.5
	15	30.1	20.6	21.5	4.5
01/24/2022	11	28.4	27.7	21.6	5.58
	12	28.4	27.8	21.7	5.04
	13	28.3	27.9	21.8	4.61
	16	28.2	29.9	22	3.85
	17	28.2	27.9	21.9	3.85
	18	28.2	28	21.8	3.85
01/25/2022	5b	29.3	27.8	21.7	5.37
	6b	29.2	28	21.6	3.85
	7b	29.1	28.2	21.4	3.85
	8b	29	28.2	21.1	3.85
	10b	29	28.2	21.1	3.85

A fire flow calibration scenario was set up within the model and each of the hydrant test locations was simulated. **Table 4-9** provides the field flow data compared to the flow data input into the model. **Table 4-10** provides a comparison of the static pressures and pressure drops observed at each hydrant test.

Table 4-9 | Fire Flow Test Flow Comparison

Date of Test	Test #	Flow Hydrant			Notes
		Flow (gpm)	Model Flow (gpm)	Difference (gpm)	
1/20/2022	1	---	---	---	
	2	---	---	---	
	3	---	---	---	
	4	740	740.68	0.68	Difference due to demand on Node
	5a	812.5	813.3	0.8	Difference due to demand on Node
	6a	700	701.02	1.02	Difference due to demand on Node
	7a	650	650.8	0.8	Difference due to demand on Node
	8a	937.5	937.5	0	
	9	962	962.34	0.34	Difference due to demand on Node
	10a	914	916.28	2.28	Difference due to demand on Node
	14	760	762.36	2.36	Difference due to demand on Node
	15	990	990.46	0.46	Difference due to demand on Node
1/24/2022	11	760	760	0	
	12	974	974.71	0.71	Difference due to demand on Node
	13	500	500	0	City indicated "Low Flow" for this hydrant test
	16	---	---	---	
	17	---	---	---	
	18	---	---	---	
1/25/2022	5b	1940	1940.77	0.77	Difference due to demand on Node
		740	740.66	0.66	Difference due to demand on Node
	6b	1680	1680.99	0.99	Difference due to demand on Node
		675	675.44	0.44	Difference due to demand on Node
	7b	1880	1880.77	0.77	Difference due to demand on Node
	8b	2380	2380	0	
	10b	2380	2382.21	2.21	Difference due to demand on Node

Table 4-10 | Fire Flow Test Pressure Comparison

Date of Test	Test #	Pressure Hydrant					
		Static Pressure (psi)	Model Static Pressure (psi)	Difference (psi)	Pressure Drop (psi)	Model Pressure Drop (psi)	Difference (psi)
1/20/2022	1	110	110.52	0.52	---	---	---
	2	52	53.81	1.81	---	---	---
	3	105	104.27	-0.73	---	---	---
	4	60	60.65	0.65	3	5.83	2.83
	5a	57	57.37	0.37	0	1.52	1.52
	6a	62	62.73	0.73	0	1.78	1.78
	7a	85	83.39	-1.61	5	7.12	2.12
	8a	88	89.01	1.01	2	1.39	-0.61

Date of Test	Test #	Pressure Hydrant					
		Static Pressure (psi)	Model Static Pressure (psi)	Difference (psi)	Pressure Drop (psi)	Model Pressure Drop (psi)	Difference (psi)
	9	93	88.48	-4.52	7	4.13	-2.87
	10a	88	90.83	2.83	4	1.2	-2.8
	14	77	75.58	-1.42	17	9.77	-7.23
	15	70	71.13	1.13	22	17.15	-4.85
1/24/2022	11	67	67.11	0.11	13	7.65	-5.35
	12	80	84.44	4.44	11	8.94	-2.06
	13	59	53.95	-5.05	39	41.35	2.35
	16	73	78.53	5.53	---	---	---
	17	93	97.56	4.56	---	---	---
	18	29	24.69	-4.31	---	---	---
1/25/2022	5b	56	57.9	1.9	8	11.37	3.37
	6b	59	61.96	2.96	5	12.58	7.58
	7b	81	82.45	1.45	22	40.27	18.27
	8b	83	84.59	1.59	7	6.64	-0.36
	10b	87	90.83	3.83	3	4.17	1.17

4.5.2.2.1 Test 1

The purpose of this test was to confirm the HGL at a location in Zone X downstream of Brownell Springs. In order to satisfy the HGL of this test, the HGL of Brownell Springs was adjusted to 1545 feet.

4.5.2.2.2 Test 2

The purpose of this test was to confirm the HGL at a location in Zone X upstream of Sandercock Lane Reservoir. In order to satisfy the HGL of this test, additional losses were required in the pipeline upstream of the reservoir. It was determined that the pipeline into the reservoir was incorrect. Based on field investigations, the diameter of the pipeline into Sandercock Lane Reservoir was reduced to 8 inches. Even with this change, the losses observed in the field did not match the losses in the model. It was determined that C-factor adjustments and/or adding minor losses in the model would not provide the required losses in the pipeline to simulate the additional losses observed in the field. Therefore, a pressure sustaining valve was added to the model to set the appropriate HGL in the area upstream of Sandercock Lane Reservoir.

4.5.2.2.3 Test 3

The purpose of this test was to confirm the HGL at a location in Zone X upstream of Vista Loop Reservoir. In order to satisfy the HGL of this test, additional losses were required in the pipeline upstream of Vista Loop Reservoir. The losses observed in the field did not match the losses in the model. It was determined that C-factor adjustments and/or adding minor losses in the model would not provide the required losses in the pipeline to simulate the additional losses observed in the field. Therefore, a pressure sustaining valve was added to the model to set the appropriate HGL in the area upstream of Vista Loop Reservoir.

4.5.2.2.4 Test 4

The purpose of this test was to stress the system in Zone 1. Based on the observed static pressure and pressure drops, the following changes were made to the model.

- Vista Loop & Highway 26 PRV
  - Lowered the 3-inch PRV setpoint from 60 psi to 53 psi
  - Lowered the 8-inch PRV setpoint from 55 psi to 48 psi

4.5.2.2.5 Tests 5 – 8

The purpose of these tests was to stress the system in Zone 2. Tests 5 through 8 had to be retested due to insufficient pressure drops observed in the field. Based on the observed static pressure and pressure drops, the following changes were made to the model.

- Raised the concrete Vista Loop Reservoir floor elevation from 1,114 feet to 1,136 feet
- Raised the steel Vista Loop Reservoir floor elevation from 1,118 feet to 1,136 feet
- Adjusted elevation of pressure fire hydrants 5, 6, and 7 to match Digital Terrain Model

Even with these changes, there were still locations where the model could not simulate field conditions. Test 6B observed a higher pressure drop in the model than what was observed in the field at the second observation hydrant. As the pressure drop in the model was higher than what was observed in the field, the C-factor adjustment required would smooth the pipe (i.e. increase the C-factor) and would make the other tests and observation hydrants out of range. In addition, the C-factor for specific pipe types would be outside of acceptable ranges (i.e. too high). In addition to test 6, the two observation hydrants for test 7B observed a higher pressure drop in the model than what was observed in the field. This area is fed by a single pipeline. The only plausible explanation for the pressure drop observed in the field is a second feed to this area (i.e. there is a unknown pipeline supplying water to this area that completes a loop). Further field investigations would be required to rectify this error.

4.5.2.2.6 Tests 9 – 10

The purpose of these tests was to stress the system in Zone 3. Test 10 had to be retested due to insufficient pressure drops observed in the field. Based on the observed static pressure and pressure drops, the following changes were made to the model.

- Dubarko & Tupper PRV
  - Raised the 2.5-inch PRV setpoint from 80 psi to 81 psi
  - Lowered the 8-inch PRV setpoint from 80 psi to 76 psi
- Sandy Heights & Beebee PRV
  - Lowered the 1.5-inch PRV setpoint from 57 psi to 55 psi
  - Lowered the 6-inch PRV setpoint from 57 psi to 50 psi
- Strawbridge & Tupper PRV
  - Kept 1.5-inch PRV setpoint at 80 psi
  - Lowered the 6-inch PRV setpoint from 85 psi to 83 psi

- 38871 Proctor PRV
    - Lowered the 3-inch PRV setpoint from 55 psi to 53 psi
    - Lowered the 10-inch PRV setpoint from 55 psi to 50 psi
- Adjusted elevation of pressure fire hydrant to match Digital Terrain Model

4.5.2.2.7 Tests 11 – 13

The purpose of these tests was to stress the system in Zone 4. Based on the observed static pressure and pressure drops, the following changes were made to the model.

- 37151 HWY 26 PRV
    - Lowered the 4-inch PRV setpoint from 65 psi to 58 psi
    - Lowered the 10-inch PRV setpoint from 58 psi to 55 psi
- Bluff, north of high school, PRV
    - Lowered the 2-inch PRV setpoint from 55 psi to 43 psi
    - Lowered the 6-inch PRV setpoint from 55 psi to 37 psi
- Adjusted elevation of pressure fire hydrant to match Digital Terrain Model

Test 11 had more pressure drop observed in the field than what was simulated in the model. However, further C-factor adjustments would adversely affect other hydrant tests. Therefore, the C-factors were not adjusted further to increase losses at this test. Test 13 had a static pressure that was different from the field, but further PRV Setpoint adjustments were not completed as Test 12 static pressure would then be out of range.

4.5.2.2.8 Tests 14 – 15

The purpose of these tests was to stress the system in Zone 5. Based on the observed static pressure and pressure drops, the following changes were made to the model.

- Dubarko & Ruben PRV
    - Raised the 3-inch PRV setpoint from 65 psi to 75 psi
    - Raised the 10-inch PRV setpoint from 65 psi to 70 psi
- 37000 HWY 26 PRV
    - Kept 3-inch PRV setpoint at 61 psi
    - Raised the 10-inch PRV setpoint from 61 psi to 65 psi

Tests 14 and 15 had less pressure drop observed in the field than what was simulated in the model. However, further C-factor adjustments would adversely affect other hydrant tests. Therefore, the C-factors were not adjusted further to increase losses at these tests.

4.5.2.2.9 Tests 16 – 18

The purpose of these test was to confirm the HGL along the PWB upstream of Revenue Avenue Reservoir. Tests 16 and 17 had static pressures that were approximately 5 psi too high while Test 18 had a static pressure that was approximately 5 psi too low. No model changes were made due to these tests.

4.5.3 Distribution System Analysis

The distribution system was analyzed using the demands shown in **Table 4-6** above. **Table 4-11** presents the scenarios created and boundary conditions.

Table 4-11 | Distribution System Scenarios

Scenario	Demand (MGD)	Facilities	Notes
Existing ADD	1.33	Existing system	Placeholder scenario
Existing MDD	2.59	Existing system	Placeholder scenario
Existing MDD+FF	2.59	Existing system	Analyzed available fire flow
Existing PHD	4.26	Existing system	Analyzed pressure and velocity
Near-term ADD	1.5	Existing system with CIP improvements	Placeholder scenario
Near-term MDD	2.95	Existing system with CIP improvements	Placeholder scenario
Near-term MDD+FF	2.95	Existing system with CIP improvements	Analyzed available fire flow in 2030
Near-term PHD	4.83	Existing system with CIP improvements	Analyzed pressure and velocity in 2030
Buildout ADD	2.1	Existing system with CIP improvements	Placeholder scenario
Buildout MDD	4.21	Existing system with CIP improvements	Placeholder scenario
Buildout MDD+FF	4.21	Existing system with CIP improvements	Analyzed available fire flow in 2050
Buildout PHD	6.85	Existing system with CIP improvements	Analyzed pressure and velocity in 2050

Figure 4-5 through **Figure 4-10** present the results of distribution system analysis.

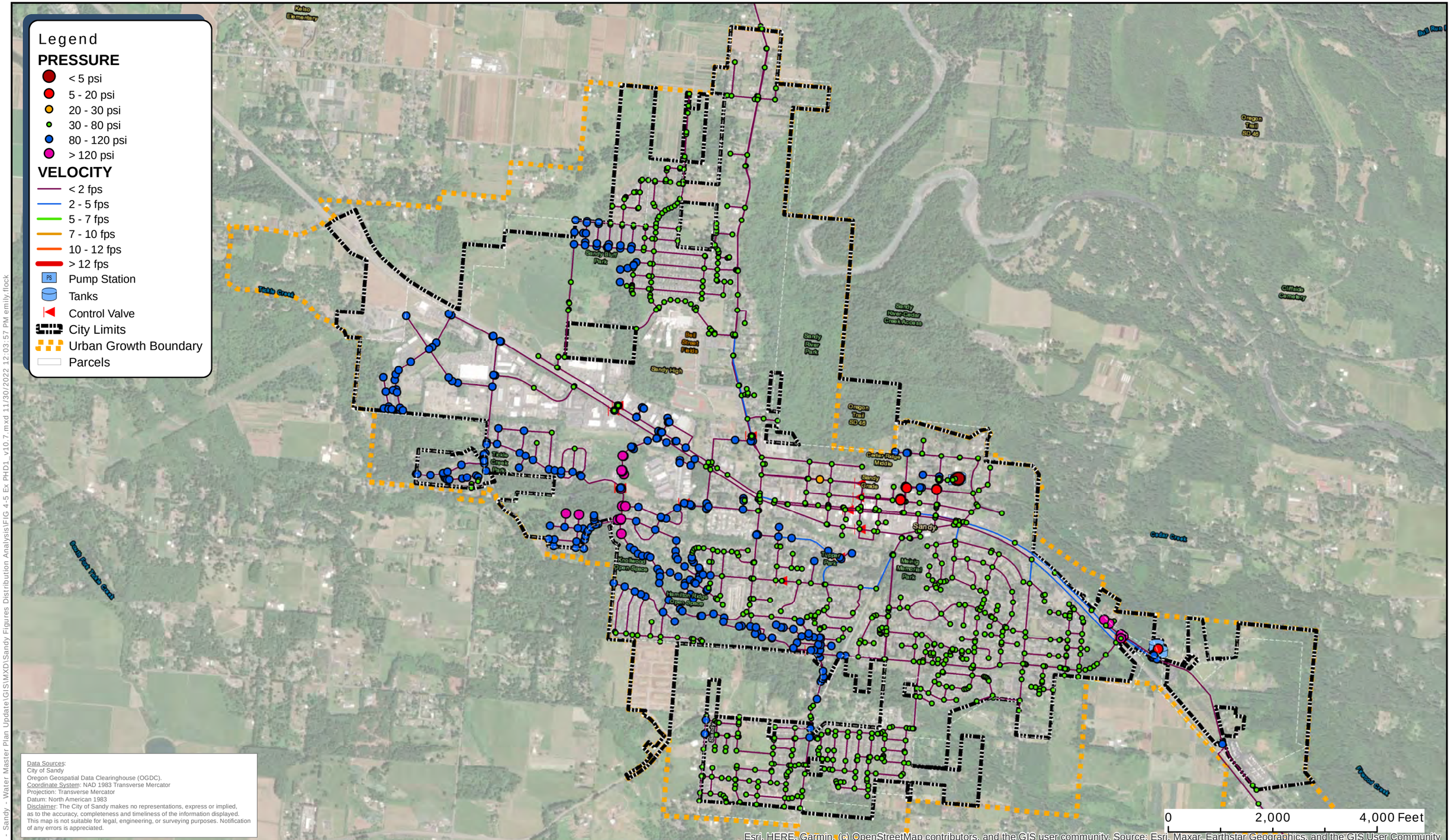

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Figure 4-5
Existing PHD
Pressure and Velocity

December 2022

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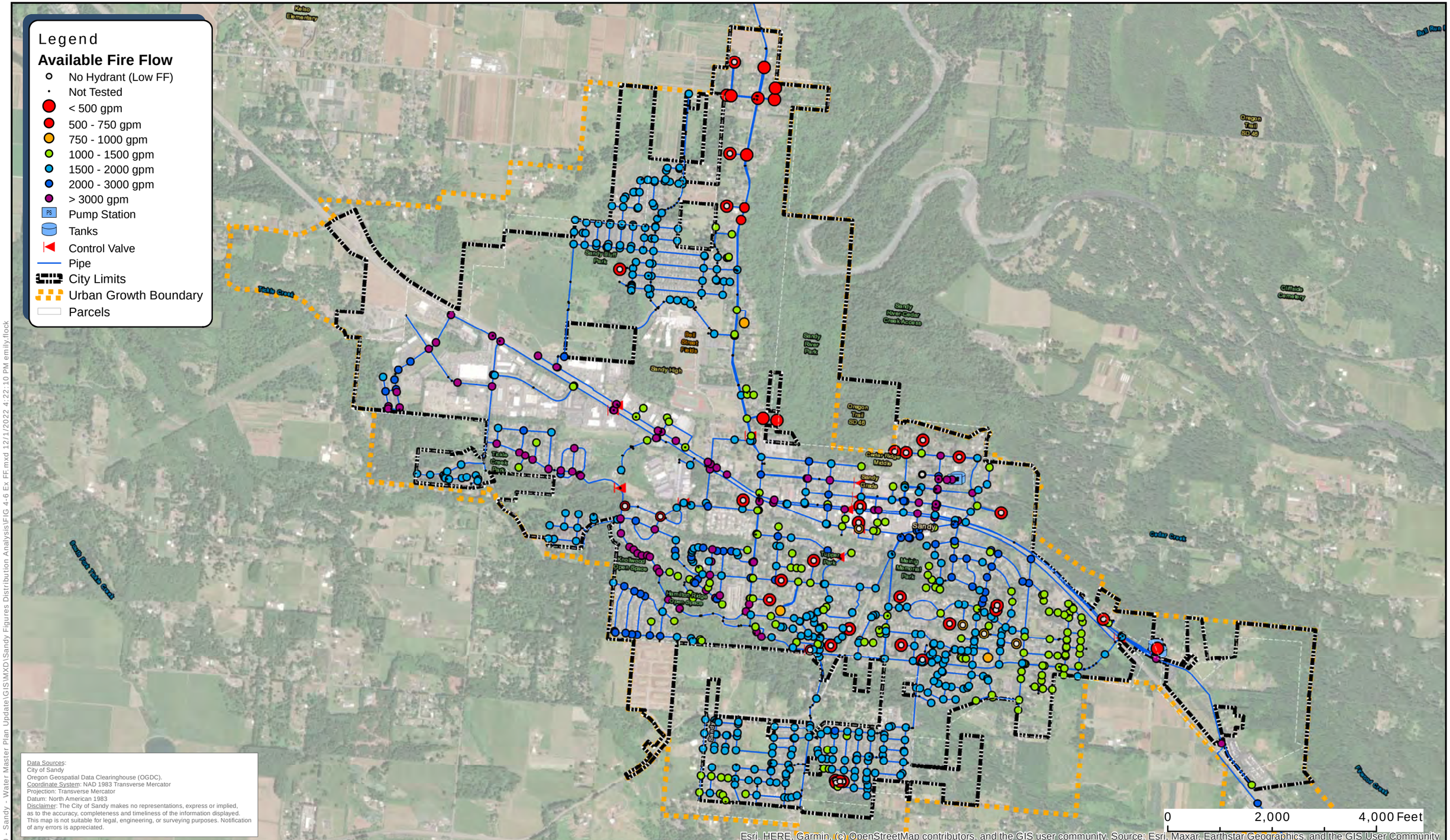

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Figure 4-6
Existing MDD
Available Fire Flow

December 2022

20-2800

Legend

PRESSURE

- < 5 psi
- 5 - 20 psi
- 20 - 30 psi
- 30 - 80 psi
- 80 - 120 psi
- > 120 psi

VELOCITY

- < 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- 10 - 12 fps
- > 12 fps
- Pump Station
- Tanks
- Control Valve
- Pipe Improvement
- City Limits
- Urban Growth Boundary
- Parcels

Note: Existing System Improvements, fire flow pipe and storage improvements are assumed to be completed.

Data Sources:
City of Sandy
Oregon Geospatial Data Clearinghouse (OGDC).
Coordinate System: NAD 1983 Transverse Mercator
Projection: Transverse Mercator
Datum: North American 1983
Disclaimer: The City of Sandy makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

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Figure 4-7
Near-Term PHD w/ Prop Improv
Pressure and Velocity

December 2022

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Legend

Available Fire Flow

- No Hydrant (Low FF)
- Not Tested
- < 500 gpm
- 500 - 750 gpm
- 750 - 1000 gpm
- 1000 - 1500 gpm
- 1500 - 2000 gpm
- 2000 - 3000 gpm
- > 3000 gpm
- Pump Station
- Tanks
- Control Valve
- Pipe
- Pipe Improvement
- City Limits
- Urban Growth Boundary
- Parcels

Note: Existing System Improvements, fire flow pipe and storage improvements are assumed to be completed.

Data Sources:
City of Sandy
Oregon Geospatial Data Clearinghouse (OGDC).
Coordinate System: NAD 1983 Transverse Mercator
Projection: Transverse Mercator
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Figure 4-8
Near-Term MDD w/ Prop Improv
Available Fire Flow

December 2022

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G:\PDX_Projects\2012800 - Sandy - Water Master Plan Update\GIS\MXD\Sandy Figures Distribution Analysis\FIG 4-8 NT FF.mxd 12/1/2022 4:27:58 PM emily.flock

Legend

PRESSURE

- < 5 psi
- 5 - 20 psi
- 20 - 30 psi
- 30 - 80 psi
- 80 - 120 psi
- > 120 psi

VELOCITY

- < 2 fps
- 2 - 5 fps
- 5 - 7 fps
- 7 - 10 fps
- 10 - 12 fps
- > 12 fps
- Pump Station
- Tanks
- Control Valve
- Pipe Improvement
- City Limits
- Urban Growth Boundary
- Parcels

Note: Existing System Improvements, fire flow pipe and storage improvements are assumed to be completed.

Data Sources:
City of Sandy
Oregon Geospatial Data Clearinghouse (OGDC).
Coordinate System: NAD 1983 Transverse Mercator
Projection: Transverse Mercator
Datum: North American 1983
Disclaimer: The City of Sandy makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

0 2,000 4,000 Feet

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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SANDY

N W E S

City of Sandy
Water Master Plan Update

Figure 4-9
Buildout PHD w/ Prop Improv
Pressure and Velocity

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Legend

Available Fire Flow

- No Hydrant (Low FF)
- Not Tested
- < 500 gpm
- 500 - 750 gpm
- 750 - 1000 gpm
- 1000 - 1500 gpm
- 1500 - 2000 gpm
- 2000 - 3000 gpm
- > 3000 gpm
- Pump Station
- Tanks
- Control Valve
- Pipe
- Pipe Improvement
- City Limits
- Urban Growth Boundary
- Parcels

Note: Existing System Improvements, fire flow pipe and storage improvements are assumed to be completed.

Data Sources:
City of Sandy
Oregon Geospatial Data Clearinghouse (OGDC).
Coordinate System: NAD 1983 Transverse Mercator
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Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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City of Sandy
Water Master Plan Update

Figure 4-10
Buildout MDD w/ Prop Improv
Available Fire Flow

December 2022

20-2800

G:\PDX_Projects\20\2800 - Sandy - Water Master Plan Update\GIS\MXD\Sandy Figures Distribution Analysis\FIG 4-10 BO FF_v10.7.mxd 12/1/2022 4:24:24 PM emily.flock

4.5.3.1 Peak Hour Demand

The PHD was analyzed for Existing, Near-Term, and Buildout Scenarios. Based on the analysis, there were no service connections that were below 30 psi for each of these scenarios. The Near-Term and Buildout scenarios were retested using floating storage at the sites identified by the City. With appropriate pipeline transmission from the floating storage sites, the service connections all maintained higher than 30 psi. There are some locations of low pressures observed in each of these scenarios, which occur on the PWB Transmission pipeline and near existing storage facilities. No improvements are recommended at this time to maintain 30 psi under peak hour conditions for each of the scenarios tested.

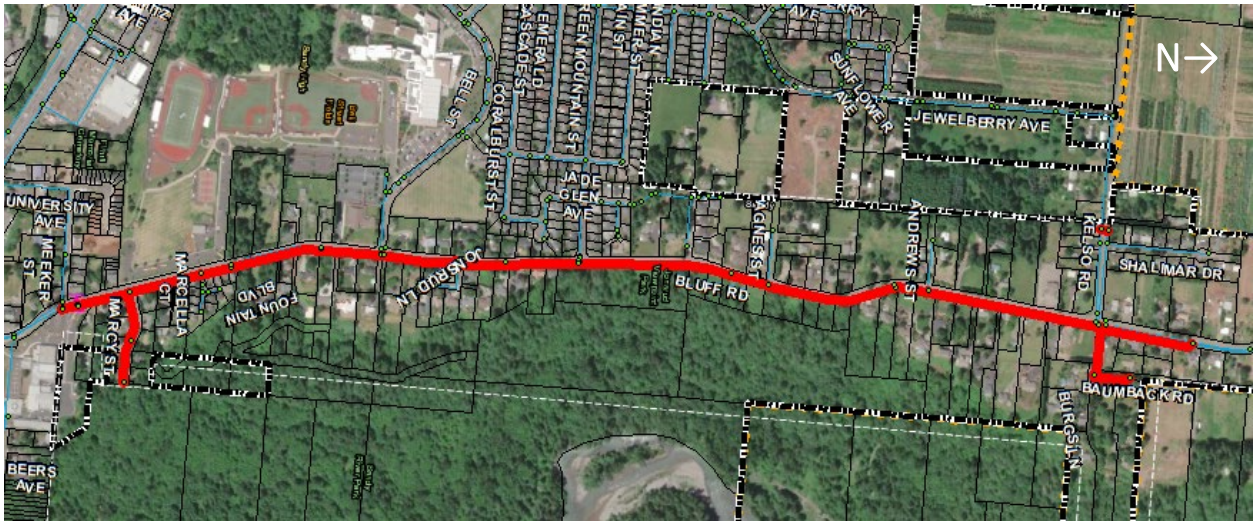
4.5.3.2 Fire Flow Availability

The available fire flow was analyzed for Existing, Near-Term, and Buildout Scenarios. The analysis focused on Demand Nodes, to simulate the conditions observed at service connections. Based on the analysis, there were multiple locations that failed Fire Flow under Existing Conditions. These locations also failed under Near-Term and Buildout Conditions. Each of the failed locations were reviewed to determine if a hydrant was nearby. Where hydrants were not in the vicinity of the failed node, no improvements are recommended. Improvements were identified to provide adequate fire flow to locations where a hydrant was near the failure.

4.5.3.2.1 Bluff Road Fire Flow Improvements

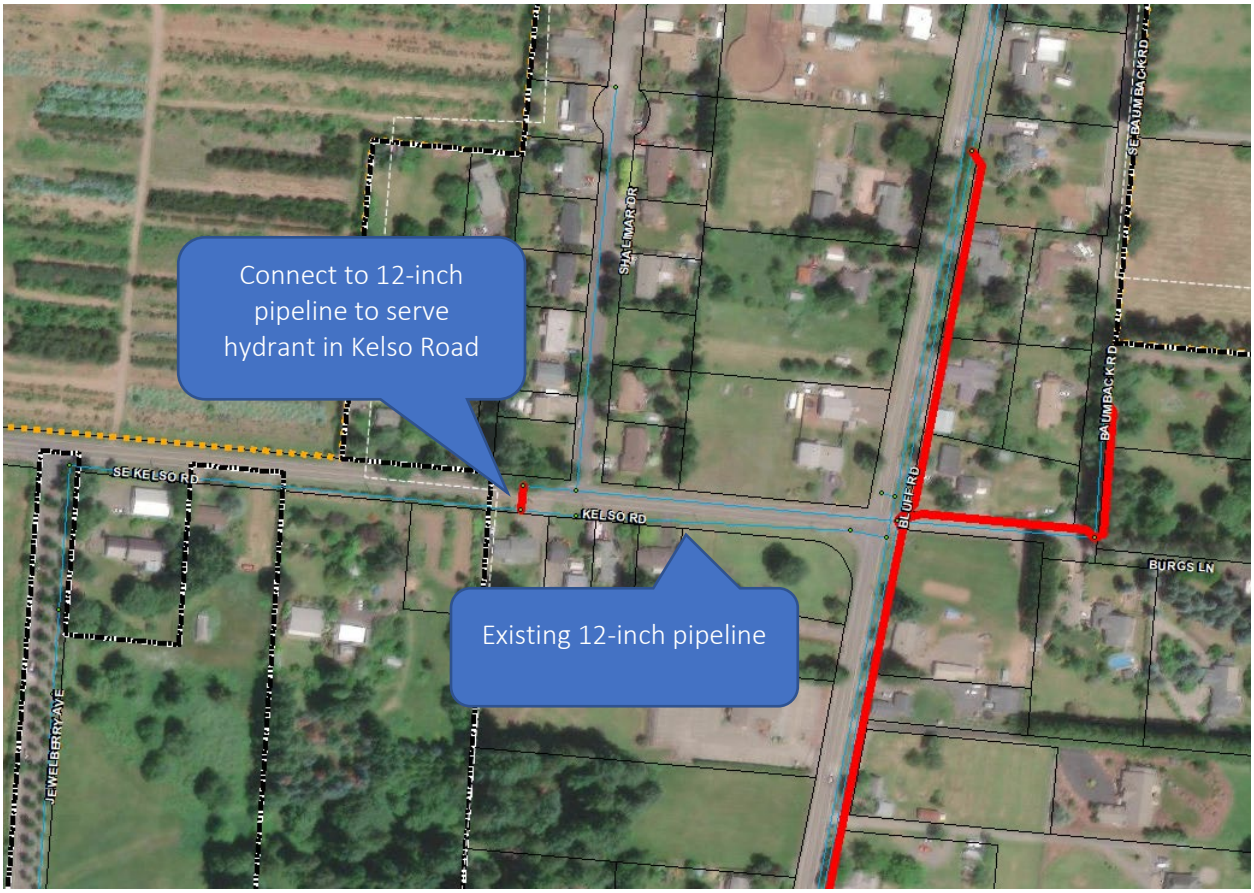
This project consists of improving the pipelines on Bluff Road, Burgs Lane, Kelso Road, and SE Baumback Avenue. There is also a hydrant in the GIS on Marcy Street, which is being reviewed by the City to determine if improvements are required to serve. For cost estimating purposes, it is assumed that Fire Flow service is required on Marcy Street. **Figure 4-11** shows the location of the Bluff Road Improvements.

Figure 4-11 | Bluff Road Improvements



Based on comments from the City, it was determined that there is already a 12-inch diameter pipeline in Kelso Road. It is recommended that the hydrant in Kelso Road be connected to this 12-inch diameter line in lieu of a new pipeline. This pipeline is connected to the PWB Pipeline in Bluff Road with a normally closed isolating valve. The services and hydrant on Kelso Road and the pipeline on Shalimar Drive can be connected directly to the 12-inch diameter pipeline, which will also back feed the 6-inch diameter Zone 4 pipeline in Bluff Road. **Figure 4-12** shows the recommended connection on Kelso Road.

Figure 4-12 | Kelso Road Improvements



4.5.3.2.2 Hood Street Fire Flow Improvements

This project consists of improving the pipelines on SE Ten Eyck Road and Hood Street to meet fire flow requirements. A new 8-inch pipeline is needed to provide the required fire flow to the hydrant on Hood Street. See **Figure 4-13** for the location of the Hood Street Improvements.

Figure 4-13 | Hood Street Improvements

4.5.3.2.3 Mitchell Court Fire Flow Improvements

This project consists of improving the pipelines on Mitchell Court to meet fire flow requirements. A new 8-inch pipeline is needed to provide the required fire flow to the hydrant on Mitchell Court. **Figure 4-14** shows the location of the Mitchell Court Improvements.

Figure 4-14 | Mitchell Court Improvements

4.5.3.2.4 Seaman Avenue Fire Flow Improvements

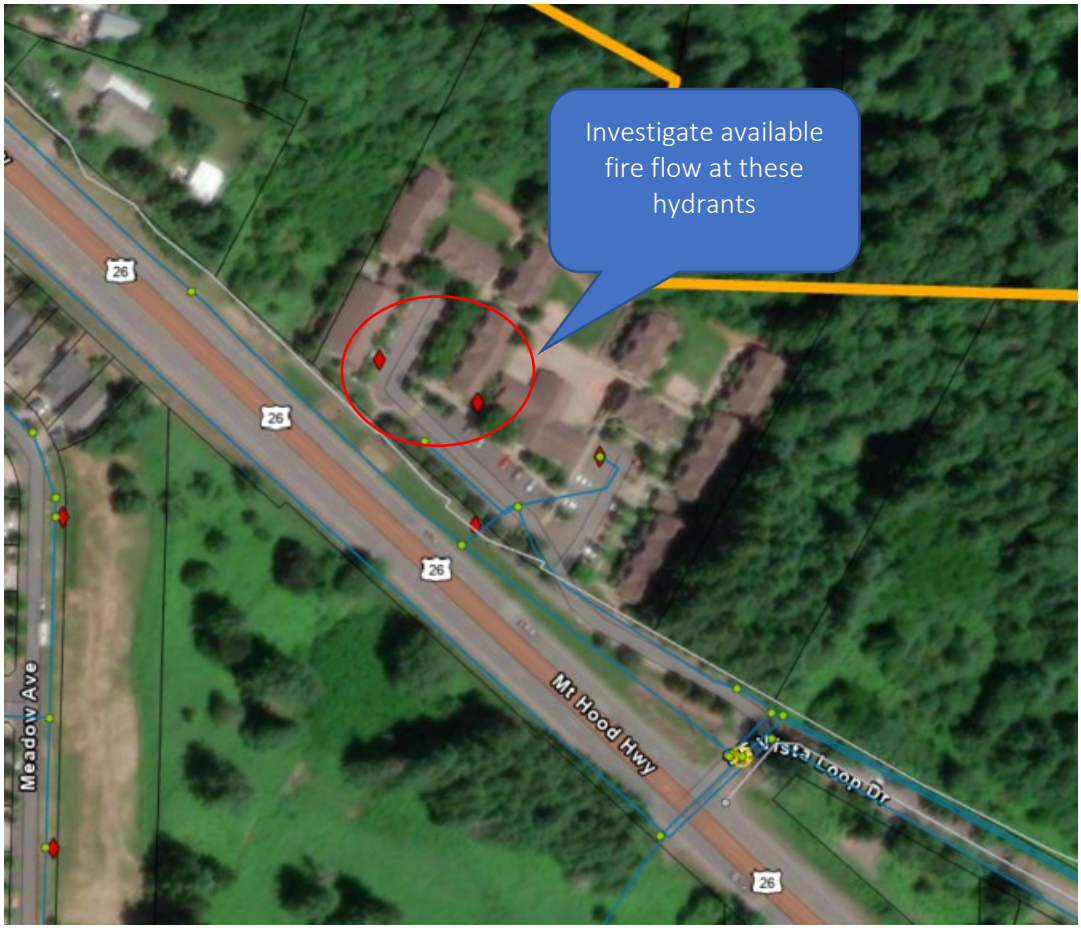
This project consists of improving the pipelines on Seaman Avenue to meet fire flow requirements. A new 12-inch pipeline is needed to provide the required fire flow to the hydrant on Hood Street. Alternatively, a new 8-inch pipeline may be installed in the walkway between Seaman Avenue and Miller Road. It is unknown if it is possible to install a pipeline at this location without a site investigation. See **Figure 4-15** for the location of the Seaman Avenue Improvements.

Figure 4-15 | Seaman Avenue Improvements

4.5.3.2.5 Area North of Mt Hood Highway near Vista Loop Drive

This area north of Mt. Hood Highway near Vista Loop Drive has multiple hydrants and pipelines from both Zone X and Zone 2. It is unknown how these hydrants are connected to these pipelines. If the hydrants are connected to the Zone X pipeline, then the hydrants would not meet fire flow requirements. The 6-inch and 4-inch Zone X pipelines would need to be upsized to 12 inches. It is suggested that flow testing be conducted in this area to determine the available fire flow at these hydrants. See **Figure 4-16** for the location of the hydrants in question.

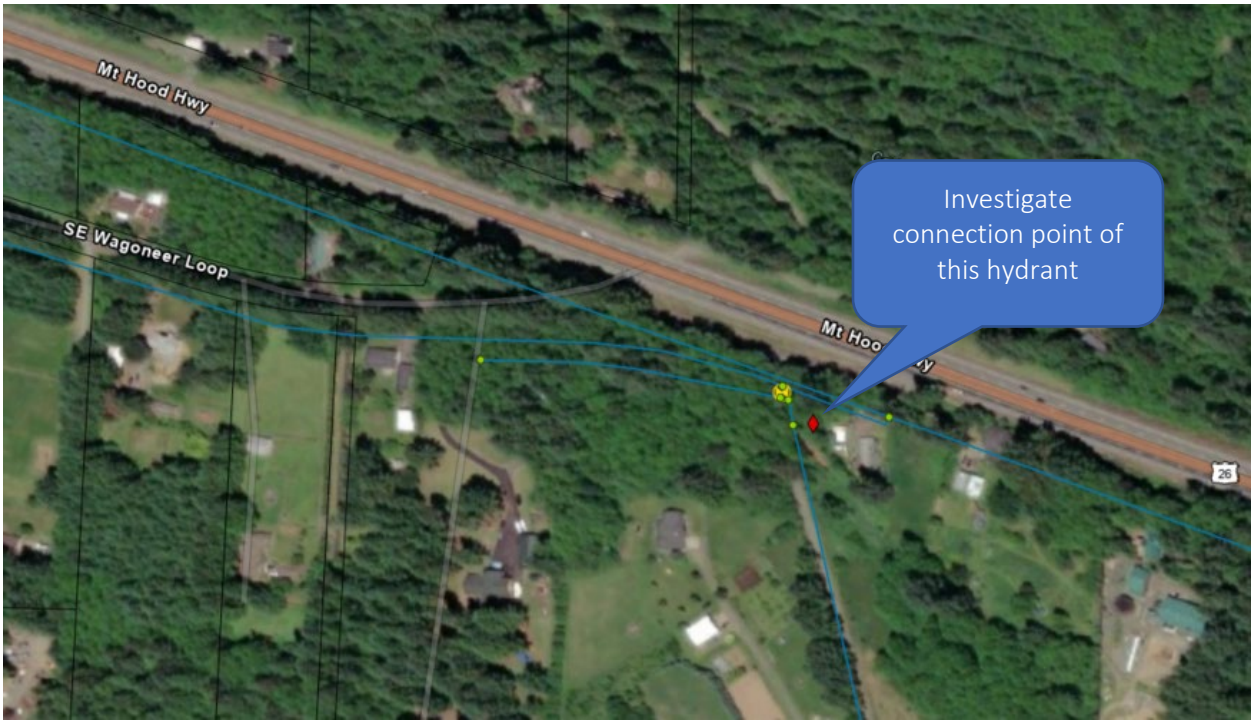
Figure 4-16 | Area North of Mt Hood Highway near Vista Loop Drive



4.5.3.2.6 Area South of Mt Hood Highway on Wagoneer Loop

The area south of Mt Hood Highway on Wagoneer Loop has a hydrant where the connection is unknown. If the hydrant is connected to the pipeline to the west (which connects to Brownell Springs Source), it should be reconnected to the 16-inch pipeline located to the north (parallel to Mt Hood Highway). A site investigation should be conducted to determine where the hydrant connects to the distribution system. See Figure 4-17 for the location of the hydrant in question.

Figure 4-17 | Area South of Mt Hood Highway on Wagoneer Loop



4.6 Summary

The current boundaries of the City's six pressure zones allow the system to provide water during peak hour conditions to customers within the acceptable range of 30 psi and 80 psi, with the use of individual PRVs as needed. Adjustments of these boundaries are recommended to accommodate future growth within city limits and the UGB.

The storage capacity analysis concluded that the City currently has a storage deficit of 2.81 MG, which will increase to 4.75 MG at buildout conditions in 2050. It is recommended that the City construct an additional 5.0 MG of storage to overcome this deficiency.

The City's current pumping capacity was determined to be sufficient to meet current and future demands. Though the construction of an additional pump station is recommended, it is not necessary to meet pumping capacity requirements.

Four areas within the existing distribution system exhibit pressures below 20 psi under MDD plus fire flow conditions. Piping improvements are recommended to mitigate these deficiencies. Two additional areas require further investigation to determine if deficiencies exist.

- Bluff Road Improvements – New pipelines on Bluff Road, Burgs Lane, Kelso Road, Marcy Street, and SE Baumback Avenue
    - Kelso Road – Connect hydrant to the existing 12-inch pipeline in Kelso Road
    - Marcy Road – Determine if the hydrant in Marcy Road is required to provide fire flow
- Hood Street Improvements – New 8-inch pipelines on SE Ten Eyck Road and Hood Street
- Mitchell Court Improvements – New 8-inch pipeline on Mitchell Court
- Seaman Avenue Improvements – New 12-inch pipeline on Seaman Avenue
    - Alternative – New 8-inch pipeline in the walkway between Seaman Avenue and Miller Road
- Area north of Mt Hood Highway near Vista Loop Drive – Conduct fire flow test for the hydrants in this area
- Area south of Mt Hood Highway on Wagoneer Loop – Investigate the connection of the hydrant to the distribution system

CHAPTER 5

Water Supply Analysis

5.1 Introduction

This chapter presents an assessment of the City's current water supply system, a summary of existing water rights and analysis of future supply development needs. Due to the age and condition of the City's surface water and springs supply source, and the PWB's planned modifications to the Bull Run surface water supply, the City needs to make major supply improvement decisions to meet projected future water demands presented in Chapter 2.

5.2 Supply Source Evaluation

5.2.1 Water Rights

The City holds water rights associated with three water supply sources: three certificated water rights for Brownell Springs, a certificated water right for Alder Creek, and an undeveloped permit for the Salmon River. Table 5-1 summarizes these water rights.

Table 5-1 | City of Sandy Municipal Water Rights

Source	Permit	Certificate	Priority Date	Authorized Rate (MGD)	Authorized Date of Completion	Notes
Brownell Springs	S-6597	5427	7/11/1924	0.13	--	Limited to 0.13 MGD during summer season
	S-21879	26132	11/10/1952	0.45	--	
	S-35394	91156	7/23/1970	1.19	--	
Alder Creek		93884	11/11/1971	2.6	--	
Salmon River		--	4/28/1983	16.1	10/1/2069	Limited to ~10.5 MGD during summer season

A further detailed discussion of the City's water rights is included in Appendix A, *Groundwater Supply Evaluation for City of Sandy Water Master Plan Update (GSI Water Solutions, July 2022).*

5.2.2 Source of Supply – Capacity and Condition

5.2.2.1 Brownell Springs

The City's Brownell Springs source provides a reliable 0.3 MGD of supply year-round, but is limited by interference with senior water rights, resulting in frequent notification by the Water master to reduce flows to 0.13 MGD during the summer. As a result, the reliable peak season capacity of the springs source is 0.13 MGD.

Brownell Springs remains a low-cost, low-maintenance gravity source of supply feeding the system with the only treatment required being the addition of sodium hypochlorite (chlorine) to serve as residual disinfectant in the distribution system.

The primary deficiencies at the Brownell Springs site involve access and maintenance of equipment in a remote location. Improved vehicular access to the site and control of vegetation for operator access to the spring boxes and reservoir are the highest priority improvements.

5.2.2.2 Alder Creek

The City's Alder Creek source was the primary source of supply to the City until approximately 2014 when the City began purchasing wholesale water supply from the PWB due to anticipated capacity limits to meet peak summer demands. The existing constructed infrastructure provides a total supply capacity of 2.6 MGD, but the condition of several components of the supply and treatment system reduces the current operational capacity of the Alder Creek source to approximately 1.4 MGD. In addition, both scenarios lack redundancy to provide firm capacity as all available filter trains are needed to provide the capacities stated. For the purposes of this analysis, an existing capacity of 1.4 MGD is assumed, with the understanding that incremental operation and deferred maintenance improvements to existing facilities could increase this capacity back to 2.6 MGD, with further improvements to increase the reliability and redundancy of this source phased over time. A list of the major deficiencies limiting the reliable capacity is presented below.

5.2.2.2.1 Raw Water Intake and Pump Station

City staff have observed that the intake structure, which is almost entirely unchanged from the original construction, is experiencing many of the access and age-related issues that are typical of this type of stream intake, including:

- Access is challenging during high flow and wet weather season.
- Both the screen frame and screens are showing signs of deterioration.
- Diversion dam wooden beams are failing.
- Aging control valve operators
- The raw water intake pipeline has reached its expected life and should be rehabilitated or replaced.
- The seismic stability of the raw water intake pipeline should be evaluated.
- The raw water booster pump station should be rehabilitated or replaced.
- The site of the stream intake is silted in with deposits and debris.

In addition, there is no stream gauge on Alder Creek to track seasonal and annual variation in creek flows. Stream gauge data would be beneficial in validating the reliable supply from Alder Creek, as the anticipated reliable capacity from the Alder Creek source is currently based on anecdotal information from operation of the Alder Creek WTP at full capacity over 15 years ago. A record of seasonal low flow rates over a longer period of time will also help inform the reliability of this supply under future conditions due to the impacts of climate change.

The Raw Water Pump Station, which is required to deliver the full water right capacity of 2.6 MGD to the Alder Creek WTP, lacks firm capacity to supply 2.6 MGD, as both of the pumps must operate to convey the full capacity. In addition, the pump station electrical and mechanical equipment is reaching the end of its service life. The site also needs to be redesigned to allow easier service of pumps.

