City of Oregon City

2012 Water Distribution System Master Plan Amendment

Revised 1-20-2021

Adopted via Ordinance 21-1001
Effective March 5, 2021

murraysmith

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Introduction

In 2012, the City of Oregon City (City) adopted the *Water Distribution System Master Plan* (2012 WDSMP) prepared by West Yost Associates, an ancillary document to the City's Comprehensive Plan and the Public Facilities Plan for the City's water distribution system as required by Oregon Administrative Rule (OAR) Chapter 660, Division 11, Public Facilities Planning. The 2012 WDSMP includes the Capital Improvement Program (CIP) which consists of a list of prioritized water distribution system projects and estimated costs were based on 2009 dollars. The CIP is a blueprint for forecasting capital expenditures and is one of the most important means of meeting the City's obligation towards community development and financial public facilities planning.

This document is an amendment to the 2012 WDSMP, developed primarily to provide an updated CIP in current dollars for implementation over a 20-year time frame, through 2040. In order to prepare a comprehensive update, elements of the 2012 WDSMP were either retained as the basis for updated analysis, revised and updated to current conditions, or replaced in their entirety. A summary of the relationship between the original Chapters of the 2012 WDSMP and this Amendment is presented below:

2012 WDSMP Chapter	2020 Amendment
1. Introduction	Documents updates presented herein as a supplement to Chapter 1
2. Existing Water Distribution System	Retained as is, limited system modifications have occurred
3. Water Demand Analysis	Replaces this Chapter with current and forecasted demands through the year 2040
4. Water Distribution System Service Standards	Amends specific criteria for service pressures, fire flows, pump stations and storage
5. Hydraulic Model Update	Replaces this Chapter with comprehensive model update and calibration
6. Existing Water Distribution System Evaluation	Replaces this Chapter with updated analysis and findings
7. Future Water Distribution System Evaluation	Replaces this Chapter with updated analysis and findings
8. Recommended Capital Improvement Program	Replaces this Chapter with updated CIP based on new existing and future system evaluation
9. Water Distribution System Financing Plan	Proposed method of funding is not changed, however project list is replaced by the project list in the Amendment

This 2012 WDSMP Amendment has been developed in accordance with Oregon Administrative Rule (OAR) 660-011 which requires that "a city or county shall develop and adopt a public facility plan for areas within an urban growth boundary containing a population greater than 2,500

persons. The purpose of the plan is to help assure that urban development in such urban growth boundaries is guided and supported by types and levels of urban facilities and services appropriate for the needs and requirements of the urban areas to be serviced, and that those facilities and services are provided in a timely, orderly and efficient arrangement…"

Water Distribution Model

A steady-state hydraulic network model was used to evaluate the performance of the distribution system under existing and future demand conditions to identify deficiencies and evaluate adequacy of improvements. The model uses the Innovyze InfoWater software, and the EPANet hydraulic engine, to simulate system pressures and demands throughout the distribution system. The model was most recently updated and calibrated in 2017, as documented in the *Water Distribution Model Calibration Technical Memorandum (*Murraysmith, 2017, Appendix A).

System Supply and Demands

The South Fork Water Board (SFWB) supplies treated water to the City of Oregon City, the Clackamas River Water District (CRW), and the City of West Linn. Until recently, SFWB was the localized sole supply for all three providers. However, West Linn upgraded their connection with Lake Oswego-Tigard to access emergency supply from the Lake Oswego-Tigard Water Treatment Plant, completed in 2017. Additionally, CRW is extending supply from their own treatment through an on-going "Backbone" Project. The diversified supply will decrease the total demand on the SFWB system but will primarily not affect projected demands on the City system, or water wheeled through the City system. Therefore, for this analysis, it was assumed that SFWB would continue to supply all three providers without hydraulic deficiencies.

Currently, the City, West Linn, and CRW share supply via the SFWB 30-inch transmission line and the SFWB Division Street Pump Station, or the SFWB 42-inch transmission line and the City Hunter Avenue Pump Station. The supply system is shown in Figure 1 and described in the bullets below. Included in Appendix B is a hydraulic profile of the complete system. A looped connection between the SFWB 30-inch and 42-inch transmission lines was completed in December 2018 and is not reflected in either the figure or the descriptions. This project serves to bypass a leaking portion of the SFWB 30-inch transmission line near the SFWB Water Treatment Plant (WTP) and does not significantly affect system supply. The planning and modeling for this project are documented in the *Emergency Water Supply Analysis Technical Memorandum* (Murraysmith 2019) included in Appendix C.

- West Linn supply is located downstream of the SFWB Division Street Pump Station, directly off SFWB transmission lines, at Master Meter 3 (MM03). West Linn owns and operates their supply line between MM03 and the West Linn Bolton Reservoir. System demands for West Linn are modeled at the Bolton Reservoir.

- CRW demands are supplied via a master meter directly off SFWB infrastructure (MM02), wheeled through City infrastructure to master meters (MM08, MM09, MM11, MM12,

MM13), and directly off City infrastructure, without an intervening master meter. CRW customers supplied without intervening master meters are considered regular City customers, for the purposes of modeling system demands. CRW customers supplied through City infrastructure and via master meters are included as modeled demands at the meter location. Similarly, CRW customers supplied directly off the SFWB line are represented as a single demand at the location of the master meter.

- The City service area includes all areas within the City's Urban Growth Boundary (UGB) as shown in Figure 1 including 10 pressure zones. The City is supplied through both the SFWB 30-inch transmission line via the SFWB Division Street Pump Station, and through the SFWB 42-inch transmission lines via the Hunter Avenue Pump Station. Currently, CRW serves some areas within the City's UGB, including the Barlow Crest area and portions of the South End. These areas have been discussed in detail between the City and CRW in the *Joint Engineering Study Technical Memorandum* (Murraysmith 2018, Appendix D).

Demand Definition

The following demand conditions were used to evaluate system capacity.

- Average daily demand (ADD) is the total annual water volume used system-wide divided by 365 days per year.
- Maximum day demand (MDD) is the largest 24-hour water volume for a given year. In western Oregon, MDD usually occurs each year between July 1st and September 30th, referred to as the peak season.
- Peak hour demand (PHD) is estimated as the largest hour of demand on the peak use day.
- Fire flow demand is the flow rate required by the fire marshal to fight a fire at each hydrant. Demands are based on building size, material, and use. Fire flow demands are modeled in addition to MDD system demands.
- Equivalent Dwelling Units (EDUs) are used to quantify water demands for all forms of development in terms of typical water demand for single family residential units. Water demand per EDU is calculated as the total water demand for all single-family residential units in the system divided by the total number of single-family residential units.

Demand Summary

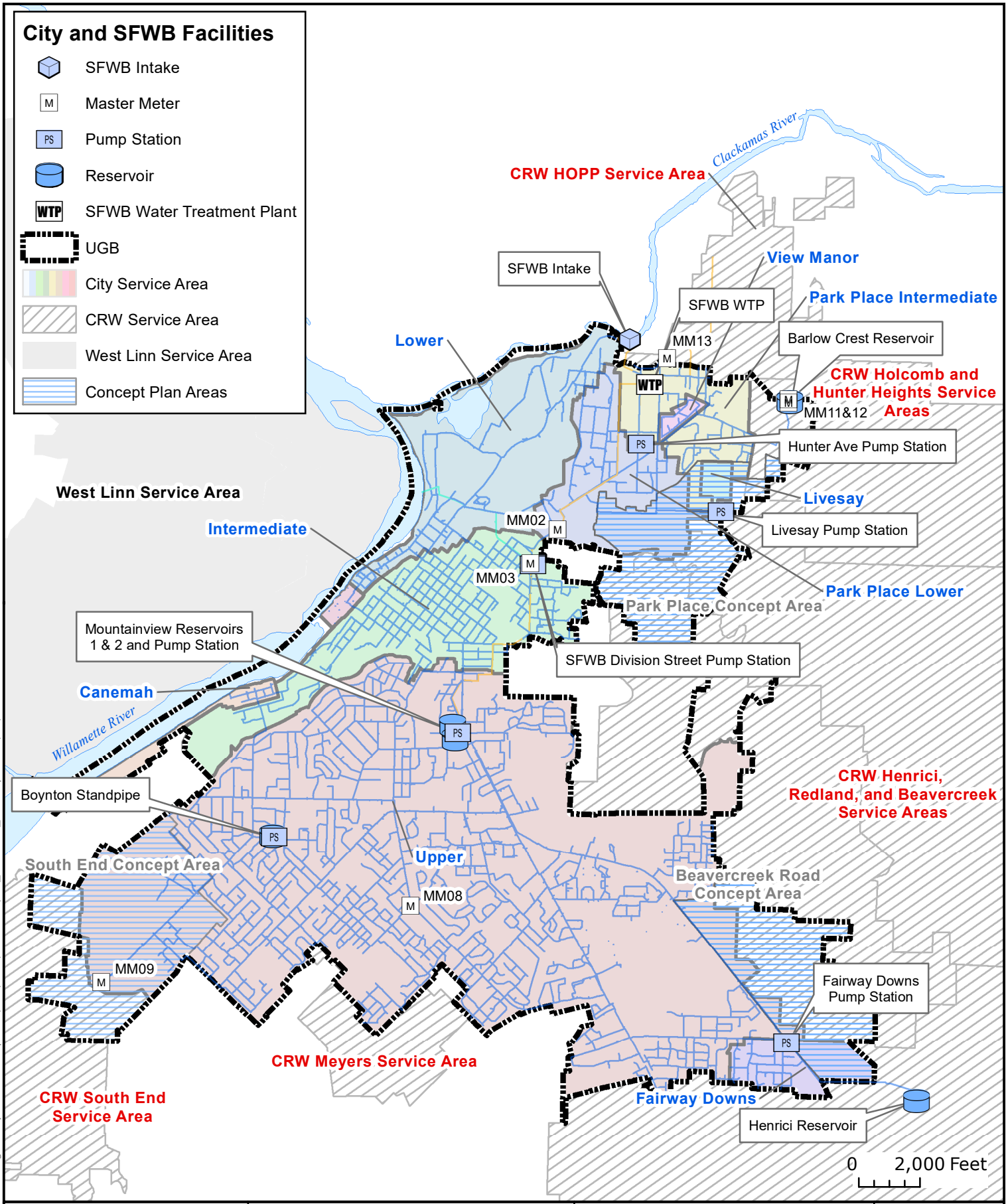
Demand projections were developed for Oregon City pressure zones and relevant master meters from individual water provider projections and are summarized in Tables 1 and 2. Demand projections include existing through the year 2040. The existing condition was approximated as the City's 2015 demands, as these were the most recent data available at the start of the CIP update process, and 2016 demands for West Linn and CRW.