5.2.2.2.2 Alder Creek WTP

The Alder Creek WTP has fallen into disrepair over the past 15 years, as the City has focused on the investments necessary to transmit the wholesale water supply from the PWB to the City. As a result, the WTP is currently operating at a reduced capacity with only one train in operation and without prudent redundant equipment. Redundancy to the water system is currently provided by the PWB connection. However, use of this connection for redundancy must include facilities to treat for cryptosporidium after September 30, 2027. In order to return the WTP to an operational capacity of 2.6 MGD, a number of deficiencies must be addressed. The initial list of upgrades to address existing deficiencies includes:

- Replace programmable logic controller to allow for operation of Filter #1 and #2. Once Filters #1 and #2 are operational, further upgrades, including replacement of control valving may be required.
- Repair Filter #3 pneumatic control valves. Currently, operation of the filter valving requires manual control by an on-site operator.
- Full filter media replacement and package treatment unit assessment for all three packaged filter units. The condition of the structure of the packaged water treatment units is unknown and requires a thorough investigation with the filter media removed. Once Filters #1 and #2 are operational and high priority improvements have addressed Filter #3 to allow for automatic operation, the City should proceed with a thorough assessment of the condition of each filter unit to determine if repair or replacement is the best course of action.
- Upgrade the chemical feed systems to include:
    - Automated control
    - Replacement of containment systems
    - Re-configuration of storage and feed pumps to fully utilize stored chemical volumes
- Upgrade standby power systems to include an ATS
- Evaluation and replacement of SCADA communication system to allow for reliable remote monitoring and operation of the Alder Creek WTP
- General site improvements to maintain access and minimize the risk of power and communications disruption, including clearing trees along the access roadway and evaluating the resiliency of the power feed to the site

The findings of the investigation of the filter units may result in a determination that rehabilitation and upgrade of the existing facilities is not cost effective. If this is the case, the City should complete the minimum improvement required to maintain effective operation at 2.6 MGD and begin planning for full replacement of the Alder Creek WTP.

5.2.2.2.3 PWB Wholesale Supply

In 2008, the City signed a 20-year wholesale supply agreement with the PWB. Over the next several years, the City completed major infrastructure improvement projects to transmit this wholesale supply to the City distribution system. These improvements included 4 major components.

- *Hudson Road Intertie and Pump Station:* The intertie at Hudson Road provides a metered connection to the PWB's water supply conduits which deliver chlorinated water from the Bull Run Watershed to terminal reservoirs at Powell Butte and Kelly Butte. The City's Pump Station boosts water from the intertie into a dedicated transmission main that extends from Hudson Road to the Revenue Avenue Reservoir.

- *Transmission Main:* An 18/24-inch diameter transmission main transmits the boosted supply from the Hudson Road Intertie to the Revenue Avenue Reservoir.

- *Revenue Avenue Reservoir:* The 1.0 MG reservoir is the terminal reservoir for the City's PWB wholesale supply and is where supply from PWB and the Alder Creek WTP is blended before being transmitted to customers in the distribution system to minimize the aesthetic impact of highly chlorinated PWB water.

- *Transfer Pump Station:* The Transfer Pump Station boosts the blended supply from the Revenue Avenue Reservoir into Pressure Zone 2 and the Vista Loop Reservoirs.

- *Service Area:* PWB supply cannot be transmitted to Zones 1 and X (above the Vista Loop Reservoirs).

The PWB is currently in the process of completing a major improvement to the Bull Run water supply, as required by the OHA-DWS. In order to comply with the Long-Term 2 Enhanced Surface Water Treatment Rule, the PWB must begin filtration of the Bull Run supply by September 30, 2027, as documented in a Bilateral Compliance Agreement.

The result of these improvements is that the City's Hudson Road Intertie will be located on a connection to the PWB conduits that is transmitting raw water (un-filtered and un-disinfected) to the new PWB filtration plant, currently under construction. The City also has a bilateral compliance agreement with the OHA-DWS, requiring the City to address this deficiency by either relocating the point of wholesale supply to the PWB filtration plant or treating the wholesale water supply before transmitting it to the City's distribution system.

The existing wholesale water supply contract expires in 2028. The City is currently negotiating a new wholesale water supply contract with PWB. The terms of this agreement and the anticipated cost of wholesale water supply should be considered as the City prioritizes investment in existing and future water supply sources.

The wholesale supply connection provides for a current capacity of approximately 3.1 MGD, limited by the firm capacity of the Hudson Road Pump Station. The intertie facilities and transmission main are sized to provide approximately 10 MGD of wholesale supply in the future.

5.2.2.2.4 Salmon River

The City has not completed detailed investigations of the feasibility of developing the Salmon River as a water supply source. Several potential alternatives exist, including development of a surface water intake at the currently identified point of diversion near to Highway 26 at Brightwood, transfer of the water right

to a new diversion location downstream on the Sandy River, or potential transfer of the right to a groundwater use to support local development of groundwater. The memorandum in Appendix A, *Groundwater Supply Evaluation for City of Sandy Water Master Plan Update (GSI Water Solutions, July 2022)* includes a more detailed discussion of these options.

While the Salmon River water right presents an opportunity for long-term water supply development to meet the City's needs, the actions required to develop this source cannot be feasibly completed prior to the City's deadlines outlined in the Bilateral Compliance Agreement. Therefore, it is recommended that the City further investigate this alternative water supply source as a long-term alternative to wholesale water supply from the PWB beyond the 20-year planning horizon. Investigations should include a detailed assessment of water diversion locations, water rights and environmental permitting constraints, treatment approaches, and transmission alignments.

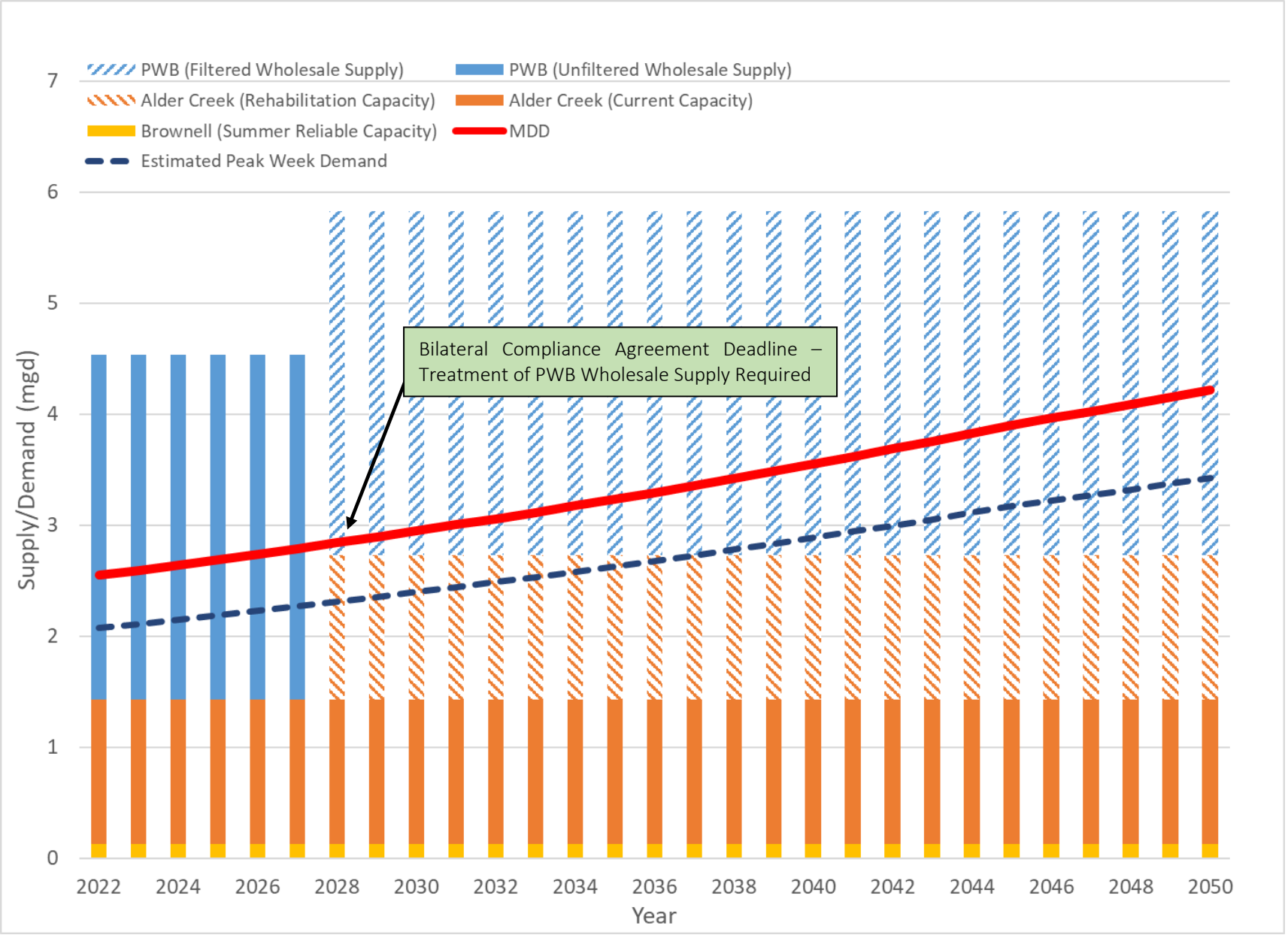
5.3 Water Supply Needs

As described in Chapter 3, it is recommended that the City maintain a firm supply capacity that equals or exceeds the City's MDD. While the City currently has adequate supply capacity to meet existing demands, there are three conditions that threaten the City's ability to meet its water supply requirements.

- Future development within the City's UGB is expected to increase the MDD of the City's water system customers from 2.6 MGD to 4.2 MGD by 2050.
- Reliable operation of the Alder Creek supply at 2.6 MGD. Currently, the WTP is limited to approximately 1.3 MGD and has nearly no redundancy.
- Major infrastructure improvements are required to continue accessing the PWB wholesale supply.

Figure 5-1 illustrates a comparison of existing supply capacities with the projected City water demands. This chart illustrates the three conditions listed above. As this comparison shows, it is critical that the City advance a water supply strategy that addresses the near-term water supply needs triggered by the changes to the PWB wholesale supply by 2028 and further develop a long-term water supply strategy that balances wholesale water supply with continued development of City-owned water supply sources and provides system redundancy.

Figure 5-1 | Water Supply and Water Demand Comparison



5.4 Water Supply Strategy

5.4.1 Initial Decision Regarding PWB Wholesale Supply (Spring 2021)

The City began developing a water supply strategy in 2021 to respond to the requirements of the Bilateral Compliance Agreement. An initial investigation was conducted to inform City policy makers of the terms of the Bilateral Compliance Agreement and to provide information to allow them to decide if the City would construct the infrastructure necessary to purchase treated wholesale water supply from PWB or purchase raw water and construct a separate facility to treat the unfiltered wholesale supply from the existing Hudson Road Intertie. This limited analysis was prepared to meet the PWB's identified deadline of July 2021. While the analysis demonstrated that the long-term total cost (capital investment, wholesale water purchase and operations and maintenance (O&M)) was expected to be similar, based on the information provided, the City Council directed staff to proceed with planning for the purchase of raw water supply from PWB and development of a new WTP for the City's supply.

5.4.2 Updated Analysis, Findings and Recommendations

In the Spring of 2022, as the WSMP progressed and further information became available, City staff re-evaluated the decision to purchase unfiltered wholesale supply from PWB. The decision to re-evaluate was driven by a number of factors, including:

- Dramatic increases in the cost of public infrastructure construction
- Refined understanding of the alternatives available to deliver filtered wholesale supply from PWB
- Assessment of the development schedule for a City-owned WTP for the PWB unfiltered supply
- Updated analysis of life-cycle costs, considering capital investments required for the Alder Creek source and the significant benefit of maximizing use of City-owned sources

Based on this refined analysis, City Council was presented with the new findings on June 6, 2022, and as a result, directed City staff to plan for and implement connection to the new PWB WTP for treated water purchase from PWB. In order to achieve this objective, the City must construct a new pump station at or near to the PWB WTP and a pipeline from the PWB WTP to the existing Hudson Road Intertie transmission main.

A summary of the analysis and presentation to the City Council is included in Appendix B.

5.4.3 Next Steps

In order to meet the requirements of the Bilateral Compliance Agreement and maintain adequate and reliable water supply, the City should proceed with the following immediate action items.

1. *Confirm that PWB wholesale supply of unfiltered water will remain uninterrupted through September 30, 2027.* As shown in Figure 5-1, the City is at risk of being unable to meet MDD in the summer of 2027 without the full developed capacity of the Alder Creek source and wholesale supply from PWB. The City should obtain written confirmation from PWB that unfiltered supply will remain available through the summer of 2027.
2. *Coordinate with PWB to secure property on the PWB WTP site for a new Booster Pump Station and Transmission Main alignment (and necessary easements) extending south to Bluff Road.* In

preliminary discussions, PWB has indicated that siting of the new booster pump station on the PWB WTP site is feasible, and further indicated that access easements being obtained to the south of the PWB's property to SE Bluff Road could accommodate the City's new wholesale supply transmission main. The City should confirm the current status of these opportunities and take steps necessary to formalize this arrangement. If either becomes infeasible, then the City will need to identify both a booster pump station property and transmission main alignment and begin securing the necessary property and easements.

3. *Continue participation in regional wholesale contract negotiations before September 30, 2027.* With the expiration of the current PWB wholesale water supply contracts in the upcoming years (the City's contract expires in 2028), current efforts are underway to negotiate a new wholesale contract and rate structure. The City's wholesale water supply situation is unique and requires active participation in the negotiations to protect the City's interest in this process and ensure a fair and equitable wholesale contract for the City.

4. *Complete near-term improvements to address Alder Creek supply deficiencies before September 30, 2027.* As described earlier in this chapter, much of the Alder Creek supply facilities are approaching the end of their useful life, have fallen into disrepair, or lack sufficient redundancy to provide reliable supply. It is recommended that the City begin a program of addressing the identified deficiencies and further assessment to ultimately achieve a reliable 2.6 MGD supply from Alder Creek. The initial actions include:

    a. Control Panel upgrades to return Filters #1 and #2 to operation

    b. Filter #3 maintenance (once Filters #1 and #2 are back on-line)

    c. Upgrade of standby power systems with an automatic transfer switch

    These improvements restore the WTP to an operational capacity of 2.6 MGD

    d. Detailed assessment of the condition of all structural, mechanical, and electrical systems at the Alder Creek WTP

    e. Cost-benefit analysis of rehabilitation versus replacement of the Alder Creek WTP

    f. Development of an Alder Creek Source Improvement Plan

5. *Design and construction of the PWB filtered wholesale supply connection before September 30, 2027.*

6. *Long-term water supply study.* Investigation of the feasibility and cost of developing the Salmon River water supply source as a long-term alternative, or supplement, to the City's existing supply sources should be completed. Development of the Salmon River as a source of supply for the City will take several years to advance from evaluation of feasibility through permitting, design, and ultimately construction. As the new PWB wholesale contract is completed and the City develops a better understanding of the investments required in the Alder Creek source, the potential benefit of adding the Salmon River to the City's water supply portfolio can be better defined.

7. *Implement Long-Term Supply Study Recommendations.*

CHAPTER 6

Capital Improvement Program

This chapter presents recommended improvements for the City's water system based on the analysis and findings presented in Chapter 4 and Chapter 5 and projects identified in the City's current water CIP projects list. These improvements include supply, storage reservoir, water main, and seismic resilience projects. The CIP presented in Table 6-3 summarizes recommended improvements and provides an approximate timeframe for each project. Appendix C contains planning level cost estimate details for each project. Proposed improvements are illustrated in Figure 6-1.

6.1 Project Cost Estimates

An estimated project cost has been developed for each recommended improvement consistent with previously identified projects from the City's current CIP and current preliminary design work, as applicable. Cost estimates represent opinions of cost only, acknowledging that final costs of individual projects will vary depending on actual labor and material costs, market conditions for construction, regulatory factors, final project scope, project schedule, and other factors.

6.2 Timeframes

A summary of all improvement projects and estimated project costs is presented in Table 6-3. This CIP table provides for project sequencing by showing prioritized projects for the 5-year, 6 to 10-year, and 11 to 20-year timeframes defined as follows.

- 5-year timeframe - recommended completion through 2027
- 6 to 10-year timeframe - recommended completion between 2028 and 2032
- 11 to 20-year timeframe - recommended completion beyond 2032

6.3 Storage Reservoirs

As presented in Table 4-1, the City currently has a deficit in storage capacity serving the water system. The existing Sandercock Lane site can accommodate construction of an additional reservoir or replacement with a larger storage facility to add 1.0 MG of storage above Zone X. As discussed in further detail in Section 4.3.2, three City-owned sites were identified that could serve as potential reservoir sites. It is recommended that the City construct at least two reservoirs to add 4.0 MG of storage to the system, for a total of 5.0 MG, as identified in Project No. R.1. Further investigation is required before design and construction of these reservoirs can occur. A Storage Siting Study is presented as Project No. R.2. These reservoirs will all require altitude control valves, additional supply and transmission main piping, and it is recommended that they be of prestressed concrete tank construction.

In addition to constructing new storage, the City should conduct a Reservoir Seismic and Condition Assessment of their existing reservoirs, which is included in this CIP as Project No. R.3. It is recommended the Seismic and Condition Assessment be completed before any new reservoir projects as it could inform system storage improvement plans. For example, if the assessment indicated a tank needed major refurbishment, building a new, larger tank could be an alternative to refurbishing the existing tank.

6.4 Pump Stations

As noted in Table 4-3, the City has adequate distribution system pumping capacity through the build-out scenario (2050) and no additional capacity is required. However, as discussed in detail in Section 4.4.2, it is recommended that the City complete upgrades to the Terra Fern Pump Station so that fire flow demands are met above the Sandercock Lane Reservoir, which is included as Project No. PS.1.

It is also recommended that the City construct a pump station at the Vista Loop site that can supply Zones X and 1 with PWB wholesale supply in the event that Alder Creek WTP and Brownell Springs sources are unable to supply sufficient flows. The Vista Loop Pump Station is included in this CIP as Project No. PS.2.

6.5 Distribution Mains

As presented in Chapter 4, hydraulic modeling of the City's water distribution system revealed few areas of low pressure. There were no service connections below 30 psi for the existing, near-term, and buildout scenarios. Modeled low pressures were located along the PWB transmission mains and near existing storage facilities. No improvements are recommended to raise low pressures.

Multiple areas failed fire flow conditions under existing conditions. Proposed distribution piping projects are presented as Project Nos. D.1, D.2, D.3, and D.4. These pipeline improvement projects will take place near Bluff Road, Hood Street, Mitchell Court, and Seaman Avenue to provide fire hydrants with sufficient fire flows.

6.6 Supply

As described in Chapter 5, the City is currently in the process of coordinating regional wholesale contract and source changes with the PWB as well as evaluating and updating the Alder Creek WTP before September 2027. In order to maintain an adequate and reliable water supply, the City should proceed with the steps detailed in Section 5.4.3 and summarized below. The short-term improvements (first four bullets below) should be completed before September 30, 2027, the date the PWB is guaranteeing unfiltered wholesale water through.

- Coordinate with the PWB and participate in regional wholesale contract negotiations.
- Complete near-term Alder Creek WTP improvements to restore the WTP to an operational capacity of 2.6 MGD.
- Complete a detailed assessment of the Alder Creek WTP and its associated infrastructure, evaluate alternatives, and develop an Alder Creek Source Implementation Plan.
- Design and construct the PWB Filtered Wholesale Supply Connection.
- Refurbish or replace the raw water intake infrastructure.
- Complete a Long-Term Water Supply Study.

These improvements are included in Table 6-3. Implementation of recommendations from the Long-Term Supply Study should be evaluated in the study and included in an updated CIP as recommended. It is expected that some or many of the recommendations may extend beyond the planning period of the WSMP.

6.7 Other Projects

6.7.1 Water System Master Plan Update

It is recommended that the City continue to update this WSMP every ten years. An updated WSMP is required by the State of Oregon for a 20-year planning period. The Alder Creek WTP detailed assessment and/or the Long-Term Water Supply Study could prompt an update to the WSMP and CIP depending on the findings and recommendations. As the City grows or more information is collected, it is prudent for the City to continue to regularly evaluate capital investment, prioritize needs for the water system, and document this long-term water service strategy in the WSMP.

6.7.2 Water Management and Conservation Plan

The City was required to submit a WMCP by April 2016, with an update required in 10 years. The next update of the WMCP is due to the state of Oregon Water Resources Department in November 2025, and it is anticipated that a future update within this WSMP's 20-year planning horizon will be required in 2024.

6.7.3 SCADA Upgrades

The water utility SCADA system equipment is out of date and reaching the end of its useful life. Furthermore, the communication systems consist of numerous aging and unreliable leased lines that are prone to failure. It is recommended that the City proceed with a SCADA Master Plan to identify the most effective approach to upgrade and replace aging equipment.

While the full scope and cost of a SCADA system upgrade will be defined by the SCADA Master Plan, a preliminary budget placeholder has been included in the CIP as Project M.5. This preliminary budget estimate should be refined and incorporated into the City's capital planning following completion of the SCADA Master Plan.

6.7.4 Water Meter Replacement

The City completed a water service meter replacement and AMI project between 2019 and 2021. Water meters typically have a service life of 15-20 years, at which point the meter accuracy may decrease and the battery operated meter registers that transmit data to the City's AMI system begin to fail. It is recommended that the City include a budget in the CIP for a meter replacement program. Based on the year of installation of most current meters in the system, the meter replacement program should be completed in the 11-to-20-year timeframe. The City has approximately 3,000 service meters, so it is assumed that the replacement program will be conducted over 5 years.

6.7.5 Replacement and Operations and Maintenance

A systematic, planned replacement program will provide the following benefits.

- Reduced impacts to customers and the environment from unplanned pipe failures
- Reduced repair and replacement costs by performing the work proactively rather than on an emergency basis
- Reduced water loss that results from main breaks and leaks

- Reduction in claims for property damage and loss of revenues from commercial and industrial customers

It is recommended that the City aim to implement an aggressive pipe replacement program to avoid having to replace a disproportionate amount of pipe in the future as the pipes age. For this reason, it is recommended that the City aim to replace 4,750 linear feet (LF) of pipe per year. This is a replacement rate of about one percent of pipe per year. Pipe replacement projects should be coordinated with other City programs such as the Pavement Management Program and other utility projects to save on cost and prevent redundant work and obstruction of roadways. Water mains were assumed to need replacement after 75 years. Total costs for the full time period were uniformly divided into annual costs for the respective timeframes. These costs represent a significant investment in the water system, and substantially more than the City's current annual water main replacement budget. However, continued investment in renewal and replacement of the water system is essential to ensuring reliable system operation and minimizing expensive emergency repairs associated with failing pipeline infrastructure.

The existing system contains 4-inch diameter mains as well as asbestos concrete (AC) and CI mains. The small pipes can cause flow restrictions, reducing system capacity. Replacement of AC and CI material pipes are recommended for health and safety and reducing risk of breaks or failures. There is approx. 64,000 LF of 4-inch diameter, AC, or CI mains in the existing system. These pipes are recommended to be the highest priority in the City's Replacement Program. At the recommended replacement length described above (4,750 LF), it would take approximately 13.5 years to replace all of these mains.

Annual maintenance for pipes, tanks, pump stations, valves, and other facilities is not considered in the CIP list. It is assumed these maintenance items are addressed in the operations budget.

6.8 Cost Estimating Assumptions

All cost estimates for CIP projects presented in this WSMP are planning level costs approximately equivalent to Association for the Advancement of Cost Engineering Class 5 estimates. Cost estimates of this type are classified as order-of-magnitude cost estimates, which assume a 0 to 2 percent level of project definition to reflect the significant number of unknowns in project scope and conditions. Correspondingly, Class 5 cost estimates have a wide accuracy range to reflect these uncertainties at the master planning stage; actual costs may vary from these by minus 50 percent to plus 100 percent:

- Low End Accuracy Range: -20 to -50 percent (i.e. the low end of the accuracy range for a $1 million cost estimate is $0.5 to $0.8 million).
- High End Accuracy Range: +30- to +100 percent (i.e. the high end of the accuracy range for a $1 million cost estimate is $1.3 to $2.0 million).

All costs are in 2022 dollars, and the Engineering News-Record's Seattle, WA Construction Cost Index for November 2022 was 15202.68. The estimates are subject to change as the project designs mature. The cost of labor, materials, and equipment may also vary in the future.

6.8.1 Pipeline Unit Cost Assumptions

Table 6-1 presents general assumptions for unit costs of different-sized pipelines that may be used in a CIP project.

Table 6-1 | Pipeline Unit Costs

Pipe Diameter (Inches)	Pipeline Cost, Arterial Road, Including Cost Factors ($/Linear Foot)
8	$509
10	$598
12	$686
18	$931

Pipeline costs are for ductile iron pipe and include general markups for earthwork and construction, erosion and traffic control, fittings and valves, mobilization, contingencies, contractor overhead, engineering design, and legal/admin coordination. Pipeline construction costs do not include property acquisition costs or easement or right-of-way costs. Roadway resurfacing unit costs assume open trench construction with trench patches and do not include full street resurfacing. Where open trench construction may not be possible, individual project cost estimates were modified, as needed, to reflect costs for boring or other construction methods.

6.8.2 Direct Construction Cost Development

Direct construction costs were developed using historical project data, vendor quotes, and general market trends. Direct construction cost estimates focused on major facilities and equipment and include allowances for additional civil, mechanical, electrical, and instrumentation requirements.

6.8.3 Cost Factors

To estimate total project costs for inclusion in the CIP, cost factors were added to the direct construction cost estimates. Table 6-2 summarizes the cost factors and provides an example of how they were applied to determine a CIP project's cost.

Table 6-2 | Cost Factors

Cost Element	Cost Factor	Cost
Direct Construction Cost		$1.00M
Bonds and Insurance	2%	$0.02M
Mobilization	10%	$0.10M
Construction Cost		$1.12M
Project Contingency	30%	$0.33M
Total Construction Cost		$1.45M
Oregon Corporate Activity Tax	1%	$0.02M
Engineering Allowance	20%	$0.29M
Permitting, Inspections, and Administration	5%	$0.07M
Construction Contract Administration	10%	$0.14M
Total CIP Project Cost		**$1.97M**

6.9 CIP Funding

The City may fund the water system CIP from a variety of sources including governmental grant and loan programs, publicly issued debt, and cash resources and revenue. The City's cash resources and revenue available for water system capital projects include water rate funding, cash reserves, and SDCs.

Generated through development and system growth, SDCs are typically used by utilities to support capital funding needs. The charge is intended to recover a fair share of the costs of existing and planned facilities that provide capacity to serve new growth. Projects intended to serve only new growth would have 100 percent of the cost allocated to growth. Other projects that are intended to improve reliability and efficiency or address asset renewal are assumed to benefit existing and new customers. For these projects, the percent allocated to growth is the percentage of future demand projected to be generated from new customers. The percentage of project costs allocated to growth are shown in Table 6-3 as the Preliminary SDC Eligibility.

Subsequent to the final review and approval of this WSMP, the City will conduct a financial analysis to review the current water rates and SDC methodology to support the recommended CIP described in this section.

6.10 CIP Summary

The CIP is summarized in Table 6-3 and Figure 6-1 on the following pages.

Table 6-3 | Capital Improvement Program

Project No.	Project Description	CIP Schedule and Project Cost Summary (2022 Dollars)				Preliminary SDC Eligibility
		1-5 Years (2023-2027)	6-10 Years (2028-2032)	11-20 Years (2033-2042)	TOTAL	
R.1	5.0 MG Additional Storage		$17,290,000	$17,290,000	$34,580,000	49%
R.2	Storage Siting Study	$180,000			$180,000	49%
R.3	Reservoir Seismic and Condition Assessment		$375,000		$375,000	49%
	Storage Subtotal	**$180,000**	**$17,665,000**	**$17,290,000**	**$35,135,000**	
PS.1	Terra Fern Pump Station Upgrades	$780,000			$780,000	45%
PS.2	Vista Loop Pump Station	$1,420,000			$1,420,000	45%
	Pump Station Subtotal	**$2,200,000**	**$-**	**$-**	**$2,200,000**	
D.1	Bluff Rd Fire Flow Improvements		$5,580,000		$5,580,000	45%
D.2	Hood St Fire Flow Improvements		$540,000		$540,000	45%
D.3	Mitchell Ct Fire Flow Improvements		$260,000		$260,000	45%
D.4	Seaman Ave Fire Flow Improvements		$550,000		$550,000	45%
	Distribution Subtotal	**$-**	**$6,930,000**	**$-**	**$6,930,000**	
S.1	Near-Term Alder Creek WTP Improvements	$1,050,000			$1,050,000	0%
S.2	Short-Term Alder Creek WTP Assessment	$240,000			$240,000	45%
S.3	Alder Creek WTP Improvements	$42,080,000			$42,080,000	45%
S.4	PWB Filtered Water Supply Connection	$39,416,000			$39,416,000	45%
S.5	Long-Term Supply Study		$240,000		$240,000	45%
	Supply Subtotal	**$82,786,000**	**$240,000**	**$-**	**$83,026,000**	
M.1	Water System Master Plan Update		$220,000		$220,000	45%
M.2	Water Management and Conservation Plan	$110,000			$110,000	45%
M.3	Annual Replacement Budget	$-	$6,000,000	$24,000,000	$30,000,000	45%
M.4	Water Service Meter Replacement			$7,920,000	$7,920,000	0%
M.5	SCADA Master Plan	$150,000			$150,000	45%
M.6	SCADA Upgrades (Preliminary Budget Placeholder)		$760,000		$760,000	45%
	Other Subtotal	***$260,000***	***$6,980,000***	***$31,920,000***	***$39,160,000***	
	CIP Total	**$85,426,000**	**$31,815,000**	**$49,210,000**	**$166,451,000**	

[1] All costs in 2022 dollars and include all soft costs including bonds and insurance, mobilization, contingency, engineering, permitting and admin, and construction contract admin

[2] Engineering News-Record's Seattle, WA Construction Cost Index for November 2022 was 15202.68 (for all costs)

[3] Percentage based on MDD (or governing demand) from 2023 compared to MDD (governing demand) in 2043

Legend

- Potential New Tank Sites
- Vista Loop PS
- Existing Pump Station
- Existing Tanks
- Control Valve

Model Pipes

- Pipe Improvement
- Pipe
- City Limits
- Urban Growth Boundary

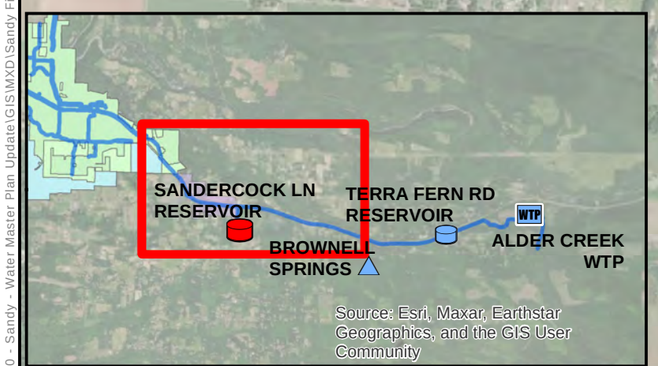
D.1 BLUFF RD IMPROVEMENTS

D.2 HOOD ST IMPROVEMENTS

PS.2 VISTA LOOP PS

D.4 SEAMAN AVE IMPROVEMENTS

D.3 MITCHELL CT IMPROVEMENTS



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Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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consor SANDY

City of Sandy
Water Master Plan Update

Figure 6-1
Capital Improvement Plan

APPENDIX A
GROUNDWATER SUPPLY EVALUATION FOR CITY OF SANDY WATER MASTER PLAN UPDATE, GSI WATER SOLUTIONS, JULY 2022

consor

TECHNICAL MEMORANDUM-FINAL

Groundwater Supply Evaluation for City of Sandy Water Master Plan Update

To: Brian Ginter, PE, - Murraysmith
Jeff Fuchs, PE - Murraysmith

From: Owen McMurtrey, GSI Water Solutions, Inc.
Andrew Wentworth, RG - GSI Water Solutions, Inc.
Walt Burt, RG - GSI Water Solutions, Inc.
Ronan Igloria, PE – GSI Water Solutions, Inc.

Date: July 7, 2022

1. Introduction and Summary of Findings

At the request of Murraysmith and the City of Sandy (City), GSI Water Solutions, Inc. (GSI) developed the following summary of information pertinent to whether and how the City could meet its water demands using water supplied under its own water rights. This memorandum discusses the limitations of the City's water rights for Brownell Springs, Alder Creek, and the Salmon River, as well as the hydrogeology of the area around the City and its suitability for development as a water supply source.

The City's most senior water right for Brownell Springs, combined with an estimated maximum reliable supply from Alder Creek of 3.7 cubic feet per second (cfs) or 2.4 million gallons per day (mgd), provide a reliable supply of 2.72 mgd (4.2 cfs).[1] The City's undeveloped water use permit from the Salmon River, with permitted use of 16.2 mgd (25.0 cfs), has limitations on the maximum rate of diversion allowed, and development of a point of diversion (POD) anywhere on the Salmon River or Sandy River faces significant regulatory obstacles. The key limitations and challenges to the Salmon River permit include:

- With POD upstream of Boulder Creek confluence (river mile [RM] 0.8):
  - No water may be diverted from August 16 through October 31
  - No water may be diverted from November 1 through February 29 when target flows are not met upstream of Boulder Creek confluence.
- With POD downstream of Boulder Creek confluence (RM 0.8):
  - The City must provide the Oregon Water Resources Department (OWRD) with an executed agreement between the City and Oregon Department of Fish and Wildlife (ODFW) setting out specific fish passage requirements.

[1] This reliable supply estimate may be high and operations data from the City's water treatment plant (WTP) indicate there are periods when streamflows may not support the City's entire 4.0 cfs water right. This is discussed further in Section 2.2 of this tech memo.

With a POD upstream of Boulder Creek, aquifer storage and recovery (ASR) could provide an option to meet the peak summer demands; however, the restrictions on diversion from November through February makes the Salmon River an unreliable source of supply for ASR injection during winter. Furthermore, available data suggests that the aquifer characteristics in the vicinity of the City are not conducive for ASR. As a result, the most feasible pathway for the development of the City's Salmon River surface water permit as a reliable, year-round source of supply is through a surface water to groundwater transfer to a hydraulically connected well on the Sandy River downstream of the confluence with the Salmon River. Approval of the permit amendment needed to transfer the surface water diversion to groundwater would be contingent on demonstrating that the withdrawals do not impact Cedar Creek.

Based on a review of the hydrogeologic conditions in areas near the City where an infiltration gallery or collector well could be constructed, the composition of the aquifer appears to be too thin and not laterally extensive enough for a 5 mgd facility. However, a 1 mgd facility may be feasible under favorable circumstances.

2. Water Rights Review

The City holds three water right certificates for municipal use authorizing diversions from Brownell Springs. Certificate 5427 authorizes the use of up to 0.13 mgd (0.2 cfs), Certificate 26132 authorizes the use of up to 0.7 cfs (0.45 mgd), and Certificate 91156 authorizes the use of up to0.19 mgd (0.3 cfs). In addition, the City holds Certificate 93884 for the use of up to 2.59 mgd (4.0 cfs) from Alder Creek and Permit S-48451 for the use of up to 16.16 mgd (25.0 cfs) from the Salmon River. Table 1 summarizes these water rights.

Table 1. City of Sandy Municipal Water Rights

Source	Application	Permit	Certificate	Priority Date	Type of Beneficial Use	Authorized Rate (cfs/mgd)	Authorized Date for Completion
Brownell Springs (tributary of Beaver Creek)	S-9669	S-6597	5427	7/11/1924	Municipal	0.2/0.13	N/A
	S-27810	S-21879	26132	11/10/1952	Municipal	0.7/0.45	N/A
	S-47254	S-35394	91156	7/23/1970	Municipal	0.3/0.19	N/A
Alder Creek (tributary of Sandy River)	S-48840	S-36601	93884	11/11/1971	Municipal	4.0/2.59	N/A
Salmon River	S-65051	S-48451	N/A	4/28/1983	Municipal	25.0/16.16	10/1/2069

Note

cfs = cubic feet per second

mgd = million gallons per day

N/A = not applicable

Historically, the City has used a combination of its sources from Brownell Springs and Alder Creek to meet demands. As presented in the City's 2015 water management and conservation plan, the City has relied on the springs to meet approximately one-third of demand and Alder Creek to meet approximately two-thirds of demand.

2.1 Brownell Springs

The City holds three water right certificates authorizing a total of 1.2 cfs from Brownell Springs. The priority date of Certificate 5427 (0.2 cfs) pre-dates all other water rights within the Beavercreek and Cedar Creek system. The City's other two certificates, Certificates 26132 and 91156, are junior in priority to the ODFW's 25.0 cfs water right for fish propagation (i.e., a hatchery); ODWF's water right has a priority date of 1949. In at least one instance, occurring in 2015, these two certificates held by the City were regulated off in favor of ODFW's water right. The City's records indicate that Brownell Springs reliably produces approximately 0.77 cfs, but due to the potential for regulation in favor of ODFW's senior fish hatchery water right on Cedar Creek, the City only has 0.2 cfs of reliable supply from Brownell Springs.

2.2 Alder Creek

The City's Alder Creek water right certificate has a priority date of November 11, 1971. The City's water rights on Alder Creek are senior to instream water rights on Alder Creek and the Sandy River. There is no history of regulation by priority on Alder Creek. There are no long-term streamflow records available for Alder Creek, but as part of the City's water supply investigation for the Alder Creek Basin, the City measured fairly consistent streamflows of approximately 5.1 cfs on Alder Creek approximately 0.5 miles above the Mt. Hood Loop Highway in August and September of 1971 and 1973. According to the City's WTP operators, however, there are periods when streamflows may not support the City's entire 4.0 cfs water right. The water use records available through OWRD's water use reporting database show that the City's average daily diversion during peak demand months of July and August does not exceed approximately 2.0 cfs. Murraysmith has assumed Alder Creek produces a reliable supply of 2.4 mgd (3.7 cfs) in the Water Master Plan. For purposes of this memo, Alder Creek is assumed to provide a reliable supply of 3.7 cfs. The City could further evaluate the reliable supply available from the Alder Creek source during periods of low flow.

2.3 Salmon River

The City holds Permit S-48451 for use of up to 16.2 mgd (25.0 cfs) from the Salmon River, which is currently undeveloped and has an extension of time to October 1, 2069. In the *Agreement for Instream Conversion* executed October 24, 2002 as part of the *Settlement Agreement Concerning the Removal of the Bull Run Hydroelectric Project (FERC Project No. 447)* (Settlement Agreement), the City voluntarily agreed to reduce the maximum rate of diversion under Permit S-48451 from 25.0 cfs to 16.3 cfs when the flow available in the Sandy River near Marmot, Oregon is 600 cfs or less, but can still divert up to 25.0 cfs when the flow available is more than 600 cfs. Based on data from a stream gage on the Sandy River near Marmot (U.S. Geological Survey Gage 14137000), a flow of 600 cfs is typically not exceeded from July through October, and for longer periods of time during years with low snowpack (e.g., 2015, 2018), when flows drop below 600 cfs prior to the beginning of June.

2.3.1 Fish Persistence Conditions Imposed by Extension Final Order

In addition to the restriction imposed by the Settlement Agreement, the order approving the City's extension of time for Permit S-48451 (extension order) imposes several conditions on the City's use of water under the permit, depending on where water is diverted. The City's currently authorized POD from the Salmon River is located at approximately RM 7.5. For diversion from the Salmon River at a location **upstream** from the confluence with Boulder Creek (RM 0.8), the extension order includes the following conditions:

1. Prior to using water under the permit, the City must install a means of measuring streamflow at a location between the confluence with Cheeney Creek (RM 7) and the mouth of the Salmon River. The City must receive OWRD's written concurrence with the location of measurement.
2. Prior to using water under the permit, the City must provide OWRD with an executed agreement between the City and ODFW, setting out specific fish passage requirements that ensure adequate upstream and downstream passage for fish.

3. No water may be diverted from August 16 to October 31.
4. From November 1 through February 29, the target flow for maintaining the persistence of listed fish species in the Salmon River is 129 cfs, or the average flow for the previous October, whichever is less. When the target flow is not met, no water can be diverted.

Given the restriction on any diversion of water from August 16 to October 31 for a diversion located above the confluence with Boulder Creek, the City would need to provide water from an alternate source from August 16 through October 31. The City's late August demands are likely similar to the maximum day demand. Alder Creek and Brownell Springs are not expected to be capable of meeting the City's projected maximum day demand. Figure 1 shows the City's projected demands compared to reliable supply under the City's Brownell Springs and Alder Creek water rights.

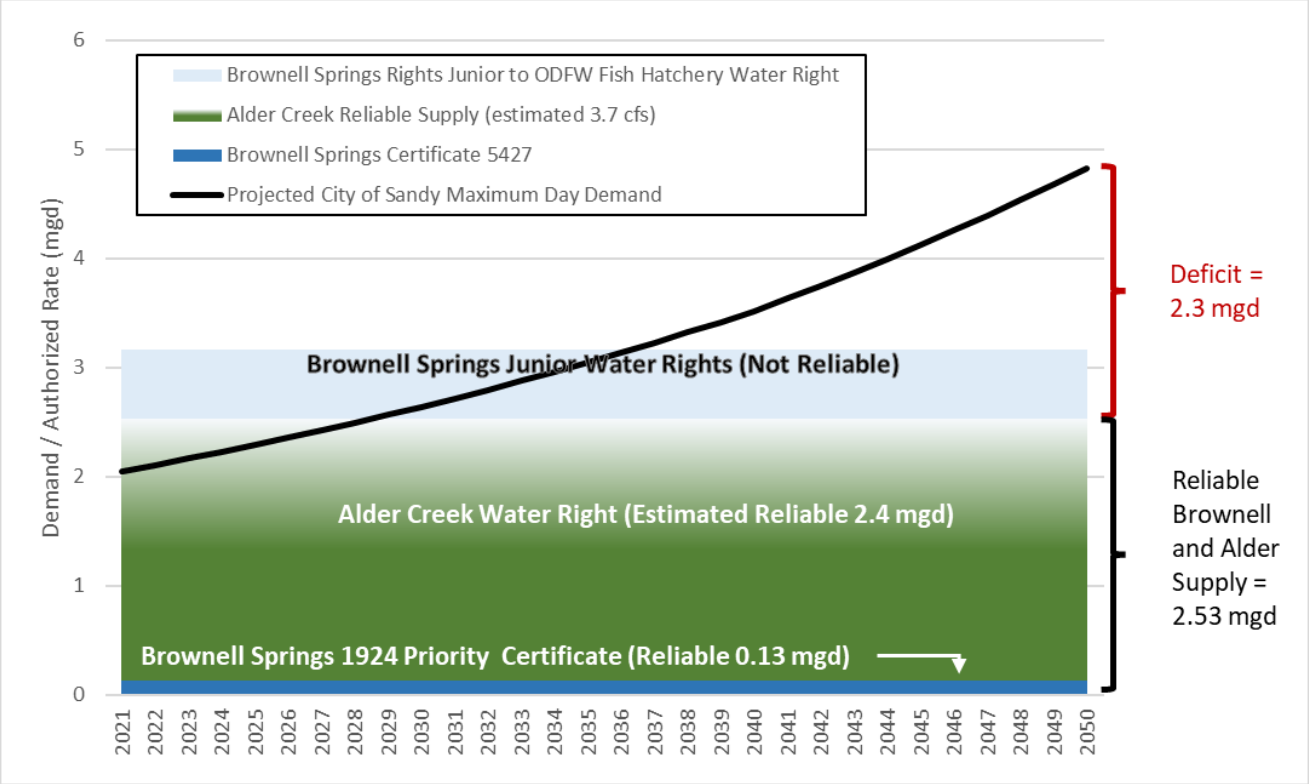


Figure 1. City of Sandy Projected Demand and Reliable Water Supply from Alder Creek and Brownell Springs

For diversion of water from a location **downstream** from the confluence with Boulder Creek at approximately RM 0.8, including a diversion from the Sandy River, the only condition included in the extension order, apart from repetition of conditions of the Settlement Agreement, is that prior to using water under the permit, the City must provide OWRD with an executed agreement between the City and ODFW setting out specific fish passage requirements that ensure adequate upstream and downstream passage for fish.

2.3.2 Surface Water to Groundwater Modification

The requirement for an agreement with ODFW regarding fish passage requirements, and the potential for additional federal conditions on any surface water diversion structure pose significant regulatory challenges to the development of a surface water diversion anywhere on the Salmon River or Sandy River. However, it may be possible for the City to minimize state and federal permitting associated with a new POD by

amending Permit S-48451 to change the surface water POD on the Salmon River to a hydraulically connected groundwater point of appropriation (POA) downstream on the Sandy River.

The City previously evaluated the potential to develop a groundwater source with a capacity of at least 5 mgd that meets OWRD requirements for transferring surface water rights to a hydraulically connected groundwater source (GSI, 2007). GSI's review and update of this evaluation is discussed in Section 4.

While there are no administrative rules governing permit amendments, OWRD reviews permit amendments using the same criteria as it does for water right transfers. OWRD would require the City's permit amendment application include a report prepared by a licensed geologist demonstrating that the use of the groundwater at the new POA downstream near the Sandy River would meet the following criteria:

1. The change would not result in injury or enlargement[2].
2. The new POD appropriates groundwater from an aquifer that is hydraulically connected to the authorized surface source.
3. The proposed change in POD will affect the surface water source similarly to the authorized POD specified in the water use subject to transfer.

OWRD considers "similarly" to mean that the use of groundwater at the new POA will affect the surface water source specified in the permit and would result in stream depletion of at least 50 percent of the rate of appropriation within 10 days of continuous pumping.

Although the surface water source identified in the City's permit is the Salmon River, recent OWRD practice indicates that OWRD likely would not preclude a surface water to groundwater change to a downstream surface water body.

One potential obstacle to completing a surface water to groundwater permit amendment to a well hydraulically connected to the Sandy River is the proximity of Cedar Creek to the Sandy River in areas most suitable for development of a hydraulically connected groundwater POD. Near Sandy, Cedar Creek flows parallel to the Sandy River at a distance of 0.75 to 0.25 miles from the Sandy River. It is theoretically possible, although unlikely, that a well hydraulically connected to the Sandy River could also influence flows in Cedar Creek. Depending on the pumping rate, recharge from the Sandy River would probably limit the extent of the cone of depression. Regardless, if OWRD determines that a well hydraulically connected to the Sandy River also influence flows in Cedar Creek, then OWRD may find that such a change would not meet the criteria that use of the well impact surface water "similarly." Furthermore, any impact to Cedar Creek flows would likely result in a finding that the change would cause injury. ODFW holds a surface water right for the use of water from Cedar Creek for its fish hatchery at a location near the confluence with the Sandy River. This water right has previously been the basis for regulation of one the City's junior Brownell Springs water rights in 2015, so any impact to Cedar Creek flows identified through modelling of the proposed hydraulically connected well would have the potential to result in OWRD finding injury.