City demands were calculated on a parcel level using Metro and Clackamas County household and employment projections (*Population Forecasts for Clackamas County Service Districts*, EcoNorthwest, 2016). EDUs were developed for each parcel based on residential, commercial, and industrial zoning classifications. Parcels were spatially assigned to the nearest model node within the same pressure zone and demands for each time period were calculated using 2012 WDSMP unit demands of 287 gallons per day per EDU (gpd/EDU). Water demand forecasts assume development occurs within the City's UGB and for the three concept plan areas as illustrated in Figure 1. These include the Park Place Concept Area, the South End Concept Area, and the Beavercreek Road Concept Area.

City MDD and PHD were calculated using peaking factors typical of similar systems in the region. Peaking factors of 2.3 for MDD:ADD and 2.0 for PHD:MDD were used.

CRW demands were distributed to master meter locations based on actual 2016 billing records and projected using a 1.5% per year growth rate, as presented in CRW's *Table 101.B South Storage Capacity Summary (1.5% Growth Forecast)* (CRW 2016, Appendix E).

West Linn demands were projected from actual 2016 billing records and the same 1.5% growth rate as used in CRW demand projections.



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City of Oregon City Water CIP Analysis

Figure 1 Study Area

August 2020 17-2119

Table 1
Oregon City ADD/MDD/PHD Existing through Year 2040 Conditions by Pressure Zone

Demand by Zone	ADD (mgd)					MDD (mgd)					PHD (mgd)				
Zone	EXST	2020	2025	2035	2040	EXST	2020	2025	2035	2040	EXST	2020	2025	2035	2040
Lower	0.2	0.3	0.4	0.5	0.6	0.5	0.8	1.0	1.2	1.3	1.0	1.6	1.9	2.4	2.5
Intermediate	0.5	0.5	0.5	0.6	0.6	1.2	1.2	1.2	1.3	1.4	2.3	2.4	2.4	2.6	2.7
Upper	2.3	2.7	2.9	3.4	3.5	5.4	6.2	6.8	7.9	8.2	10.5	12.1	13.3	15.5	16.0
Fairway Downs	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.1	0.1	0.1	0.1	0.2	0.2
Park Place Lower	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.1	1.2
Park Place Intermediate	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.8	0.8
Park Place Livesay	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.02	0.03	0.04	0.00	0.02	0.04	0.06	0.1
Park Place View Manor	0.04	0.04	0.04	0.04	0.05	0.10	0.10	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Canemah	0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.03	0.03	0.03	0.05	0.06	0.06	0.06	0.07
Total	**3.4**	**3.9**	**4.3**	**5.1**	**5.2**	**7.9**	**9.1**	**10.0**	**11.7**	**12.1**	**15.4**	**17.8**	**19.5**	**22.9**	**23.7**

Notes:

1 ADD = average day demand; MDD = maximum day demand; PHD = peak hour demand; mgd = million gallons per day

2 EXST = Existing conditions reflecting 2015 data for the City pressure zone demands.

Table 2
CRW and West Linn Demands

Demand (meter)	ADD (mgd)					MDD (mgd)					PHD (mgd)				
Zone	EXST	2020	2025	2035	2040 to BO	EXST	2020	2025	2035	2040 to BO	EXST	2020	2025	2035	2040 to BO
West Linn Total - MM03	2.9	3.1	3.3	3.9	6.0	7.2	7.8	8.4	9.7	15.2	14.1	15.1	16.3	18.9	29.6
CRW Zones- MM02	1.3	1.4	1.5	1.7	2.6	3.3	3.5	3.8	4.4	6.9	6.4	6.9	7.4	8.6	13.4
Barlow Crest PS - MM12	0.2	0.2	0.3	0.3	0.5	0.7	0.8	0.8	1.0	1.5	1.4	1.5	1.7	1.9	3.0
HOPP Forsythe - MM13	0.02	0.02	0.02	0.02	0.04	0.05	0.05	0.05	0.06	0.10	0.09	0.1	0.1	0.1	0.2
Leland/Meyers - MM08	0.09	0.09	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.6
South End - MM09	0.04	0.04	0.04	0.05	0.07	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.4
CRW Metered Total	1.6	1.8	1.9	2.2	3.4	4.3	4.6	5.0	5.8	9.0	8.3	9.0	9.7	11.2	17.6

Notes:

1 BO = buildout; ADD = average day demand; MDD = maximum day demand; PHD = peak hour demand; mgd = million gallons per day

2 EXST = Existing conditions reflecting 2016 data for the West Linn and CRW demands.

3 Future buildout demands include growth as determined by each water service provider.

Design Criteria

System Pressures

Water systems are constrained by service pressures and pipe velocity. For typical water systems, the acceptable service pressure range under ADD operating conditions is 40 to 100 pounds per square inch (psi). Where mainline pressures exceed 80 psi, services must be equipped with individual pressure reducing valves (PRVs) to protect water heaters per the *Oregon Plumbing Specialty Code (Section 608.2, 2014)*. Many of the City's customers fall within this category. During a fire flow event or emergency, the minimum service pressure is 20 psi as required by *Oregon Health Authority, Drinking Water Program* (OAR 333.061.0050(8)(e)) regulations. Recommended service pressure criteria are summarized in **Table 3**.

Table 3
Recommended Service Pressure Criteria

Service Pressure Criterion	Pressure (psi)
Normal range, during ADD	50-100
Maximum without PRV	80
Minimum, during emergency or fire flow	20

The acceptable flow velocity under MDD conditions is less than 4 feet per second (fps) velocity. The system should also be able to provide fire flow at less than 10 fps. However, velocity criteria are secondary to pressure and fire flow requirements.

Fire Flow Demands

Fire flow demands within the City's system are assigned based on land use type and summarized in **Table 4**. Fire flow requirements are set by the fire marshal and are consistent with tables in **Appendix B** of the *Oregon Fire Code* (OFC, 2014).

Table 4
Required Fire Flow Summary

Land Use Type	Required Fire Flow (gallons per minute)[1]	Required Duration (hours)
Single Family and Duplex Residential <3,600 sq ft	1,000	2
Single Family and Duplex Residential >3,600 sq ft	1,500	2
Medium Density Residential, Neighborhood and Community Service (Commercial)	2,500	2
High Density Residential, Commercial, Industrial, and Institutional	3,000	3

Notes:

1 A minimum service pressure of 20 psi is required at all services throughout the system during all fire flow.

Facility Criteria

Pump stations to zones with gravity storage are required to supply MDD with the largest pump out of service (firm capacity). This standard applies to all pump stations with the exception of the Fairway Downs Pump Station, which currently pumps to a closed zone (no reservoir) and thus is required to provide adequate supply for MDD and fire flow. In the future, the Fairway Downs zone is expected to be served by a new reservoir, eliminating the additional pumping capacity requirements for fire flow.

Reservoirs storage is allocated into multiple components including emergency, fire, equalization, and operational. Emergency storage is based on the amount of risk a system is willing to accept and is intended for supply during a treatment plant outage, or other emergency. A typical volume for emergency storage is two times ADD. Reservoir storage for fire flow demands is required for the maximum combination of fire flow demand and fire flow duration within each pressure zone. For an entirely residential zone, this value is 180,000 gallons (1,500 gpm x 2 hours). Equalization storage is the volume differential between MDD and PHD. Sometimes a value of 0.25xADD is substituted for equalization in place of an exact volume. Finally, operational storage is available to limit pump cycling or to sustain system pressures. This is the volume of water typically cycled throughout the day while supply is off, or the water surface required to sustain minimum pressures within the pressure zone. **Table 5** lists the water system facility criteria used to evaluate the City's system.