Therefore, although a surface water to groundwater permit amendment to a well hydraulically connected to the Sandy River appears to present the most feasible opportunity of navigating the conditions imposed by the Settlement Agreement and the final order approving the City's extension of time for Permit S-48451, some uncertainty remains as to the possibility of receiving approval of the permit amendment.

[2] OWRD considers "injury" to mean a proposed water right action would result in another, existing water right not receiving previously available water to which it is legally entitled. OWRD considers "enlargement" to mean expansion of a water right and includes using a greater rate or duty of water per acre than currently allowed; increasing the acreage irrigated; failing to keep the original place of use from receiving water from the same source; or diverting more water at the new point of diversion or appropriation than is legally available to that right at the original point of diversion or appropriation.

It should be noted that the City has the option to include only a portion of its Salmon River permit in a downstream surface water to groundwater permit amendment. For example, the City's projected groundwater supply need of 2.53 mgd (3.91 cfs), described in section 3, could be included in a surface water to groundwater modification to a downstream hydraulically connected well, while the remaining permitted rate remains associated with the currently authorized point of diversion on the Salmon River.

Furthermore, if the downstream surface water to groundwater permit amendment is approved, but for some reason, the City does not want to complete development of a hydraulically connected well, the City can return the rate moved to a downstream hydraulically connected well to the original point of diversion within five years of the approval of the permit amendment to move the point of diversion to a hydraulically connected well.

3. Groundwater Supply Needs

The City's current water master planning effort projects demand through 2050. The water demand projection is predicated on assumption of steady, continual growth of Sandy over the next 30 years. Table 2 provides a summary of the results of the projection in the draft Water Master Plan at the time this tech memo was prepared.

Table 2. City of Sandy Projected Demands through 2050 (in million gallons per day)[3]

Year	Single-Family Residential	Multi-Family Residential	Commercial/ Industrial	Other (Wholesale, Backwater, Bulk)	Total ADD[1]	EDUs	MDD
2021	0.65	0.11	0.21	0.05	1.20	6,613	2.05
2030	0.77	0.13	0.35	0.06	1.55	8,535	2.64
2040	0.89	0.15	0.64	0.07	2.07	11,362	3.52
2050	0.99	0.16	1.17	0.08	2.84	15,618	4.83

Notes

[1] Includes 18% water loss

ADD = average-day demand

EDU = Equivalent dwelling unit

MDD = maximum day demand

As described above, the City's maximum reliable supply under its senior Brownell Springs water right and Alder Creek is 2.53 mgd. This is lower than the City's projected maximum day demand of 4.83 mgd and average day demand of 2.84 mgd by 2050. If the City maintains its Brownell Springs and Alder Creek sources of supply, in order to meet the City's maximum day demand using its own existing water rights, the City would need to develop a reliable supply of at least 2.3 mgd from a hydraulically connected well on the Sandy River downstream of the confluence with the Salmon River.

4. Future Groundwater Supply Alternatives

In 2007, GSI, under contract with Curran-McLeod, completed the *City of Sandy Groundwater/Riverbed Filtration Hydrogeologic Evaluation* (GSI, 2007). The objective of this evaluation was to determine if a groundwater source with a capacity of at least 5 mgd could be developed on the Sandy River that meets OWRD requirements for transferring surface water rights to a hydraulically connected groundwater source.

[3] Data in this table is from Draft City of Sandy Water Master Plan (2022) being prepared by Murraysmith at the time this tech memo was prepared.

The information presented below is based on a review of those findings to confirm if other/newer data warrant updates or refinements to those findings and recommendations.

Figure 2 is a map of the City's authorized surface water POD and areas evaluated as part of the 2007 hydrogeologic evaluation.

4.1 Aquifer Storage and Recovery Feasibility near the City of Sandy

An ASR project would allow the City to inject water into the aquifer during the winter months for recovery during the high demand summer period. A successful ASR system requires an aquifer with several characteristics, including the ability to accept/yield water at a sufficient rate, sufficient storage volume, confined conditions that will not lose stored water to surface water bodies, and an acceptable depth from the surface (i.e., not so deep as to render drilling and operation of the well prohibitively expensive).

GSI evaluated the feasibility of ASR development for the following water-bearing formations in the vicinity of Sandy:

- **Columbia River Basalt Group (CRBG) —** The CRBG unit consists of a series of basalt sheetflows characterized by thin, often permeable, interflow zones separated by thick, low permeability flow interiors. Interflow zones include the top of one flow, the base of an overlying flow, and intervening sediments. Well yields are moderate to high, with most high-capacity wells open to multiple interflow zones. In the Sandy area, the CRBG is assumed to underlie the younger sedimentary units, but the depth to the top of the CRBG is uncertain, and likely greater than 1,000 feet below ground surface. A productive ASR well would likely need to extend at least several hundred feet into the basalt. Costs associated with drilling and operation of a high-capacity ASR well in the CRBG would be very high, and the presence and nature of suitable aquifer storage targets in the CRBG is not known in this area.
- **Rhododendron Formation —** The Rhododendron Formation consists of debris-flow breccias and andesite lava flows, with generally poor water-bearing characteristics (Swanson et al., 1993). Yields range from 10 to 60 gallons per minute (gpm), often with considerable drawdown (specific capacity 0.04 to 3 gpm per foot).[4]
- **Troutdale Formation —** The Troutdale Formation is an important aquifer for water supply in the area and consists of volcanic and quartzite-bearing conglomerate and vitric sandstone. The greater well yields in the Troutdale Formation near the City are 40 to 50 gpm, much less than the City's needs. The Troutdale Formation near Sandy is mostly unconfined and in hydraulic connection with surface water bodies. Both the unconfined condition and hydraulic connection with surface water are associated with considerable risk of losing stored water.
- **Boring Lava —** The Boring Lava consists of localized accumulations of basaltic lavas, vent plugs, and volcanic debris. The potential to encounter favorable conditions in the Boring Laval for an ASR system that can meet the City's needs is low because of the limited extent and locally variable nature of the unit.

The feasibility of developing ASR in the shallower water-bearing units is mostly limited by aquifer characteristics, whereas the development potential of a deeper aquifer is more affected by uncertainty regarding the presence of a suitable storage aquifer, and the drilling and construction depth that would be required to construct a high-capacity ASR well.

[4] This information was obtained from the following reference well logs for the Rhododendron Formation near Sandy: CLAC 6699, CLAC 18898, CLAC 18519, CLAC 6688, and CLAC 51283/52951.

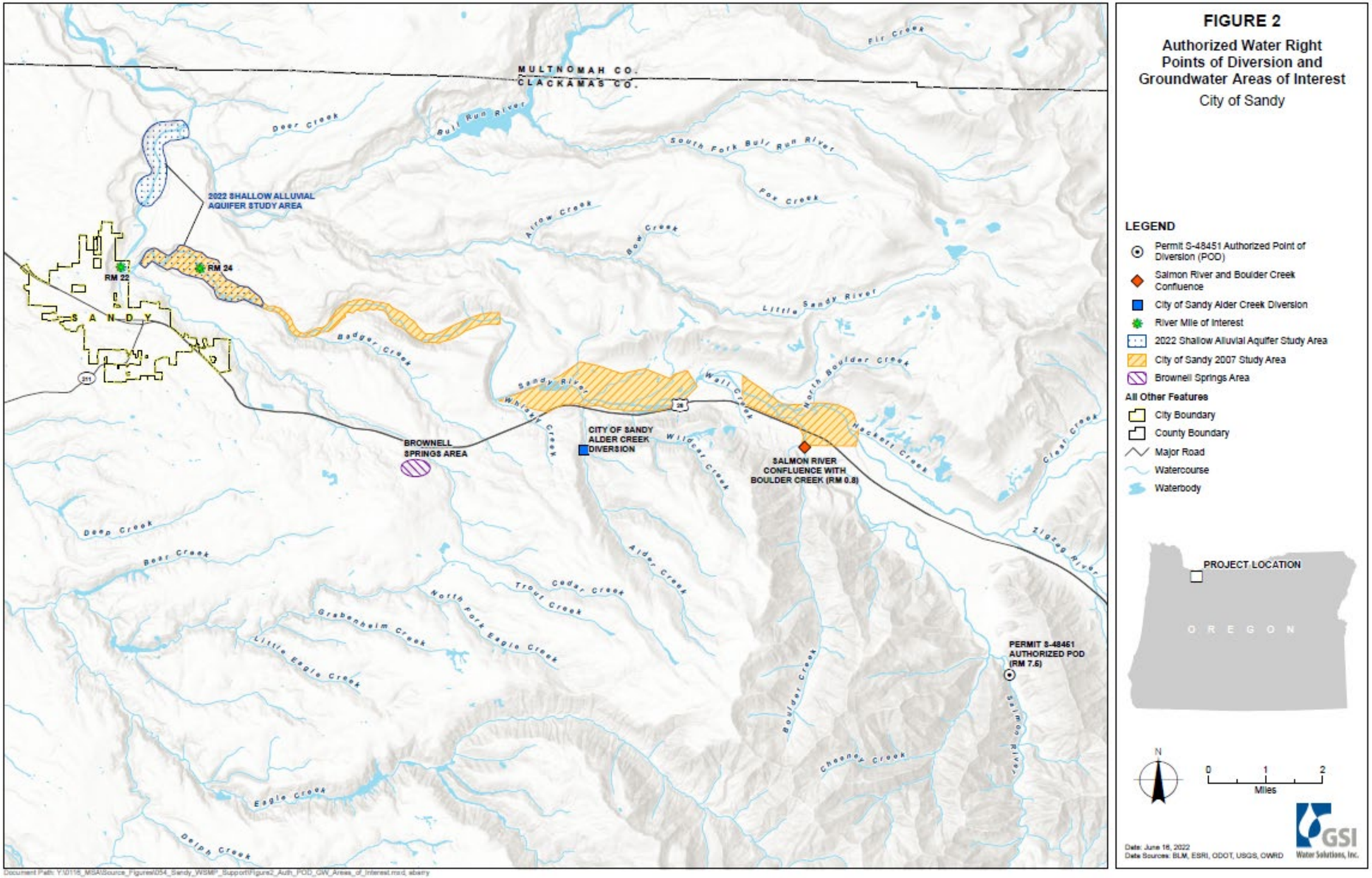


FIGURE 2

Authorized Water Right Points of Diversion and Groundwater Areas of Interest

City of Sandy

LEGEND

- Permit S-48451 Authorized Point of Diversion (POD)
- Salmon River and Boulder Creek Confluence
- City of Sandy Alder Creek Diversion
- River Mile of Interest
- 2022 Shallow Alluvial Aquifer Study Area
- City of Sandy 2007 Study Area
- Brownell Springs Area

All Other Features

- City Boundary
- County Boundary
- Major Road
- Watercourse
- Waterbody

N

0 1 2
Miles

Date: June 16, 2022
Data Sources: BLM, ESRI, ODOT, USGS, OWRD

GSI Water Solutions, Inc.

Document Path: Y:\0116_MSA\Source_Figures\054_Sandy_WSMP_Support\Figure2_Auth_POD_GW_Areas_of_Interest.mxd; sbarry

In addition, restrictions on diversion of water from an upstream POD during November through February may make the Salmon River an unreliable source of supply for ASR injection during winter. GSI reviewed Salmon River flow data from 1925 through 1952. While water was typically available from November through February, during dry years from the 1925 through 1952 period of record, data indicate that water would have been available for less than 90 days in 3 out of 25 years in the period of record. There is no Salmon River flow data available for the winter of 1976 to 1977, but Sandy River flow data from 1976 to 1977 suggest the possibility that no water would have been available from November through February in that year. The City would need to have sufficient excess water supply available from Alder Creek and Brownell Springs to provide water for ASR injection.

4.2 Shallow Alluvial Aquifer near the City of Sandy

GSI evaluated the favorability of groundwater development from the shallow alluvial aquifer on the south side of the Sandy River between RM 22 and RM 24 (GSI, 2007) and between RM 19 and RM 22. Both reaches of the Sandy River are downstream from the confluence with Boulder Creek and would likely meet the criteria for a downstream transfer of the Salmon River water right. Although the composition of the aquifer indicates potential for high-yielding shallow groundwater production, the shallow alluvial aquifer appears not to be laterally extensive, and the limited saturated thickness may constrain yield potential from either riverbank filtration (RBF) or a vertical well. According to nearby wells logs (CLAC 6688, CLAC 6723, CLAC 18462, CLAC 1327, CLAC 74908, and CLAC 11163) the saturated thickness of the aquifer is approximately 20 to 25 feet. Two well logs from geotechnical borings (CLAC 51394 and CLAC 51395) located near where Lusted Road meets Dodge Park (approximately RM 19) reported gravels and cobbles to a depth of 35 feet. However, the majority of logs between RM 19 and RM 22 reported depths of coarse alluvial deposits between 11 and 27 feet. GSI affirms the findings from the 2007 study that it is unlikely that an infiltration gallery or collector well system constructed in the shallow alluvial aquifer near the City could produce the desired 5 mgd.

A vertical well that is hydraulically connected to the Sandy River may be able to produce yields in excess of 100 gpm, but there are considerable uncertainties that might limit actual yields, including seasonal water level fluctuations and the depth of the productive zone(s). For example, if only the uppermost layer of the aquifer is in connection with the river, it might be highly productive during the wet season, but lose some or all hydraulic connection during periods of low water levels in the river. Similarly, pumping from the well might cause the water level to drawdown below the top of a shallow screen interval and cause water to cascade into the well. Cascading water should be avoided because it increases the risks of corrosion and biofouling. A horizontal gallery or lateral well may be capable of higher rates. Similar settings with suitable hydrogeologic characteristics may yield more than 1 mgd to a horizontal facility under the right conditions. Completion of a test well would be the best recommended approach to estimate actual sustainable production rates from the shallow alluvial aquifer.

In summary, the current review confirms that the saturated thickness of the shallow alluvial aquifer in this area is likely insufficient to provide a 5 mgd groundwater supply source, but may be capable of yielding 1 mgd to a horizontal well at a site under favorable circumstances.

5. Additional Data Needs

A comprehensive field characterization program would be necessary should the City decide to investigate the feasibility of developing a lower capacity source (i.e., 1 mgd) in the alluvial aquifer through a surface to groundwater transfer. The objectives of the field characterization program include:

1. Determine potential yield of a groundwater source under low stage/flow (summer) conditions on the river

2. Evaluate the feasibility of a surface to groundwater transfer based on hydraulic connection with the river during the summer season, assessing the likelihood of interference with streamflow in Cedar Creek.

The characterization program should include the following elements to develop a sufficient confidence in the capacity of a given location to before investing in infrastructure to develop the source:

1. Identify a site(s) adjacent to the flood plain and with space within 100 feet of the river. The City may consider identifying more than one site to explore in the event that characteristics at the first site are unsuitable and/or the City should desire to develop an additional increment of supply.
2. Complete a field exploration and monitoring program including the following activities:
   - Generate an accurate topographic map of the site using either survey or LiDAR data, depending on availability
   - Conduct a geophysical survey to map the extent and thickness of shallow deposits
   - Drill 2–4 small boreholes using sonic drilling technique to identify geologic materials and assess initial suitability
   - Construct a test well and two piezometers to serve as observation wells
   - Perform a constant-rate aquifer test during the low flow season in the Sandy River, and monitor water level responses and field water quality parameters.
   - Collect samples for water quality analysis and conduct microscopic particulate analysis (MPA) during the constant-rate aquifer test
   - Monitor water levels in the test well and observation wells over periods of high- and low-stages in the Sandy River
3. Evaluate source capacity and stream depletion from testing and monitoring data, water quality data and analytical modeling.
4. Develop preliminary design of horizontal well or infiltration gallery.

We estimate that planning level costs for this assessment per site are approximately $225,000. Including a 25 percent contingency, the total per site assessment cost would be $281,000.

6. References

GSI. 2007. *City of Sandy Groundwater/Riverbed Filtration Hydrogeologic Evaluation*. Draft report prepared for Curran-McLeod, Inc. and City of Sandy. May 2007.

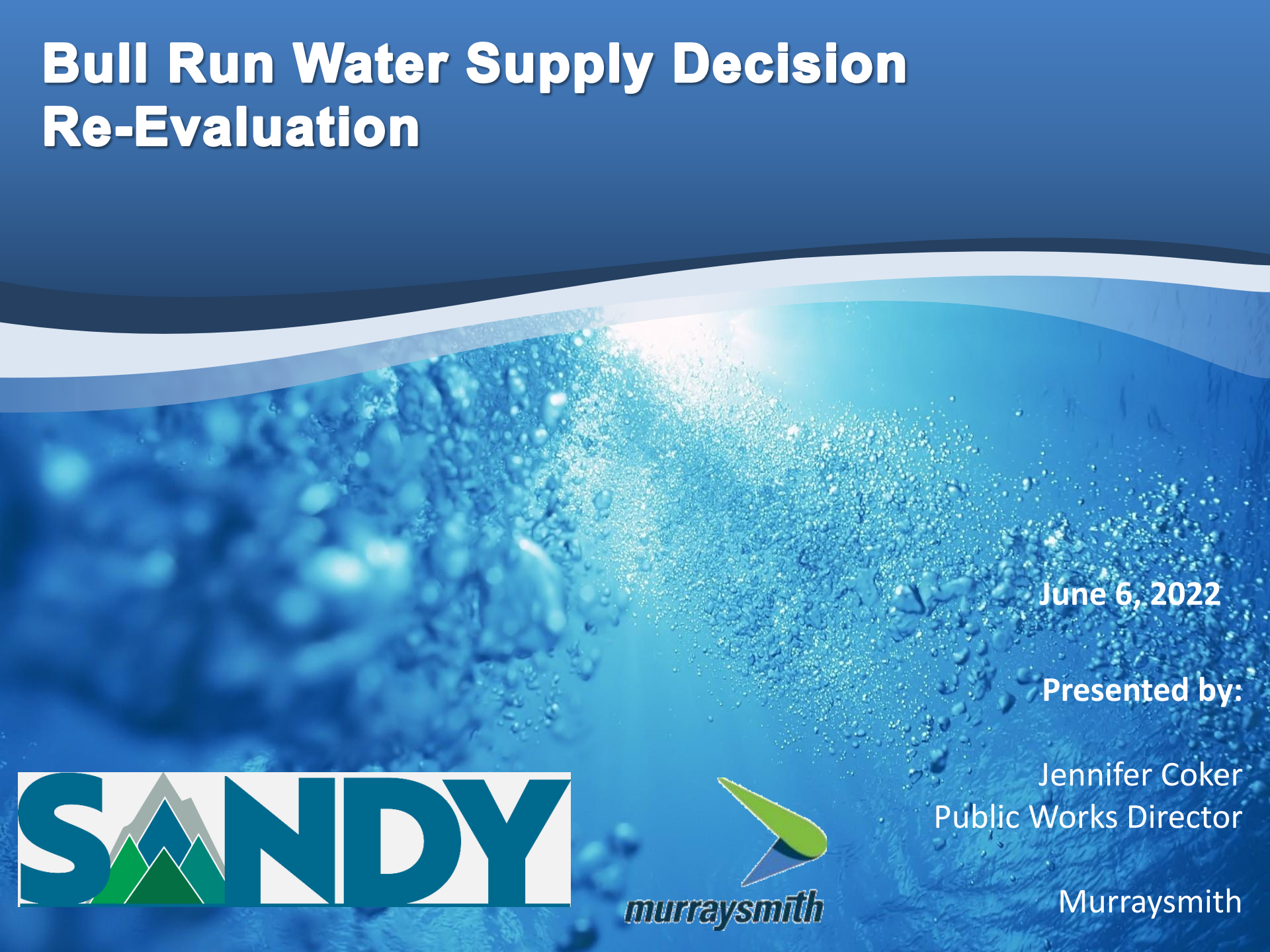
GSI. 2015. City of Sandy Water Management and Conservation Plan.

PGE. 2002. Settlement Agreement Concerning the Removal of the Bull Run Hydroelectric Project (FERC Project No. 447

Swanson, R.D., McFarland, W.D., Gonthier, J.B., and Wilkinson, J.M. 1993. A description of hydrogeologic units in the Portland Basin, Oregon and Washington: U.S. Geological Survey Water-Resources Investigations Report 90–4196, 56 p., 10 sheets, scale 1:100,000.

APPENDIX B
PRESENTATION TO
SANDY CITY COUNCIL

Bull Run Water Supply Decision Re-Evaluation



June 6, 2022

Presented by:

Jennifer Coker
Public Works Director

Murraysmith

Presentation Overview

- Background, Drivers
- Existing Water Supply Sources
- Water Demand
- Changes to Portland Supply
- Water Supply Alternatives
- Schedule
- Recommendation & Next Steps
- Q&A

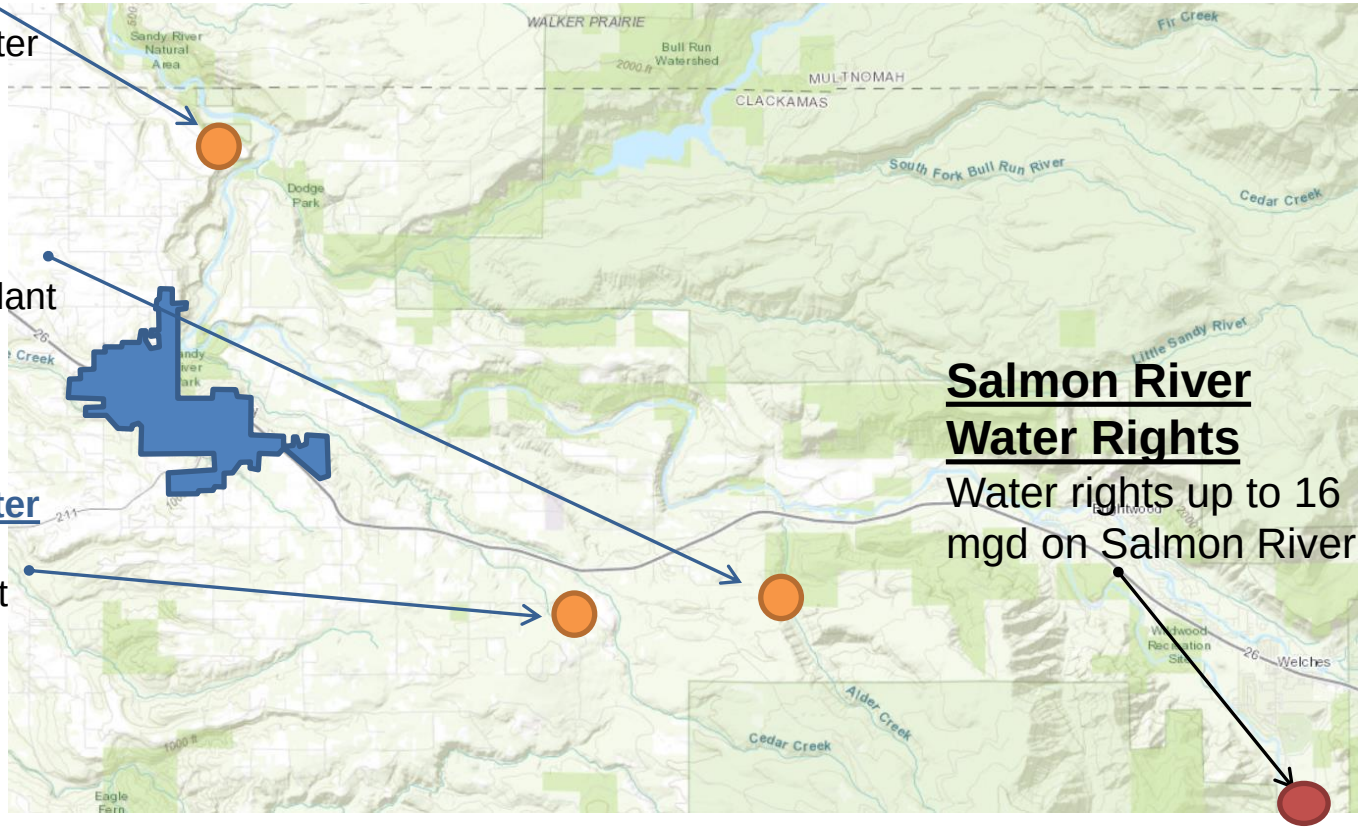
Existing Water Supply

Today, water is supplied from three sources

Portland Wholesale Supply
Purchase unfiltered treated water from Portland : 3 (mgd)

Alder Creek Surface Water Source
City owned Water Treatment Plant on Alder Creek: 0.9 mgd

Brownell Springs Groundwater Source
City owned groundwater well at Brownell Springs: 0.12 mgd



Salmon River Water Rights
Water rights up to 16 mgd on Salmon River

Groundwater

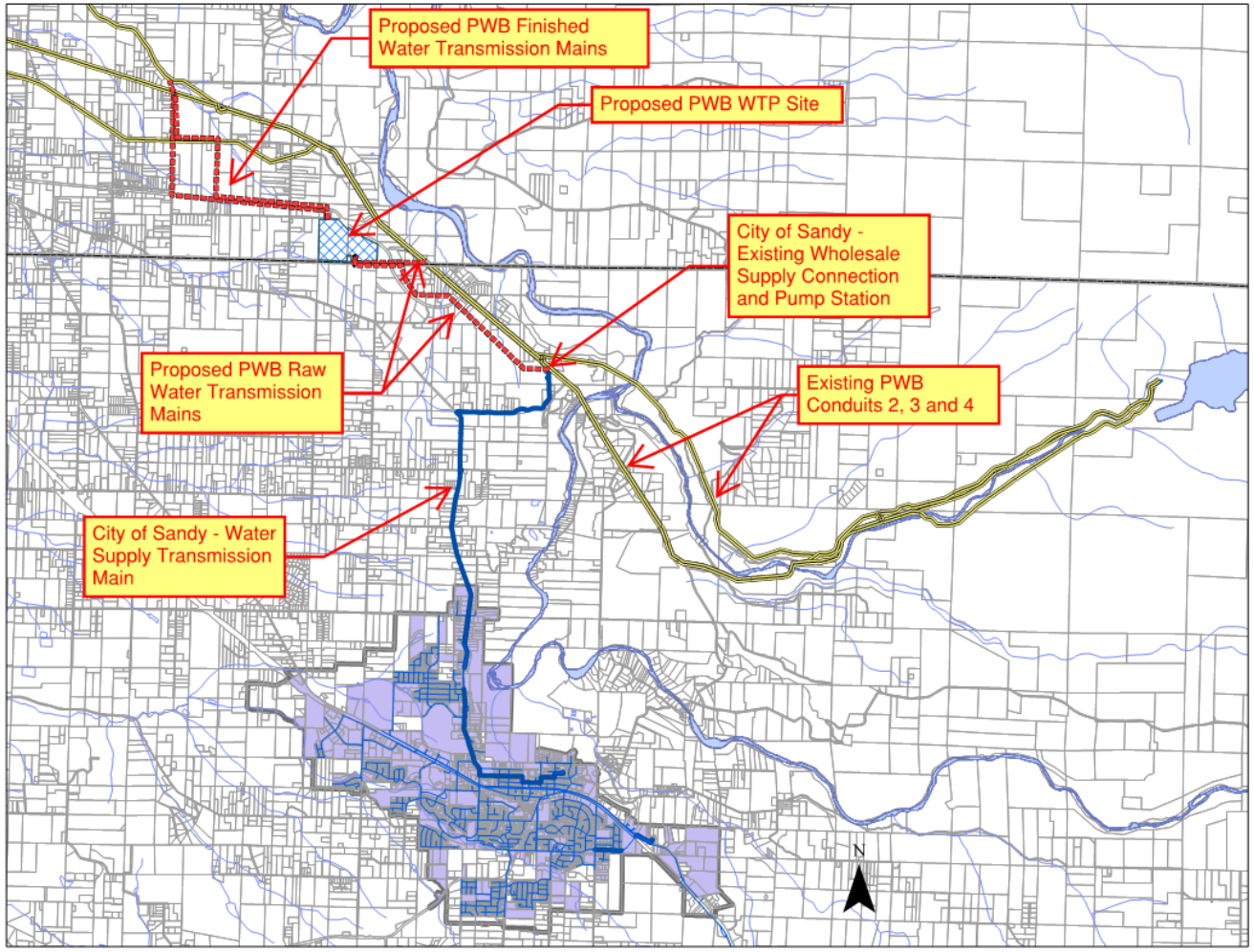
- **Water Rights Review**
  - Brownell Springs & Alder Creek @ 2.7 MGD water right priority
  - Undeveloped Salmon River Permit – 16.2 MGD– significant regulatory hurdles.
    - Surface water to groundwater transfer of permit to a well on the Sandy River downstream of Salmon River confluence may be feasible.
    - Uncertain outcome, cannot happen by 2027
- **Groundwater Review**
  - Unlikely a wellfield could produce 5 MGD

Changes to Portland Supply

- **Portland is building a new filtration plant to meet Surface Water Treatment Rules**
- **Must be in service by fall 2027**
- **Treated water will not be available to Sandy when plant goes in service without constructing improvements**
- **Sandy can buy untreated water from Portland and build a treatment plant**

or

- **Sandy can buy filtered water from Portland and build a new pipeline from Portland's WTP to existing connection at Lusted Road and Hudson Road**



Sandy Water Supply History

2008 20-year Water Supply Agreement w/ PWB

2011 Sandy constructs infrastructure to connect to PWB

2018 Sandy Agreement w/OHA treat Bull Run Water for Cryptosporidum by **September 2027**

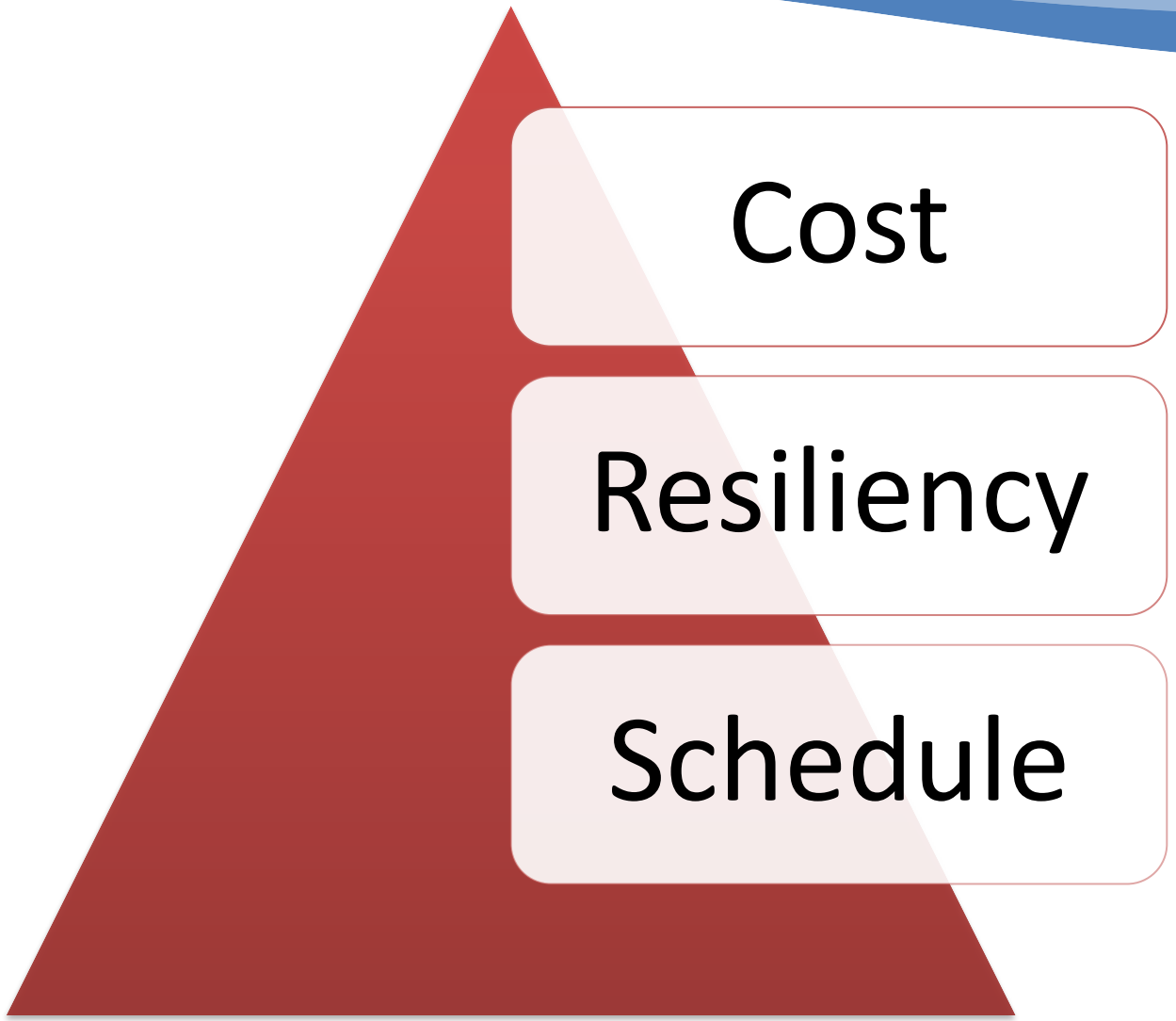
June 2021 Sandy chooses water treatment plant & purchase unfiltered water from PWB

May 2022 Revisit Decision based on updated costs

Compliance Status with OHA

Bilateral Compliance Agreement	Date Issued	Due Date	Closed Date
Submit Master Plan	Sept 2018	December 2020	**OVERDUE**
Begin Construction	Sept 2018	July 31, 2024	
Correct Water Quality Deficiencies	Sept 2018	September 30, 2027	

Decision Drivers

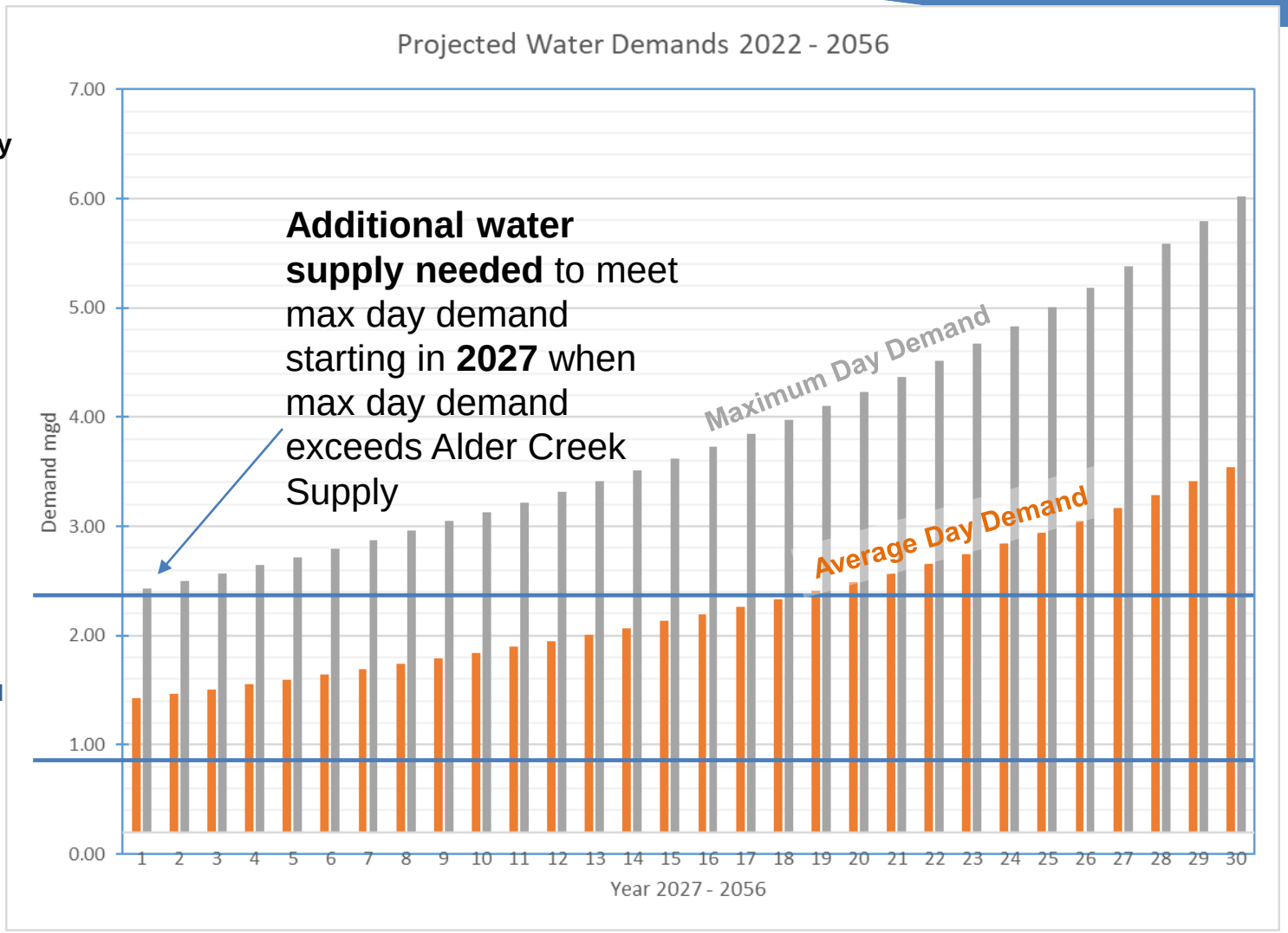


Water Demand

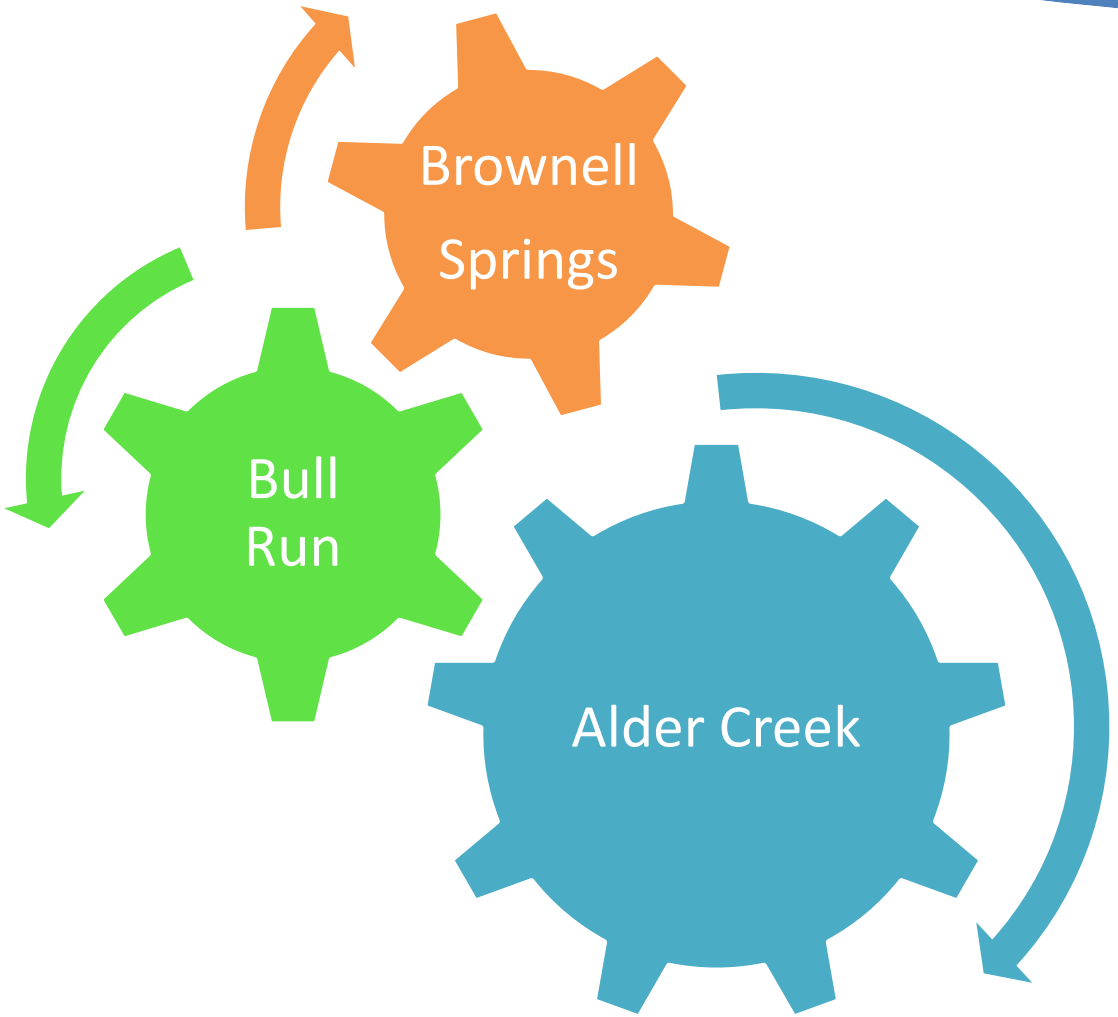
- **Additional water supply needed in 2027** to meet max day demand
- **Size of additional supply varies** depending on capacity of Alder Creek
- **Brownell Springs provides** additional 0.12 mgd in the winter
- **Max day demand** occurs in summer
- **Today max day demand** is 2.1 mgd (ADD is 1.2 mgd)

ALDER CREEK
Maximum future capacity 2.4 mgd

ALDER CREEK
Current reliable capacity 0.9 mgd



Water Supply Alternatives Screening



Water Supply Alternatives Screening

Upgrade existing supply at Alder Creek,

- Maintain existing capacity of 0.9 mgd with minor maintenance
- Improve supply to 1.4 mgd with major maintenance
- Maximize supply to 2.4 mgd with upgrades

PLUS:

A) Purchase raw water & build second treatment plant;

or

B) Purchase filtered water and build Pipeline

Pipeline Alignment for Finished Water

Potential PWB Backfeed Pipeline

Would need to be oversized to feed Sandy

Bluff Rd. Pipeline

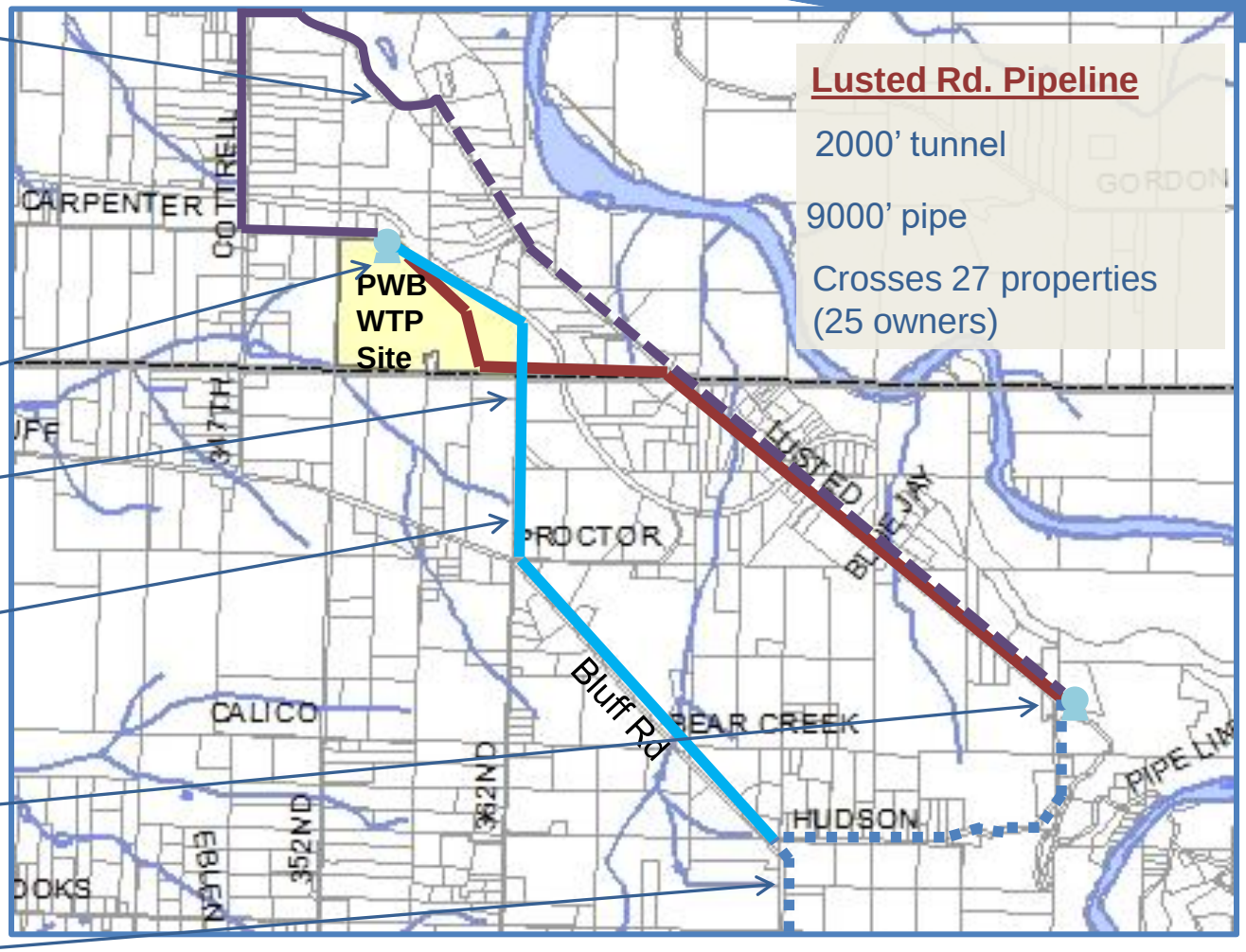
New low-head pump station – 5 mgd

PWB obtaining easement

New pipeline 11,500 FT – 24” dia.