Table 5
Water System Facility Criteria

Water Facility Type	Criteria
Pump Station to Gravity Storage	Firm capacity for MDD
Pump Station to Closed Zone	Firm capacity for MDD + fire flow
Reservoir Storage (sum of components)	Emergency = 2xADD Fire flow = maximum fire flow x duration within zone Equalization = 0.25xADD Operational = Based on zone specific HGL or Pump Cycling

System Evaluation

Distribution and Fire Flow Deficiencies

The system was evaluated at existing and future demands, based on the pressure design criteria presented in **Table 3** and the fire flow criteria presented in **Table 4**. The results of both analyses (existing and future) were similar.

Figure 2 highlights areas of high velocity and low pressures under existing MDD. For both existing and year 2040 conditions, low pressures are generally not an issue, although higher velocities can be seen in one of the parallel Molalla Avenue transmission mains near the Mountainview Site.

Figure 3 highlights available fire flow at existing MDD throughout the system. Based on minimum pressure and fire flow criteria, the system performs adequately with fire flow deficiencies generally isolated to small diameter or dead-end pipes. This is true for both existing and future demand scenarios, although these deficiencies are typically more extreme under future system demands.

The results of the existing MDD condition analysis are shown in Figures 2 and 3, as deficiencies visible under the existing condition remain localized to the same areas under future conditions.

The City operates many of its zones at the higher end of pressure recommendations (Figure 2). This places stress on distribution piping and increases risk of water losses. For new developments, distribution piping should be designed within the recommended pressure ranges including redundant PRVs where pressures are in excess of 80 psi. Individual PRVs owned and maintained by the property owner may be required to further reduce local distribution pressure.

City staff have expressed concerns about balancing supply and demand between the Henrici Reservoir and Boynton Standpipe. While filling the Henrici Reservoirs from the Mountainview Pump Station, the system experiences high pressures and increased water losses. Additional transmission capacity is required to improve supply to and from the Henrici Reservoir while maintaining pressures within recommended ranges and is documented in Appendix F, *Molalla Avenue Streetscape Concurrent Waterline Improvements* (Murraysmith, October 2018).

Reservoir Capacity Analysis

Reservoir storage is provided for four purposes: emergency supply, fire flow, equalization, and operations. The total distribution storage requirement is the sum of the components. An evaluation of reservoir storage was performed including a review of each component. Because some zones can be supplied by multiple reservoirs or supplemented by pump station capacity, the following assumptions were developed for the reservoir storage analysis:

- Barlow Crest Reservoir supplies Park Place Intermediate Zone, View Manor, Livesay, and CRW MM13 (Forsythe)
- Mountainview Reservoirs 1 & 2 supply the Lower Zone, Intermediate Zone, and Canemah
- Boynton & Henrici Reservoirs supply Upper Zone, Fairway Downs, CRW MM08 (Leland) and MM09 (South End)
- The Upper Zone storage deficiencies can be supplied by the excess storage in Mountainview Reservoirs 1 & 2 depending on adequate pumping capacity at the Mountainview Pump Station.
- Proposed reservoirs for the Beavercreek Road Concept Area (Fairway Downs Reservoir) and the Park Place Concept Area (Holly Lane Reservoir) were included in the analysis and sized for growth within their respective service areas.

- Many zones can be alternately supplied by either the Barlow Crest or Mountainview Reservoirs via control valves and PRVs which provides system redundancy. For the purposes of this analysis, demands from these zones were only assigned to one of the supplying reservoirs.

- SFWB Water Treatment Clear Well supplies the Park Place Lower Zone. As discussed in the SFWB *Water Master Plan* (2016), the 2 million-gallon (MG) clear well has adequate capacity for storage within the zone.

The reservoir storage analysis is presented in **Table 6**. A negative value in available storage represents the additional storage required.

Table 6
Reservoir Storage Calculations

Reservoir	Existing Storage (MG)	Total Storage Required (MG)					Available Storage (MG)				
		Existing	2020	2025	2035	2040	Existing	2020	2025	2035	2040
Barlow Crest	1.75	0.7	0.7	0.8	0.9	1.0	1.1	1.0	1.0	0.8	0.7
Mountainview	12.5	2.7	3.0	3.2	3.6	3.8	9.8	9.5	9.3	8.9	8.7
Henrici/Boynton[1]	4	6.7	7.7	8.4	9.8	10.5	-2.7	-3.7	-4.4	-5.8	-6.5
Holly Lane	0	na				0.5	na				
Fairway Downs	0	na				1.1	na				

Notes:
1 MG = millions of gallons, na = not applicable
2 Existing condition assumed to be 2015/2016 depending on data source.
3 Storage deficit shown in Henrici/Boynton by 2035 can be provided by the excess storage in the Mountainview Reservoirs, if the Mountainview Pump Station can meet the MDD demands of the Upper Zone and emergency power supply at the station is adequate for operation.