Exist. Connection and pumpstation

Exist. Sandy supply pipeline



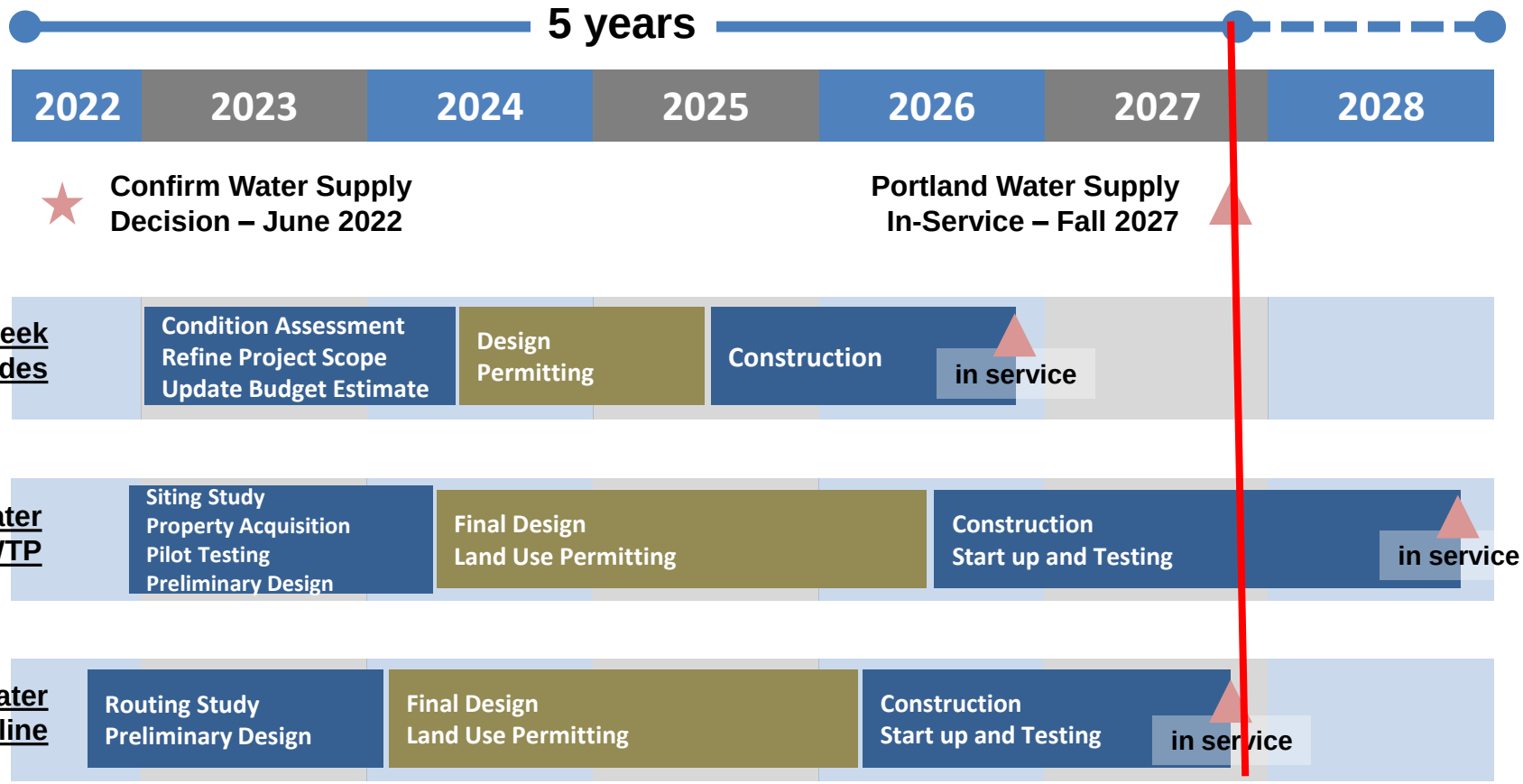
Supply Alternatives Filtered vs. Unfiltered Water Purchase

CRITERIA	PURCHASE FILTERED WATER FROM PDX BUILD BLUFF ROAD PIPELINE			PURCHASE RAW WATER FROM PDX BUILD WATER TREATMENT PLANT		
Water Supply Cost (30-yr cost in 2026 $)	LifeCycle Cost: Total Investment:	**$85.6M** **$47.2M**	+	LifeCycle Cost: Total Investment:	**$143.4M** **$ 58.4M**	-
Cost of Portland Water (in 2026 $)	30-yr Cost:	**$10.7M**	-	30-yr Cost:	**$ 6.1M**	+
Implementation Risk	* Entire pipeline must be built - can't be phased * Requires Carpenter Ln Easement * All construction is outside the City * Without pipeline, City can't meet summer demand in 2027		-	* WTP can be built in phases * Requires one (1) 3-to-5-acre property near existing pipeline * Land use permitting provides some uncertainty		+

Supply Alternatives including Alder Creek Upgrades

CRITERIA	PURCHASE FILTERED WATER FROM PDX BUILD BLUFF ROAD PIPELINE		PURCHASE RAW WATER FROM PDX BUILD WATER TREATMENT PLANT	
Water Filtration	* Water Treatment Plant (WTP) built by Portland * WTP cost shared by wholesale purchasers & Portland rate payers	+	* City builds and owns new WTP * WTP paid for by City Rate Payers	-
Operational Complexity	* Minimal O&M cost for pipeline * Need To evaluate disinfection approach * City operates only upgraded Alder Creek WTP and new pumpstation * PWB responsible for compliance	+	* City operates two water treatment plants * Higher O&M cost * City responsible for compliance	-
Resilience / Reliability	Portland groundwater supply provides redundancy	+	Portland groundwater supply **not** available for raw water option	-

Water Supply Program Schedule



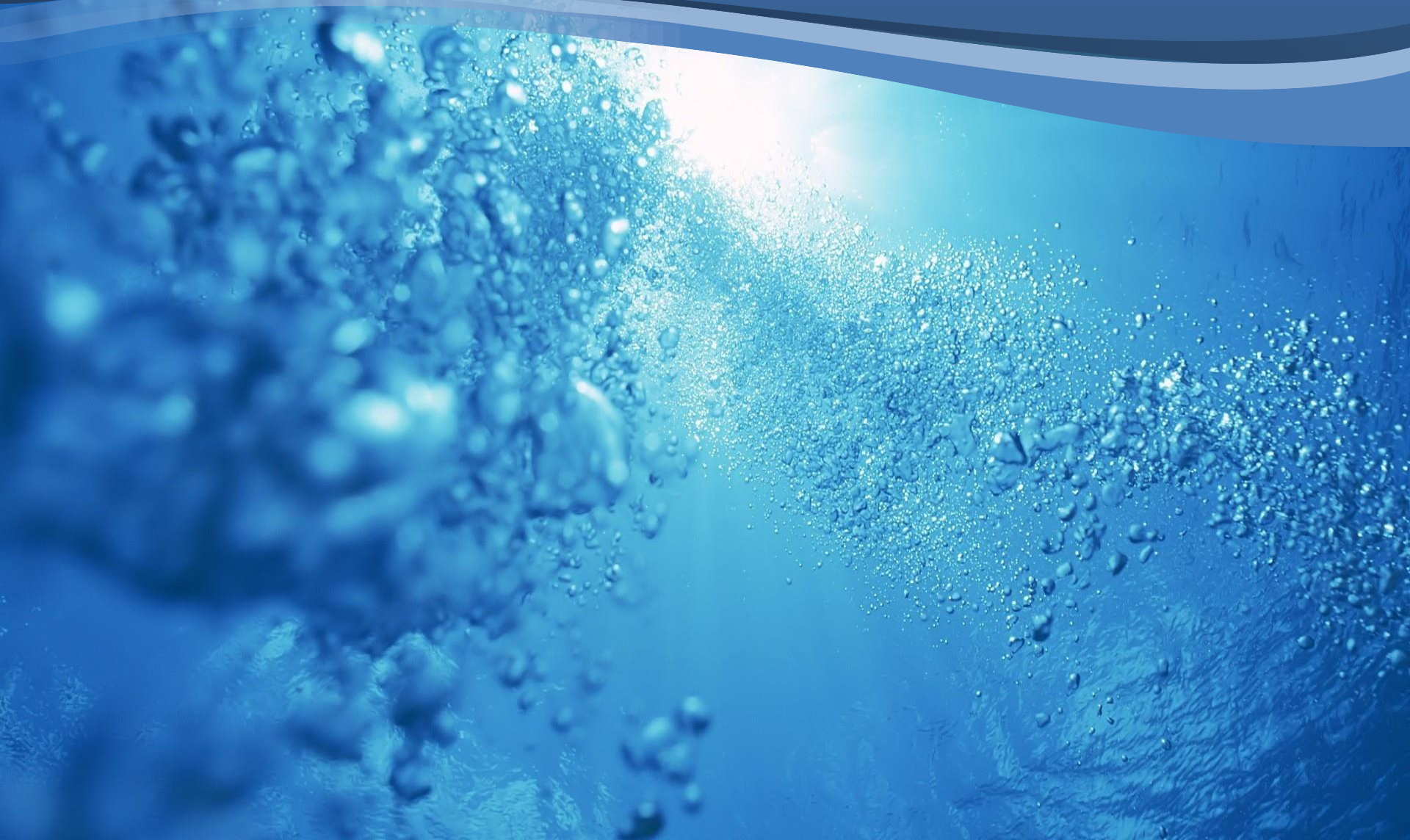
Recommendation

- Upgrade Alder Creek & Install Bluff Road Water Transmission Pipe, **purchase filtered water**
- Capital Cost **$47.2 Million**
- 30-year Lifecycle cost **$85.6 Million**
- Lowest Capital and Lifecycle Costs, Faster Schedule, and Resiliency/Groundwater access

Next Steps

- **Council Formalize** purchase decision
- **Refine condition assessment** to maximize Alder Creek WTP and determine water system CIP
- **Complete Master Plan**
- **Evaluate land use and permitting** associated with building a pipeline
- **Develop funding** approach for program
- **Hire** program manager/design team

Questions



Portland Supply Alternatives

We also considered new pipeline in Lusted Road.

- Included a 2,000 ft tunnel and 200’ deep bore shaft – high risk
- Required property acquisition from 25 property owners along Lusted Road – high risk
- Cost was higher than Bluff Road option

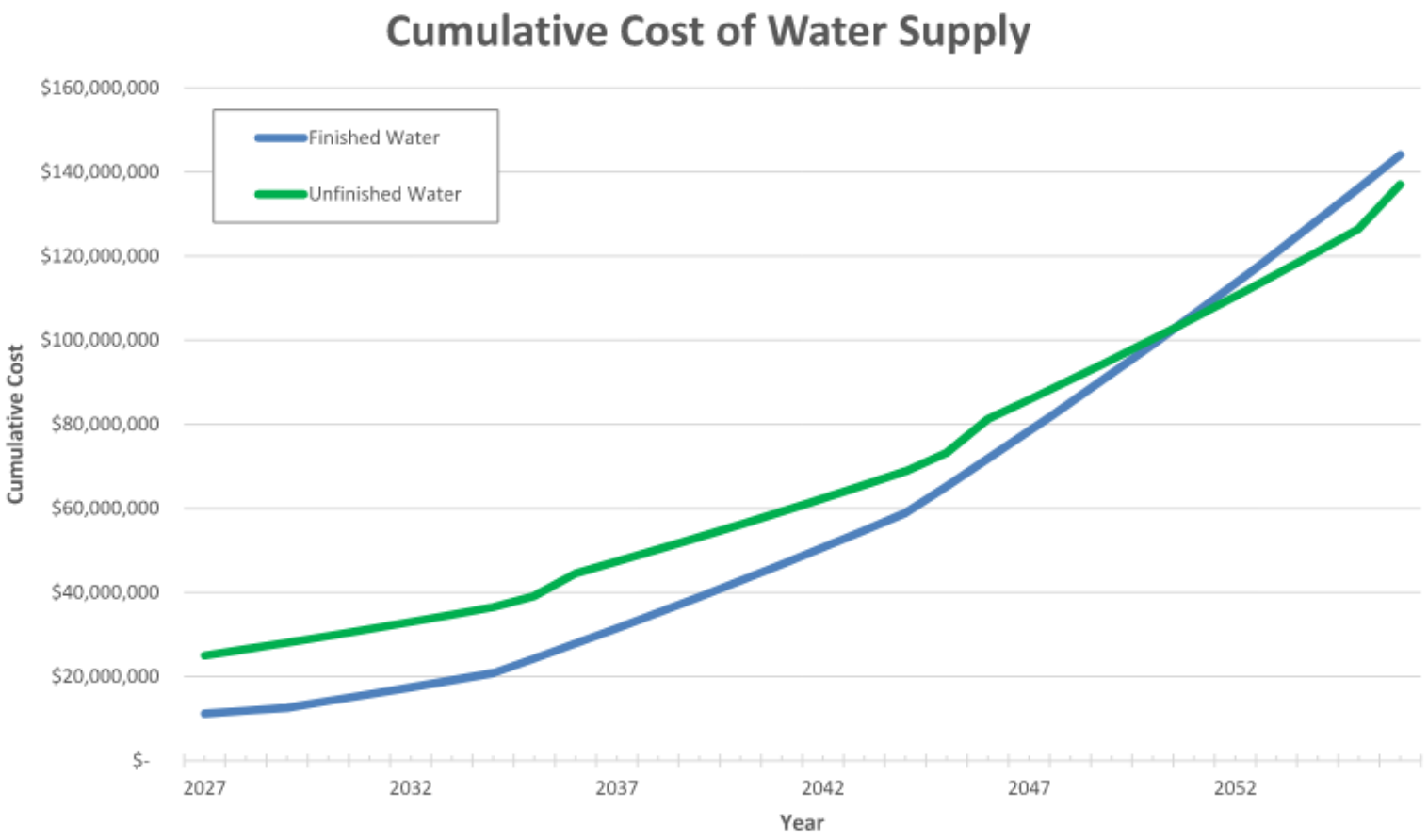
Screening: Raw Water Alternatives

Raw Water Alternatives	Initial Investment (2026 Dollars)	Lifecycle Cost (30 years)	Water Purchase	O & M
(R1) New Plant +	$43,947,000	$176,607,000	$37,756,000	$27,300,000
Alder minor	$ 1,033,000	*Build a new WTP and perform minor maintenance at Alder Creek. Alder Creek Contributes today's amount 0.9 MGD*		
TOTAL	$44,900,000			
(R2) New Plant +	$43,947,000	$161,668,000	$17,835,000	$36,270,000
Alder major maintenance	$ 4,164,000	*Major maintenance at Alder Creek includes new filters, control repair/upgrades. Alder Creek contributes 1.4 MGD.*		
TOTAL	$48,100,000			
(R3) New Plant +	$43,947,000	$143,356,000	$6,057,000	$32,240,000
Upgrade Alder Creek	$ 14,407,000	*Partial replacement of Alder Creek includes new filters, new control, new process piping and upgraded pump station. Alder Creek contributes 2.4 MGD*		
TOTAL	$58,400,000			

Screening: Filtered Water Alternatives

Filtered Water Alternative	Initial Investment (2026 $)	Lifecycle Cost (30 years)	Water Purchase	O & M
(FB1) New Bluff Rd Pipe Alder Creek minor maintenance TOTAL	$32,784,000 $1,033,000 $33,817,000	$177,700,000 *11,500 LF of 24" pipe including 5 mgd pump station. Alder Creek produces current rate for 10 years*	$75,061,000	$4,977,000
(FB2) New Bluff Rd Pipe Alder Creek major maintenance TOTAL	$32,784,000 $4,164,000 $36,948,000	$119,289,000 *11,500 LF of 24" pipe including 5 mgd pump station. Increase Alder Creek production to 1.4 MGD*	$31,146,000	$14,208,000
(FB3) New Bluff Rd Pipe Upgrade Alder Creek TOTAL	$32,784,000 $14,407,000 $47,190,000	$85,618,000 *11,500 LF of 24" pipe including 5 mgd pump station. Increase Alder Creek production to 2.4 MGD*	$10,682,000	$10,177,000

Previous Analysis



Future Water Supply Alternatives

Evaluating Alder Creek Alternatives

All options assume Alder Creek improvements are completed before 2027

Note: Maximum capacity from Alder Creek requires additional source to meet max day demand

Alternative	Capacity	Cost	Benefits/Risk
Minor Maintenance	0.9 mgd	$ 1M	• Requires most water from Portland • Alder Creek has approx. 10-year life expectancy without significant upgrades • Does not Maximize Alder Creek supply
Major Maintenance	1.4 mgd	$ 4.2M	• Reduces water needed from Portland • Restores reliable long-term water supply • Does not Maximize Alder Creek supply
Partial Replacement	2.4 mgd	$ 14.4M	• Maximizes Supply from Alder Creek • Requires least water from Portland • Restores reliable long-term water supply

APPENDIX C
CIP COST ESTIMATES

Table 6-3
Sandy Capital Improvement Plan Summary

Project No.	Project Description	CIP Schedule and Project Cost Summary (2022 Dollars) 1-5 Years (2023-2027)	6-10 Years (2028-2032)	11-20 Years (2033-2042)	TOTAL	Preliminary SDC Eligibility
R.1	5.0 MG Additional Storage		$ 17,290,000	$ 17,290,000	$ 34,580,000	49%
R.2	Storage Siting Study	$ 180,000			$ 180,000	49%
R.3	Reservoir Seismic and Condition Assessment		$ 375,000		$ 375,000	49%
	Storage Subtotal	$ 180,000	$ 17,665,000	$ 17,290,000	$ 35,135,000	
PS.1	Terra Fern Pump Station Upgrades	$ 780,000			$ 780,000	45%
PS.2	Vista Loop Pump Station	$ 1,420,000			$ 1,420,000	45%
	Pump Station Subtotal	$ 2,200,000	$ -	$ -	$ 2,200,000	
D.1	Bluff Rd Fire Flow Improvements		$ 5,580,000		$ 5,580,000	45%
D.2	Hood St Fire Flow Improvements		$ 540,000		$ 540,000	45%
D.3	Mitchell Ct Fire Flow Improvements		$ 260,000		$ 260,000	45%
D.4	Seaman Ave Fire Flow Improvements		$ 550,000		$ 550,000	45%
	Distribution Subtotal	*$ -*	*$ 6,930,000*	*$ -*	*$ 6,930,000*	
S.1	Near-Term Alder Creek WTP Improvements	$ 1,050,000			$ 1,050,000	0%
S.2	Short-Term Alder Creek WTP Assessment	$ 240,000			$ 240,000	45%
S.3	Alder Creek WTP Improvements	$ 42,080,000			$ 42,080,000	45%
S.4	PWB Filtered Water Supply Connection	$ 39,416,000			$ 39,416,000	45%
S.5	Long-Term Supply Study		$ 240,000		$ 240,000	45%
	Supply Subtotal	$ 82,786,000	$ 240,000	$ -	$ 83,026,000	
M.1	Water System Master Plan Update		$ 220,000		$ 220,000	45%
M.2	Water Management and Conservation Plan	$ 110,000			$ 110,000	45%
M.3	Annual Replacement Budget	$ -	$ 6,000,000	$ 24,000,000	$ 30,000,000	45%
M.4	Water Service Meter Replacement			$ 7,920,000	$ 7,920,000	0%
M.5	SCADA Master Plan	$ 150,000			$ 150,000	45%
M.6	SCADA Upgrades (Preliminary Budget Placeholder)		$ 760,000		$ 760,000	45%
	Other Subtotal	$ 260,000	$ 6,980,000	$ 31,920,000	$ 39,160,000	
	CIP Total	**$ 85,426,000**	**$ 31,815,000**	**$ 49,210,000**	**$ 166,451,000**	

consor

Probable Cost of Construction
CIP R.1

Project: 5.0 MG Additional Storage
Location To be assessed
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	2.0 MG Reservoir	1	LS	$4,000,000	$4,000,000
A2	2.0 MG reservoir	1	LS	$4,000,000	$4,000,000
A3	1.0 MG Reservoirs	1	LS	$3,000,000	$3,000,000
A4	12-inch transmission piping	15,900	LF	$370	$5,890,000
A5	Control Valve Vault	3	EA	$100,000	$300,000
			SubTotal:		**$17,190,000**
Special					
C1	Property Acquisition	2	AC	$660,000	$1,320,000
			SubTotal:		**$1,320,000**
	Material & Labor Total:				**$18,510,000**
	Bonds and Insurance	2%			$370,200
	Mobilization:	10%			$1,851,000
Subtotal					**$20,740,000**
	Oregon Corporate Activity Tax	1.0%			$207,400
	Subtotal:				**$20,950,000**
	Contingency:	30%			$6,290,000
	Engineering	20%			$4,190,000
	Permitting and Admin	5%			$1,050,000
	Construction Contract Administration	10%			$2,100,000
Total Estimated Project Cost:					***$34,580,000***
Cost Range		***-30%***			***$24,206,000***
		50%			***$51,870,000***

consor

Probable Cost of Construction
CIP R.2

Project: Storage Siting Study
Location n/a
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	Storage Siting Study	1	LS	$150,000	$150,000
			SubTotal:		**$150,000**
		Contingency:	20%		$30,000
Total Estimated Project Cost:					***$180,000***
Cost Range		***-30%***			***$126,000***
		50%			***$270,000***

consor

Probable Cost of Construction
CIP R.3

Project: Reservoir Seismic and Condition Assessment
Location Reservoir Locations
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	Reservoir Seismic and Condition Assessment	1	LS	$375,000	$375,000
			SubTotal:		**$375,000**
Total Estimated Project Cost:					***$375,000***
Cost Range		***-30%***			***$262,500***
		50%			***$562,500***

consor

Probable Cost of Construction
CIP PS.1

Project: Terra Fern Pump Station Upgrades
Location Terra Fern Road
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	Fire Flow Pump	1	LS	$400,000	$400,000
			SubTotal:		**$400,000**
			Material & Labor Total:		**$400,000**
			Bonds and Insurance	2%	$8,000
			Mobilization:	10%	$40,000
Subtotal					**$450,000**
			Oregon Corporate Activity Tax	1.0%	$4,500
			Subtotal:		**$460,000**
			Contingency:	30%	$140,000
			Engineering	20%	$100,000
			Permitting and Admin	5%	$30,000
			Construction Contract Administration	10%	$50,000
Total Estimated Project Cost:					***$780,000***
Cost Range			***-30%***		***$546,000***
			50%		***$1,170,000***

consor

Probable Cost of Construction
CIP PS.2

Project: Vista Loop Pump Station
Location Vista Loop
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	Pump Station	1	LS	$750,000	$750,000
			SubTotal:		**$750,000**
				Material & Labor Total:	**$750,000**
				Bonds and Insurance 2%	$15,000
				Mobilization: 10%	$75,000
Subtotal					**$840,000**
				Oregon Corporate Activity Tax 1.0%	$8,400
				Subtotal:	**$850,000**
				Contingency: 30%	$260,000
				Engineering 20%	$170,000
				Permitting and Admin 5%	$50,000
				Construction Contract Administration 10%	$90,000
Total Estimated Project Cost:					***$1,420,000***
Cost Range		***-30%***			***$994,000***
		50%			***$2,130,000***

consor

Probable Cost of Construction
CIP D.1

Project: Bluff Rd Fire Flow Improvements
Location Bluff Rd, Burgs Ln, Kelso Rd, SE Baumback Ave, Marcy St
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	8-inch diameter	1800	LF	$270	$490,000
A2	12-inch diameter	6700	LF	$370	$2,480,000
			SubTotal:		**$2,970,000**
	Material & Labor Total:				**$2,970,000**
	Bonds and Insurance	2%			$59,400
	Mobilization:	10%			$297,000
Subtotal					**$3,330,000**
	Oregon Corporate Activity Tax	1.0%			$33,300
	Subtotal:				**$3,370,000**
	Contingency:	30%			$1,020,000
	Engineering	20%			$680,000
	Permitting and Admin	5%			$170,000
	Construction Contract Administration	10%			$340,000
Total Estimated Project Cost:					***$5,580,000***
Cost Range		***-30%***			***$3,906,000***
		50%			***$8,370,000***

consor

Probable Cost of Construction
CIP D.2

Project: Hood St Fire Flow Improvements
Location Hood St and SE Ten Eyck Rd
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	12-inch diameter	680	LF	$370	$260,000
			SubTotal:		**$260,000**
		Material & Labor Total:			**$260,000**
		Bonds and Insurance	2%		$5,200
		Mobilization:	10%		$26,000
Subtotal					**$300,000**
		Oregon Corporate Activity Tax	1.0%		$3,000
		Subtotal:			**$310,000**
		Contingency:	30%		$100,000
		Engineering	20%		$70,000
		Permitting and Admin	5%		$20,000
		Construction Contract Administration	10%		$40,000
Total Estimated Project Cost:					***$540,000***
Cost Range		***-30%***			***$378,000***
		50%			***$810,000***

consor

Probable Cost of Construction
CIP D.3

Project: Mitchell Ct Fire Flow Improvements
Location Mitchell Court
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	8-inch diameter	430	LF	$270	$120,000
			SubTotal:		**$120,000**
			Material & Labor Total:		**$120,000**
			Bonds and Insurance	2%	$2,400
			Mobilization:	10%	$12,000
Subtotal					**$140,000**
			Oregon Corporate Activity Tax	1.0%	$1,400
			Subtotal:		**$150,000**
			Contingency:	30%	$50,000
			Engineering	20%	$30,000
			Permitting and Admin	5%	$10,000
			Construction Contract Administration	10%	$20,000
Total Estimated Project Cost:					***$260,000***
Cost Range		***-30%***			***$182,000***
		50%			***$390,000***

consor

Probable Cost of Construction
CIP D.4

Project: Seaman Ave Fire Flow Improvements
Location Seaman Ave
Date: December 1, 2022

ENR, CCI - Seattle, WA: 15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	12-inch diameter	720	LF	$370	$270,000
			SubTotal:		**$270,000**
			Material & Labor Total:		**$270,000**
			Bonds and Insurance	2%	$5,400
			Mobilization:	10%	$27,000
Subtotal					**$310,000**
			Oregon Corporate Activity Tax	1.0%	$3,100
			Subtotal:		**$320,000**
			Contingency:	30%	$100,000
			Engineering	20%	$70,000
			Permitting and Admin	5%	$20,000
			Construction Contract Administration	10%	$40,000
Total Estimated Project Cost:					***$550,000***
Cost Range		***-30%***			***$385,000***
		50%			***$825,000***

consor

Probable Cost of Construction
CIP S.1

Project: Near-Term Alder Creek WTP Improvements
Location Alder Creek WTP
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	Minor Maintenance at Alder Creek WTP	1	LS	$550,000	$550,000
			SubTotal:		**$550,000**
				Material & Labor Total:	**$550,000**
				Bonds and Insurance 2%	$11,000
				Mobilization: 10%	$55,000
Subtotal					**$620,000**
				Contingency: 30%	$190,000
				Engineering 20%	$130,000
				Permitting and Admin 5%	$40,000
				Construction Contract Administration 10%	$70,000
Total Estimated Project Cost:					***$1,050,000***
Cost Range		***-30%***			***$735,000***
		50%			***$1,575,000***

consor

Probable Cost of Construction
CIP S.2

Project: Short-Term Alder Creek WTP Assessment
Location Alder Creek WTP
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	Detailed WTP Assessment (includes structure, mechanical, and electrical assessments; cost benefit analysis; improvement plan	1	LS	$200,000	$200,000
			SubTotal:		**$200,000**
		Contingency:	20%		$40,000
Total Estimated Project Cost:					***$240,000***
Cost Range		***-30%***			***$168,000***
		50%			***$360,000***

Probable Cost of Construction
CIP S.3

Project: Alder Creek WTP Improvements
Location Alder Creek WTP
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	Full Replacement of Alder Creek WTP and Associated Infrastructure (2.6 MGD Capacity)	1	LS	$22,530,000	$22,530,000
			SubTotal:		**$22,530,000**
	Material & Labor Total:				**$22,530,000**
	Bonds and Insurance	2%			$450,600
	Mobilization:	10%			$2,253,000
Subtotal					**$25,240,000**
	Oregon Corporate Activity Tax	1.0%			$252,400
	Subtotal:				**$25,500,000**
	Contingency:	30%			$7,650,000
	Engineering	20%			$5,100,000
	Permitting and Admin	5%			$1,280,000
	Construction Contract Administration	10%			$2,550,000
Total Estimated Project Cost:					***$42,080,000***
Cost Range		***-30%***			***$29,456,000***
		50%			***$63,120,000***

Probable Cost of Construction
CIP S.4

Project: PWB Filtered Water Supply Connection
Location Hudson PS
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	5 MG Pump Station	1	LS	$12,005,000	$12,005,000
A2	24-inch diameter transmission line	11,500	LF	$738	$8,490,000
			SubTotal:		**$20,495,000**

Material & Labor Total:		**$20,495,000**
Bonds and Insurance	2%	$409,900
Mobilization:	10%	$2,049,500
Subtotal		**$22,955,000**
Oregon Corporate Activity Tax	1.0%	$229,550
Subtotal:		**$23,185,000**
Contingency:	35%	$8,115,000
Engineering	20%	$4,637,000
Permitting and Admin	5%	$1,160,000
Construction Contract Administration	10%	$2,319,000

Total Estimated Project Cost:		***$39,416,000***
Cost Range	***-30%***	***$27,591,200***
	50%	***$59,124,000***

consor

Probable Cost of Construction
CIP S.5

Project: Long-Term Supply Study
Location n/a
Date: December 1, 2022

ENR, CCI - Seattle, WA:

For the purposes of future updating, all cost estimates are in November 2022 dollars

15,202.68

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	Long-Term Water Supply Study	1	LS	$200,000	$200,000
			SubTotal:		**$200,000**
	Contingency:	20%			$40,000
Total Estimated Project Cost:					***$240,000***
Cost Range		***-30%***			***$168,000***
		50%			***$360,000***

consor

Probable Cost of Construction
CIP M.1

Project: Water System Master Plan Update
Location n/a
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	Water System Master Plan Update	1	LS	$200,000	$200,000
			SubTotal:		**$200,000**
	Contingency:	10%			$20,000
Total Estimated Project Cost:					***$220,000***
Cost Range		***-30%***			***$154,000***
		50%			***$330,000***

consor

Probable Cost of Construction
CIP M.2

Project: Water Management and Conservation Plan
Location n/a
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	Water Conservation Management Plan	1	LS	$100,000	$100,000
			SubTotal:		**$100,000**
		Contingency:	10%		$10,000
Total Estimated Project Cost:					***$110,000***
Cost Range		***-30%***			***$77,000***
		50%			***$165,000***

Probable Cost of Construction
CIP M.3

Project: Annual Replacement Budget
Location Distribution System
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	8-inch diameter (average)	4740	LF	$270	$1,280,000
			SubTotal:		**$1,280,000**
	Material & Labor Total:				**$1,280,000**
	Bonds and Insurance	2%			$25,600
	Mobilization:	10%			$128,000
Subtotal					**$1,440,000**
	Oregon Corporate Activity Tax	1.0%			$14,400
	Subtotal:				**$1,454,400**
	Contingency:	30%			$437,000
	Engineering	20%			$291,000
	Permitting and Admin	5%			$73,000
	Construction Contract Administration	10%			$146,000
Total Estimated Project Cost:					***$2,400,000***
Cost Range		***-30%***			***$1,680,000***
		50%			***$3,600,000***

consor

Probable Cost of Construction
CIP M.4

Project: Water Service Meter Replacement
Location n/a
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	Water Service Meter Replacement	3000	EA	$2,400	$7,200,000
			SubTotal:		**$7,200,000**
	Contingency:	10%			$720,000
Total Estimated Project Cost:					***$7,920,000***
Cost Range		***-30%***			***$5,544,000***
		50%			***$11,880,000***

consor

Probable Cost of Construction
CIP M.5

Project: SCADA Master Plan
Location n/a
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	SCADA Master Plan	1	LS	$125,000	$125,000
			SubTotal:		**$125,000**
		Contingency:	10%		$20,000
Total Estimated Project Cost:					***$150,000***
Cost Range		***-30%***			***$105,000***
		50%			***$225,000***

consor

Probable Cost of Construction
CIP M.6

Project: SCADA Upgrades (Preliminary Budget Placeholder)
Location n/a
Date: December 1, 2022

ENR, CCI - Seattle, WA:
15,202.68

For the purposes of future updating, all cost estimates are in November 2022 dollars

Item No.	Item	Quantity		Unit Costs	Total Cost
Facilities					
A1	SCADA Upgrades (Preliminary Budget Placeholder)	1	LS	$450,000	$450,000
			SubTotal:		**$450,000**
	Contingency:	30%			$140,000
	Engineering	20%			$90,000
	Permitting and Admin	5%			$30,000
	Construction Contract Administration	10%			$50,000
Total Estimated Project Cost:					***$760,000***
Cost Range		***-30%***			***$532,000***
		50%			***$1,140,000***

EXHIBIT B

Final

Water Management and Conservation Plan

Prepared for

City of Sandy, Oregon

June 2016

Prepared by

GSI Water Solutions, Inc.
1600 SW Western Blvd., Suite 240 Corvallis, OR 97333
P: 541.753.0745 F: 541.754.4211
info@gsiws.com www.gsiws.com

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Oregon
Kate Brown, Governor

Water Resources Department
North Mall Office Building
725 Summer St NE, Suite A
Salem, OR 97301
Phone (503) 986-0900
Fax (503) 986-0904
www.wrd.state.or.us

June 3, 2016

City of Sandy
Attn: Mike Walker, Public Works Director
39250 Pioneer Blvd.
Sandy, OR 97055

Subject: Water Management and Conservation Plan

Dear Mr. Walker:

Enclosed, please find the final order approving your water management and conservation plan, and specifying that no diversion of water is authorized at this time under Permit S-48451.

The attached final order specifies that the City of Sandy's plan shall remain in effect until **June 2, 2026**. Additionally, the City of Sandy is required to submit a progress report to the Department by **June 2, 2021**, detailing progress made toward the implementation of conservation benchmarks scheduled in the plan. Finally, the City of Sandy must submit an updated Water Management and Conservation Plan to the Department by **November 30, 2025.**

NOTE: *The deadline established in the attached final order for submittal of an updated Water Management and Conservation Plan (consistent with OAR Chapter 690, Division 086) shall not relieve the City of Sandy from any existing or future requirement(s) for submittal of a water management and conservation plan at an earlier date as established through other final orders of the Department.*

We appreciate your cooperation in this effort. Please do not hesitate to contact me at 503-986-0919 or *Kerri.H.Cope@wrd.state.or.us* if you have any questions.

Sincerely,

Kerri H. Cope

Kerri H. Cope
Water Management and Conservation Analyst
Water Right Services Division

Enclosure

cc: WMCP File
Application # S-65051 (Permit # S-48451)
Watermaster # 20 Amy Kim
GSI Water Solutions, Inc., Attn: Adam Sussman, 1600 Western Blvd., Suite 240, Corvallis, OR 97333

BEFORE THE WATER RESOURCES DEPARTMENT
OF THE
STATE OF OREGON

In the Matter of the Proposed Water Management and Conservation Plan for the City of Sandy, Clackamas County	)))	FINAL ORDER APPROVING A WATER MANAGEMENT AND CONSERVATION PLAN

Authority

OAR Chapter 690, Division 086, establishes the process and criteria for approving water management and conservation plans required under the conditions of permits, permit extensions and other orders of the Department.

Findings of Fact

1. The City of Sandy submitted a Water Management and Conservation Plan (plan) to the Water Resources Department (Department) on January 28, 2016. The plan was submitted to comply with conditions set forth under the City's previously approved plan (Sp. Or. Vol. 73, Pg. 376 issued on September 27, 2007, and a condition set forth in the final order issued on November 16, 2012 approving an Extension of Time for Permit S-48451.

2. The Department published notice of receipt of the plan on February 2, 2016, as required under OAR Chapter 690, Division 086. No comments were received.

3. The Department provided written comments on the plan to the City on April 7, 2016. In response, the City submitted a revised plan on May 16, 2016.

4. The Department reviewed the revised plan and finds that it is consistent with the relevant requirements under OAR Chapter 690, Division 086.

Conclusion of Law

The Water Management and Conservation Plan submitted by the City of Sandy, is consistent with the criteria in OAR Chapter 690, Division 086.

Now, therefore, it is ORDERED:

Duration of Plan Approval:

1. The City of Sandy Water Management and Conservation Plan is approved and shall remain in effect until June 2, 2026, unless this approval is rescinded pursuant to OAR 690-086-0920.

This is a final order in other than a contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60-day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080, you may petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the Director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied.

Development Limitation:

2. The limitation of the diversion of water under Permit S-48451 established in the Final Order approving an Extension of Time for Permit S-48451 *(issued on November 16, 2012)* remains unchanged. Subject to other limitations or conditions of the permit, therefore, the City of Sandy is not authorized to divert any water under Permit S-48451 at this time.

Plan Update Schedule:

3. The City of Sandy shall submit an updated plan meeting the requirements of OAR Chapter 690, Division 086 within ten years and no later than November 30, 2025.

Progress Report Schedule:

4. The City of Sandy shall submit a progress report containing the information required under OAR 690-086-0120(4) by June 2, 2021.

Other Requirements for Plan Submittal:

5. The deadline established herein for the submittal of an updated Water Management and Conservation Plan (consistent with OAR Chapter 690, Division 086) shall not relieve the City of Sandy from any existing or future requirement(s) for submittal of a Water Management and Conservation Plan at an earlier date as established through other final orders of the Department.

Dated at Salem, Oregon this 1 day of June, 2016.

Dwight French
Water Right Services Division Administrator, for
Thomas M. Byler, Director
Oregon Water Resources Department

Mailing date: JUN 07 2016

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Appendices

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Executive Summary

The City of Sandy (City), the eastern-most city in Clackamas County, serves as a gateway to Mt. Hood. The City is surrounded by scenic rivers and wilderness areas appreciated by both residents and tourists. This proximity to precious natural resources continuously reminds the City of the importance of environmental sustainability. As a result, the City views management and conservation of its water resources as a key priority. With this in mind, the City has developed this updated Water Management and Conservation Plan (WMCP, or Plan), to guide development and implementation of water management and conservation programs promoting sustainable water use. This updated WMCP meets the requirements of three final orders issued by the Oregon Water Resources Department (OWRD). The final order approving the City's first WMCP (issued on September 27, 2007) included the requirement that the City submit an "updated" WMCP within 10 years and no later than January 31, 2016. The final order approving an extension of time for the City's water use Permit S-48451 for use of water from the Salmon River (issued on November 16, 2012) included the requirement that the City submit a WMCP by November 16, 2015. (This date was later extended by OWRD to January 29, 2016.)

This WMCP describes the City's water supply, water management and conservation programs, water curtailment plan, and water supply projections and plans.

Municipal Water Supplier Description

Currently, the City's water supply comes from three sources: Alder Creek (a tributary of the Sandy River), Brownell Springs, (a tributary of Beaver Creek), and the City of Portland's Portland Water Bureau (PWB), which provides the City water from its Bull Run surface water supply. The water rights that the City holds for these sources are as follows:

- **Brownell Springs**: Certificate 5427 for the use of up to 0.2 cubic feet per second cubic feet per second (cfs), Certificate 26132 for the use of up to 0.7 cfs, and Certificate 91156 for the use of up to 0.3 cfs from Brownell Springs.
- **Alder Creek**: Certificate, 91176, approved on January 28, 2016, for the use of up to 3.0 cfs.
- **Alder Creek:** Permit S-36601 for the use of up to 1.0 cfs (pending extension of time).
- **Salmon River**: Permit S-48451 for the use of up to 25.0 cfs from the Salmon River.

The City's 2014 estimated service population is 10,387, which includes the estimated population of 10,170 inside the City and the estimated population of 217 served through 81 connections outside city limits.

From 2006 through 2014, the City's annual demand averaged 395.8 million gallons (MG). Average day demand (ADD) averaged 1.08 million gallons per day (mgd) during the same period and the highest maximum day demand (MDD) was 1.24 mgd, which occurred in 2006. For this WMCP, demand refers to the quantity of water delivered to the City's water distribution system. This includes the Alder Creek water pumped to the Terra Fern Reservoir from the Alder Creek Water Treatment Plant (WTP), the water diverted from Brownell Springs that is chlorinated then blended with the Terra Fern Reservoir water, and

wholesale water from the PWB. Annual demand decreased by nearly 100 MG from 2006 to 2014, which the City attributes to reduced irrigation as a result of in-filling in the City's single-family and low-density zones, implementation of higher water rates, the City's water conservation efforts, and to a lesser degree, the economic downturn. The City's ADD also showed a decreasing trend during that time period and the City's MDD dropped markedly in 2013 and 2014, possibly reflecting milder summer weather during those years.

The City has four customer categories: single family residential, multi-family residential, commercial/industrial, and wholesale. The City's wholesale customers are Alder Creek Barlow Water District (District) and Skyview Acres Water Company (Skyview). In 2014, residential water use represented 65 percent of total consumption, while commercial/industrial water use represented 22 percent, multi-family residential water use represented 11 percent, and wholesale water use represented 2 percent.

Consumption refers to the portion of water use that is metered. The City's total annual consumption fluctuated between 287.1 MG and 322.6 MG during the period from 2006 through 2014. Metered consumption did not follow a decreasing trend similar to demand, which likely reflects improvements in customer meter accuracy. The City believes that customer meters were reading low, so that more of the water produced was actually recorded as consumed following meter replacement.

The City's unaccounted-for water was 11.5 percent in 2014 and averaged 22.3 from 2006 through 2014, both substantial reductions in unaccounted-for water compared to the period 1999 through 2005. For the purposes of this WMCP, unaccounted-for water is the difference between demand and metered water consumption. The City attributes its reduction of unaccounted-for water in recent years to a meter replacement efforts and installation of meters at previously unmetered connections, and water demand and consumption accounting improvements.

Section 2 provides more details about the City's water supply, water use, water rights, and water system.

Water Conservation

Highlights of the City's recent water management and conservation efforts include:

- The City implemented a fixed-based radio Automatic Meter Reading (AMR) metering system for all new service connections in December 2011.
- The City gives all new homeowners a welcome packet containing information on indoor and outdoor conservation measures.
- The City distributes indoor and outdoor water conservation kits at the City's Earth Day event, a rotating neighborhood-specific event in the fall, and at additional neighborhood fairs/block parties upon request.
- The City joined in the EPA "Water Sense" program in 2012 and participated in the WaterSense "Fix a Leak Week" in 2013.
- The City partnered with Iseli Nursery in August 2012 to implement a water reuse project at the nursery.

OWRD requires that all water suppliers establish five-year benchmarks for initiating or expanding water management and conservation measures associated with required conservation programs. **Exhibit ES-1** lists the five-year benchmarks associated with the required conservation programs.

Exhibit ES-1. Five-Year Water Conservation Benchmarks.

Conservation Program	Five-year Benchmarks
Annual Water Audit	• The City will continue to conduct an annual water audit. • In the next two years, the City will investigate its billing software for potential sources of accounting errors.
System-wide Metering	• The City will continue to install AMR meters on all new connections. • In the next five years, the City will complete a cost-benefit analysis of replacing all non-AMR meters with AMR meters and will decide how to proceed with meter replacement.
Meter Testing and Maintenance	• The City will continue its meter testing and maintenance program. In the next five years, the City will begin to track the number of meters that it replaces at existing connections. • In the next five years, the City will complete a cost-benefit analysis of replacing all non-AMR meters with AMR meters and will decide how to proceed with meter replacement.
Water Rate Structure and Billing Practices that Encourage Conservation	• The City will continue to bill customers based on the quantity of water metered at the service connection. • The City will continue to bill its customers monthly and to periodically include water conservation messages in utility bills.
Leak Detection	• The City will continue to conduct its leak detection and repair program.
Public Education	• The City will continue to be a member of the Regional Water Providers Consortium. • The City will continue to promote water conservation at the City's Earth Day event and neighborhood events.

Exhibit ES-1. Five-Year Water Conservation Benchmarks Continued.

Conservation Program	Five-year Benchmarks
Technical and Financial Assistance	• In the next five years, the City will explore ways to increase interest in the xeriscaping outreach program materials.
Supplier Financed Retrofit or Replacement of Inefficient Fixtures	• The City will continue to make water conservation kits available at no charge to any customer requesting one.
Water Reuse, Recycling, and Non-potable Opportunities	• The City will continue to make downspout rain barrels available to water customers to reduce demand for finished water for residential irrigation. • The City will continue the water reuse project with Iseli Nursery. • In the next five years, the City will explore additional water reuse, recycling, and non-potable water opportunities.

Section 3 contains more details about the City's water management and conservation programs.

Water Curtailment

Water curtailment plans outline proactive measures that water suppliers may take during short-term water supply shortages. The City has adopted a four-stage water curtailment plan that it will implement in the event of a water supply shortage that requires water curtailment. The four stages of curtailment increase in severity and are intended to be implemented in progressive steps. The curtailment stages include both voluntary and mandatory limitations. The potential initiating conditions (i.e. triggers) for the City's curtailment stages focus on supply capacity, but also include such conditions as drought, failure of a major system component, and source water contamination.

The curtailment plan identifies voluntary or mandatory actions under each stage of water curtailment, including:

- **Stage 1: Water Supply Shortage Warning**
  The City may request that its customers take the following voluntary actions:
  - Limit landscape watering between the hours of 10:00 am and 6:00 pm.
  - Comply with an alternate days system for landscape watering.
  - Implement other conservation measures, such as those suggested by the RWPC website and the RWPC brochures, *H20utdoor* and *H20 indoor.*

- **Stage 2: Moderate Water Supply Shortage**
  The City may impose such mandatory water restrictions as:
  - Watering landscapes prohibited between 10:00 am and 6:00 pm.
  - No water use to wash sidewalks, walkways, driveways, parking lots, tennis court, and other hard-surfaced outdoor areas.

  - No water use for fountains or ponds for aesthetic or scenic purposes, except where necessary to support fish life.

- **Stage 3: Severe Water Supply Shortage**

  The City may impose such additional mandatory water restrictions as:
  - Prohibition on all outdoor watering (with a few exceptions)
  - No water use from hydrants for construction purposes (except on a case-by case basis), firefighting exercises, or any purpose other than firefighting.
  - Implement limitations on commercial uses of water as determined appropriate by the city manager.
- **Stage 4: Critical Water Supply Shortage**

  The City may impose the following additional mandatory water restrictions:
  - Limit residential water use to essential uses only, such as drinking, cooking, basic sanitation, and maintaining human health.
  - Prohibit all non-essential water uses by commercial/industrial customers

The City will issue a notice to customers describing the current water situation, the reason for the voluntary or mandatory conservation measures, and the RWPC website (www.conserveh2o.org), which contains conservation information and tips. The City may issue a similar notice through local media (newspaper, radio, or TV).

Section 4 further describes the initiating conditions and response actions for each curtailment stage.

Water Supply

WMCPs must provide 10-year and 20-year population and water demand projections. The City's projected population for its future water service area, which includes its current UGB and Urban Reserve Area, is 13,123 in 2025 and 16,769 in 2035. These population projections were prepared by Portland State University's Population Research Center (PRC) in October 2014 based on Metro's Buildable Land Inventory (BLI), household forecasts for areas called transportation analysis zones (TAZs) adopted by the Metro Council in 2012, data from the PRC, and data from the US Census Bureau.

To estimate the City's future water demands, the City's average annual water demand from 2006 through 2014 (395.8 MG) was apportioned among the City's customer categories based on the percentage of water that each customer category consumed in 2014. Average annual water demand for each customer category was divided by 365 days to calculate ADD per customer category.

The City then projected future Residential ADDs using an annual residential growth rate of 2.12 percent applied to the average Residential (single family + multi-family) ADD of 0.82 mgd, developed as described above. The projected future Commercial/Industrial ADD was estimated using the annual employment growth rate of 4.0 percent applied to the average Commercial/Industrial ADD of 0.24 mgd. Finally, the projected Wholesale ADD was developed assuming no growth (no additional wholesale customers and no increase from any population growth in the District and Skyview), resulting in the average Wholesale demand of 0.02 mgd continuing through 2035.

The City summed the projected Residential, Commercial/Industrial, and Wholesale ADDs for each year through 2035 then applied the maximum peaking factor (MDD:ADD) from 2006-2014 of 2.3 to obtain the projected MDD for each year through 2035.

Finally, the City determined the standard deviation of the MDDs from 2006 through 2014, which was 0.3 mgd (0.46 cfs), and added the 0.3 mgd "weather allowance" to the MDD projections to account for the potential effects of weather variations on MDD.

Exhibit ES-2 presents the City's MDD projections with and without the weather allowance. The City's projected MDDs with the weather allowance are 3.6 mgd (5.5 cfs) in 2025 and 4.5 mgd (7.0 cfs) in 2035.

Exhibit ES-2. Projected Maximum Day Demand (MDD) With and Without a Weather Allowance.

Year	MDD		MDD with Weather Allowance (mgd)	MDD with Weather Allowance (cfs)
	(mgd)	(cfs)		
2025	3.3	5.1	3.6	5.5
2035	4.2	6.6	4.5	7.0

The City presently relies principally on its Alder Creek and Brownell Springs water supply, and PWB water is a supplemental water supply. To meet its future demands, the City intends to fully utilize its Alder Creek and Brownell Springs water rights in order to minimize its reliance on the water it purchases from the PWB, which is particularly important in the event of a disruption in the PWB water supply.

The City's analysis of the water supply reliability of its sources indicates that the City can reliably use 4.0 cfs from Alder Creek and 0.2 cfs from Brownell Springs plus 0.77 cfs from the PWB for a total reliable water supply of 4.97 cfs (3.21 mgd). The City's projected MDD with a weather allowance shows that in less than 10 years (by 2021) the City will need the entire reliable supply of 4.97 cfs.

In the coming years, the City will evaluate the best approach to meet its projected water demands through at least 2035. The City is considering three options:

1) Begin to develop the City's Salmon River water supply,
2) Purchase additional wholesale water from the PWB, or
3) Pursue a combination of options 1 and 2.

Section 5 describes the City's future service area, population and demand projections, and water supply strategies in further detail.

SECTION 1

Municipal Water Supplier Plan

This section satisfies the requirements of OAR 690-086-0125.

This rule requires a list of affected local governments to whom the plan was made available, and a proposed date for submittal of an updated plan.

Introduction

The City of Sandy (City), once the site of a trading post on the Oregon Trail, is a growing community in the western foothills of Mt. Hood. The City recognizes the importance of properly managing the natural resources that its community members depend on, and as a result, has been implementing numerous water management and conservation measures.

The purpose of this Water Management and Conservation Plan (WMCP) is to guide development and implementation of water management and conservation programs that promote sustainable water use and to consider the City's future water needs. This WMCP is intended to be a working document that will aid future water planning.

Plan Requirement

This WMCP is an update of the City's first WMCP, which the Oregon Water Resources Department (OWRD) approved in a Final Order issued on September 27, 2007. The WMCP Final Order included the requirement that the City submit an "updated" WMCP within 10 years and no later than January 31, 2016. The Final Order also required a WMCP Progress Report by January 31, 2011, which was submitted and acknowledged by OWRD.

On November 16, 2012, OWRD issued a Final Order approving an extension of time on the City's water right Permit S-48451 for use of water from the Salmon River. The extension of time Final Order included the requirement that the City submit a WMCP by November 16, 2015. This date was later extended by OWRD to January 29, 2016.

The City is submitting this updated WMCP to meet the requirements of both of the Final Orders described above. This WMCP meets all of the requirements of the Oregon Administrative Rules (OAR) adopted by the Water Resources Commission in November 2002 (OAR Chapter 690, Division 86) regarding WMCPs.

Plan Organization

The WMCP is organized into the following sections, each addressing specific sections of OAR Chapter 690, Division 86. Section 2 is a self-evaluation of the City's water supply, water use, water rights, and water system. The information developed for Section 2 is the foundation for the sections that follow. The later sections use this information to consider how the City can improve its water conservation and water supply planning efforts. The WMCP also includes appendices with supporting information.

Section	*Requirement*
Section 1 – Water Supplier Plan	*OAR 690-086-0125*
Section 2 – Water Supplier Description	*OAR 690-086-0140*
Section 3 – Water Management and Conservation	*OAR 690-086-0150*
Section 4 – Water Curtailment Plan	*OAR 690-086-0160*
Section 5 – Water Supply	*OAR 690-086-0170*

The City has relied on information from the following sources in preparing this plan:

- City of Sandy 2007 WMCP [Approved September 27, 2007]
- City of Sandy Public Works staff
- Portland State University Population Research Center
- Oregon Water Resources Department (OWRD)

Affected Governments
OAR 690-086-0125(5)

The following local governments may be affected by this WMCP:

- City of Sandy
- Clackamas County

Thirty days before submitting this WMCP to OWRD, the City made the draft WMCP available for review by each affected local government listed above along with a request for comments relating to consistency with the local government's comprehensive land use plan. The letters requesting comment are in **Appendix A.** No comments were received.

In addition, the City provided Alder Creek Barlow Water District and Skyview Acres Water Company with a copy of the plan as a courtesy.

Plan Update Schedule
OAR 690-086-0125(6)

The City anticipates submitting an update of this WMCP within 10 years of the final order approving this WMCP, or upon the approval of the pending permit extension application for Permit S-36601 As required by OAR Chapter 690, Division 86, and a progress report will be submitted within 5 years of the final order.

Time Extension
OAR 690-086-0125(7)

The City is not requesting additional time to implement metering or a previous benchmark.

SECTION 2

Water Supplier Description

This section satisfies the requirements of OAR 690-086-0140.

This rule requires descriptions of the City's water sources, water delivery area and population, water rights, and adequacy and reliability of the existing water supply. The rule also requires descriptions of the City's customers and their water use, the water system, interconnections with other water suppliers, and quantification of system leakage.

Water Sources

OAR 690-086-0140(1)

The City's water supply currently comes from three sources: Alder Creek (a tributary of the Sandy River), Brownell Springs, (a tributary of Beaver Creek), and the City of Portland's Portland Water Bureau (PWB), which provides the City water from its Bull Run surface water supply.

The Alder Creek diversion is approximately 7 miles east of the City. The City has a raw water intake located along the creek, approximately one mile upstream from its confluence with the Sandy River.

Brownell Springs consists of a group of eight natural springs approximately 6 miles southeast of the City, on the north slope of Lenhart Butte. Brownell Springs is located at the headwaters of Beaver Creek, a tributary of Cedar Creek, which flows into the Sandy River.

The City also purchases wholesale water from the PWB as a supplemental water supply and to provide water supply redundancy in the event of an emergency.

Finally, the City also holds a permit for use of water from the Salmon River, but does not currently use that water source.

Interconnections with Other Systems

OAR 690-086-0140(7)

The City has a new interconnection with the PWB, which was placed into service in April 2014. PWB water supplements the City's Brownell Springs and Alder Creek sources, reduces the City's reliance on the single transmission line along Hwy 26 for its entire water supply, and provides redundancy in case of emergencies. The City does not have the ability to convey water back to the PWB through this interconnection.

The City serves wholesale water to the Alder Creek Barlow Water District (District), which is Public Water System Identification (PWS ID) Number 4100630. The City is the District's only water supply source. The District has no ability to supply water to the City. The two systems are connected through a 4-inch main at one location.

In 2014, the City began serving wholesale water to Skyview Acres Water Company (Skyview), which is PWS ID Number 4100786. The City is Skyview's primary water supply source and the PWB is an emergency water supply source. Skyview has no ability to supply water to the City.

Intergovernmental Agreements

OAR 690-086-0140(1)

The City has a wholesale water supply agreement with the City of Portland. The term of the agreement is from November 2008 until June 30, 2028. The agreement allows the City to obtain a minimum of 0.5 million gallons per day (mgd) and up to a maximum of 3 mgd from the City of Portland's Bull Run source. The City is required to pay for at least 0.5 mgd regardless of the amount used. If the average of the 3 highest usage days in any calendar year exceeds the minimum purchase amount (0.5 mgd), then that 3-day average becomes the new minimum purchase amount for subsequent years. The City of Portland is responsible for maintaining and calibrating the master meter at the water system connection and includes the cost of maintenance in the established water rate. The agreement requires the City to submit a Water Conservation Plan to the City of Portland every 5 years that describes the City's water management and conservation programs. WMCPs approved by OWRD meet this agreement requirement. If the City of Portland declares a water shortage, the City is required to implement curtailment measures that meet the requirements of the mutually agreed-upon curtailment plan.

The City has had a water supply agreement with Alder Creek Barlow Water District since 1984. The agreement requires a 6-month notification period before a change to the agreement is implemented, and as of 2004, the agreement automatically renews every two years unless either party wishes to terminate the agreement. The agreement does not specify a maximum amount of water that the City will supply. The District is responsible for operating and maintaining its water system to minimize water "losses, leakage, and overuse" of water. The City agreed to test and calibrate the master meter biannually and the District agreed to pay the associated costs. The agreement also discusses how water will be curtailed in times of water shortage.

The City also has a water supply agreement with Skyview that became effective July 1, 2014 and will remain in effect until June 30, 2034. The agreement will then be renewed every 5-years unless either party terminates the agreement. The agreement states that the City will initially supply a maximum demand of 60,000 gallons per day and a maximum flow rate of 200 gallons per minute, and the City may revise the maximum day demand and maximum flow rate in the future. The City will pay costs associated with bi-annual testing and calibration of the master meter. Skyview and its water users are subject to the water use regulations, water conservation practices, and curtailment measures applicable to the City's other wholesale and retail customers under its WMCP, Section 13.0 4.220 of the Sandy Municipal Code, and/or its water purchase agreement with the City of Portland. Skyview is responsible for operating and maintaining its water distribution system in a manner that minimizes water "losses, leakage, and overuse" of water.

Service Area Description and Population

OAR 690-086-0140(2)

The City's 2014 estimated population is 10,387, which was calculated by adding the City's population (10,170) to the estimated number of people served outside the City limits (217). The City's 2014 estimated population was obtained from Portland State University's Population Research Center. The population served outside the City limits was estimated by multiplying the number of residential connections outside the city limits in 2014 (81), according to City records, by the City's estimated persons per household (2.68), according to the US Census 2010.

Exhibit 2-1 shows the City's current service area, which consists of the area within city limits plus the approximately 81 residential connections served outside of city limits, primarily east of the city limits along Highway 26.

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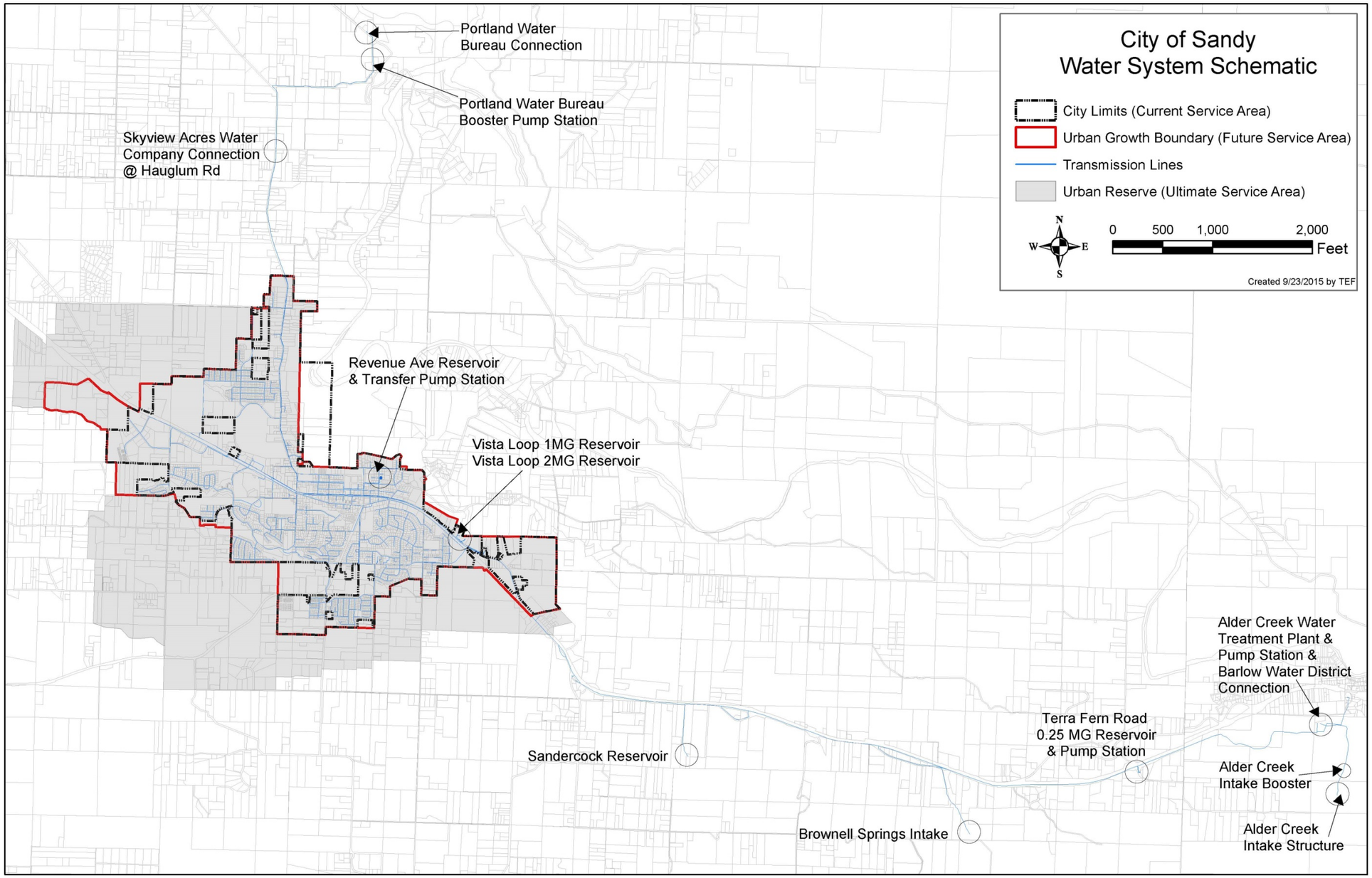
Exhibit 2-1. Service Area Map and System Schematic.



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Records of Water Use

OAR 690-086-0140(4) and (9)

Terminology

For this WMCP, demand refers to the quantity of finished water delivered to the City's water distribution system. This includes the Alder Creek water pumped to the Terra Fern Reservoir from the Alder Creek Water Treatment Plant (WTP), the water diverted from Brownell Springs that is chlorinated then blended with the Terra Fern Reservoir water, and wholesale water from the PWB. The finished water is used through metered consumption, unmetered uses, and water lost to leakage. For the purposes of this WMCP, the terms demand and production are synonymous. Consumption refers to the portion of water use that is metered.

Generally, demand and consumption in municipal systems are expressed in units of million gallons per day (mgd). They may also be expressed in cubic feet per second (cfs) or gallons per minute (gpm). One mgd is equivalent to 1.55 cfs or 694 gpm. For annual or monthly values, a quantity of water is typically reported in million gallons (MG).

This WMCP uses the following terms to describe specific values of system demands:

- Average day demand (ADD) equals the total annual system input (demand) divided by the number of days in the year (typically 365 days).
- Maximum day demand (MDD) equals the highest system demand that occurs on any single day during a calendar year.
- Maximum monthly demand (MMD) in MG equals the highest total monthly demand of the 12 months of a calendar year. MMD in mgd equals the average day demand of the month with the highest total demand within a calendar year.
- Peaking factors are the ratios of one demand value to another. The most common and important peaking factor is the ratio of the MDD to the ADD.

Historical Water Demands

Annual and Daily Demands

The City's water demands from 2006 through 2014 are summarized in **Exhibit 2-2**.

Exhibit 2-2. Historical Annual Water Demand, Average Day Demand (ADD), Maximum Day Demand (MDD), Peaking Factor, and Maximum Month Demand (MMD), 2006-2014.

Year	Annual Demand (MG)	ADD (mgd)	MDD (mgd)	MDD: ADD Peaking Factor	MMD (MG)	MMD (mgd)
2006	450.8	1.24	2.20	1.8	55.7	1.80
2007	428.1	1.17	2.36	2.0	50.7	1.63
2008	403.5	1.10	2.41	2.2	53.2	1.72
2009	383.5	1.05	2.46	2.3	53.6	1.73
2010	404.3	1.11	2.19	2.0	51.9	1.68
2011	378.4	1.04	2.17	2.1	47.4	1.53
2012	391.7	1.07	2.19	2.0	51.5	1.66
2013[1]	365.7	1.00	1.69	1.7	47.9	1.54
2014	356.0	0.98	1.72	1.8	49.6	1.60
Average	395.8	1.08	2.15	2.0	51.3	1.65
Maximum	450.8	1.24	2.46	2.3	55.7	1.80

[1] Brownell Springs demand data was lost for June and July 2013. Average demands for June and July from 2006 through 2012 and 2014 were used to estimate demands during those months in 2013.

Annual demand decreased by nearly 100 MG from 2006 to 2014, as shown in **Exhibit 2-2** and **Exhibit 2-3**. The City attributes this decreasing trend to in-filling in the City's single-family and low-density zones, implementation of higher water rates, the City's water conservation efforts, and to a lesser degree, the economic downturn. **Exhibit 2-2** and **Exhibit 2-4** show that ADD also had a decreasing trend during that time period, decreasing from a high of 1.24 mgd in 2006 to 0.98 mgd in 2014. The City's MDD dropped markedly in 2013 and 2014, which could reflect milder summer weather during those years.

Exhibit 2-3. Annual Demand, 2006-2014.

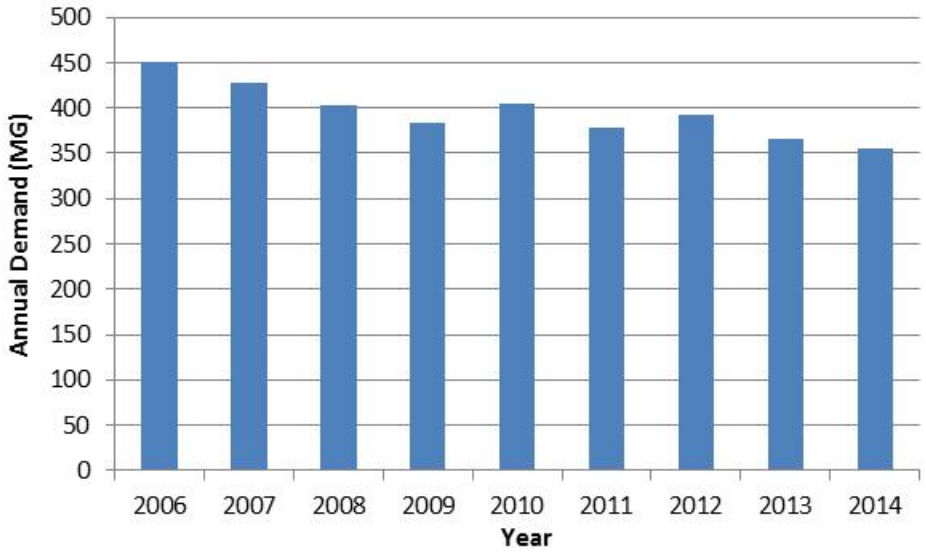
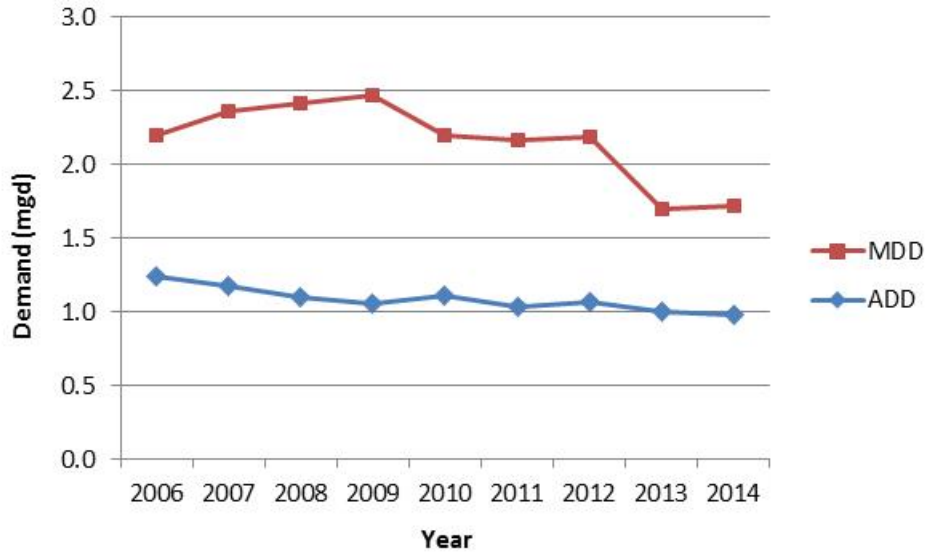


Exhibit 2-4. Average Day Demand (ADD) and Maximum Day Demand (MDD), 2006-2014.



For the purposes of this WMCP, MDD from 2006 through 2013 was calculated by adding the MDD at the Alder Creek WTP to the ADD at Brownell Springs for the month when the MDD at the Alder Creek WTP occurred (Demand at Brownell Springs is only recorded monthly due to the City's relatively consistent daily water diversions). MDD in 2014 was calculated using the same methodology, but also adding the PWB demand on the same day as the MDD at the Alder Creek WTP.

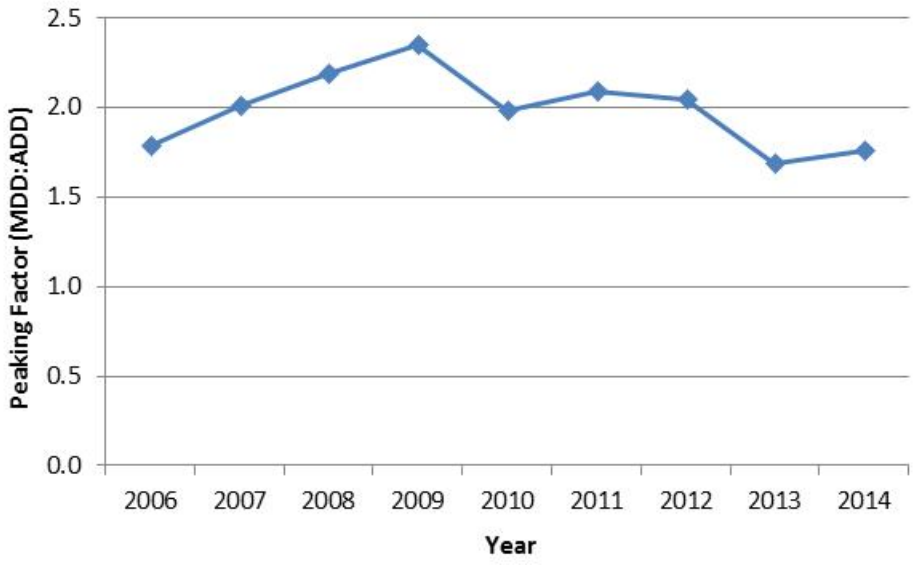
MDD is an important value for water system planning. Water rights and supply facilities (e.g. treatment plants, pipelines, and reservoirs) must be capable of meeting a city's MDD. If the MDD exceeds the combined supply capacity on any given day, finished water storage levels will be reduced, and if the MDD exceeds combined supply capacity on several consecutive days, a water shortage may occur.

Weather patterns and the economy strongly influence MDD. Weather patterns that can cause fluctuations in MDD from year to year include: maximum temperatures, the number of consecutive days with high temperatures, when high temperatures occur in the summer, overall rainfall levels during the summer, and consecutive days without rainfall. Unusually hot and/or dry weather results in more outdoor irrigation, which increases the MDD. The economy can affect MDD by influencing: customer spending on irrigation, the number of new homes with landscapes needing intense irrigation for plant establishment, and the opening or closing of facilities that use water in their operations.

Peaking Factors

From 2006 through 2014, the City's MDD to ADD peaking factor averaged 2.0. This peaking factor is within the range of other water utilities in the Portland area, such as the City of Lake Oswego (averaged 2.3 from 2001 to 2008; *City of Lake Oswego July 2010 WMCP*) and the City of Gresham and Rockwood Water People's Utility District, which averaged 1.8 and 1.6 from 2000 to 2006, respectively (*Rockwood Water People's Utility District and City of Gresham 2013 WMCP*). A peaking factor can be an important tool used in demand forecasting and in developing targeted water conservation measures.

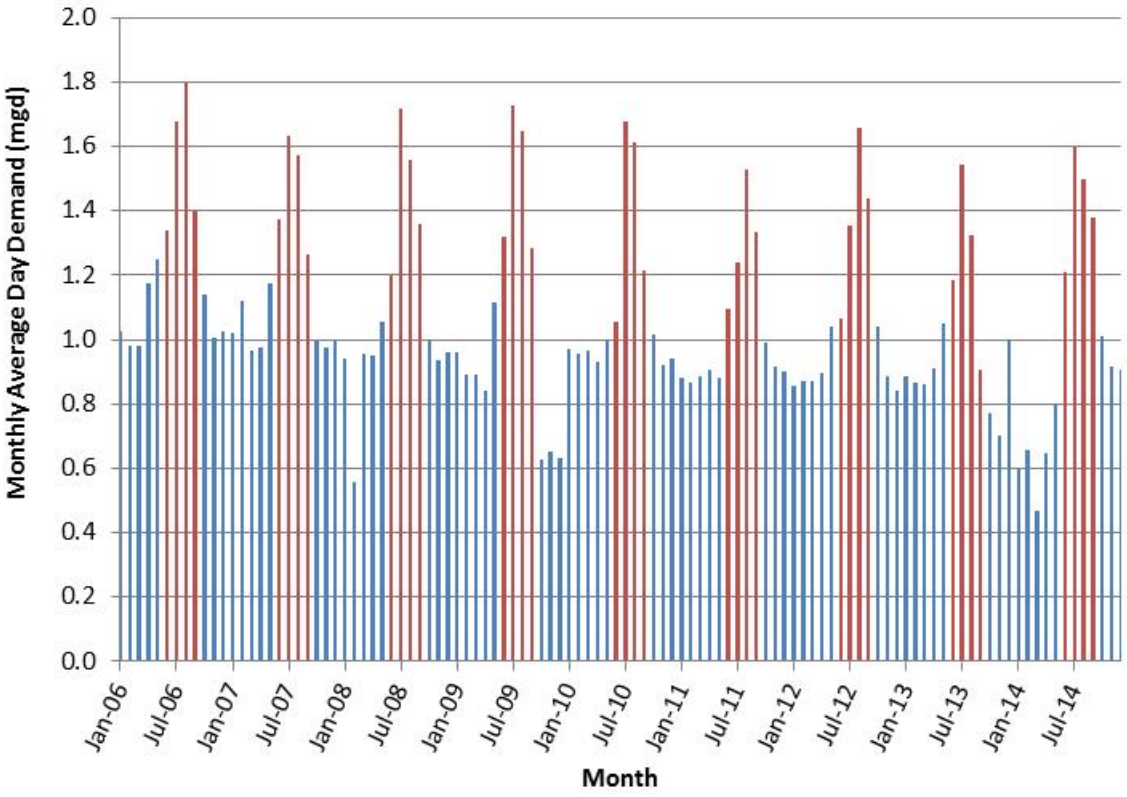
Exhibit 2-5. Peaking Factors (MDD: ADD), 2006-2014.



Monthly Demand

The City's average maximum month demand (MMD) volume from 2006 through 2014 was 51.3 MG. During those maximum-demand months, the City's ADD averaged 1.65 mgd. **Exhibit 2-6** shows monthly ADD, with the peak season months of June through September in red. The highest monthly ADD of 1.80 mgd occurred in July 2006, and the months with the greatest ADD were consistently July and August.

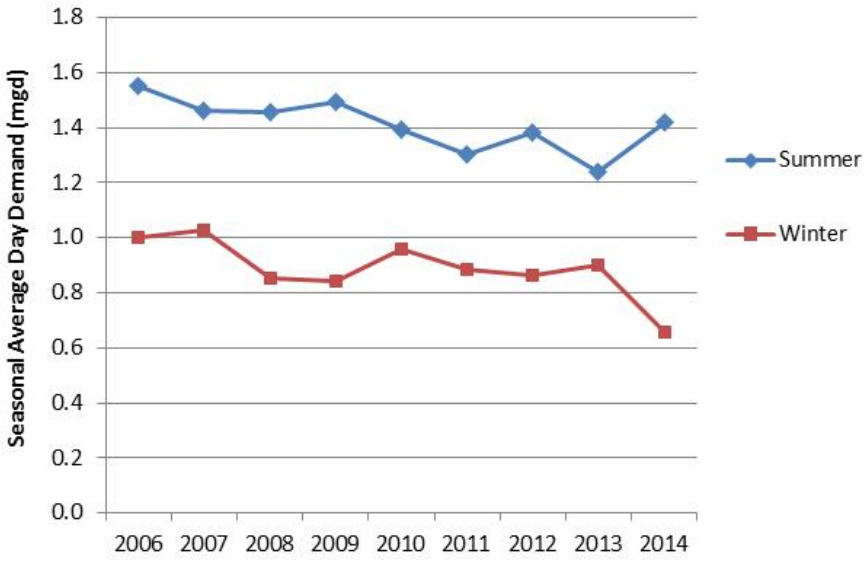
Exhibit 2-6. Monthly Average Day Demand, 2006-2014. Red indicates peak season months (June through September) while blue indicates non-peak season months.



Seasonal Demand

Exhibit 2-7 shows that from 2006 through 2014, Summer (June through September) ADD ranged from 1.30 mgd to 1.55 mgd (the data point of 1.24 mgd in 2013 has been disregarded for this analysis due to the missing Brownell Springs summertime data in this year) and Winter (December through March) ADD ranged from 0.66 mgd to 1.03 mgd. During this period, the average of the City's ADD in the summer was 1.6 times greater than the average of the City's ADD in winter. The difference between seasons is largely attributable to water demand for irrigation during the summer months.

Exhibit 2-7. Historical Seasonal Average Day Demand, 2014. Summer = June to September. Winter = December to March.



Authorized Consumption

Authorized consumption is equal to the metered and certain unmetered water uses within the system.

Customer Characteristics and Use Patterns

OAR 690-086-0140(6)

Customer Description

The City has four customer categories: single family residential, multi-family residential, commercial/industrial, and wholesale. As previously described, the City's wholesale customers are Alder Creek Barlow Water District and Skyview. **Exhibit 2-8** presents the number of accounts by customer category from 2006 through 2014. The number of single-family residential accounts steadily increased during this period while the number of accounts for the other customer categories remained relatively stable. The commercial/industrial customer category is broken down by meter size to provide further details about these customers. Small commercial accounts use a ¾-inch or smaller meter and would include businesses such as real estate offices, stores, and some restaurants. Large

commercial accounts use a meter larger than ¾-inch and would include laundries, manufacturers, and light industrial companies.

Exhibit 2-8. Number of Accounts by Customer Category, 2006-2014.

Year	Single Family Residential	Multi-Family Residential	Commercial/Industrial			Wholesale	Total
			Small (3/4-inch meters)	Large (>3/4-inch meters)	Total Commercial /Industrial		
2006	2,479	88	134	105	239	1	3,046
2007	2,744	81	133	113	246	1	3,318
2008	2,841	87	133	136	269	1	3,467
2009	2,916	87	131	114	245	1	3,494
2010	2,973	86	128	117	245	1	3,550
2011	2,998	87	125	118	243	1	3,572
2012	3,039	88	123	120	243	1	3,614
2013	3,067	88	123	123	246	1	3,648
2014	3,196	87	124	124	248	2	3,781

Annual Consumption

As shown in **Exhibit 2-9**, total annual consumption fluctuated from 2006 through 2014. The greatest consumption of 322.6 MG occurred in 2006 and the lowest consumption of 287.1 MG occurred in 2011. The average total annual consumption during this period was 306.0 MG. Metered consumption does not follow a decreasing trend similar to demand, which likely reflects improvements in customer meter accuracy. The City believes that customer meters were reading low, so that more of the water produced was actually recorded as consumed following meter replacement. This underreporting of customer consumption likely contributed substantially to the high unaccounted-for water recorded in 2006 and 2007.

Exhibit 2-9. Annual Consumption, 2006-2014.

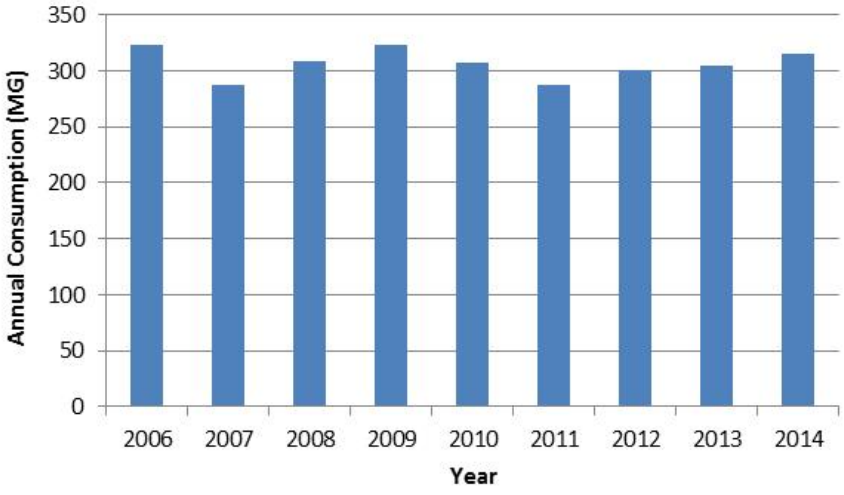


Exhibit 2-10 presents annual consumption by customer category from 2006 through 2014. Single-family residential consumption fluctuated during this period and peaked in 2014 with 203.8 MG. Multi-family residential and wholesale consumption experienced minor fluctuations from 2006 through 2014 while commercial/industrial consumption decreased from 2006 through 2011 and has since been rebounding.

Exhibit 2-10. Annual Consumption by Customer Category, 2006-2014.

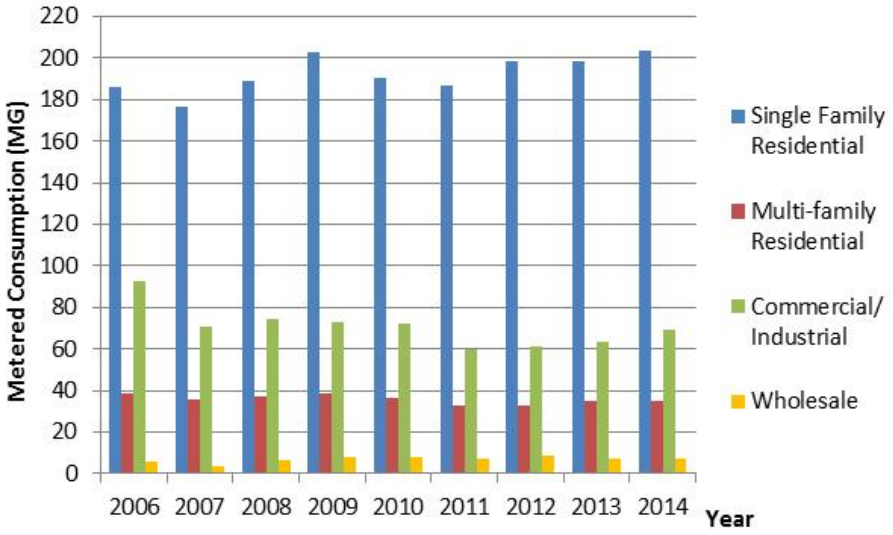
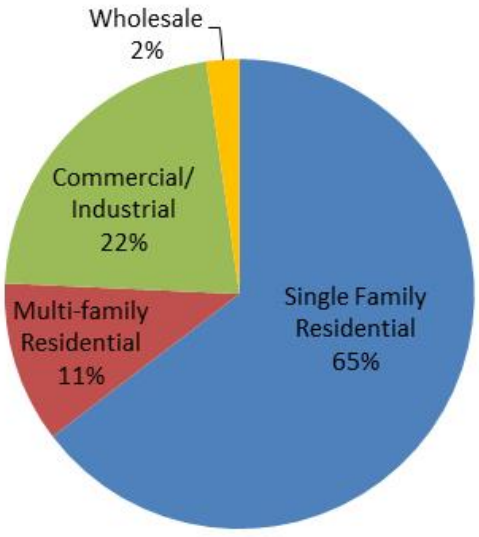


Exhibit 2-11 shows that single-family residential and the commercial/industrial customer categories represented 65 percent and 22 percent of total consumption in 2014, respectively. Water conservation efforts targeting all customer categories would be beneficial, but particularly targeting single family residential customers could be most cost-effective given that this customer category represented 65 percent of total water consumption in 2014.

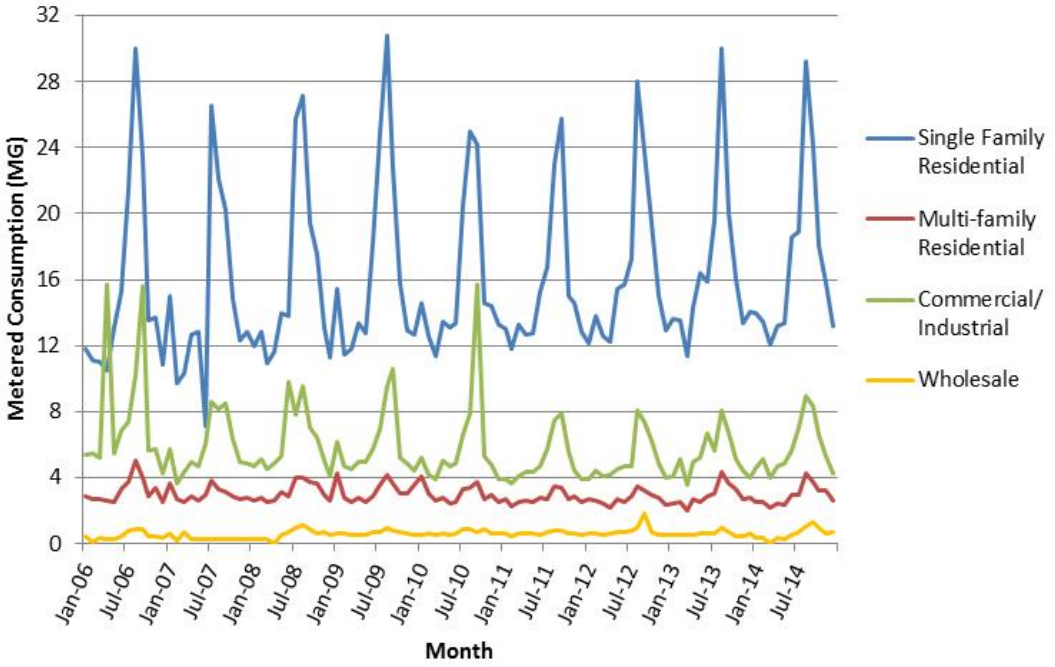
Exhibit 2-11. Percent of Annual Consumption by Customer Category, 2014.



Monthly Consumption

Exhibit 2-12 presents monthly consumption by customer category from 2006 through 2014. Consumption generally peaked during the summer months for each customer category. However, multi-family residential consumption also peaked on a few occasions in the winter. Wholesale consumption remained flat for much of 2007.

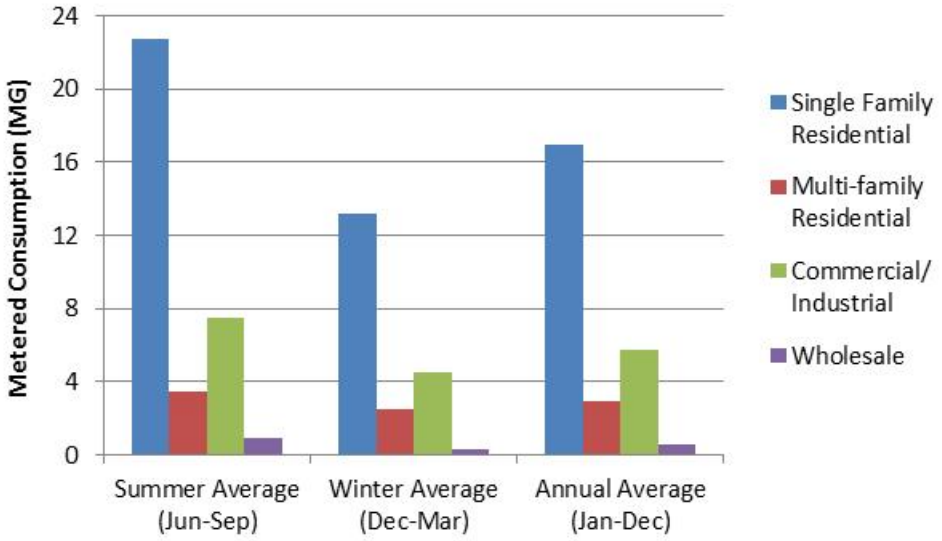
Exhibit 2-12. Monthly Consumption by Customer Category, 2006-2014.



Seasonal Consumption

Exhibit 2-13 shows average monthly consumption by season and customer category in 2014. Single-family residential average summer consumption was 22.69 MG compared to its average winter consumption of 13.15 MG, which makes average summer consumption approximately 1.7 times greater than average winter consumption. The differences in seasonal consumption were slightly less pronounced in the commercial/industrial and multi-family residential customer categories. Wholesale summer consumption was approximately 2.64 times greater than its total winter consumption, but wholesale represented only 2 percent of total consumption in 2014.

Exhibit 2-13. Seasonal Consumption by Customer Category, 2014.



Average Day Per Capita Demand and Residential Per Capita Consumption

The Regional Water Providers Consortium (RWPC) completed an analysis of water use trends for its member agencies in 2015 (See **Appendix B** for the full RWPC analysis). The RWPC is a coordinating organization created to improve the planning and management of municipal water supplies in the greater Portland, Oregon metropolitan. The RWPC currently is made up of 20 member agencies, including the City of Sandy, and the regional government Metro. The City of Sandy has been a member of the RWPC since 1997. The RWPC analysis found the following:

- During the summer months (June through September), the City's average day per capita demand (i.e. water demand per person) averaged from 2004 through 2013 was 145.9 gallons per capita per day (gpcd), which was in the lower end of the range among RWPC members. Gallons per capita per day is calculated by dividing demand for the specified time period by the total service area population during that period.

- On a peak day (day when maximum demand occurs), average day per capita demand averaged from 2004 through 2013 was 222.2 gpcd, which was in the mid-range among RWPC members.
- For the entire year, average day per capita demand averaged from 2004 through 2013 was 115.8 gpcd, which was in the lower end of the range among RWPC members.
- The City's per capita summer and annual demand showed significant declines from 2004 through 2013.

The RWPC suggests that the reduction in summer demand could be due to the mild summers that the region experienced during the study period.

The RWPC analysis also looked at per capita consumption by customer class. According to the study the City's average day per capita consumption from 2004 through 2013 averaged 64.9 gpcd for residential customers and 86.0 gpcd for all customer classes combined. The City had the second lowest average day per capita consumption for residential customers of the RWPC member agencies and the lowest average day per capita consumption for all customer classes. The City's average day per capita consumption had a significant decreasing trend during the study period.

Unaccounted-for Water

OAR 690-086-0140(9)

For the purposes of this WMCP, unaccounted-for water is the difference between demand and metered water consumption. Thus, unaccounted-for water represents system leakage and unmetered water usage. System leakage is water lost due to deteriorating pipe, compromised pipe joints, service connections, valves, etc. Unmetered water usage could include unmetered or unauthorized connections, unmetered water for operations and maintenance uses (street cleaning), and unmetered water for firefighting, reservoir overflows, and data collection /metering errors. With proper record keeping and metering of water, the percentage of unaccounted-for water should approach the net volume lost to actual leakage.