Through the 20-year time frame (2040), all zones have adequate storage. For the Upper and Fairway Downs Zones, this assumes that any storage deficiency is minimized by pumping capacity at the Mountainview Pump Station. For 2040, this results in 6.5 MG of emergency storage for the upper zones located in the Mountainview Reservoirs, which places additional risk on the City. Therefore, an additional 6.5 MG storage is recommended within the Upper Zone beyond the year 2040, the 20-year time frame. A future update of the 2012 WDSMP and this Amendment should include further evaluation of the need for this additional storage.

Pump Station Capacity Analysis

Two types of systems are considered in the pump station analysis. The first is an open system, with at least one reservoir that sets the hydraulic grade for the pressure zone. In an open system, the pump station firm capacity must be equal to or greater than MDD for the pressure zone(s) served by the pump station. The second is a closed system, which is a zone without a reservoir. In a closed

system, the pump station must be able to provide MDD + fire flow with the largest pump out of service.

Only the existing Fairway Downs Pump Station supplies a closed zone. With the development of the upper Beavercreek Road Concept Area, a new reservoir and pump station will be required. An open system will replace the existing closed system, and the reservoir will be sized to supply the fire flow needs of the expanded Fairway Downs Pressure Zone. As previously summarized, storage requirements in the Intermediate Zone and limitations in storage at Henrici/Boynton should be considered in sizing the Fairway Downs Reservoir and associated pump station.

As shown in **Table 7**, all existing pump stations meet system demands for the next 20 years through year 2040. Improvements to the Mountainview Pump Station firm capacity may be required beyond 2040 in conjunction with additional storage in the Upper Zone.

Table 7
Pump Station Capacity Calculations

Pump Station	Firm Capacity (GPM)	MDD (GPM)					Available Pumping Capacity (GPM)				
		Existing[4]	2020	2025	2035	2040	Existing[4]	2020	2025	2035	
Hunter Ave	1,800	800	850	900	1,100	1,250	1,000	950	900	700	550
Mountain-view[1]	8,000	3,900	4,500	4,950	5,800	6,300	4,100	3,500	3,050	2,200	1,700
Fairway Downs[2]	1,050	50	50	50	50	na	0	0	0	0	na
Holly Lane	na	na				100	na				
Fairway Downs[3]	na	na				250	na				

Notes:

GPM = gallons per minute, MDD = maximum day demand, na = not applicable

1 Mountainview Pump Station required to also have emergency power supply for MDD supply operations, as some emergency storage for the Upper Zones is located in the Mountainview Reservoirs.

2, 3 Existing Fairway Downs Pump Station to be decommissioned when development occurs and replaced by new Fairway Downs Pump Station. Existing station pumps to closed zone, therefore pumping capacity required at MDD + fire flow (1,000 gpm). Check valves from Upper Zone also available for fire flow in the zone. Additional fire flow demand not required for new pump station with gravity storage.

4 Existing condition assumed to be 2015/2016 depending on data source.

Figure 2
City of Oregon City
Static Pressure Analysis

SFWB Intake and WTP

Barlow Crest Reservoir and Pump Station

Hunter Ave Pump Station

SFWB Division Street Pump Station

Mountainview Reservoirs 1&2 and Pump Station

Boynton Standpipe

Fairway Downs Pump Station

Henrici Reservoir

PIPE VELOCITY
- < 4 fps
- 4 - 10 fps
- > 10 fps

STATIC PRESSURE
- < 20 psi
- 20 - 40 psi
- 40 - 80 psi
- 80 - 120 psi
- > 120 psi
- CRW MAINS
- UGB

PRESSURE ZONE
- CANEMAH DISTRICT
- FAIRWAY DOWNS
- INTERMEDIATE ZONE
- LOWER ZONE
- PAPER MILL ZONE
- PARK PLACE - INTERMEDIATE
- PARK PLACE - LIVESAY RD
- PARK PLACE - LOWER
- PARK PLACE - VIEW MANOR
- UPPER ZONE

Water Facilities
- SFWB, Intake
- SFWB, WTP
- Master Meter
- SFWB, Pump Station
- CRW, Pump Station
- CRW, Reservoir
- OC, Pump Station
- OC, Reservoir
- OC, PRV

Note: Figure shows existing MDD conditions of 8.44MGD. Buildout MDD demands did not significantly impact results therefore, this figure is representative of existing and buildout conditions.