As shown in **Exhibit 2-14**, the City's unaccounted-for water was 11.5 percent in 2014 and averaged 22.3 from 2006 through 2014, both of which are a substantial improvement from the 1999 through 2005 annual average unaccounted-for water of 31 percent reported in the City's 2007 WMCP. The City attributes its reduction of unaccounted-for water in recent years to several factors. First, demand decreased due to in-filling in the City's single-family and low-density zones, implementation of higher water rates, the City's water conservation efforts, and the economic downturn. Meanwhile, consumption remained relatively steady instead of similarly decreasing due to installation of meters at some unmetered connections and meter accuracy improvements as older meters were replaced with more accurate meters. The City believes that customer meters were reading low, so that more of the water produced was actually recorded as consumed following meter replacement. Finally, the City made water demand and consumption accounting improvements, further reducing unaccounted-for water. Based on the relative newness of the City's customer meters and the

lack of substantial leaks detected in previous leak detection studies, the City believes that its unaccounted-for water in recent years is primarily the result of accounting errors.

Exhibit 2-14. Unaccounted-for Water, 2006-2014.

Year	Demand (MG)	Metered Consumption (MG)	Unaccounted-for Water (MG)	Unaccounted-for Water (%)
2006	450.8	322.6	128.2	28.4
2007	428.1	287.2	140.9	32.9
2008	403.5	308.0	95.5	23.7
2009	383.5	322.2	61.2	16.0
2010	404.3	306.6	97.7	24.2
2011	378.4	287.1	91.3	24.1
2012	391.7	300.9	90.7	23.2
2013	365.7	303.9	61.8	16.9
2014	356.0	315.3	40.8	11.5
Average				22.3

Water Rights

OAR 690-086-0140(5)

Exhibit 2-15 provides detailed information about the City's municipal water rights. Following is a summary of those water rights.

The City holds three water right certificates for the use of water from Brownell Springs. Certificate 5427 is for the use of up to 0.2 cfs, Certificate 26132 is for the use of up to 0.7 cfs, and Certificate 91156 is for the use of up to 0.3 cfs from Brownell Springs for municipal purposes. .

The City holds Certificate 91176 for the use of up to 3.0 cfs from Alder Creek. The City also holds Permit S-36601 for the use of 1.0 cfs from Alder Creek (pending extension of time).

Finally, the City also holds Permit S-48451 for the use of up to 25.0 cfs from the Salmon River. On November 16, 2012, OWRD issued a Final Order approving an extension of time for Permit S-48451, which extended the time to apply water to full beneficial use to October 1, 2069.

Exhibit 2-16 provides information about the City's non-municipal water right, Certificate 41492, which is for the use of up to 0.01 cfs of water from a spring for domestic use for one family. The City does not deliver water through its municipal distribution system for municipal customer supply under this water right.

Exhibit 2-15. City of Sandy Water Rights.

Source	Application	Permit	Certificate	Priority Date	Type of Beneficial Use	Authorized Rate (cfs) or Volume (AF)	Authorized Date for Completion	Maximum Rate or Volume of Withdrawal to Date		2014 Average Withdrawal		Five-Year (2010-2014) Average Withdrawal		Comments
								Instantaneous (cfs or annual volume (AF)	Annual (MG)	Monthly (MG)	Daily (mgd)	Monthly (MG)	Daily (mgd)	
Brownell Springs, *tributary of Beaver Creek*	S-9669	S-6597	5427	7/11/1924	Municipal	0.2	N/A	0.2	151.6	8.3	0.3	11.3	0.4	
	S-27810	S-21879	26132	11/10/1952	Municipal	0.7	N/A	0.7						
	S-47254	S-35394	91156	7/23/1970	Municipal	0.3	N/A	0.3						Certificate issued January 20, 2016.
Alder Creek, *tributary of Sandy River*	S-48840	S-36601	91176	11/11/1971	Municipal	3.0	N/A	3.0	306.2	12.1	0.4	18.4	0.6	Certificate issued January 28, 2016.
		S-36601	--			1.0	10/1/1996							Extension of time pending.
Salmon River	S-65051	S-48451	--	4/28/1983	Municipal	25.0	10/1/2069	0	0	0	0	0	0	Recently extended to 10/1/2069.

Exhibit 2-16. City of Sandy Non-Municipal Water Rights.

Source	Application	Permit	Certificate	Priority Date	Type of Beneficial Use	Authorized Rate (cfs)
A spring, *tributary of Cedar Creek*	S-47255	S-35395	41492	7/23/1970	Domestic use for one family	0.01

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Aquatic Resource Concerns

OAR 690-086-140(5) requires municipal water suppliers to identify the following for each of its water sources: 1) any listing of the source as water quality limited (and the water quality parameters for which the source was listed); 2) any streamflow-dependent species listed by a state or federal agency as sensitive threatened or endangered that are present in the source; and 3) any designation of the source as being in a critical groundwater area.

Water Quality

The City's sources of supply authorized by its water rights are Alder Creek, Brownell Springs, and the Salmon River. Alder Creek and Brownell Springs have been the City's sources of drinking water for decades.

Every two years, Oregon Department of Environmental Quality's (DEQ) is required to assess water quality and report to EPA on the condition of Oregon's waters. The Clean Water Act Section 303(d) requires the DEQ to identify waters that do not meet water quality standards and where a Total Maximum Daily Load (TMDL) pollutant load limit needs to be developed. Water quality parameters may be removed from the 303(d) list when TMDLs or other control measures have been established that are expected to improve water quality, when data show water quality has improved, and in some cases when water quality standards are revised.

Alder Creek and the Salmon River are listed as water quality limited streams according to DEQ due to certain parameters not meeting water quality criteria. The Brownell Springs points of diversion are located at the headwaters of Beaver Creek, a tributary of Cedar Creek, which flows into the Sandy River. Beaver Creek is also listed as a water quality limited stream according to DEQ.

The City's point of diversion (POD) on Alder Creek is at approximately River Mile (RM) 1. Alder Creek is listed as water quality limited between RM 0 and RM 2 for temperature from August 15 through June 15, and a Total Maximum Daily Load (TMDL) has been approved for that parameter. Alder Creek is also listed as water quality limited between RM 0 and RM 5.5 for flow modification, but TMDL's are not established to address flow modification.

The City's POD on the Salmon River is at approximately RM 7.5. The Salmon River, is water quality limited between RM 0 and RM 13.3 for temperature (August 15-June 15) and a TMDL has been approved for that parameter. The Salmon River is water quality limited between RM 0 and RM 33.9 for temperature (year around, non-spawning) and a TMDL has been approved for that parameter, as well. In that same stretch, the Salmon River is water quality limited for biological criteria (year around) and habitat modification. A TMDL has not been approved for the biological criteria parameter and is not required for the habitat modification parameter.

Beaver Creek is listed as water quality limited between RM 0 and RM 8.4 for biological criteria and temperature year around. Beaver Creek is listed as water quality limited between RM 0 to RM 8.3 for *E. coli* in the summer, and for flow modification. A TMDL is needed for the biological criteria parameter, TMDLs were approved for the temperature and *E. coli* parameters, and a TMDL is not needed for flow modification.

The list of water quality limiting parameters for these water bodies can be found in DEQ's Water Quality Assessment – Oregon's 2010 Integrated Report Assessment Database at http://www.deq.state.or.us/wq/assessment/rpt2010/search.asp

Listed Streamflow-Dependent Species

Exhibit 2-17 shows the fish species listed under the state and federal endangered species acts in the lower Columbia River, Sandy River, and Salmon River drainages (Hydrologic Unit Code 17080001 subbasin).

Exhibit 2-17. Listed Fish Species in the Lower Columbia River, Sandy River, and Salmon River Drainages[1].

Species	Common Name	Evolutionarily Significant Unit (ESU) (if applicable)	Federal Listing	State Listing
Oncorhynchus tshawytscha	Chinook	Lower Columbia River ESU (fall and spring runs)	Threatened	Sensitive "Critical"
Oncorhynchus mykiss	Steelhead	Lower Columbia River ESU, (winter run)	Threatened	Sensitive "Critical"
Oncorhynchus keta	Chum	Columbia River – Oregon ESU	Threatened	Sensitive "Critical"
Oncorhynchus clarkii	Coastal Cutthroat Trout	Southwestern Washington/Columbia River ESU	--	Sensitive "Vulnerable"
Oncorhynchus kisutch	Coho	Lower Columbia River ESU	Threatened	Endangered
Lampetra richardsoni	Western Brook Lamprey	--	--	Sensitive "Vulnerable"
Lampetra tridentate	Pacific Lamprey	--	Petitioned for listing	Sensitive "Vulnerable"
Thaleichthys pacificus	Pacific Eulachon	Southern DPS, including the Columbia River system	Threatened	--

[1] The fish species listed in this exhibit are from all of the sources combined, such that not all of the species listed are found in each source.

Sources:
Federal ESA listed species (T&E), from NOAA Fisheries Office of Protected Resources:
http://www.nmfs.noaa.gov/pr/species/esa/fish.htm
and http://www.westcoast.fisheries.noaa.gov/maps_data/species_population_boundaries.html
Federal Sensitive species, from the Interagency Special Status/Sensitive Species Program for Oregon and Washington State:
http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/
Oregon State ESA listed species, from the Oregon Department of Fish & Wildlife:
http://www.dfw.state.or.us/wildlife/diversity/species/threatened_endangered_candidate_list.asp
Oregon State Sensitive Species, from the Oregon Department of Fish & Wildlife:
http://www.dfw.state.or.us/wildlife/diversity/species/sensitive_species.asp
Federal Species of Concern, from the U.S. Fish & Wildlife Service, Oregon Fish & Wildlife Office:
http://www.fws.gov/oregonfwo/Species/Data/PacificLamprey/default.asp
ODFW's Division 315 Evaluation of Fish Persistence for Municipal Extension City of Sandy Application Number S-65051

Critical Groundwater Area

The City does not have a groundwater right that would require identification of whether its location is in a critical groundwater area. Nonetheless, the City is included in the Sandy/Boring Groundwater Limited Area.

Evaluation of Water Rights/Supply
OAR 690-086-0140(3)

As previously described, the City's sources of water supply are Alder Creek, Brownell Springs, and PWB wholesale water. Following is an analysis of the adequacy and reliability of these water sources.

Alder Creek and Brownell Springs

The City's Alder Creek water rights are for the use of up to 4.0 cfs and its Brownell Springs water rights are for the use of up to 1.2 cfs, for a total of 5.2 cfs (3.37 mgd). However, the City's ability to divert the full 5.2 cfs is limited by streamflows and water rights senior to those held by the City.

Source Reliability

There are no long-term streamflow records available for Alder Creek, but as part of the City's water supply investigation for the Alder Creek Basin, the City measured fairly consistent streamflows of approximately 5.1 cfs on Alder Creek approximately 0.5 miles above the Mt. Hood Loop Highway in August and September of 1971 and 1973. According to the City's WTP operators, however, there are periods when streamflows may not support the City's entire 4.0 cfs water right. Brownell Springs reliably produces only approximately 0.77 cfs (0.5 mgd), making the reliable supply from the two sources approximately 4.77 cfs (3.09 mgd).

Regulatory Reliability

The City's Alder Creek water rights (Certificate 91176 and Permit S-36601), which have a priority date of November 11, 1971, are junior in priority date to four surface water rights that name Alder Creek as the authorized source. Of the four water rights, two are small domestic use water rights (0.01 and 0.005 cfs, respectively). One water right is a non-consumptive power water right downstream of the City's POD. The fourth water right is a domestic use water right for 1.0 cfs that is in the name of Alder Creek Water Company but is now held by the Alder Creek Barlow Water District (District). The City has provided water to the District since 1984, and the District has not been using its water right on Alder Creek. There is no history of water use regulation on Alder Creek. The City's Certificate 91176 and Permit S-36601 (pending time extension) are senior to instream water right Certificate 72636, which have a 1991 priority date and protects flows in the reach from RM 2.0 to the mouth of Alder Creek. The City's permit is also senior to instream water rights Certificate 73015 and Certificate 75992 on the lower Sandy River, which have 1991 and 1992 priority dates, respectively. Based on this information, the City can only rely on 4.0 cfs from Alder Creek to meet maximum day demands.[1]

[1] The City understands that water use limitations may be added to Permit S-36601 as a result of an approved extension of time. At this time, the potential conditions are unknown.

The City's three water rights on Brownell Springs have priority dates of 1924, 1952 and 1970. According to OWRD's web-based water rights database, there are no other water rights for use of Brownell Springs and no senior water rights for "a spring" that is a tributary to Beaver Creek. In addition, the City's 1924 priority water right for 0.2 cfs is the most senior right on the Beaver Creek and Cedar Creek system. The City's 1952 water right for 0.7 cfs is junior in priority to two small water rights on Beaver Creek (0.01 and 0.26 cfs respectively) and to two small water rights on Cedar Creek (0.03 cfs and 0.01 cfs respectively). However, the City's 1952 water right for 0.7 cfs and 1970 water right for 0.3 cfs are junior to the Oregon Department of Fish and Wildlife's (ODFW) 25.0 cfs water right for fish propagation (hatchery) with a priority date of 1949. In the past, most recently in 2015, the State of Oregon Watermaster has curtailed the City's use of Brownell Springs to its senior water right of 0.2 cfs in favor of ODFW's water right. The Brownell Springs water rights are senior to instream water right Certificate 72630, which protects instream flows in the reach from Cedar Creek's confluence with Beaver Creek to the mouth of Cedar Creek. The Brownell Springs water rights are also senior to instream water right Certificate 73015 and Certificate 75992 on the lower Sandy River. Based on this information, the City can only rely on 0.2 cfs from Brownell Springs to meet maximum day demands.

Salmon River

The City holds Permit S-48451 for use of up to 25.0 cfs from the Salmon River, which is currently undeveloped and has an extension of time to October 1, 2069. The Salmon River is designated as a federal Wild and Scenic River managed by the Bureau of Land Management and the U.S. Forest Service. Management standards for the wild and scenic river are detailed in the *Salmon National Wild and Scenic River Management Plan* (USFS, 1993). This water right is intended to provide a long-term water supply to accommodate the City's growth. In the *Agreement for Instream Conversion* (executed October 24, 2002) associated with Portland General Electric's decommissioning of Marmot Dam (Agreement), the City voluntarily agreed to reduce this permit from 25.0 cfs to 16.3 cfs when the flow available in the Sandy River near Marmot, OR is 600 cfs or less, but can still divert up to 25.0 cfs when the flow available is more than 600 cfs. No gage is currently operating near Marmot, OR to provide a picture of the flow regime in the Sandy River at that location, but the City understands that 600 cfs will be frequently not be met.

In addition, as part of the extension of time for Permit S-48451, there are two sets of conditions placed on the permit. "Condition A" pertains to any POD upstream from the confluence of the Salmon River and Boulder Creek. Under "Condition A," the City cannot divert water between August 16 and October 31; diversions between March 1 through August 15 are subject to the Agreement; and diversions from November 1 through February 29 will be reduced if the target flows of 129 cfs or the average flow for the previous October, whichever is less, is not met. Diversions from November 1 through February 29 are also subject to the Agreement. "Condition B" pertains to any POD downstream from the confluence with Boulder Creek. Under "Condition B," the City's diversions are only subject to the Agreement. Under "Condition A" and "Condition B," the City also must provide OWRD an executed agreement between the City and ODFW setting out specific fish passage requirements that ensure adequate upstream and downstream passage for fish

The Salmon River water right is junior to several very small domestic water rights ranging from 0.005 cfs to 0.1 cfs, but streamflow records from a U.S. Geological Survey gage in the

vicinity (14135500) with a period of record from 1936 to 1952 show that the lowest streamflows met or exceeded 50 percent of the time is 97 cfs. Permit S-48451 is senior to instream water right certificates 72636 and 72637, which have priority dates of 1991 and protect water instream in the reach of the Salmon River from RM 16.3 to the mouth. Permit S-48451 is also senior to the two instream water rights on the lower Sandy River. Based on existing data and considering other senior water rights it appears that the Salmon River source would be reliable for meeting the City's long-term supply needs to accommodate growth. However, until the City determines where it will locate the POD, the reliability of water under Permit S-48451 is unclear with respect to the required permit conditions.

PWB

The City uses its PWB water (currently 0.5 mgd, but the City is allowed to use up to 3 mgd) as a supplemental water supply, particularly when its use of Brownell Springs is regulated back or when needed to meet peak demands. The PWB water also provides water supply redundancy in the event that the City's water sources become unavailable. PWB's Bull Run water supply is generally reliable, but occasionally experiences high-turbidity events as a result of being unfiltered. A wildfire, earthquake, or volcanic event in the Bull Run watershed could also affect the PWB water supply. The reliability of the PWB water is described in detail in the City of Portland's WMCP. The contract with the City of Portland expires on June 30, 2028 and the City has the option to renew it.

System Description

OAR 690-086-140(8)

Exhibit 2-1 presents a schematic of the City's water sources, WTP, and water distribution facilities. The City's POD on Alder Creek is located approximately 7 miles east of the City and 1 mile upstream from its confluence with the Sandy River. The concrete intake structure has a fish screen to prevent fish entrapment and water quality monitoring equipment (for measurement of water temperature, turbidity, conductivity, and flow rates). Water diverted from Alder Creek is pumped by low-lift pumps to the Alder Creek WTP, which is located approximately 4,000 feet downstream of the POD. The Alder Creek WTP is a filtration treatment plant with a capacity of 2.6 mgd that was built in 1979 and upgraded in 2001. After filtration and chlorination at the WTP, the water is pumped to Terra Fern Road Reservoir (0.25 MG).

Water is diverted from Brownell Springs using open bottom concrete boxes that are built into the slope of the butte and water in these boxes is gravity-fed to a common holding tank. Water diverted from Brownell Springs is then chlorinated and blended with water pumped from the Terra Fern Road Reservoir. The blended water is conveyed to Sandercock Lane Reservoir (0.5 MG) and the two Vista Loop Road Reservoirs (2.0 MG and 1.0 MG), at which point it flows by gravity to the majority of the City's water distribution system.

The City connects to the PWB system at the Hudson Road Intertie site. About 1,000 feet southeast of the connection on Hudson Road, the City has a booster pump station that pumps the PWB water through approximately 27,000 feet of 18-inch and 24-inch diameter pipe to a 1.0 MG reservoir on Revenue Avenue in the City of Sandy. Another pump station then pumps water from the 1.0 MG reservoir up to the Vista Loop Reservoirs.

Exhibit 2-18 and **Exhibit 2-19** provide more details about the City's five reservoirs and five pump stations, respectively. The City's water system has approximately 78.3 miles of pipeline, as shown in **Exhibit 2-20**.

Exhibit 2-18. Summary of System Reservoirs.

Reservoir	Volume (MG)	Overflow Elevation (feet)	Material	Completion Date
Terra Fern Road	0.25	1,231.5	Steel	1978
Sandercock Lane	0.50	1,384.5	Steel	1966
Vista Loop Road	2.00	1,135.0	Concrete	2001
Vista Loop Road	1.00	1,135.0	Steel	1975
Revenue Avenue	1.00	995.0	Concrete	2014
Total	4.75			

Exhibit 2-19. Summary of System Pump Station.

Name	Location	Pumps (#)	Firm Capacity (gpm)	
Intake Booster	Near the Alder Creek point of diversion	2	1,500	per pump
Alder Creek WTP	At the Alder Creek WTP	4	1,800	Total
Terra Fern	At Terra Fern Road Reservoir	5	1,750	Total
PWB Booster PS	Hudson Road	3	3,300	Total
PWB Transfer PS	At Revenue Ave. Reservoir	2	1,500	Total

Exhibit 2-20. Summary of System Pipelines.

Pipe Diameter (inches)	Total Length (feet)	Total Length (miles)	Percent of Total Pipeline (%)
2	332	0.1	0.1
4	6,677	1.3	1.6
6	163,983	31.1	39.7
8	83,191	15.8	20.1
10	6,908	1.3	1.7
12	71,409	13.5	17.3
16	51,891	9.8	12.6
18	15,729	3.0	3.8
24	13,254	2.5	3.2
	413,374	78.3	100.0

SECTION 3

Water Management and Conservation

This section addresses the requirements of OAR 690-086-0150(1) – (6).

This rule requires a description of specific required conservation measures and benchmarks, and additional conservation measures implemented by the City.

Current Conservation Measures

OAR 690-086-0150(1) and (3)

Progress Report

This is the City's second WMCP. OWRD approved the City's first WMCP on September 27, 2007. Since approval of its 2007 WMCP, the City has been striving to meet its conservation benchmarks. **Exhibit 3-1** shows the water conservation benchmarks established in the 2007 WMCP and the progress that the City has made to meet those benchmarks.

Other Conservation Measures

In addition to the accomplishments listed in the progress report of the City's conservation benchmarks in **Exhibit 3-1**, the City implemented the following water conservation measures within the past 10 years.

- The City has significantly increased water rates over the past few years to increase revenue for water system projects and to encourage water conservation.
- The City gives all new homeowners a welcome packet containing information on indoor and outdoor conservation measures.
- The City developed a display that was used at the City's Earth Day/Arbor Day events in 2010, 2011, and 2012 describing a xeriscaping project that the City's Planning Director completed at his personal residence in 2010.

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Exhibit 3-1. Water Conservation Progress Report.

Requirement	2007 Benchmarks	2015 Benchmark Status
Annual water audit	The City will continue to conduct annual water audits to measure unaccounted-for water and estimate leakage rates.	The City continues to track and analyze water production data against water sales data annually to determine unaccounted-for water totals.
System metering	The City will install meters on three unmetered connections along the Brownell Spring's transmission line by September 27, 2008.	These connections are now metered and all new connections are metered.
Meter testing and maintenance	The City will implement a program for routine testing of production meters at Alder Creek and Brownell Springs.	All production flowmeters are tested and calibrated annually. The production meter at Brownell Springs was replaced with an ultrasonic flowmeter in 2008.
	The City will routinely test large meters (ex. Meters serving the school district and Mt. Hood cleaners, and the meter at the interconnection with Alder Creek Water District) to evaluate flow rates and to determine if any meters should be replaced.	The City aims to test all meters 2-inches and larger on an annual basis, which has been achieved most years. Decisions on meter replacement and repair are made based on test results. The City tests both wholesale customer meters every other year.
	The City will develop a program to routinely repair, test, and calibrate hydrant meters for construction contractor use.	The City re-evaluated whether to develop this program and decided that the program would not be cost effective given that bulk water sales from hydrants are a small portion of overall sales (less than 0.2% in 2011).
	The City will track the performance of new meters installed and maintain records on meters removed from service.	The City tracks the performance of newly installed meters using the AMR metering system. Records on meters removed from service are maintained in the City's utility billing system software.
	The City will develop a sampling program for residential meters to assess their accuracy and age.	The City assesses accuracy of new residential meters using the AMR metering system. Given that most meters are relatively new, the City will track meter records of older meters to monitor for failure rather than develop a sampling plan for older meters.
	The City will conduct a meter repair and replacement program.	The City recently implemented a fixed-base radio AMR metering system for all new service connections. Over time, the City would like to outfit all residential meters with AMR and to use the AMR data to track meter performances. The City is investigating whether increased meter accuracy from replacement of all non-AMR meters (approximately 90% of installed meters) will increase revenue enough to cover the debt service for the meter replacement project. If the full-scale meter replacement project does not proceed, the City intends to replace 100 existing residential meters with AMR meters each biennium.
Rate structure based on the quantity of water metered and billing practices that encourage water conservation	The City will continue to use its current billing rate structure that bases customer bills on the amount of water that they use. Customers are billed monthly.	Customers continue to be billed based on the amount of water consumed. The City continues to bill its customers monthly to provide timely feedback about water consumption. Customers with AMR meters (about 360 currently) can be quickly notified of excessive or unusual water use instead of waiting for the next utility bill to discover excessive or unusual water use. Customers with AMR may also contact the City on any work day to find out their water consumption.
Leak detection and leak repair or line replacement	The City will conduct a baseline leak survey of the water system using the sampling plan described in the 2000 water audit (targeted assessment of certain high-value and/or old lines and random sampling of the remaining system).	The baseline leak survey has not yet been performed. Previous leak surveys were inconclusive or only turned up a few small leaks. Consequently, the City does not believe that the unaccounted-for water is attributable to leaks and has decided to invest resources in other water conservation efforts.
	The City will target the following for segments for leak detection: o The 6-inch transmission line between the Brownell Springs meter and its intersection with the Alder Creek 16-inch line o The 16-inch transmission line from Alder Creek and Sandercock Storage Tank o The 2-inch and 4-inch transmission lines supplying the Alder Creek and Special Water Service Districts	The 6-inch transmission main between the Brownell Springs meter and the 16-inch transmission main is located on very difficult to access and inaccessible terrain. With the exception of difficult to access portions of the transmission lines, the City performs a visual inspection of the pipelines every summer. In addition, this line is metered so excessive water loss would be simple to detect. The 16" transmission main between the Alder Creek WTP and Sandercock Reservoir is located in the shoulder of Hwy 26. Acoustic leak detection methods are not effective due to heavy traffic noise, so the City relies on visual inspection for this transition main. The 2-inch and 4-inch transmission lines supplying the Alder Creek Barlow Water Districts are both metered and all customer service connections are metered. Excessive water loss would be simple to detect and would be reported by the wholesale customer.
	The City will perform leak detection at 36 randomly selected pipe sections throughout the system to determine a statistically significant estimate of leakage rates.	This sampling has not yet been performed. Previous leak surveys were inconclusive or only turned up a few small leaks. Consequently, the City does not believe that the unaccounted-for water is attributable to leaks and has decided to invest resources in other water conservation efforts.
	The City will maintain records of repaired and reported leaks including the cause of leaks, the age and type of pipe, and other information.	All repaired and reported leaks have been recorded to include these factors.
	The City will annually survey approx. 10% of the water system for leaks in order to survey the entire system every 10 years.	The annual survey has not yet been performed. Previous leak surveys were inconclusive or only turned up a few small leaks. Consequently, the City does not believe that the unaccounted-for water is attributable to leaks and has decided to invest resources in other water conservation efforts.
	The City will strive to, within available resources, reduce the unaccounted-for water rate to 10 percent or less by 2010.	The City reduced its unaccounted-for water from 28 percent in 2005 to 11.5 percent in 2014. The City will continue to strive to reduce its unaccounted-for water.
	The City will conduct annual leak detection surveys and repairs.	See responses above.

Exhibit 3-1. Water Conservation Progress Report Continued.

Requirement	2007 Benchmark	2015 Benchmark Status
Public education program to encourage water conservation	The City will continue to be a member of Regional Water Providers Consortium (RWPC) and benefit from RWPC's services (public education).	The City remains a member of the RWPC and continues to benefit from the RWPC's outreach and public education programs.
	The City will continue to make conservation kits available.	The City makes indoor and outdoor conservation kits available to all customers and passes out these kits at the City's Earth Day event, a rotating neighborhood-specific event in the Fall, and at additional neighborhood fairs/block parties upon request.
	Additional public education activities will be employed as new conservation programs are implemented.	The City participates in the RWPC conservation and public education programs. The City joined in the EPA "Water Sense" program in 2012 and participated in the WaterSense "Fix a Leak Week" in 2013 (See Appendix C for "Fix a Leak Week" press releases.)
	The City will initiate an open-house workshop where all conservation measures should be promoted.	This function is performed annually at the City's Earth Day event and at least once each year at neighborhood fairs and block parties.
Technical and financial assistance programs to encourage water conservation	The City will conduct sample water audits for commercial/tourist facilities.	These audits have not been implemented to date. The City will need to hire a consultant to conduct these audits due to lack of staff availability. The City intends to have this activity funded within the next five years.
Supplier financed retrofitting or replacement of existing inefficient water using fixtures	The City will distribute low-flow showerheads in conservation kits or with a low-flow toilet rebate program.	The City has distributed approximately 500 indoor conservation kits with 2.5 gpm low flow showerheads and faucet aerators. The City continues to make water conservation kits available at no charge to any customer requesting one.
	The City will implement a low-flow toilet rebate program, mainly targeting residential customers, but also available to commercial and tourist-related facilities.	Due to the City having mostly new homes that contain low-flow toilets, the City has decided to direct funds to other water conservation programs instead.
Water reuse, recycling, and non-potable water opportunities; and	Not specified.	The City has distributed approximately 126 downspout rain barrels to utility customers.
Any other conservation measures identified by the water supplier that would improve water use efficiency.	Not specified.	The City finalized and implemented a xeriscaping outreach program in 2013, which provides technical advice and printed materials. The City has not received responses to its xeriscaping outreach thus far.

Use and Reporting Program

OAR 690-086-0150(2)

The City's water measurement and reporting program complies with the measurement and reporting standards in OAR Chapter 690, Division 85.

The City currently measures water demand using four ultrasonic master meters. These master meters are located at the Alder Creek WTP, Brownell Springs diversion, Hudson Road pump station, and Revenue Avenue pump station.

The City submits monthly water use measurements to OWRD on an annual basis. Reporting is for the previous water year (October 1 to September 30). The City's water use records can be found at http://apps.wrd.state.or.us/apps/wr/wateruse_report/

Required Conservation Programs

OAR 690-086-0150(4)

OAR 690-086-0150(4) requires that all water suppliers establish five-year benchmarks for implementing the following water management and conservation measures:

1. Annual water audit
2. System-wide metering
3. Meter testing and maintenance
4. Unit-based billing
5. Leak detection and repair (if system leakage exceeds 10 percent)
6. Public education

Five-Year Benchmarks for Required Conservation Measures

During the next five years, the City plans to initiate, continue, or expand the following conservation measures that are required of all municipal water suppliers when a condition of a water use permit, permit extension, or another order or rule requires a WMCP:

1. **Annual Water Audit.**

   OWRD defines a water audit as an analysis of the water system that includes a thorough accounting of all water entering and leaving the system to identify leaks in the system, and authorized and unauthorized water uses, metered or estimated. The water audit also includes analysis of the water supplier's own water use.

   The City conducts an annual water audit based on records of total demand (volume of finished water that enters the water distribution system), and total consumption (volume of water consumed through metered service connections). The City's unaccounted-for water was 11.5 percent in 2014.

   Given the relative newness of the City's customer meters (installed in 2002 or more recently) and the lack of substantial leaks detected in previous leak detection studies, both of which are described later in Section 3, the City believes that its unaccounted-for water is primarily the result of accounting errors related to its billing software or its non-AMR meters.

Five-Year Benchmarks: The City will continue to conduct an annual water audit. In the next two years, the City will investigate its billing software for potential sources of accounting errors.

2. System-wide Metering.

The City's water system is fully metered. The City installs meters on all new connections. Since January 2006, the City has installed over 800 new meters at new connections.

The City implemented a fixed-based radio Automatic Meter Reading (AMR) metering system for all new service connections in December 2011. Since then, the City has installed approximately 360 AMR meters, which represents approximately 10 percent of the City's customer meters. **Exhibit 3-2** presents a breakdown of the City's meters by age.

Exhibit 3-2. Number of New and Existing Meters Installed.

Year Installed	Number of Meters	Age (Years)
pre-1991	756	
1991	7	24
1992	18	23
1993	54	22
1994	66	21
1995	31	20
1996	80	19
1997	54	18
1998	82	17
1999	133	16
2000	171	15
2001	195	14
2002	213	13
2003	174	12
2004	159	11
2005	185	10
2006	269	9
2007	185	8
2008	160	7
2009	108	6
2010	77	5
2011	55	4
2012	77	3
2013	59	2
2014	122	1
2015	71	0
Unknown	53	
Total	**3,614**	

The City is investigating whether increased meter accuracy from replacement of all non-AMR meters (approximately 90 percent of installed meters) in the near future will increase revenue enough to cover the debt service for the meter replacement project. If the full-scale meter replacement project does not proceed, the City intends to replace 100 existing residential meters with AMR meters each biennium.

Five-Year Benchmarks: The City will continue to install AMR meters on all new connections. In the next five years, the City will complete a cost-benefit analysis of replacing all non-AMR meters with AMR meters and will decide how to proceed with meter replacement.

3. Meter Testing and Maintenance.

The City has a meter testing and maintenance program. All production meters are tested and calibrated annually. The City strives to test all meters two-inches and larger on an annual basis, and achieves that goal most years. The City replaces or repairs these meters based on test results. The City tests both wholesale customer meters every other year. The performance of AMR meters can be tracked by analyzing AMR meter records. For non-AMR meters, the City will track meter records for signs of failure and will replace the meters with AMR meters when deemed necessary. The City also tests meters in response to customer inquiries. The City maintains records of meters removed from service in its utility billing system software. The City has replaced up to approximately 20 meters per year at existing connections. The failed existing meters have been replaced with AMR meters since December 2011.

Five-Year Benchmarks: The City will continue its meter testing and maintenance program. In the next five years, the City will begin to track the number of meters that it replaces at existing connections. In the next five years, the City will complete a cost-benefit analysis of replacing all non-AMR meters with AMR meters and will decide how to proceed with meter replacement.

4. Water Rate Structure.

The City has a uniform rate structure consisting of a monthly base charge (to cover fixed costs, such as meter reading, billing, and debt service), a meter charge (the larger the meter, the greater the charge), and a volume charge that is based on the quantity of water metered at the connection. Tiered water rates are currently considered unnecessary given that high water rates already encourage water conservation and that most water customers have small lots and do not maintain green lawns in the summer. As shown in **Exhibit 3-3**, the City has significantly increased single-family residential water rates over the past few years to increase revenue for water system projects and to encourage water conservation. The rates for the other customer categories have similarly increased

Exhibit 3-3 shows the single-family residential customer charges from 2008 through 2014 inside and outside the City. **Appendix D** details water rates for multi-family residential customers, commercial and industrial customers, wholesale customers, and Skyview.

Exhibit 3-3. Single Family Residential Monthly Base, Monthly Meter, and Volume Charges, as of 2014.

Year	Monthly Base Charge Inside City	Monthly Base Charge Outside City	Monthly Meter Charge (5/8" x 3/4" meter) Inside City	Monthly Meter Charge (5/8" x 3/4" meter) Outside City	Volume Charge per CCF Inside City	Volume Charge per CCF Outside City
2008	$4.80	$7.20	$0.17	$0.26	$1.91	$2.86
2010	$4.99	$7.49	$0.18	$0.27	$1.99	$2.97
2011	$5.29	$7.94	$0.19	$0.28	$2.11	$3.15
2012	$5.60	$8.42	$0.20	$0.30	$2.24	$3.34
2013	$5.94	$8.93	$0.21	$0.32	$2.37	$3.54
2014 (current)	$6.18	$9.29	$0.22	$0.33	$2.46	$3.68

Five-Year Benchmarks: The City will continue to bill customers based on the quantity of water metered at the service connection.

5. Leak Detection and Repair.

The City has a leak detection and repair program to minimize system leakage. Leak detection studies that the City conducted in the past were inconclusive or only turned up a small number of minor leaks, which leads the City to believe that leaks are not a major contributor to unaccounted-for water. Consequently, the City currently monitors for leaks on a regular basis using visual inspections where possible. The City also maintains records of repaired and reported leaks on a continuous basis, including the cause of leaks, the age and type of pipe, and other information. Since 2006, the City has replaced 3,200 linear feet of existing pipeline since 2006.

Five-Year Benchmarks: The City will continue to conduct its leak detection and repair program.

6. Public Education.

The City provides public education about water conservation through a combination of internal efforts and membership in the Regional Water Providers Consortium (RWPC).

The City gives all new homeowners a welcome packet containing information on indoor and outdoor conservation measures, such as repairing leaky faucets, avoiding over-watering of outdoor plants, and limiting outdoor water use for cleaning sidewalks and driveways. The City also makes indoor and outdoor water conservation kits available to all existing customers, which it distributes at the City's Earth Day event, a rotating neighborhood-specific event in the fall, and at additional neighborhood fairs/block parties upon request. The City staffs a booth at the Earth Day event to promote water conservation. In addition, the City occasionally includes water conservation messages in its monthly newsletter, which is on the back of the utility bill. **Appendix E** shows the water conservation message in the July 2015 newsletter.

The City is a member of the RWPC. (Membership currently costs the City $5,502 per year.) The benefit of membership is that the RWPC has a variety of water conservation public outreach efforts that become available to the City and its water customers. For example, the RWPC provides workshops for developers and landscapers that focus on water–efficient landscape design and installation and using water-efficient irrigation equipment. The RWPC also develops conservation displays available to members for use at local events, and produces brochures containing conservation information. In addition, the RWPC sponsors a summer water conservation media campaign that includes TV and radio advertisements and news interviews on local stations, conducts outreach at large regional events (e.g. Yard, Garden, and Patio Show and the Salmon Festival), and maintains a Web site (www.conserveh2o.org) that has indoor and outdoor water conservation information and suggestions. The City and the RWPC also sponsored annual water conservation education presentations at local elementary schools in 2010, 2013, 2014, and 2015 (See Appendix F for the announcements of these presentations). Presentations did not occur in 2011 and 2012 due to lack of interest from local elementary schools.

The City joined in the EPA "Water Sense" program in 2012 and participated in the WaterSense "Fix a Leak Week" in 2013 (See Appendix C for "Fix a Leak Week" press releases.)

Five-Year Benchmarks: The City will continue to be a member of the RWPC. The City will continue to promote water conservation at the City's Earth Day event and neighborhood events.

Additional Conservation Measures

OAR 690-086-0150(6)

OAR 690-086-0150(6) requires municipal water suppliers that serve a population greater than 1,000 and propose to expand or initiate the diversion of water under an extended permit for which resource issues have been identified, or if the population served is greater than 7,500, to provide a description of the specific activities, along with a five-year schedule to implement several additional conservation measures., The City served a population of 10,387 in 2014,therefore, the City is required to address the following additional conservation measures.

1. **Leak Repair or Line Replacement Program**

   Under this rule requirement, the City is required to implement a system-wide leak repair program or line replacement program to reduce system leakage to 15 percent, and if feasible to 10 percent. As previously described, the City's unaccounted-for water was 11.5 percent in 2014. The City has a leak detection and repair program to minimize system leakage. Leak detection studies that the City conducted in the past were inconclusive or only turned up a small number of minor leaks, such that the City believes that leaks are not a major contributor to unaccounted-for water. Consequently, the City currently monitors for leaks on a regular basis using visual inspections. The City maintains records of repaired and reported leaks on a

continuous basis, including the cause of leaks, the age and type of pipe, and other information.

Five-Year Benchmarks: The City will continue to conduct its leak detection and repair program.

2. Technical and Financial Assistance Programs

As mentioned under Public Education, the City makes indoor and outdoor water conservation kits available to all existing customers. The indoor water conservation kits include a shower timer and toilet tank dye tablets. The outdoor water conservation kits include the RWPC outdoor conservation brochure, Water Efficient Plants of the Willamette Valley booklets, and watering/irrigation gauge.

In 2013, the City funded an intern to implement activities associated with the EPA's National Fix a Leak Week, which included leak detection information on the City's website and Facebook page, as well as a question and answer session at City Hall with a local plumber to address customer questions about leak detection and repair (See Appendix C).

The City's Planning Director did a xeriscaping project at his personal residence in 2010 that both KATU News (http://www.katu.com/about/green/126381243.html) and the RWPC website featured in 2011. The Planning Director also had a display describing his project at the City's Earth Day/Arbor Day events in 2010, 2011, and 2012. In 2013, the City implemented a xeriscaping outreach program, which consists of technical advice and printed materials. The City has not received questions or requests for materials provided in response to the xeriscaping outreach program thus far.

Five-Year Benchmarks: In the next five years, the City will investigate ways to increase interest in the xeriscaping outreach program materials by reviewing how other cities are implementing xeriscaping programs, and will then implement changes to the program.

3. Supplier Financed Retrofit or Replacement of Inefficient Fixtures

As previously mentioned, the City makes indoor and outdoor water conservation kits available to all existing customers. The indoor water conservation kits include a low-flow showerhead and faucet aerators. To date, the City has distributed approximately 500 indoor conservation kits with low-flow (2.5 gpm) showerheads and faucet aerators.

Five-Year Benchmarks: The City will continue to make water conservation kits available at no charge to any customer requesting one.

4. Rate Structure and Billing Practices that Encourage Conservation

The City bills its customers monthly to provide timely feedback about water consumption. In addition, customers with AMR may contact the City on any work day to find out their water consumption, which the AMR system metering enables. The City periodically includes water conservation messages in utility bills, as well. **Appendix E** contains the most recent water conservation message in its monthly newsletter, which was on the back of the July 2015 utility bill.

Five-Year Benchmarks: The City will continue to bill its customers monthly and to periodically include water conservation messages in utility bills.

5. Water Reuse, Recycling, and Non-potable Water Opportunities

The City makes downspout rain barrels available to water customers to reduce demand for finished water for outdoor watering. Since April 2008, the City has distributed approximately 126 downspout rain barrels to utility customers.

The City partnered with Iseli Nursery in August 2012 to implement a water reuse project at the nursery. From May 1 to October 31, the City is providing up to 2.90 cfs of reclaimed water to Iseli Nursery for nursery uses and for irrigation of approximately 348 acres currently, and potentially up to 614 acres. Treated wastewater is delivered to Iseli Nursery through approximately 8,000 feet of 14-inch diameter pipe. Reclaimed water is blended with other water in storage ponds at the nursery.

Five-Year Benchmarks: The City will continue to make downspout rain barrels available to water customers to reduce demand for finished water for residential irrigation. The City will continue the water reuse project with Iseli Nursery. In the next five years, the City will contact at least two commercial/industrial customers to discuss the potential for water reuse, recycling, or non-potable water use opportunities.

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SECTION 4

Water Curtailment Plan

This section satisfies the requirements of OAR 690-086-0160.

This rule requires a description of past supply deficiencies and current capacity limitation. It also requires inclusion of stages of alert and the associated triggers and curtailment actions for each stage.

Introduction

Water curtailment plans outline proactive measures that water suppliers may take to reduce demand and to find alternative supply during short-term water supply shortages. The intent of water curtailment plans is to minimize the impacts of water supply shortages and to ensure water supply for public health and safety.

The curtailment plan presented in this section is based on the City's ordinance 13.04.220 Regulations Pertaining to Inadequate Supply or Shortages of Water contained in **Appendix G**, but has been updated to comply with Division 86 requirements. The City's existing ordinance outlines three stages of alert for dealing with potential water shortages. Stage 1 calls for voluntary reductions in water use, Stage 2 implements compulsory restrictions, and Stage 3 prohibits certain water uses. The ordinance also allows the city council to temporarily raise water rates, and describes enforcement provisions including fines and disconnection of service. While the city manager is authorized to trigger a Stage 1 alert level, under the city's existing ordinance, only the city council can declare higher curtailment stages. The existing ordinance does not describe the "pre-determined levels of severity of shortage or water service difficulties that will trigger the curtailment actions" as required by Division 86. In addition, the existing ordinance does not provide for a Stage 4 curtailment response to an interruption of water service because of some type of catastrophic event. The curtailment plan presented in this section modifies the City's current plan (ordinance) by adding a Stage 4, identifying objective measures that will trigger the curtailment stages, and increasing the level of response triggered at Stages 2 and 3.

History of System Curtailment Episodes

OAR-690-086-0160(1)

The City has only implemented water curtailment measures once during the past 10 years. The City activated Stage 1 voluntary curtailment on July 27, 2009 in response to the combination of record high air temperatures that increased water demands and record low stream flow levels in Alder Creek that affected the City's ability to divert water. The City changed its diversion dam and intake structure to enable the City to provide more water to the WTP at that time. The City lifted Stage 1 curtailment on July 31 in response to decreased temperatures.

Since then, the City has not activated any curtailment stages and has taken action to reduce the likelihood of the need for water curtailment in the future by securing a redundant water supply. In 2014, the City began utilizing a new interconnection with the PWB. This interconnection provides additional water supply from PWB's Bull Run water supply source to meet peak demands and provides the City with water supply redundancy in the

event that the City's water sources (i.e. Alder Creek and Brownell Springs) are impacted by a long-term drought, contamination, or system failure that results in a water shortage. The addition of the PWB water source increased the City's production capacity to approximately 5 mgd, which is more than double the City's MDD. Consequently, the City expects to maintain water delivery during most long-term water shortages.

Currently, the City's water system infrastructure is sufficient to meet water demands in the near future.

Curtailment Event Triggers and Stages

OAR-690-086-0160(2) and (3)

The City's water curtailment plan as presented in this WMCP has four stages that increase in severity and are intended to be implemented in progressive steps. The curtailment stages include both voluntary and mandatory limitations and the type of limitations will depend on the cause, severity, and anticipated duration of the water shortage.

The City's four curtailment stages and their potential initiating conditions (i.e. triggers) are presented in **Exhibit 4-1**. The City's initiating conditions focus on supply capacity, but include other supply shortage initiating conditions, as well.

Exhibit 4-1. Curtailment Stages 1 through 4.

Curtailment Stages	Potential Initiating Conditions
Stage 1: Water Alert	General recognition of drought conditions in Clackamas County, or Demand reaches 80 percent of supply capacity for 3 or more consecutive days, or Water storage is approaching the minimum required for fire protection or other essential needs as determined by the City
Stage 2: Serious Shortage	Demand reaches 90 percent of supply capacity for 3 or more consecutive days.
Stage 3: Critical Shortage	Demand is 100 percent or more of supply capacity for 3 or more consecutive days.
Stage 4: Emergency	System failure, such as a main break or treatment plant interruption. Chemical spill, malevolent attack on the system or other event introduces a contaminant at some point in the system.

Curtailment Plan Implementation

OAR-690-086-0160(4)

Stage 1: Water Alert

Stage 1 will activate a program to inform customers of the potential for drought and/or water shortages, and reasons to voluntarily conserve water. Stage 1 will be activated by the city manager and will be triggered when any of the following conditions exist:

1. General recognition of drought conditions in Clackamas County.
2. Demand reaches 80 percent of water supply capacity as determined by the city manager for a period of 3 or more consecutive days.
3. Water storage approaches the minimum required for fire protection or other essential needs as determined by the city manager.

Under Stage 1, the City will issue a notice requesting voluntary reduction in water use by all customers. The notice will include a description of the current water situation, the reason for the requested conservation measures, and a warning that mandatory restrictions will be implemented if voluntary measures are not sufficient to achieve water use reduction goals. The notice also will direct customers to the RWPC website (www.conserveh2o.org) for conservation information and tips. A similar notice could be issued through local media (newspaper, radio, or TV) if a regional drought has not already triggered media coverage of water shortage concerns.

When Stage 1 is triggered, the City will ask customers to voluntarily take one or more of the following actions:

- Limit landscape watering between the hours of 10:00 am and 6:00 pm, the period of highest water loss due to evaporation.
- Comply with an alternate days system for landscape watering (i.e. even numbered addresses water on even numbered days and odd numbered addresses water on odd numbered days).
- Implement other conservation measures, such as those suggested by the RWPC website and the RWPC brochures, *H20utdoor* and *H20 indoor.*

Stage 2: Serious Water Shortage

Stage 2 is similar to Stage 1 except that the voluntary measures regarding outdoor water use will be made compulsory by the city council, and additional non-essential water use will be prohibited. Stage 2 will be activated by the city council when demand on the water system reaches 90 percent of the supply capacity for 3 days or more.

Under Stage 2, the City will issue a notice describing the current water situation, the need for mandatory conservation measures, and the mandatory water conservation actions imposed. The notice also will direct customers to the RWPC website (www.conserveh2o.org) for conservation information and tips. A similar notice could be issued through local media (newspaper, radio, or TV).

When Stage 2 is triggered, the City will impose one or more of the following mandatory water restrictions:

1. Watering landscapes prohibited between 10:00 am and 6:00 pm.
2. Comply with the alternate day system for landscape watering (i.e. even numbered addresses water on even numbered days and odd numbered addresses on odd numbered days).
3. No water use for washing motorbikes, motor vehicles, boat trailers, or other vehicles except at a commercial washing facility that practices wash water recycling. (Exceptions include vehicles that must be cleaned to maintain public health and welfare such as food carriers and solid waste transfer vehicles.)
4. No water use to wash sidewalks, walkways, driveways, parking lots, tennis court, and other hard-surfaced outdoor areas.
5. No water use to wash buildings and structures, except as needed for painting or construction.
6. No water use for a fountain or pond for aesthetic or scenic purposes, except where necessary to support fish life.
7. Discourage serving water to customers in restaurants unless water is requested by the customer. (This action does not provide significant water savings, but is useful for generating awareness of the need to curtail use.)
8. Water only tees and greens and not other golf course areas.
9. No water use for dust control unless absolutely necessary, as determined by the City Council.
10. No water use for gutter cleaning.

Stage 3: Critical Water Shortage

Stage 3 will be activated by the city council when demand on the water system is 100 percent or more of available supply capacity for 3 days or more. The City will issue public service announcements to notify customers of the severity of the conditions.

Under Stage 3, the City will issue a notice describing the severity of the current water situation and the additional mandatory water conservation actions imposed. The notice also will direct customers to the RWPC website (www.conserveh2o.org) for conservation information and tips. A similar notice could be issued through local media (newspaper, radio, or TV).

When Stage 3 is triggered, the City will impose one or more of the following mandatory water restrictions (in addition to water restrictions that may have been imposed under Stage 1 or Stage 2):

1. Replace the restriction of alternate days system for landscape watering from Stage 2 with a prohibition on all outdoor watering (Exceptions include new lawn, grass or turf planted after March 1st of the calendar year in which restrictions are imposed, sod farms, high-use athletic fields, golf tees and greens, or park and recreation areas specifically designated by the city council.)

2. No water use to fill, refill, or add to any indoor or outdoor swimming pools or hot tubs, except if one of the following conditions is met: the pool is used for a neighborhood fire control supply, the pool has a recycling water system, the pool has an evaporative cover, or the pool's use is required by a medical doctor's prescription.
3. No water use from hydrants for construction purposes (except on a case-by case basis), fire drills, or any purpose other than firefighting.
4. Implement limitations on commercial uses of water as determined appropriate by the city manager.

Stage 4: Emergency Water Shortage

Stage 4 will be activated when failure of a system component or non-drought emergency conditions results in an immediate shortage of water. Examples include failure of the main transmission line from the Terra Fern Road Reservoir to the City, failure of the intake or water treatment plant, a chemical spill on Alder Creek upstream of the intake or in the PWB's Bull Run water supply upstream of the point of diversion, or a malevolent attack on the system that introduces a contaminant at some point in the system.

If water in the system is unsafe to drink or an emergency shortage exists from a failure in the water system, the city manager will direct staff to notify customers as quickly as possible to inform them about the emergency water shortage and the necessary mandatory water curtailment measures. (This scenario assumes that a decision to implement Stage 4 will need to happen immediately and that approval from the entire city council will not be expeditious enough.)

When Stage 4 is triggered, the City will impose one or more of the following mandatory water restrictions (in addition to water restrictions that may have been imposed under Stage 2 or Stage 3):

1. Limit residential water use to essential uses only, such as drinking, cooking, basic sanitation, and maintaining human health.
2. Prohibit all non-essential water uses by commercial/industrial customers.

In addition, the city manager will implement the following:

1. Contact the Oregon Drinking Water Program, Department of Human Services and request their assistance in responding to the problem.
2. Notify the local news media, if appropriate, to ask for their assistance in notifying customers.
3. Call an emergency city council meeting
4. Contact the Oregon State Police and Clackamas County Sheriff to obtain help in contacting customers.

The City will continue to investigate and develop specific back-up plans for a Stage 4 emergency. These plans may include renting a water hauling truck and purchasing water from neighboring communities, sending customers to a pre-designated water distribution location, and supplying bottled water.

Conservation Water Rate Schedule

In addition to the above measures, the City shall retain ordinance provisions regarding the adoption of temporary conservation water rate schedules and enforcement.

Enforcement

The city code includes the following enforcement provisions for violations of the regulations related to water curtailment. (13.04.220(E)):

1. The City shall personally deliver a notice of violation to the occupant of the premises. If the occupant is not present, the City may post a notice on the premises advising the user of the violation and warning the user of what specific sanctions may be imposed if the violations continue. The City shall also mail the notice of violation by regular mail to the occupant at the address of the subject premises where the violation has occurred.
2. The following penalties may be imposed if violations continue:
    - Second violation: $100.00 Fine
    - Third violation: $300.00 Fine
    - Fourth and subsequent violations: $500.00 Fine

In the case of continuing violations, the City also has the authority to discontinue water service. (Ord. 12-92 §1, 1992: Ord. 10-73 § 23, 1973.)

SECTION 5

Water Supply

This section satisfies the requirements of OAR 690-086-0170.

This rule requires descriptions of the City's current and future water delivery areas and population projections, demand projections for 10 and 20 years, and the schedule for when the City expects to fully exercise its water rights. The rule also requires comparison of the City's projected water needs and the available sources of supply, an analysis of alternative sources of water, and a description of required mitigation actions.

Delineation of Service Areas

OAR 690-086-0170(1)

Exhibit 2-1 shows the City's urban growth boundary and its urban reserve area, which together represent the City's future service area.

Population Projections

OAR 690-086-0170(1)

The City's projected population for its future water service area, which includes its current UGB and Urban Reserve Area, is 13,123 in 2025 and 16,769 in 2035, as shown in **Exhibit 5-1**. These population projections were prepared by Portland State University's Population Research Center (PRC) in October 2014. The projections are based on household forecasts for areas called transportation analysis zones (TAZs) adopted by the Metro Council in 2012, Metro's Buildable Land Inventory (BLI), data from the US Census Bureau, and data from the PRC. **Appendix B** pages 5 and 6 are part of the report detailing the methods and the data sources used for the population projections. The population projections do not include areas served by the Alder Creek Barlow Water District or Skyview Acres Water Company.

Exhibit 5-1. Projected Water Service Area Population.

Year	Population[1]
2010[2]	10,863
2013	11,290
2014	11,447
2015	11,606
2016	11,761
2017	11,916
2018	12,073
2019	12,225
2020	12,384
2021	12,532
2022	12,680
2023	12,826
2024	12,976
2025	13,123
2026	13,470
2027	13,823
2028	14,178
2029	14,539
2030	14,909
2031	15,271
2032	15,638
2033	16,012
2034	16,390
2035	16,769

[1]All population projections presented above are for the City water service area and do not include areas served by the Alder Creek Barlow Water District and Skyview Acres Water Company.

[2]April 1, 2010 census data used. All other years use July 1 (2013 estimates and 2014-2045 forecasts).

Demand Forecast

OAR 690-086-0170(3)

The City developed its demand forecasts using the following steps. First, the City's average annual water demand from 2006 through 2014 (395.8 MG) was apportioned among the City's customer categories based on the percentage of water that each customer category consumed in 2014, as shown in **Exhibit 5-2**. Average annual water demand was divided by 365 days for each customer category to calculate ADD by customer category. Average annual water demand from 2006 through 2014 was used instead of annual demand for 2014 to provide a historically representative annual water demand. (The City's 2014 annual water demand was the lowest during the period 2006 through 2014.) The year 2014 was used instead of an average from 2006 through 2014 for the percentage of water that each customer category consumed to represent the most current distribution of water usage by customer category.

Exhibit 5-2. Average Annual Water Demand and Average Day Demand (ADD) by Customer Category.

Customer Category	Percentage of Annual Consumption in 2014 (%)	Average Annual Water Demand from 2006-2014 (MG)	ADD Averaged from 2006-2014 (mgd)
Single Family Residential	65	257.2	0.70
Multi-family Residential	11	43.5	0.12
Commercial/ Industrial	22	87.1	0.24
Wholesale	2	7.9	0.02
Total	100%	395.8	1.08

To project demand through 2035, the City then took the following steps:

- **Projected Residential ADD** -- An annual residential growth rate of 2.12 percent, based on the PRC Population Projections for the years 2015 through 2035, was applied to Residential (single family + multi-family) ADD averaged from 2006 through 2014 of 0.82 mgd (0.70 mgd + 0.12 mgd = 0.82 mgd).
- **Projected Commercial/Industrial ADD** -- The annual employment growth rate of 4.0 percent, based on the Metro Transportation Plan for the years 2010 through 2014, was applied to the Commercial/Industrial ADD averaged from 2006 through 2014 of 0.24 mgd.
- **Projected Wholesale ADD** -- The annual wholesale growth rate was assumed to be 0 percent based on the assumptions that the City will have no additional wholesale customers and the District and Skyview will not have an increase in population over the next 20 years that would increase their demand, resulting in the Wholesale demand of 0.02 mgd continuing through 2035.

The City summed the projected Residential, Commercial/Industrial, and Wholesale ADDs for each year through 2035 then applied the maximum peaking factor (MDD:ADD) from 2006-2014 of 2.3 to obtain the projected MDD for each year through 2035.

Exhibit 5-3 presents the City's MDD projections that were developed using the above described methodology. The demand projections estimate that the City's MDD will reach 3.3 mgd (5.1 cfs) by 2025 and 4.2 mgd (6.6 cfs) by 2035. These initial MDD projections do not, however, consider the variability in demand based on climactic conditions (weather). To account for the effects of weather variations on MDD, the City determined the standard deviation of the MDDs from 2006 through 2014, which was 0.3 mgd (0.46 cfs). The City added the 0.3 mgd "weather allowance" to the MDD projections. **Exhibit 5-3** shows the City's projected MDD with the weather allowance, which is estimated to be 3.6 mgd (5.5 cfs) in 2025 and 4.5 mgd (7.0 cfs) in 2035.

Exhibit 5-3. Projected Maximum Day Demand (MDD) With and Without a Weather Allowance.

Year	MDD		MDD with weather allowance (mgd)	MDD with weather allowance (cfs)
	(mgd)	(cfs)		
2014	2.5	3.9	2.8	4.3
2015	2.6	4.0	2.9	4.4
2016	2.6	4.1	2.9	4.5
2017	2.7	4.2	3.0	4.6
2018	2.8	4.3	3.1	4.7
2019	2.8	4.4	3.1	4.8
2020	2.9	4.5	3.2	4.9
2021	3.0	4.6	3.3	5.1
2022	3.0	4.7	3.3	5.2
2023	3.1	4.8	3.4	5.3
2024	3.2	5.0	3.5	5.4
2025	3.3	5.1	3.6	5.5
2026	3.4	5.2	3.7	5.7
2027	3.5	5.3	3.8	5.8
2028	3.5	5.5	3.8	5.9
2029	3.6	5.6	3.9	6.1
2030	3.7	5.8	4.0	6.2
2031	3.8	5.9	4.1	6.4
2032	3.9	6.1	4.2	6.5
2033	4.0	6.2	4.3	6.7
2034	4.1	6.4	4.4	6.9
2035	4.2	6.6	4.5	7.0

Schedule to Exercise Permits and Comparison of Projected Need to Available Sources

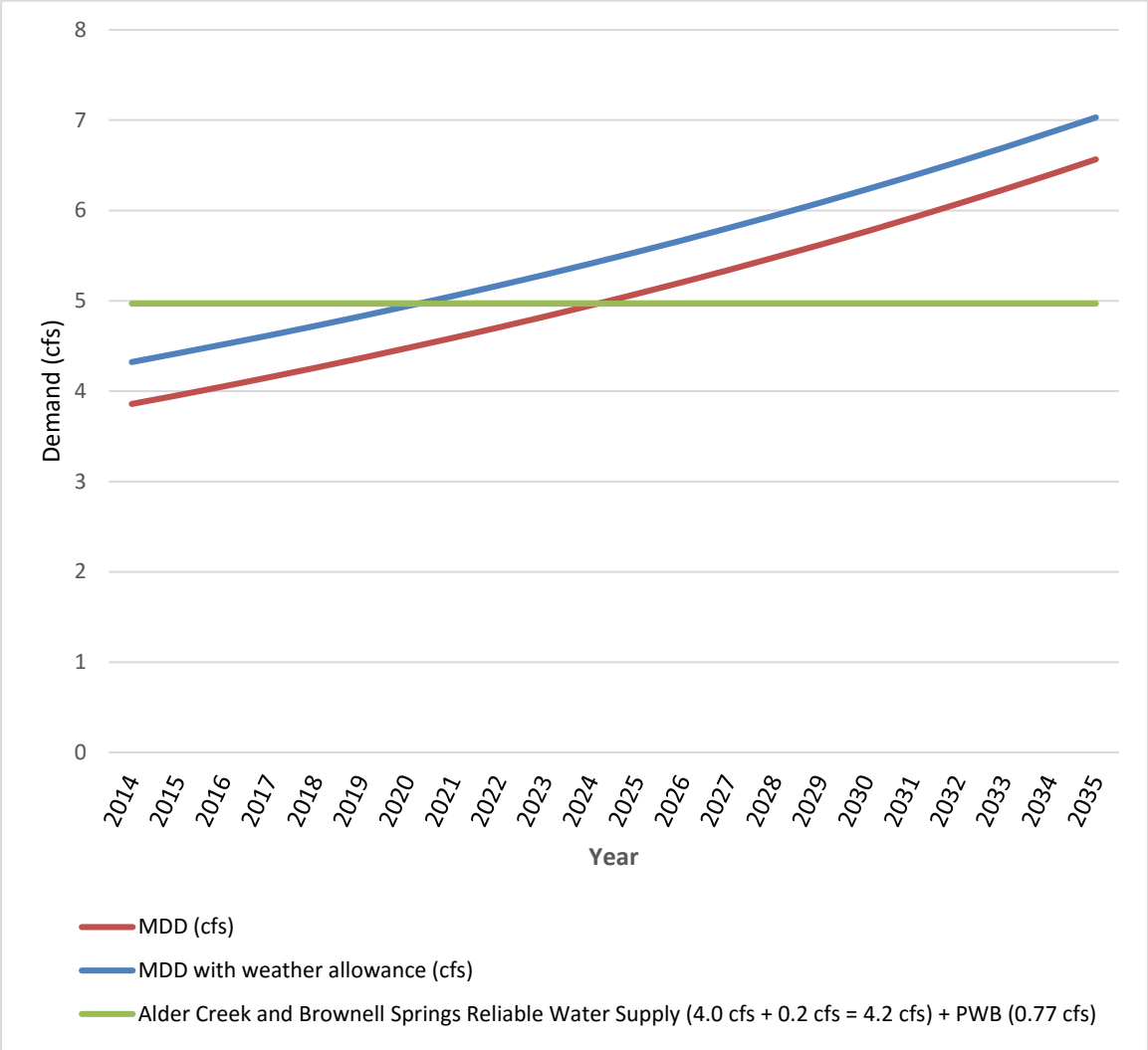
OAR 690-086-0170(2) and (4)

As described in Section 2, the City currently relies principally on its Alder Creek and Brownell Springs water rights to supply water to its customers, and PWB water is a supplemental water supply. The City currently is authorized to use up to 5.2cfs under its Alder Creek water rights and Brownell Springs water rights (4.0 cfs under Certificate 91176 and Permit S-36601 and 1.2 cfs under its Brownell Springs water rights). The water supply reliability of the City's Alder Creek water rights (4.0 cfs)[2] and Brownell Springs water rights (0.2 cfs) plus the PWB water (0.77 cfs) totals 4.97 cfs (3.21 mgd).

The City's projected MDD with a weather allowance shows that the City needs 4.97 cfs in less than 10 years (by 2021). (See **Exhibit 5-3** and **Exhibit 5-4).** The City intends to fully utilize its Alder Creek and Brownell Springs water rights to minimize its reliance on the water it purchases from the PWB, which is particularly important in the event of a disruption in the PWB Bull Run water supply.

[2] As previously described, City understands that water use limitations may be added to Permit S-36601 as a result of an approved extension of time. At this time, the potential conditions are unknown.

Exhibit 5-4. Projected Maximum Day Demand (MDD) and Water Supply Sources.



Over the next few years, the City will evaluate the best approach to meet its projected water demands through at least 2035. The City is considering three options: 1) begin to develop the City's Salmon River water supply, 2) purchase additional wholesale water from the PWB (purchase of up to 3.0 mgd is allowed under the current contract, which is in effect until June 30, 2028), or 3) pursue a combination of options 1 and 2. The City will provide an update on its evaluation of the best approach to use to meet its projected water demands through 2035 in the 10-year update of this WMCP.

Alternative Sources
OAR 690-086-0170(5)

OAR 690-086-0170(5) requires an analysis of alternative sources of water if any expansion or initial diversion of water allocated under existing permits is necessary to meet future water demand. The City is not seeking expansion or initial diversion of water under its existing permits; therefore, this provision is not applicable.

Quantification of Projected Maximum Rate and Monthly Volume
OAR 690-086-0170(6)

OAR 690-086-0170(6) requires a quantification of the maximum rate of withdrawal and maximum monthly use if any expansion or initial diversion of water allocated under an existing permit is necessary to meet demands in the 20-year planning horizon. The City is not seeking expansion or initial diversion of water under its existing permits; therefore, this provision is not applicable.

Mitigation Actions under State and Federal Law
OAR 690-086-0170(7)

Under OAR 690-086-0170(7), for expanded or initial diversion of water under an existing permit, the water supplier is to describe mitigation actions it is taking to comply with legal requirements of the Endangered Species Act, Clean Water Act, and other applicable state or federal environmental regulations.

The City currently is not required to take any mitigation actions under state or federal law. The final order approving an extension of time for the City's Permit S-48451 (use of water from Salmon River) did, however, include "fish persistence" conditions. These conditions were included to maintain the persistence of fish species listed under the Endangered Species Act in portions of the river affected by the water user under the permit. The City is fully aware of these conditions, and upon initiating use of Permit S-48451, the City will monitor streamflows and use as needed to comply with its permit requirements. The City is also aware that fish persistence conditions may be added to Permit S-36601 upon approval of the pending permit extension.

New Water Rights
OAR 690-086-0170(8)

Under OAR 690-086-0170(8), if a municipal water supplier finds it necessary to acquire new water rights within the next 20 years in order to meet its projected demand, an analysis of alternative sources of the additional water is required. The analysis must consider availability, reliability, feasibility and likely environmental impacts and a schedule for development of the new sources of water. The City does not intend to acquire new water rights to meet demands within the next 20 years, so the provisions of this section are not applicable.

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Appendix A

Letters to Local Governments

GSI
Water Solutions, Inc.

December 21, 2015

Tracy Brown, Director
Planning and Development Department
City of Sandy
39250 Pioneer Blvd.
Sandy, OR 97055

Subject: Water Management and Conservation Plan for the City of Sandy

Dear Mr. Brown:

The City of Sandy has developed a draft Water Management and Conservation Plan (WMCP) to fulfill the requirements of Oregon Administrative Rule Chapter 690, Division 86 of the Oregon Water Resources Department.

Under these rules, the water supplier shall make its draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. Enclosed is a CD containing the City of Sandy's draft WMCP for your review.

Please provide comments to me within 30 days from the date of this letter. If the plan appears consistent with your agency's Comprehensive Land Use Plan, a letter response to that effect would be appreciated. You may send your comment to me at the address on this letterhead or e-mail them to me directly at: asussman@gsiws.com.

If you have any questions, please feel free to contact me at 541-257-9001. Thank you for your interest.

Sincerely,
GSI Water Solutions Inc.

Adam Sussman
Principal Water Resources Consultant

Enclosure

1600 SW Western Blvd., Suite 240 Corvallis, OR 97333 P: 541.753.0745 F: 541.754.4211 info@gsiws.com www.gsiws.com

GSI
Water Solutions, Inc.

December 21, 2015

Clackamas County - Planning and Zoning Division
Development Services Building
150 Beavercreek Rd.
Oregon City, OR 97045

Subject: Water Management and Conservation Plan for the City of Sandy

Dear Sir or Madam:

The City of Sandy has developed a draft Water Management and Conservation Plan (WMCP) to fulfill the requirements of Oregon Administrative Rule Chapter 690, Division 86 of the Oregon Water Resources Department.

Under these rules, the water supplier shall make its draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. Enclosed is a CD containing the City of Sandy's draft WMCP for your review.

Please provide comments to me within 30 days from the date of this letter. If the plan appears consistent with your agency's Comprehensive Land Use Plan, a letter response to that effect would be appreciated. You may send your comment to me at the address on this letterhead or e-mail them to me directly at: asussman@gsiws.com.

If you have any questions, please feel free to contact me at 541-257-9001. Thank you for your interest.

Sincerely,
GSI Water Solutions Inc.

Adam Sussman
Principal Water Resources Consultant

Enclosure

1600 SW Western Blvd., Suite 240 Corvallis, OR 97333 P: 541.753.0745 F: 541.754.4211 info@gsiws.com www.gsiws.com

GSI
Water Solutions, Inc.

December 21, 2015

Jeremy Tower
Alder Creek Barlow Water District
PO Box 542
Sandy, OR 97055

Subject: Water Management and Conservation Plan for the City of Sandy

Dear Mr. Tower:

The City of Sandy has developed a Draft Water Management and Conservation Plan (WMCP) to fulfill the requirements of Oregon Administrative Rule Chapter 690, Division 86 of the Oregon Water Resources Department. Under these rules, the water supplier shall make its Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans.

As a courtesy, the City of Sandy is providing you a copy of the Draft WMCP. If you have any questions, please feel free to contact me at 541-257-9001.

Sincerely,
GSI Water Solutions Inc.

Adam Sussman
Principal Water Resources Consultant

Enclosure

1600 SW Western Blvd., Suite 240 Corvallis, OR 97333 P: 541.753.0745 F: 541.754.4211 info@gsiws.com www.gsiws.com

GSI
Water Solutions, Inc.

December 21, 2015

David Jacob
Skyview Acres Water Company
PO Box 2072
Sandy, OR 97055

Subject: Water Management and Conservation Plan for the City of Sandy

Dear Mr. Jacob:

The City of Sandy has developed a Draft Water Management and Conservation Plan (WMCP) to fulfill the requirements of Oregon Administrative Rule Chapter 690, Division 86 of the Oregon Water Resources Department. Under these rules, the water supplier shall make its Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans.

As a courtesy, the City of Sandy is providing you a copy of the Draft WMCP. If you have any questions, please feel free to contact me at 541-257-9001.

Sincerely,
GSI Water Solutions Inc.

Adam Sussman
Principal Water Resources Consultant

Enclosure

1600 SW Western Blvd., Suite 240 Corvallis, OR 97333 P: 541.753.0745 F: 541.754.4211 info@gsiws.com www.gsiws.com

Appendix B

Regional Water Providers Consortium

Population, Housing Unit, and Household Forecasts

2014 to 2045

DRAFT

Regional Water Providers Consortium

Population, Housing Unit, and Household Forecasts

2014 to 2045

Portland State UNIVERSITY

Population Research Center

JUNE 2014

DRAFT

Regional Water Providers Consortium

Population, Housing Unit, and Household Forecasts

2014 to 2045

Prepared By

Population Research Center

Portland State University

Charles Rynerson, Research Associate, principal investigator
Kevin Rancik, Research Assistant

JUNE, 2014

Background

Water providers have an ongoing need for estimates and forecasts of the total population and the number of housing units and households within their service areas. While some of the water providers within Clackamas, Multnomah, and Washington counties have obtained this information periodically on an individual basis, a complete and systematic set of estimates and forecasts for all members of the Regional Water Providers Consortium has not been prepared for nearly 10 years.

The Portland Water Bureau (PWB), on behalf of the Regional Water Providers Consortium, requested that the Portland State University Population Research Center (PRC) update service area boundaries and prepare population, housing unit, and household estimates and forecasts for the water service areas of the municipalities and water districts in the Consortium, as well as the wholesale customers of the PWB that are not Consortium members.

This report includes a brief description of the procedures, methodologies, and data sources used to prepare forecasts for each year from 2014 to 2045. The appendix contains summaries of population and household forecasts for each service area for 2035 and 2045 and a detailed one page profile for each service area that includes annual estimates of population, household population, housing units, households, persons per household, and vacancy rates. *[Note: the detailed profiles in draft form are available on the ftp site, in the "PRC" subfolder under each provider's folder. They will be added to the appendix when the forecasts are final.]* A report issued in February 2014 described the process of collecting and reviewing boundaries for each provider and preparing estimates for each year from 1990 to 2013.

Service Area Boundaries

Forecasts for all years have been prepared based on 2013 boundaries for every water provider included in the study. Boundaries for many of the providers may change in the future, and tentative plans are to update the forecasts in five years.

Several providers submitted shapefiles or maps that included future expanded service areas, in addition to their current boundaries. For these providers, PRC prepared forecasts for current service areas and also for future service areas. However, please note that PRC made no attempt to predict when the expansion would occur. The detailed forecast profiles simply tabulate 2010 census, 2013 estimates, and 2014 to 2045 forecasts for the larger areas. Also, because forecasts from 2014 to 2024 were

interpolated from 2013 and 2025 figures, the results may imply that residential development in new urban areas will begin sooner than is likely. For example, an area slated for development of 1,000 housing units by 2025 may in reality remain undeveloped until 2022, but the interpolation procedure will place housing in the area beginning in 2014. These forecasts are intended to depict likely long range future growth scenarios, not to precisely depict growth in the short run. Annual updates of the estimates will be prepared for 2014, 2015, and so on, incorporating actual residential development that has occurred by the date of the estimates.

Forecast Model and Data Sources Overview

In November 2012 the Metro Council adopted household (HH) forecasts by jurisdiction.[1] These forecasts were also produced for smaller areas called transportation analysis zones (TAZs). There are 1,482 TAZs in Clackamas, Multnomah, and Washington counties, making TAZs ideal for aggregating to larger geographic areas such as the 35 water service areas for which these forecasts are produced. However, the imprecise geographic fit between TAZs and water provider boundaries and the need for housing unit (HU) and population (POP) estimates in addition to HH estimates requires additional data and a relatively complex model.

Metro prepares forecasts for HHs, which are occupied HUs. We also needed to prepare HU forecasts for water providers, so we derived HU growth forecasts at the TAZ level by dividing HH growth forecasts by occupancy rates. POP forecasts were not generated at the TAZ level, but were produced for water service areas after HH forecasts were aggregated to service areas.

Most water service areas are composed of partial TAZs as well as whole TAZs. Therefore, the forecasts for TAZs that are split among more than one water provider must be allocated based on shares of expected growth within each TAZ/provider part. All of the data inputs were prepared for whole TAZs and TAZ/provider pieces, and provider shares of whole TAZs were calculated as a means to allocate TAZ level forecasts to providers. Six sets of shares were derived — four categories of net residential capacity from Metro's Buildable Land Inventory (BLI) at the parcel level, an inventory of existing HUs on parcels not included in the BLI, and land area.

We used the shares to distribute HU and HH growth forecasts to TAZ/provider pieces in three increments: 2010 to 2025, 2010 to 2035, and 2010 to 2040. Most TAZs are entirely within a single

[1] Ordinance No. 12-1292A, Metro Council, November 29, 2012.

water service area; the location and timing of development within a TAZ would not matter in those cases. For TAZs that are split between more than one provider, the amount of net residential capacity in each piece as well as the type of capacity makes a difference in the allocation of growth to each service area. We used the simple assumptions that growth within each TAZ would initially occur on vacant land, followed by underdeveloped land with net capacity (most of the region's net residential capacity is on these parcels), followed by infill on existing developed multiple family parcels (this category accounts for relatively little capacity), followed by the remainder of the TAZ not included in the BLI.

An additional piece of TAZ level information from Metro's Metroscope model is "2045 HH Capacity"[2] For TAZs in which the 2045 HH capacity exceeds the 2010 to 2040 HH growth, we allocated the excess capacity to TAZ/provider pieces based on land area.

Household Forecasts

HH growth for the three increments and the remaining capacity for 2040 to 2045 were aggregated from the TAZ/provider pieces to water service areas. Initial HH forecasts for 2025, 2035, and 2040 were calculated by adding the growth increments to the 2010 census base. To ensure that the HH forecasts are consistent with regional control totals and the 2013 base year estimates for each water service area, service area shares of the regional HH totals (based on the sum of these initial forecasts) were computed for the benchmark years 2013, 2025, 2035, and 2040. These shares were then interpolated for the intermediate forecast years, and the shares for each year from 2014 to 2040 were applied to regional control totals to produce final HH forecasts by water service area.[3] The 2041 to 2045 HH forecasts were distributed from the regional control totals based on the service area's shares of regional excess capacity.

Housing Unit Forecasts

Once the TAZ/provider HU growth forecasts were generated, initial forecasts by water service area were prepared for 2025, 2035, and 2040 using the same method as the initial HH estimates. Growth increments for each service area were added to the 2010 base. The interpolation method differed, however. Rather than computing regional shares for the benchmark years, we computed occupancy rates (HH divided by HU) and interpolated those. Using the occupancy rates calculated for 2013, 2025,

[2] MetroScope Gamma 2035 TAZ Forecast, DRAFT 9/19/12.
[3] For a description of the regional control totals, see the "Preliminary county forecasts by age group" item in the Data Sources and Uses section of this report.

2035, and 2040, interpolations for intermediate years and extrapolations for 2041 to 2045, we derived final HU forecasts by multiplying occupancy rates by the final HH forecasts.

Group Quarters Forecasts

All persons are reported by the Census Bureau as living in either HHs (occupied HUs), or group quarters (GQs) such as dorms, prisons, and nursing homes.[4] The region's GQ population (GQPOP) grew faster than HH population (HHPOP) between 2000 and 2010, but it is difficult to predict the future rate or location of GQPOP growth. GQPOP is currently less than two percent of current total population, and would be barely over two percent even if its growth rate continued to outpace the HHPOP growth rate in a manner similar to the 2000 to 2010 period. Considering the small impact of GQPOP and the uncertainty of future GQ sites or GQPOP change at existing sites, the safest assumption is that GQPOP will grow at the same rate as total POP, and that GQPOP in each service area will grow at the same rate as the region.

Household Population Forecasts

We estimated the future distribution of single family (SF) and multifamily (MF) growth for each service area using shares of net capacity by HU type aggregated from Metro's BLI. We then multiplied the HH growth by persons per HH (PPH) — 2.75 for SF HHs and 1.97 for MF HHs, deriving initial estimates of annual HHPOP growth.[5] These were added to the 2013 base year HHPOP to produce initial annual estimates of HHPOP, which were finally adjusted to match the regional control totals.

Total Population

Total population is the sum of household population and group quarters population. Because HHPOP and GQPOP forecasts for each service area are consistent with the regional control totals, no additional adjustments to POP are required.

$$POP = HHPOP + GQPOP$$

[4] A more detailed definition of group quarters is included in the Glossary.

[5] These PPHs are from the Census Bureau's 2008-2012 American Community Survey 5 year estimates. Future PPHs are expected to decline significantly due to the aging of the population and declining fertility rates. Although the 2008-2012 PPHs are not adjusted in the model, the increasing share of multifamily homes and the regional HHPOP control result in declining future PPHs.

Data Sources and Uses

From Metro

Transportation Analysis Zone (TAZ) shapefile. Metro's regional forecast is allocated to zones within the metro area, including 1,482 TAZs within Clackamas, Multnomah, and Washington counties. The forecast model relies on TAZ data, so all data inputs must be summarized at the TAZ level.

Buildable Land Inventory (BLI). Residential capacity by taxlot within Metro's Urban Growth Boundary (UGB), shapefiles downloaded from Metro's ftp site. "Capacity is calculated from current zoning or current comprehensive plan data (and sometimes concept plans when there isn't any urban zoning or comp plan in place). The [BLI is] based on a 2008 vacant land survey data that was subsequently revised to represent 2010 capacity."[6]

Household forecasts by TAZ. 2010 base year and 2025, 2035, and 2040 forecasts.[7] Household forecasts were divided by occupancy rates for each TAZ to derive TAZ housing unit forecasts.

From U.S. Census Bureau

Census 2010, Summary File 1, Table H3. Housing unit and household counts were aggregated from census blocks to TAZs, in order to calculate initial occupancy rates for each TAZ. Some initial rates were adjusted to correct for extreme values in 2010, such as newly developing areas where homes were not yet occupied, or relatively unpopulated areas where a small number of existing homes were 100 percent occupied.

Census 2010, Summary File 1, Table H17. Householders by age were divided by age group population totals to derive age-specific headship rates. These rates are used to derive household forecasts, given population forecasts by age group.

From PSU Population Research Center

Regional water providers shapefile. PRC created a regional layer based on files submitted by individual water providers, finalized in January 2014, for use in the population, housing unit, and household estimates prepared in February 2014.[8] This shapefile and the TAZ shapefile were used to aggregate data to unique TAZ/provider geographies.

Water providers 2013 estimates. The 2013 estimates of population, housing units, households, and household population prepared in February 2014 are the base year data for the 2014 to 2045 forecasts.

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[6] *Regional Forecast Distribution Methodology & Assumptions. Population and Employment 2010-40 TAZ Forecast Distribution "Gamma Scenario"*. Metro, Attachment 6 (Staff Report to Ordinance no. 12-1292A), November 2012.

[7] Datasets and associated information are available at http://www.oregonmetro.gov/regional-2035-forecast-distribution.

[8] A more detailed description may be found in *Regional Water Providers Consortium, Population, Housing Unit, and Household Estimates, 1990 to 2013*. Portland State University Population Research Center, February 2014.

Housing unit inventory shapefile. PRC created a layer in GIS with a point representing each housing unit in Clackamas, Multnomah, and Washington counties. This layer, based on Metro's RLIS taxlot and multifamily housing inventory, was initially developed for the estimates prepared in February. In the forecast model it is used to allocate TAZ housing unit forecasts to water providers in areas outside of the UGB not covered by Metro's BLI, and within the UGB where the forecast exceeds net capacity.

Preliminary county forecasts by age group. PRC has recently initiated the Oregon Population Forecast Program (OPFP) and is currently refining county level forecasts.[9] Preliminary forecasts for the tri-county area in five year increments were interpolated to create annual forecast series and were used in the model as regional population and household control totals. These OPFP population forecasts will be revised after extensive review, but the preliminary figures at the regional level were applicable due to their comparability to forecasts from the Oregon Office of Economic Analysis' 2013 county forecast series as well as to Metro's 2012 TAZ allocation.[10]

[9] See OPFP description at http://www.pdx.edu/prc/opfp.
[10] See OEA forecast at http://www.oregon.gov/DAS/OEA/Pages/demographic.aspx and Metro's City and county profiles.

Glossary

The following definitions are furnished by the U.S. Census Bureau.[11]

Group Quarters	A group quarters is a place where people live or stay that is normally owned or managed by an entity or organization providing housing and/or services for the residents. These services may include custodial or medical care as well as other types of assistance, and residency is commonly restricted to those receiving these services. People living in group quarters are usually not related to each other. Group quarters include such places as college residence halls, residential treatment centers, skilled nursing facilities, group homes, military barracks, correctional facilities, workers' dormitories, and facilities for people experiencing homelessness.
Household	A person or group of people who occupy a housing unit as their usual place of residence. The number of households equals the number of occupied housing units in a census.
Housing unit	A single-family house, townhouse, mobile home or trailer, apartment, group of rooms, or single room that is occupied as a separate living quarters or, if vacant, is intended for occupancy as a separate living quarters (in which one or more occupants live separately from any other individual(s) in the building and have direct access to the living quarters without going through another living quarters, such as from outside the building or through a common hall. For vacant units, the criteria of separateness and direct access are applied to the intended occupants.)
Population	All people living in a geographic area.
Vacant Housing Unit	A housing unit in which no one is living on Census Day, unless its occupants are only temporarily absent. Units temporarily occupied at the time of enumeration by individuals who have a usual home elsewhere are classified as vacant. (Transient quarters, such as hotels, are housing units only if occupied. Thus, there are no vacant housing units at hotels and the like.) New units not yet occupied are classified as vacant housing units if construction has reached a point where all exterior windows and doors are installed and final usable floors are in place. Vacant units are excluded from the housing unit inventory if they are open to the elements, have a posted "condemned" sign, or are used entirely for nonresidential purposes (except storage of household furniture).

[11] U.S. Census Bureau, Decennial Management Division Glossary. Available at http://www.census.gov/dmd/www/glossary.html, last accessed on February 25, 2014.

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Population Forecast Summary

Cities (2013 Water Service Area)	2013 Population Estimate	2035 Population Forecast	2045 Population Forecast	'13 to '35 Numeric Pop. Chg.	'13 to '35 Percent Pop. Chg.
City of Beaverton Water Service Area	68,515	77,112	77,381	8,597	13%
City of Fairview Water Service Area	8,151	8,123	8,143	-28	0%
City of Forest Grove Water Service Area	22,518	27,409	29,523	4,891	22%
City of Gladstone Water Service Area	11,137	11,918	12,236	781	7%
City of Gresham Water Service Area	71,654	91,368	97,473	19,714	28%
City of Hillsboro Water Service Area	81,310	91,292	93,634	9,982	12%
Cherry Grove (City of Hillsboro) Water Service Area	1,456	1,637	1,650	181	12%
City of Lake Oswego Water Service Area	35,145	39,592	43,489	4,447	13%
City of Milwaukie Water Service Area	19,430	21,296	21,325	1,866	10%
Portland Water Bureau Service Area	575,365	767,341	827,080	191,976	33%
City of Sandy Water Service Area	10,337	15,161	18,713	4,824	47%
City of Sherwood Water Service Area	18,575	19,147	19,688	572	3%
City of Tigard Water Service Area	60,236	76,571	79,174	16,335	27%
City of Tualatin Water Service Area	26,510	26,172	26,604	-338	-1%
City of Wilsonville Water Service Area	21,550	26,468	27,177	4,918	23%
Districts (2013 Water Service Area)					
Clackamas River Water District*	44,271	59,892	65,825	15,621	35%
Clackamas River Water/Oregon City Overlap	10,396	13,925	13,971	3,529	34%
Oak Lodge Water District	27,417	29,546	29,591	2,129	8%
Raleigh Water District	4,142	4,260	4,385	118	3%
Rockwood Water PUD	61,514	71,893	76,008	10,379	17%
South Fork Water Board (Oregon City Part*)	23,944	28,352	30,046	4,408	18%
Clackamas River Water/Oregon City Overlap	10,396	13,925	13,971	3,529	34%
South Fork Water Board (West Linn Part)	25,529	27,901	29,450	2,372	9%
Sunrise Water Authority	46,228	67,003	74,310	20,775	45%
Tualatin Valley Water District (Total)	211,361	257,440	268,842	46,079	22%
TVWD (Metzger sub-area)	*20,160*	*23,992*	*25,111*	*3,832*	*19%*
TVWD (Wolf Creek sub-area)	*191,201*	*233,448*	*243,731*	*42,247*	*22%*
West Slope Water District	10,245	11,706	12,145	1,461	14%

**Does not include CRW/Oregon City overlap area*

Population Research Center, Portland State University, May 2014 www.pdx.edu/prc

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Population Forecast Summary

PWB Wholesale Customers (2013 Water Service Area)	2013 Population Estimate	2035 Population Forecast	2045 Population Forecast	'13 to '35 Numeric Pop. Chg.	'13 to '35 Percent Pop. Chg.
Burlington Water District	280	333	332	53	19%
GNR Water Company	48	54	54	6	13%
Green Valley Water Company	7	9	9	2	29%
Hideaway Hills Water Company	52	57	56	5	10%
Lake Grove Water District	2,881	3,281	3,445	400	14%
Lorna Water Company	249	277	288	28	11%
Lusted Water District	1,069	1,085	6,000	16	1%
Palatine Hill Water District	1,531	1,874	1,925	343	22%
Pleasant Home Water District	1,462	1,417	3,815	-45	-3%
Skyview Acres Water Company	35	39	39	4	11%
Two Rivers Water Association	14	15	15	1	7%
Valley View Water District	900	1,099	1,110	199	22%
Future Water Service Areas*					
City of Beaverton Water Service Area	68,617	80,499	82,930	11,882	17%
City of Hillsboro Water Service Area	81,481	106,676	111,887	25,195	31%
South Fork Water Board (Oregon City Part**)	24,206	29,340	31,113	5,134	21%
City of Sandy Water Service Area	11,290	16,769	20,878	5,479	49%
City of Sherwood Water Service Area	18,752	21,767	22,883	3,015	16%
Tualatin Valley Water District (Total)	211,556	262,276	274,458	50,720	24%
TVWD (Wolf Creek sub-area)	*191,396*	*238,284*	*249,347*	*46,888*	*24%*

**For water providers that provided current and future service areas, these estimates and forecasts include expanded service area boundaries, with no attempt to predict when expansion might occur .*

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***Does not include CRW/Oregon City overlap area*

Population Research Center, Portland State University, May 2014 www.pdx.edu/prc

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Household Forecast Summary

Cities (2013 Water Service Area)	2013 Household Estimate	2035 Household Forecast	2045 Household Forecast	'13 to '35 Numeric HH Chg.	'13 to '35 Percent HH Chg.
City of Beaverton Water Service Area	27,793	33,913	34,481	6,120	22%
City of Fairview Water Service Area	3,282	3,512	3,571	230	7%
City of Forest Grove Water Service Area	7,821	10,448	11,491	2,627	34%
City of Gladstone Water Service Area	4,418	5,080	5,292	662	15%
City of Gresham Water Service Area	26,755	37,810	41,161	11,055	41%
City of Hillsboro Water Service Area	27,871	34,577	36,126	6,706	24%
Cherry Grove (City of Hillsboro) Water Service Area	526	631	644	105	20%
City of Lake Oswego Water Service Area	15,325	18,137	20,036	2,812	18%
City of Milwaukie Water Service Area	8,248	9,506	9,619	1,258	15%
Portland Water Bureau Service Area	245,837	360,194	395,290	114,357	47%
City of Sandy Water Service Area	3,830	6,081	7,642	2,251	59%
City of Sherwood Water Service Area	6,492	7,256	7,605	764	12%
City of Tigard Water Service Area	24,277	32,646	34,148	8,369	34%
City of Tualatin Water Service Area	10,212	10,753	11,071	541	5%
City of Wilsonville Water Service Area	8,657	11,210	11,584	2,553	29%
Districts (2013 Water Service Area)					
Clackamas River Water District*	17,607	25,297	28,132	7,690	44%
Clackamas River Water/Oregon City Overlap	3,596	5,272	5,355	1,676	47%
Oak Lodge Water District	11,335	12,850	13,004	1,515	13%
Raleigh Water District	2,038	2,189	2,262	151	7%
Rockwood Water PUD	21,162	28,211	30,730	7,049	33%
South Fork Water Board (Oregon City Part*)	9,231	11,917	12,861	2,686	29%
Clackamas River Water/Oregon City Overlap	3,596	5,272	5,355	1,676	47%
South Fork Water Board (West Linn Part)	9,728	11,300	12,064	1,572	16%
Sunrise Water Authority	16,292	26,588	30,184	10,296	63%
Tualatin Valley Water District (Total)	79,837	106,267	112,865	26,430	33%
TVWD (Metzger sub-area)	*8,476*	*10,750*	*11,387*	*2,274*	*27%*
TVWD (Wolf Creek sub-area)	*71,361*	*95,517*	*101,478*	*24,156*	*34%*
West Slope Water District	4,429	5,305	5,552	876	20%

**Does not include CRW/Oregon City overlap area*

Population Research Center, Portland State University, May 2014 www.pdx.edu/prc

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Household Forecast Summary

PWB Wholesale Customers (2013 Water Service Area)	2013 Household Estimate	2035 Household Forecast	2045 Household Forecast	'13 to '35 Numeric HH Chg.	'13 to '35 Percent HH Chg.
Burlington Water District	134	170	172	36	27%
GNR Water Company	19	23	23	4	21%
Green Valley Water Company	3	4	4	1	33%
Hideaway Hills Water Company	18	21	21	3	17%
Lake Grove Water District	1,257	1,496	1,582	239	19%
Lorna Water Company	99	122	130	23	23%
Lusted Water District	384	415	2,345	31	8%
Palatine Hill Water District	525	686	714	161	31%
Pleasant Home Water District	523	540	1,480	17	3%
Skyview Acres Water Company	15	18	18	3	20%
Two Rivers Water Association	7	8	8	1	14%
Valley View Water District	359	468	479	109	30%
Future Water Service Areas*					
City of Beaverton Water Service Area	27,832	35,492	37,105	7,660	28%
City of Hillsboro Water Service Area	27,935	41,975	45,028	14,040	50%
South Fork Water Board (Oregon City Part**)	9,350	12,372	13,358	3,022	32%
City of Sandy Water Service Area	4,187	6,724	8,519	2,537	61%
City of Sherwood Water Service Area	6,555	8,329	8,932	1,774	27%
Tualatin Valley Water District (Total)	79,911	108,438	115,421	28,527	36%
TVWD (Wolf Creek sub-area)	*71,435*	*97,688*	*104,034*	*26,253*	*37%*

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***Does not include CRW/Oregon City overlap area*

Population Research Center, Portland State University, May 2014 www.pdx.edu/prc

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Household Size Forecast Summary

Cities (2013 Water Service Area)	2013 Household Size Estimate	2035 Household Size Forecast	2045 Household Size Forecast	'13 to '35 Numeric PPHH Chg.	'13 to '35 Percent PPHH Chg.
City of Beaverton Water Service Area	2.44	2.24	2.21	-0.19	-8%
City of Fairview Water Service Area	2.48	2.31	2.28	-0.17	-7%
City of Forest Grove Water Service Area	2.71	2.46	2.41	-0.25	-9%
City of Gladstone Water Service Area	2.50	2.32	2.29	-0.18	-7%
City of Gresham Water Service Area	2.64	2.38	2.33	-0.26	-10%
City of Hillsboro Water Service Area	2.87	2.59	2.54	-0.28	-10%
Cherry Grove (City of Hillsboro) Water Service Area	2.75	2.58	2.55	-0.17	-6%
City of Lake Oswego Water Service Area	2.27	2.16	2.14	-0.11	-5%
City of Milwaukie Water Service Area	2.32	2.20	2.17	-0.12	-5%
Portland Water Bureau Service Area	2.27	2.07	2.03	-0.20	-9%
City of Sandy Water Service Area	2.69	2.49	2.44	-0.20	-8%
City of Sherwood Water Service Area	2.86	2.64	2.59	-0.22	-8%
City of Tigard Water Service Area	2.47	2.33	2.30	-0.14	-5%
City of Tualatin Water Service Area	2.59	2.42	2.39	-0.16	-6%
City of Wilsonville Water Service Area	2.29	2.16	2.14	-0.13	-6%
Districts (2013 Water Service Area)					
Clackamas River Water District*	2.49	2.35	2.32	-0.14	-6%
Clackamas River Water/Oregon City Overlap	2.84	2.60	2.56	-0.24	-9%
Oak Lodge Water District	2.38	2.26	2.23	-0.12	-5%
Raleigh Water District	2.01	1.92	1.91	-0.09	-5%
Rockwood Water PUD	2.86	2.50	2.43	-0.36	-12%
South Fork Water Board (Oregon City Part*)	2.54	2.33	2.28	-0.21	-8%
Clackamas River Water/Oregon City Overlap	2.84	2.60	2.56	-0.24	-9%
South Fork Water Board (West Linn Part)	2.61	2.46	2.43	-0.16	-6%
Sunrise Water Authority	2.83	2.52	2.46	-0.32	-11%
Tualatin Valley Water District (Total)					
TVWD (Metzger sub-area)	*2.32*	*2.18*	*2.15*	*-0.15*	*-6%*
TVWD (Wolf Creek sub-area)	*2.66*	*2.43*	*2.38*	*-0.23*	*-9%*
West Slope Water District	2.29	2.18	2.16	-0.11	-5%

**Does not include CRW/Oregon City overlap area*

Population Research Center, Portland State University, May 2014 www.pdx.edu/prc

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Household Size Forecast Summary

PWB Wholesale Customers (2013 Water Service Area)	2013 Household Size Estimate	2035 Household Size Forecast	2045 Household Size Forecast	'13 to '35 Numeric PPHH Chg.	'13 to '35 Percent PPHH Chg.
Burlington Water District	2.09	1.96	1.93	-0.13	-6%
GNR Water Company	2.53	2.35	2.35	-0.18	-7%
Green Valley Water Company	2.33	2.25	2.25	-0.08	-4%
Hideaway Hills Water Company	2.89	2.71	2.67	-0.17	-6%
Lake Grove Water District	2.28	2.18	2.17	-0.10	-4%
Lorna Water Company	2.51	2.26	2.21	-0.24	-10%
Lusted Water District	2.76	2.59	2.55	-0.17	-6%
Palatine Hill Water District	2.92	2.73	2.70	-0.18	-6%
Pleasant Home Water District	2.78	2.60	2.57	-0.18	-6%
Skyview Acres Water Company	2.33	2.17	2.17	-0.17	-7%
Two Rivers Water Association	2.00	1.88	1.88	-0.13	-6%
Valley View Water District	2.50	2.35	2.32	-0.16	-6%
Future Water Service Areas*					
City of Beaverton Water Service Area	2.44	2.24	2.20	-0.20	-8%
City of Hillsboro Water Service Area	2.87	2.50	2.44	-0.37	-13%
South Fork Water Board (Oregon City Part**)	2.54	2.32	2.28	-0.22	-9%
City of Sandy Water Service Area	2.69	2.49	2.45	-0.20	-7%
City of Sherwood Water Service Area	2.86	2.61	2.56	-0.25	-9%
TVWD (Wolf Creek sub-area)	*2.66*	*2.42*	*2.38*	*-0.24*	*-9%*

**For water providers that provided current and future service areas, these estimates and forecasts include expanded service area boundaries, with no attempt to predict when expansion might occur .*

The City of Hillsboro includes South Hillsboro; South Fork - Oregon City includes areas witin the UGB but not in the CRW overlap area; City of Sandy includes the Urban Reserve Area; TVWD includes North Bethany and Bonny Slope.