0 2,000 4,000 Feet

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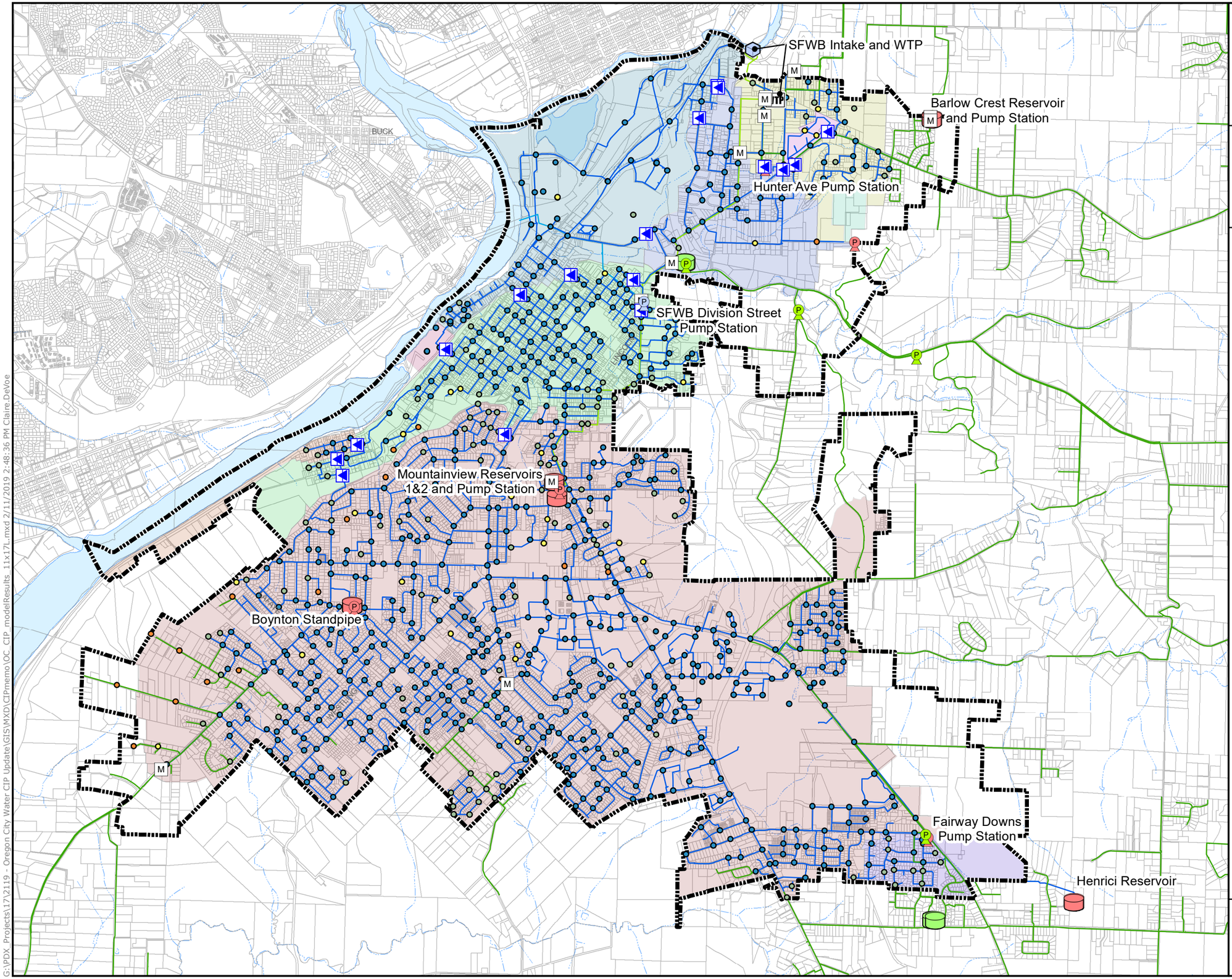

Figure 3
City of Oregon City
Available Fireflow

AVAILABLE FIREFLOW
- 0
- <1000
- 1000 - 1500
- 1500 - 3000
- >3000

WATER MAINS
- OREGON CITY
- SFWB
- WEST LINN
- CRW
- UGB

PRESSURE ZONE
- CANEMAH DISTRICT
- FAIRWAY DOWNS
- INTERMEDIATE ZONE
- LOWER ZONE
- PAPER MILL ZONE
- PARK PLACE - INTERMEDIATE
- PARK PLACE - LIVESAY RD
- PARK PLACE - LOWER
- PARK PLACE - VIEW MANOR
- UPPER ZONE

Water Facilities
- SFWB, Intake
- SFWB, WTP
- Master Meter
- SFWB, Pump Station
- CRW, Pump Station
- CRW, Reservoir
- OC, Pump Station
- OC, Reservoir
- OC, PRV

Note: Figure shows existing MDD conditions of 8.44MGD. Buildout MDD demands did not significantly impact results therefore, this figure is representative of existing and buildout conditions.