***Does not include CRW/Oregon City overlap area*

Population Research Center, Portland State University, May 2014 www.pdx.edu/prc

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Vacancy Rate Forecast Summary

Cities (2013 Water Service Area)	2013 Vacancy Rate Estimate	2035 Vacancy Rate Forecast	2045 Vacancy Rate Forecast	'13 to '35 Numeric VAC Chg.	'13 to '35 Percent VAC Chg.
City of Beaverton Water Service Area	5.3%	5.4%	5.4%	0.2%	3%
City of Fairview Water Service Area	6.3%	6.2%	6.2%	0.0%	0%
City of Forest Grove Water Service Area	5.7%	5.9%	6.0%	0.2%	3%
City of Gladstone Water Service Area	5.1%	5.1%	5.2%	0.0%	1%
City of Gresham Water Service Area	5.4%	6.0%	6.0%	0.6%	11%
City of Hillsboro Water Service Area	5.0%	5.4%	5.4%	0.4%	7%
Cherry Grove (City of Hillsboro) Water Service Area	5.6%	5.8%	6.1%	0.3%	5%
City of Lake Oswego Water Service Area	6.5%	6.5%	6.7%	0.1%	1%
City of Milwaukie Water Service Area	5.0%	5.0%	5.0%	0.0%	1%
Portland Water Bureau Service Area	6.2%	6.9%	7.1%	0.7%	11%
City of Sandy Water Service Area	5.3%	5.5%	5.5%	0.2%	4%
City of Sherwood Water Service Area	3.8%	3.9%	3.8%	0.1%	3%
City of Tigard Water Service Area	4.5%	4.6%	4.7%	0.2%	3%
City of Tualatin Water Service Area	4.9%	5.0%	5.1%	0.1%	2%
City of Wilsonville Water Service Area	7.4%	8.2%	8.2%	0.8%	11%
Districts (2013 Water Service Area)					
Clackamas River Water District*	5.4%	5.1%	5.0%	-0.3%	-5%
Clackamas River Water/Oregon City Overlap	12.3%	9.3%	9.2%	-3.0%	-25%
Oak Lodge Water District	5.9%	5.9%	6.0%	0.0%	0%
Raleigh Water District	5.3%	5.7%	5.8%	0.4%	8%
Rockwood Water PUD	5.6%	5.9%	5.9%	0.3%	5%
South Fork Water Board (Oregon City Part*)	5.4%	5.8%	6.2%	0.5%	8%
Clackamas River Water/Oregon City Overlap	12.3%	9.3%	9.2%	-3.0%	-25%
South Fork Water Board (West Linn Part)	5.2%	5.3%	5.3%	0.1%	1%
Sunrise Water Authority	5.3%	5.2%	5.2%	-0.1%	-3%
Tualatin Valley Water District (Total)					
TVWD (Metzger sub-area)	*5.2%*	*5.3%*	*5.3%*	*0.1%*	*2%*
TVWD (Wolf Creek sub-area)	*5.4%*	*5.4%*	*5.3%*	*0.0%*	*0%*
West Slope Water District	5.3%	5.6%	5.7%	0.2%	5%

**Does not include CRW/Oregon City overlap area*

Population Research Center, Portland State University, May 2014 www.pdx.edu/prc

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Vacancy Rate Forecast Summary

PWB Wholesale Customers (2013 Water Service Area)	2013 Vacancy Rate Estimate	2035 Vacancy Rate Forecast	2045 Vacancy Rate Forecast	'13 to '35 Numeric VAC Chg.	'13 to '35 Percent VAC Chg.
Burlington Water District	10.7%	10.5%	10.4%	-0.1%	-1%
GNR Water Company	5.0%	4.2%	4.2%	-0.8%	-17%
Green Valley Water Company	0.0%	0.0%	0.0%	0.0%	
Hideaway Hills Water Company	5.3%	4.5%	4.5%	-0.7%	-14%
Lake Grove Water District	5.3%	5.6%	5.7%	0.2%	4%
Lorna Water Company	5.7%	4.7%	5.8%	-1.0%	-18%
Lusted Water District	5.7%	5.9%	3.9%	0.2%	4%
Palatine Hill Water District	10.1%	10.4%	10.3%	0.3%	3%
Pleasant Home Water District	6.4%	6.6%	8.2%	0.1%	2%
Skyview Acres Water Company	11.8%	10.0%	10.0%	-1.8%	-15%
Two Rivers Water Association	0.0%	0.0%	0.0%	0.0%	
Valley View Water District	5.5%	5.3%	5.5%	-0.3%	-5%
Future Water Service Areas*					
City of Beaverton Water Service Area	5.3%	5.4%	5.3%	0.1%	1%
City of Hillsboro Water Service Area	5.0%	5.4%	5.4%	0.4%	7%
South Fork Water Board (Oregon City Part**)	5.4%	5.8%	6.2%	0.5%	8%
City of Sandy Water Service Area	5.2%	5.4%	5.4%	0.2%	4%
City of Sherwood Water Service Area	3.8%	3.8%	3.8%	0.1%	2%
TVWD (Wolf Creek sub-area)	5.4%	5.4%	5.3%	0.0%	0%

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Appendix C

WaterSense Fix a Leak Week
Press Release

Newsroom

News Releases - Partnerships and Stewardship

Stop the Drops! EPA's National "Fix-a-Leak Week" Kicks Off in Metro Portland

Release Date: 03/19/2013
Contact Information: Bevin Horn, EPA/Seattle, 206-553-1566, horn.bevin@epa.gov

(Portland, OR – March 18, 2013) Every year, more than 1 trillion gallons of water leak from U.S. homes nationwide. That's equivalent to the total annual water use of Los Angeles, Chicago, and Miami combined! Experts estimate that leaks in almost 10 percent of American homes drip away almost 90 gallons of water a day. The usual culprits: leaky toilets, faucets and showerheads.

The U.S Environmental Protection Agency's WaterSense program is again teaming up with local partners to promote the fifth annual **National Fix a Leak Week, March 18-24, 2013**.

In cities like Portland, that can mean up to $200 per year in utility charges literally going down the drain. Finding and fixing leaks is easier than most people think. Most replacement parts can be installed by do-it-yourselfers and quickly pay for themselves. Don't waste money AND natural resources, fix your drips and leaks and make your wallet watertight!

Here are some ways people can get involved in the **Portland** Area:

Fix-a-Leak Week Photo/Video Contest - The Regional Water Providers Consortium is inviting customers to join "Drippy Drew" - the leak detection gnome - in celebrating Fix A Leak Week (March 18-24, 2013) by participating in their first-ever Fix a Leak Week Contest. Contestants are invited to submit photo or video entries(by Midnight, March 20th) that depict themselves or others finding & fixing leaks around their homes with the chance to win a $500, $300, or $200 Lowe's gift card!! **Contact**: RWPCinfo@portlandoregon.gov

RWPC website: http://www.conserveh2o.org/Fix-Leak-Week-Contest

Follow the RWPC and Drippy Drew on Facebook at: https://www.facebook.com/RegionalWaterProvidersConsortium

"Everything You Ever Wanted to Know About Fixing Leaks…but Were Afraid to Ask! - City of Sandy, OR, is sponsoring a "Do It Yourself" Fix-a-Leak presentation and Q&A with a local plumber at 6 pm, March 20th in the council chambers at Sandy City Hall. There will be more information about the City's partnership with WaterSense program and tips, tricks & trade secrets will be offered for saving water and money by fixing even minor leaks. Also: Toilet leak dye tablets are available (attached to the WaterSense Dye Tablet Card) at the City Hall's Water Billing counter. **Contact:** Liz Storn, City of Sandy (503) 489-2161, lstorn@ci.sandy.or.us

For more about EPA's WaterSense Program: http://www.epa.gov/watersense/

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Recent additions

08/18/2015 Hoboken Mayor Dawn Zimmer named to National EPA Advisory Committee
08/13/2015 Tell EPA About Your Green Infrastructure Project
08/03/2015 FACT SHEET: PRESIDENT OBAMA TO ANNOUNCE HISTORIC CARBON POLLUTION STANDARDS FOR POWER PLANTS
07/30/2015 Galveston Bay Foundation Receives Second Place Gulf Guardian Award in the Civic/Non Profit Category
07/30/2015 Coastal and Marine Operators Group Receives Second-Place Gulf Guardian Award in Business and Industry Category

City of Sandy, Oregon – City Government

March 12, 2013 ·

WATERSENSE "FIX-A-LEAK" WEEK

Do you have a faucet that has an annoying drip? Do you have to jiggle the toilet handle or hear it run/fill when no one is in the bathroom? Chances are, you have a leak! (or 2, or 3...)

A leaky faucet that drips 30 times in one hour (that's 1 drip every other second) can really start to add up. That little drip can send over 1000 gallons down your drain over the space of a year. If your toilet is leaking, that can be up to 400 gallons in just one day!

March 18-24 is the WaterSense Fix a Leak Week, and Sandy is stepping up to help. WaterSense is a partnership program sponsored by the US Environmental Protection Agency, and seeks to protect the future of our nation's water supply by offering people a simple way to use less water with water-efficient products and services. On March 20th (6 – 7pm) at City Hall's Council Chambers, there will be a Q&A with a local plumber to help you DIY your leaks away. Keep an eye on the City's website and Facebook page for more details.

Appendix D

Water Rates by Customer Category

Multi-Family Residential Customer Water Rates

Inside City Limits

Year	Monthly Base Fee MF	Monthly Meter Charge (5/8" x 3/4" meter)	Monthly Meter Charge (1" meter)	Monthly Meter Charge (1.5" meter)	Monthly Meter Charge (2" meter)	Volume Charge per CCF
2014 (current)	$6.18	$0.22	$0.56	$1.08	$1.74	$2.31
2013	$5.94	$0.21	$0.54	$1.04	$1.67	$2.22
2012	$5.60	$0.20	$0.51	$0.98	$1.58	$2.09
2011	$5.29	$0.19	$0.48	$0.93	$1.49	$1.97
2010	$4.99	$0.18	$0.45	$0.88	$1.41	$1.86
2008	$4.80	$0.17	$0.43	$0.85	$1.36	$1.79

Outside City Limits

Year	Monthly Base Fee MF	Monthly Meter Charge (5/8" x 3/4" meter)	Monthly Meter Charge (1" meter)	Monthly Meter Charge (1.5" meter)	Monthly Meter Charge (2" meter)	Volume Charge per CCF
2014 (current)	$6.18	$0.33	$0.81	$1.66	$2.61	$2.31
2013	$5.94	$0.32	$0.84	$1.60	$2.51	$2.22
2012	$5.60	$0.30	$0.76	$1.50	$2.37	$2.09
2011	$5.29	$0.28	$0.72	$1.41	$2.24	$1.97
2010	$4.99	$0.27	$0.68	$1.33	$2.12	$1.86
2008	$4.80	$0.26	$0.65	$1.28	$2.04	$1.79

Commercial-Industrial Customer Water Rates

Inside City Limits

Year	Monthly Base Fee Comm.-Ind.	Monthly Meter Charge (5/8" x 3/4" meter)	Monthly Meter Charge (1" meter)	Monthly Meter Charge (1.5" meter)	Monthly Meter Charge (2" meter)	Volume Charge per CCF Inside
2014 (current)	$6.18	$0.22	$0.56	$1.08	$1.74	$2.12
2013	$5.94	$0.21	$0.54	$1.04	$1.67	$2.04
2012	$5.60	$0.20	$0.51	$0.98	$1.58	$1.92
2011	$5.29	$0.19	$0.48	$0.93	$1.49	$1.81
2010	$4.99	$0.18	$0.45	$0.88	$1.41	$1.71
2008	$4.80	$0.17	$0.43	$0.85	$1.36	$1.64

Outside City Limits

Year	Monthly Base Fee Comm.-Ind.	Monthly Meter Charge (5/8" x 3/4" meter)	Monthly Meter Charge (1" meter)	Monthly Meter Charge (1.5" meter)	Monthly Meter Charge (2" meter)	Volume Charge per CCF
2014 (current)	$6.18	$0.33	$0.81	$1.66	$2.61	$3.29
2013	$5.94	$0.32	$0.84	$1.60	$2.51	$3.16
2012	$5.60	$0.30	$0.76	$1.50	$2.37	$2.98
2011	$5.29	$0.28	$0.72	$1.41	$2.24	$2.81
2010	$4.99	$0.27	$0.68	$1.33	$2.12	$2.65
2008	$4.80	$0.26	$0.65	$1.28	$2.04	$2.55

Wholesale Customer Water Rates

Year	Monthly Base Fee Wholesale	Monthly Meter Charge (4" meter)	Volume Charge per CCF
2014 (current)	$7.40	$8.21	$2.59
2013	$7.12	$7.90	$2.49
2012	$6.72	$7.45	$2.35
2011	$6.34	$7.03	$2.22
2010	$5.98	$6.64	$2.10
2008	$5.75	$6.38	$2.02

Skyview Water Rates

Year	Monthly Base Fee Wholesale	Monthly Meter Charge (4" meter)	Volume Charge per CCF
2015 (current)	$7.90	$8.21	$0.597
2014	$7.40	$7.90	$0.48

NOTE: By agreement, Skyview's rate is reviewed and adjusted on a different schedule than other customers

Appendix E

"At Your Service" Monthly Newsletter – Water Conservation Message, July 2015

July 2015

City of Sandy
At Your Service

A Monthly Bulletin of Community News

Water Supply

With the recent warm, dry weather and all the media coverage of drought in Oregon we wanted to inform customers on Sandy's water supply situation. While last winter's snowfall was well below average, rainfall was at or near normal in western Oregon. Our water sources are located in low-elevation watersheds where most runoff comes from rainfall, not snowmelt. The outlook for municipal supplies is generally good in the metro region.

That being said, we still don't have enough water to waste. Please visit http://www.conserveh2o.org/ for tips on reducing indoor and outdoor water consumption and water conservation strategies.

If you live in a new home, make sure your irrigation timer is set properly. Builders often adjust the timer to keep new turf well watered in order to improve curb appeal, however they don't have to pay for it. You can sign up to receive an email with your weekly watering number at www.conserveh2o.org and adjust your irrigation timer to match weather conditions for Sandy.

2015 Sandy Summer Sounds & Starlight Cinema at Meinig Park

info online at www.cityofsandy.com or pick up a brochure at City Hall, Community/Senior Center or the Library

Sundays, 7/19-8/9 **Acoustic Series** 6:30pm

Wednesdays, 7/29-8/26 **Main Stage Music** 6:30 pm

(Hops & Blues Festival, 7/29 5:30-9:30pm)

Movies at dusk ***(Note: 8/22 Movie originally Cinderella, now Into the Woods)***

~Concessions available~

REMINDER

Please remember to register your dogs with Clackamas County http://www.clackamas.us/dogs/license.html

Appendix F

Announcements for Annual Water Conservation Education Presentations at Local Elementary Schools

What Do You Know About H2O?

Sponsored by the City of Sandy
Presented by Mad Science of Portland & Vancouver

Customer Details:

Organization: Kelso Elementary
Address: 34651 SE Kelso Road
Boring, OR 97009
Contact: Katie Schweitzer
Title: Principal
Phone: 503-668-8020
Fax: 503-668-0883
Email: katie.schweitzer@ortrail.k12.or.us
Directions: Hwy 26 toward Sandy, after Swiss Village turn left onto Kelso Rd. On the left right after stop sign, set back from road.

Event Details:

Instructor: TBD
Number of Kids Attending:
Special Instructions: 4 classes - 135 Students

Event/Booth Topics	Date	Start Time	End Time	Grades/# kids
What Do You Know About H2O?	3/31/2014	9:00 AM	9:30 AM	3-5/135

Things you need to know

- Your Mad Scientist will arrive approximately 45 minutes before the event to set up.
- They will need one (1) **banquet size table** to set-up their equipment and **access to electricity and water**.
- This show requires a fair amount of water. We will need access to a deep sink to fill gallon bottles.
- If you have a PA system, please set it up for our Mad Scientist.
- If you have any questions call Mad Science at (503) 230-8040.

Mad Science of Portland & Vancouver
1522 N. Ainsworth St., Portland, OR 97217

portland.madscience.org • www.conserveh20.org

What Do You Know About H2O?

Sponsored by the Regional Water Providers Consortium
Presented by Mad Science of Portland & Vancouver

Customer Details:

Organization: Sandy Elementary
Address: 38965 Pleasant Ave.
Sandy, OR 97055
Contact: Rachael George
Title: Principal
Directions: I-84 east to Wood Village exit. Turn right and continue south. Turn left on Burnside, turns into Hwy 26. Continue into Sandy (about 10 miles). Turn left on Strauss. Right on Pleasant.

Phone: 503-668-8065
Fax: 503-668-6246
Email: rachael.george@ortrail.k12.or.us

Event Details:

Instructor: TBD
Special Instructions: 3 Classrooms, 90 Students

Number of Kids Attending: 90

Event/Booth Topics	Date	Start Time	End Time	Grades/# kids
What Do You Know About H2O?	4/2/2015	7:40 AM	8:10 AM	3-5/90

Things you need to know

- Your Mad Scientist will arrive approximately 45 minutes before the event to set up.
- They will need one (1) **banquet size table** to set-up their equipment and **access to electricity and water**.
- This show requires a fair amount of water. We will need access to a deep sink to fill gallon bottles.
- If you have a PA system, please set it up for our Mad Scientist.
- If you have any questions call Mad Science at (503) 230-8040.

Mad Science of Portland & Vancouver
1522 N. Ainsworth St., Portland, OR 97217

portland.madscience.org • www.conserveh2o.org

What Do You Know about H2O?

Sponsored by the Regional Water Providers Consortium
Presented by Mad Science of Portland & Vancouver

Customer Details:

Organization: Firwood Elementary
Address: 42900 SE Trubel Road
Sandy, OR 97055
Contact: Susan Baysinger
Title: School Contact
Phone: 503-668-8005 **X:**
Fax: 503-668-3684
Email: baysings@ortrail.k12.or.us
Directions: Hwy 26 toward Mt. Hood. 2mi. East of the last stoplight in Sandy, turn right on Firwood Rd. (Landmark is 'Shorty's Corner'). Turn left on Firwood School Rd (This is actually Trubel Road, but the sign says "Firwood School Road").

Event Details:

Instructor: TBD
Number of Kids Attending: 225
Special Instructions: **Susan Baysinger booked the show. Instructor should check in at office then drive around back to unload at the Gym door. Susan will have a student available to fill jugs. 9 teachers**

Event/Booth Topics	Date	Start Time	End Time	Grades/# kids
What Do You know about H2O?	11/18/2010	10:00 AM	10:30 AM	3-5/225

Things you need to know

- Your Mad Scientist will arrive approximately 45 minutes before the event to set up.
- They will need a **banquet size table** to set-up their equipment and **access to electricity and water**.
- There is a fair amount of water required. We will need **access to a deep sink** to fill gallon bottles.
- If you have a PA system, please set it up for our Mad Scientist.
- If you have any questions call Mad Science at 503-230-8040.

Mad Science of Portland & Vancouver
1522 N. Ainsworth St., Portland, OR 97217

www.madscience.org/portland • www.conserveh20.org

What Do You Know about H2O?

Sponsored by the Regional Water Providers Consortium
Presented by Mad Science of Portland & Vancouver

Customer Details:

Organization: Firwood Elementary
Address: 42900 SE Trubel Road
Sandy, OR 97055
Contact: Deb Manley
Title: School Contact
Phone: 503-668-8005
Fax: 503-668-3684
Email: deb.manley@ortrail.k12.or.us
Directions: Hwy 26 toward Mt. Hood. 2 miles east of the last stoplight in Sandy, turn right on Firwood Rd. (Landmark is 'Shorty's Corner'). Turn left on Firwood School Rd (This is actually Trubel Road, but the sign says "Firwood School Road").

Event Details:

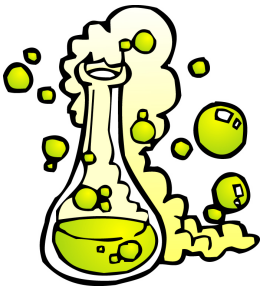
Instructor: TBD
Special Instructions:
Number of Kids Attending: 240

Event/Booth Topics	Date	Start Time	End Time	Grades/# kids
What Do You Know About H2O?	5/22/2013	1:30 PM	2:00 PM	3-5/240

Things you need to know

- Your Mad Scientist will arrive approximately 45 minutes before the event to set up.
- They will need a **banquet size table** to set-up their equipment and **access to electricity and water**.
- There is a fair amount of water required. We will need **access to a deep sink** to fill gallon bottles.
- If you have a PA system, please set it up for our Mad Scientist.
- If you have any questions call Mad Science at 503-230-8040.

Mad Science of Portland & Vancouver
1522 N. Ainsworth St., Portland, OR 97217



portland.madscience.org • www.conserveh20.org

Appendix G

Ordinance 13.04.220 - Regulations Pertaining to Inadequate Supply or Shortages of Water

13.04.220 Regulations pertaining to inadequate supply or shortages of water.
A. Upon determination that water consumption exceeds availability and/or water storage within the system is approaching the minimum required to meet fire protection and other essential requirements, as determined by the city manager, the city manager shall have authority to request voluntary reduction of water use by customers, including but not limited to the following specific actions:

1. Requesting patrons to limit landscape watering between the hours of 10:00 a.m. and 6:00 p.m.;

2. Requesting voluntary compliance with alternate day system for landscaping watering (i.e. even numbered addresses water on even numbered days, and odd numbered addresses on odd numbered days);

3. Requesting other voluntary measures on the part of city customers.

B. Upon determination of serious water shortages by the city council, the city council may declare an emergency restricting certain uses. Pursuant to such action the city council may impose the following measures:

1. Prohibiting landscape watering between the hours of 10:00 a.m. and 6:00 p.m.;

2. Requiring compliance with alternate day system for landscaping watering (i.e. even numbered addresses water on even numbered dates, and odd numbered addresses on odd numbered days.);

3. Restricting other outdoor uses as determined by the city council.

C. Upon determination of critical water shortages by the city council, the city council may declare an emergency prohibiting certain uses. Pursuant to such action by the city council it shall be expressly prohibited to:

1. Water, sprinkle or irrigate lawns, grass or turf unless:

a. It is new lawn, grass or turf that has been seeded or sodded after March 1st of the calendar year in which any restrictions are imposed, and in such cases it may be watered as necessary until established,

b. Lawn, grass or turf that is part of a commercial sod farm,

c. High use athletic fields that are used for organized play,

d. Golf tees and greens, and

e. Park and recreation areas deemed by the city council to be of a particular significance and value to the community that would allow exception to the prohibition;

2. Washing, wetting down, or sweeping with water, sidewalks, walkways, driveways, parking lots, open ground or other hard surfaced areas unless:

a. In the opinion of the city council there is a demonstrable need in order to meet public health, safety requirements including but not limited to alleviation of immediate fire or sanitation hazards, or dust control to meet air quality requirements mandated by the Oregon Department of Environmental Quality,

b. Power washing of buildings, roofs and homes prior to painting, repair, remodeling or reconstruction and not solely for aesthetic purposes;

3. Washing cars, trucks, trailers, tractors, or other land vehicles or boats or other water borne vehicles except by commercial establishments or fleet washing facilities which recycle or reuse the water in their washing processes or by bucket and hose with a shut-off mechanism unless the city council finds that the public health, safety and welfare is contingent upon frequent vehicle cleaning such as cleaning of solid waste transfer vehicles, vehicles that transport food and other perishables or otherwise required by law.

D. Upon determination that the restrictions and/or prohibitions permitted pursuant to this section have not reduced water consumption to the level necessary to eliminate emergency water conditions, the city council may as an additional conservation measure adopt a temporary conservation water rate schedule. The city council may do so by the passage of a resolution.

E. Any violation of the restrictions or prohibitions permitted by this section shall be enforced by the city as follows:

1. The city shall personally deliver a notice of violation to the occupant of the premises. If the occupant is not present, the city may post the same on the premises advising the user of the violation and warning the user of what specific sanctions may be imposed if the violations continue. The city shall also mail the notice of violation by regular mail to the occupant at the address of the subject premises where the violation has occurred.

2. The following penalties may be imposed if violations continue:

Second violation $100.00 Fine

Third violation $300.00 Fine

Fourth and subsequent violations $500.00 Fine
In the case of continuing violations, the city also has the authority to discontinue water service.
(Ord. 12-92 §1, 1992: Ord. 10-73 § 23, 1973.)

CHAPTER 13.04 WATER SYSTEM—RULES AND REGULATIONS

Sec. 13.04.010. Application for water use.

Application for the use of water shall be made on forms furnished by the city. Said application shall be made at the time a building or plumbing permit is applied for. The applicant or applicants shall agree to conform to the rules and regulations of the city, now or hereafter in effect, including the 2022 Water System Master Plan and the 2016 Water Management and Conservation Plan, as a condition for the use of water.

(Ord. No. 10-73, § 2, 1973; Ord. No. 38-75, § 1, 1975; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.020. Reserved.

Ord. No. 2021-02 , § 1, adopted March 15, 2021, repealed § 13.04.020, which pertained to inspection of a premises with a pending application for use of water, and derived from Ord. No. 10-73, adopted in 1973.

Sec. 13.04.030. Restriction on water use.

No person supplied with water from the city mains will be entitled to use it for any purpose other than that stated in his or her application. No user of water will be entitled to supply water in any way to other persons or users.

(Ord. No. 10-73, § 4, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.040. Connection.

The materials for the connection to the public water supply system, including the meter, shall be and remain the property of the city. All connections to public water mains shall be done under the direction of the public works director, or their designee. The meter shall be placed in the public right-of-way or in a dedicated utility easement. Water service laterals and connections are those pipes and connections which convey water from the public water main to the water meter. All public water mains, service laterals, connections and appurtenances shall be under the exclusive control and ownership of the city, and no person, other than the public works director or their designee, will be permitted to install any service laterals or connections or make any repairs or alterations or changes in any public water lines, service laterals, connections and meters.

(Ord. No. 10-73, § 5, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.045. Changes in service.

When new buildings are to be erected on the site of old ones or it is desired to increase the size or change the location of an existing service connection, or where a service connection to any premises is abandoned or no longer in use, a new service shall be required, as needed, upon application of the occupant and upon payment for a new connection including all applicable Systems Development Charges. Water service shall be considered abandoned if utility bills, including any unpaid balance remain unpaid for 12 consecutive billing cycles.

(Ord. No. 10-73, § 5A, 1973; Ord. No. 38-75, § 2, 1975; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.050. Placement of stop and waste cocks.

All private service pipes from the property line shall be properly installed and at all times maintained in good order by the owner with no leakage or wasting of water.

(Ord. No. 10-73, § 6, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.060. Reserved.

Ord. No. 2021-02 , § 1, adopted March 15, 2021, repealed § 13.04.060, which pertained to leaks excavation by the public works superintendent, and derived from Ord. No. 10-73, adopted in 1973.

Sec. 13.04.070. Separate service for each house—Exception.

A separate service and meter will be required for each parcel or legal lot of record that is to be supplied with water.

(Ord. No. 10-73, § 8, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.080. Conditions under which water will not be furnished.

Water will not be furnished where there are active or potential, unprotected cross-connections as defined in Chapter 13.06 or as otherwise determined through evaluations in the 2022 Water System Master Plan.

(Ord. No. 10-73, § 9, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.090. Plumber—Prohibited actions.

No plumber or other person will be allowed to make any alteration in any conduit, pipe or other fixture connecting with the city mains or to turn water off or on the premises at the meter without permission from the city.

(Ord. No. 10-73, § 10, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.100. Reserved.

Ord. No. 2021-02 , § 1, adopted March 15, 2021, repealed § 13.04.100, which pertained to the required plumber report of work done, and derived from Ord. No. 10-73, adopted in 1973.

Sec. 13.04.110. Interrupted service.

The water may at any time be shut off from the mains, without notice, for repairs or other necessary purposes, and the city will not be responsible for any consequent damages.

(Ord. No. 10-73, § 12, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.120. Reserved.

Ord. No. 2021-02 , § 1, adopted March 15, 2021, repealed § 13.04.120, which pertained to city-worker access to structures receiving water from the mains, and derived from Ord. No. 10-73, adopted in 1973.

Sec. 13.04.130. Monthly reports by administrative office.

The administrative office shall prepare a monthly report indicating: the number of customers (by customer class); the amount of water produced and sold, together with such other data as the council may require.

(Ord. No. 10-73, § 14, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.140. Records.

Utility staff shall, as a part of their duties, record the address, parcel number, meter number of all premises where water is furnished by the city, and shall furnish a record of such to utility billing staff for purposes of accurate billing. Utility staff shall also keep and maintain accurate hard copies and digital records of all pipes, valves, fittings, hydrants, services and other appurtenances within the water system.

(Ord. No. 10-73, § 15, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.150. Use of fire hydrants.

It is unlawful for any person to operate, alter, change, remove, disconnect, connect with, or interfere in any manner with any fire hydrant owned by the city or connected to the public water system without first obtaining written permission from the city. The provisions of this section shall not apply to emergency or other uses by the Sandy Rural Fire Protection District No. 72. The city may require that accurate records or estimates of City water used for fire suppression, training or other uses by the Sandy Rural Fire Protection District No. 72 be submitted on a regular basis but not more frequently than monthly.

(Ord. No. 10-73, § 16, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.160. Fire protection service.

A. When the owner of a building desires, or when the building code calls for a certain size pipe to supply water to a wet or dry sprinkler system without hose connections, such pipe or pipes may be covered by an approved proportional meter or a detector check. The owner or agent of such building shall agree in writing that water supplied through this service will not be used for any purpose except for extinguishing a fire. If at any time it is found that unapproved connections have been added to the system or that registration has been recorded on the meter or detector check, the immediate installation of a billing meter on the fire service line may be required by the city at the sole expense of the owner or agent.

B. No charge shall be made for water used in the extinguishing of fires if the owner or agent reports such use to the city in writing within ten days of such usage. A minimum service charge for fire protection purposes established by Council resolution may be billed each month to the owner or agent of the property supplied.

(Ord. No. 10-73, § 17, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.170. Use of private water and city water.

Owners of buildings desiring to use both a city water supply and a supply of water other than that furnished by the city water system may obtain city water at meter rates upon the following conditions and not otherwise. Under no circumstances shall a physical connection, direct or indirect, exist or be made in any manner, even temporarily between the city water supply and that of a private water supply. Where such connection is found to exist, or where provision is made to connect the two systems by means of a spacer or otherwise, the city water supply shall be shut off from the premises without notice. In case of such discontinuance, service shall not be reestablished until satisfactory proof is furnished that the cross-connection has been completely and permanently severed.

(Ord. No. 10-73, § 18, 1973)

Sec. 13.04.180. Water for building purposes on meter basis.

If the owner or agent of any premises applies for water service and the meter has been installed, water shall be furnished for building purposes at meter rates, to be charged against the premises.

(Ord. No. 10-73, § 19, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.190. Ownership, damage and registration of meters.

All meters of the city water system are the property of the city, and any repairs to said meters shall be made by the city. If a meter is burned out by hot water or damaged by the carelessness or negligence of the owner or occupant of the premises, the city will repair or replace the meter, and the cost of such repairs or replacement shall be charged against the owner of the property and if not paid within 30 days, shall then become a lien against said property. When a meter fails to register accurately, the charge shall be either based on the average quantity of water used, as shown by the meter when in order, or if there is no such average consumption, then the quantity of water used during the same billing cycle in the prior year shall be used. If freezing or snowing weather shall make reading of the meters impracticable, an estimated reading shall be made by the city during the time such conditions exist. Estimated readings for other just conditions affecting reading of a meter shall be made only on approval of the city.

(Ord. No. 10-73, § 20, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.200. Services outside the city.

A. Excess water of the city, as determined by the council, may be served to individual users, companies or water districts outside the city boundaries, under such rates, charges and rules as the council may from time to time prescribe, or as outlined under special contracts. All regulations now or hereafter that affect the users inside the city shall apply to users outside the city, except as provided by the council. Service to users outside the city shall at all times be subject to the prior superior right of the residents of the city to said water. The city shall have the right to refuse to sell water to consumers who do not comply with the requirement of this section.

B. The city may require annexation prior to service extension if such annexation is practical and in the best interest of the city. If annexation is not required, the owner must enter into an agreement for future annexation to the city, upon the city's request in an agreement form, satisfactory to the city attorney. The water service extension will be installed to city standards. A person or persons requesting service extension will bear all costs of the extension of the service, including, but not limited to, the cost of public lines and any

oversizing as specified by the public works director. A water service connection will be provided only for a permitted use as identified in the Clackamas County Development Code and the City Comprehensive Plan. The extension of water service facilities shall follow an approved shadow plat design for future extension of infrastructure for the site, which meets the satisfaction of the city. No service extension shall conflict with existent natural hazards and/or goals criteria.

(Ord. No. 10-73, § 21, 1973; Ord. No. 5-93, § 1, 1993; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.210. Reserved.

Ord. No. 2021-02 , § 1, adopted March 15, 2021, repealed § 13.04.210, which pertained to mandated reports for water-distributing entities besides the city, and derived from Ord. No. 10-73, adopted in 1973.

Sec. 13.04.220. Regulations pertaining to inadequate supply or shortages of water.

A. Upon determination that water consumption exceeds availability and/or water storage within the system is approaching the minimum required to meet fire protection and other essential requirements, as determined by the city manager, the city manager shall have authority to request voluntary reduction of water use by customers, including but not limited to the following specific actions:

   1. Requesting patrons to limit landscape watering between the hours of 10:00 a.m. and 6:00 p.m.;

   2. Requesting voluntary compliance with alternate day system for landscaping watering (i.e. even numbered addresses water on even numbered days, and odd numbered addresses on odd numbered days);

   3. Requesting other voluntary measures on the part of city customers.

B. Upon determination of serious water shortages by the city council, the city council may declare an emergency restricting certain uses. Pursuant to such action the city council may impose the following measures:

   1. Prohibiting landscape watering between the hours of 10:00 a.m. and 6:00 p.m.;

   2. Requiring compliance with alternate day system for landscaping watering (i.e. even numbered addresses water on even numbered dates, and odd numbered addresses on odd numbered days.);

   3. Restricting other outdoor uses as determined by the city council.

C. Upon determination of critical water shortages by the city council, the city council may declare an emergency prohibiting certain uses. Pursuant to such action by the city council it shall be expressly prohibited to:

   1. Water, sprinkle or irrigate lawns, grass or turf unless:

      a. It is new lawn, grass or turf that has been seeded or sodded after March 1 of the calendar year in which any restrictions are imposed, and in such cases it may be watered as necessary until established,

      b. Lawn, grass or turf that is part of a commercial sod farm,

      c. High use athletic fields that are used for organized play,

      d. Golf tees and greens, and

      e. Park and recreation areas deemed by the city council to be of a particular significance and value to the community that would allow exception to the prohibition;

2. Washing, wetting down, or sweeping with water, sidewalks, walkways, driveways, parking lots, open ground or other hard surfaced areas unless:

    a. In the opinion of the city council there is a demonstrable need in order to meet public health, safety requirements including but not limited to alleviation of immediate fire or sanitation hazards, or dust control to meet air quality requirements mandated by the Oregon Department of Environmental Quality,

    b. Power washing of buildings, roofs and homes prior to painting, repair, remodeling or reconstruction and not solely for aesthetic purposes;

3. Washing cars, trucks, trailers, tractors, or other land vehicles or boats or other water borne vehicles except by commercial establishments or fleet washing facilities which recycle or reuse the water in their washing processes or by bucket and hose with a shut-off mechanism unless the city council finds that the public health, safety and welfare is contingent upon frequent vehicle cleaning such as cleaning of solid waste transfer vehicles, vehicles that transport food and other perishables or otherwise required by law.

D. Upon determination that the restrictions and/or prohibitions permitted pursuant to this section have not reduced water consumption to the level necessary to eliminate emergency water conditions, the city council may as an additional conservation measure adopt a temporary conservation water rate schedule. The city council may do so by the passage of a resolution.

E. Any violation of the restrictions or prohibitions permitted by this section shall be enforced by the city as follows:

1. The city shall personally deliver a notice of violation to the occupant of the premises. If the occupant is not present, the city may post the same on the premises advising the user of the violation and warning the user of what specific sanctions may be imposed if the violations continue. The city shall also mail the notice of violation by regular mail to the occupant at the address of the subject premises where the violation has occurred.

2. The following penalties may be imposed if violations continue:

    Second violation: $100.00 fine.

    Third violation: $300.00 fine.

    Fourth and subsequent violations: $500.00 fine.

In the case of continuing violations, the city also has the authority to discontinue water service.

(Ord. No. 10-73, § 23, 1973; Ord. No. 12-92, § 1, 1992)

Sec. 13.04.230. Reserved.

Ord. No. 2021-02 , § 1, adopted March 15, 2021, repealed § 13.04.230, which pertained to water for motor power, and derived from Ord. No. 10-73, adopted in 1973.

Sec. 13.04.240. Private pipe or main—Council permission required.

No person shall be permitted to lay any private pipes or mains in or upon any public right-of-way, street or road in the city without issuance of a revocable permit by the council.

(Ord. No. 10-73, § 26, 1973; Ord. No. 2021-02 , § 1(Exh. A), 3-15-2021)

Sec. 13.04.250. Violation—Penalty.

Any person who shall in any way interfere with, change, alter or damage any water main, pipe, conduit, shutoff or any other part of the water system belonging to the city, or who shall turn on the water to any premises without due authority, shall upon conviction in municipal court of said city be fined in the sum of not more than $100.00 for each offense, or by imprisonment for a period of not more than ten days, or by both fine and imprisonment.

(Ord. No. 10-73, § 25, 1973)

Exhibit D
Ordinance No. 2023-6
Water System Master Plan Adoption

1. Goal 1 – Citizen Involvement. Both the Planning Commission and the City Council held a public hearing prior to adopting or recommending approval of the ordinance. The Commission held a public hearing on February 27, 2023. The Council held a public hearing on April 3, 2023. The City provided notice of the public hearings in accordance with state law and the City's development code. Goal 1 is satisfied.

2. Goal 2 – Land Use Planning. Goal 2 requires the ordinance to be coordinated with other governmental entities and to be supported by an adequate factual base. The City provided notice to the State of Oregon on January 18, 2023 and the plans describe the factual bases on which they rely. Goal 2 is satisfied.

3. Goal 3 – Agricultural Lands. Goal 3 does not apply to the decision.

4. Goal 4 – Forest Lands. Goal 4 does not apply to the decision.

5. Goal 5 – Natural Resources, Scenic and Historic Areas, and Open Spaces. Goal 5 does not apply to the decision.

6. Goal 6 – Air, Water and Land Resources Quality. Goal 6 does not apply to the decision.

7. Goal 7 – Areas Subject to Natural Hazards. Goal 7 does not apply to the decision.

8. Goal 8 – Recreational Needs. Goal 8 does not apply to the decision.

9. Goal 9 – Economic Development. Goal 9 does not apply to the decision.

10. Goal 10 – Housing. Goal 10 does not apply to the decision.

11. Goal 11 – Public Facilities and Services. Per Oregon Statewide Planning Goal 11, Public Facilities and Services, cities and counties are required to develop and adopt a public facilities plan for areas within an urban growth boundary containing a population greater than 2,500 persons. The public facilities plan is a support document (or documents) to the comprehensive plan that describes the water, sewer, and transportation facilities that are to support the land uses designated in the comprehensive plan. The water system component of the public facilities plan pertains to the provision of piped water for human consumption subject to regulation under ORS 448.119 to 448.285. The 2022 WSMP allows the City to meet these requirements. The 2016 Water Management and Conservation Plan (WMCP) will be adopted as an addendum to the 2022 WSMP in compliance with OAR 690-086. Goal 11 is satisfied.

12. Goal 12 – Transportation. Goal 12 does not apply to the decision.

13. Goal 13 – Energy Conservation. The City's comprehensive plan with respect to Goal 13 and its standards governing energy conservation are not affected by the decision. Goal 13 is satisfied.

14. Goal 14 – Urbanization. The decision does not analyze or expand the City's urban growth boundary. Goal 14 is not applicable.