0 2,000 4,000 Feet

N W E S

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Capital Improvement Program

Capital projects were developed based on deficiencies identified in the system evaluation and future year 2040 system demands including new growth areas. The Capital Improvement Program (CIP) is divided into three types of improvement projects: "Capacity and Operations," "Development and Growth," and "Repair and Replacement." Descriptions of these categories are defined below and further summarized in Table 8.

- Capacity and Operations - Projects are typically those to meet existing system demands, reservoir turnover, or to meet the needs of areas within the system that will require upsizing to provide for in-fill growth. Dead-end pipes with fire flow limitations where at least 500 gpm of fire flow is available were excluded from the capacity improvements.

- Development and Growth - Projects differ in that they are specifically targeted at new large development areas and are typically not required to supply existing demands.

- Repair and Replacement - Projects include both routine repair and replacement of pipes, pump replacement, reservoir maintenance, and PRV repair/replacement.

Table 8
Capital Improvement Program Projects

Improvement Type	Improvement Addresses:	Timing Trigger
Capacity and Operations	Capacity limitations and system operations	Mitigate projected deficiencies
Development and Growth	New development areas	Developer driven
Repair and Replacement	Routine maintenance on infrastructure and annual pipe replacement	Annual and cyclical investments based on infrastructure life cycle

Cost Assumptions

All project descriptions and cost estimates are consistent with Class 5 budget estimates, as established by the *American Association of Cost Engineers* (AACE). This preliminary estimate class is used for conceptual screening and assumes project definition maturity level below two percent. The expected accuracy range is -20 to -50 percent on the low end, and +30 to +100 percent on the high end. The cost estimates are consistent with the definition of OAR 660-011-0005(2) and OAR 660-011-035. Cost estimates are intended to be used as guidance in establishing funding requirements at the project planning level based on information available at the time of the estimate. Estimates exclude land acquisition, financing, inflation, and operations. Costs were developed in 2018 dollars with markups for contractor profits, overhead, engineering, and construction contingency. Since construction costs change periodically, an indexing method to adjust present estimates in the future is useful. The Engineering News-Record (ENR)

Construction Cost Index (CCI) is a commonly used index for this purpose. For purposes of future cost estimate updating; the August 2018 ENR CCI (20-city average) is 11124.

Joint Work with CRW and Neighboring Provider Upgrades

The City participates in joint infrastructure planning and supply discussions with regional water suppliers and distributers such as SFWB, CRW, Lake Oswego, and West Linn. Neighboring communities have recognized the benefits of collaborative planning and have worked together through Intergovernmental Agreements (IGAs) and joint projects like the South End supply line and Barlow Crest supply, to provide water to regional customers. This collaboration encourages purveyors to invest in essential facilities, without building redundant infrastructure. As communities develop, this collaboration will continue to be important to efficiently serve all customers. In addition, an increased focus on system interties has improved regional resiliency, in the event of a major failure at one or more of the water treatment plants within the region. Recent and anticipated system intertie investments include:

- CRW's Backbone Project to extend CRW WTP supply to CRW zones south of the Clackamas River.
- Continued operation and maintenance of City/CRW and SFWB/CRW interties.
- Operation and maintenance of the West Linn-Lake Oswego emergency connection booster station. This provides West Linn an alternate supply from the newly completed Lake Oswego–Tigard WTP upgrades, and improves regional resiliency through interconnections.

Improvements identified in the City CIP exclude analysis of alternatives related to major regional projects such as the CRW Backbone Project. The City will continue to explore opportunities for collaboration with neighboring providers at which time some of the City capital projects may be modified to account for a broader regional supply and/or distribution solution.

Improvement Descriptions

Capacity and Operations Projects

Capacity and operations projects were identified through model evaluations, discussions with City staff, and pump station/reservoir capacity reviews. These improvements are summarized for both the City and SFWB, although only the City improvements are included in the CIP.

SFWB Improvements

SFWB improvements identified in the *SFWB Water Master Plan* (CH2M and MWH, 2016) are required to maintain system operations, expand capacity, and address redundancy. These projects address limited capacity in the 30-inch SFWB supply line which causes operational difficulties at the Division Street Pump Station, and eventual capacity limitations in the rest of the SFWB system. A 42-inch connection on Cleveland St between the 30-inch and 42-inch SFWB supply lines

(referenced earlier in *System Supply and Demands*) was completed recently in December 2018. Key SFWB transmission improvements include:

- Increased transmission capacity between the WTP and the Mountainview Pump Station (upsizing the existing 30-inch line)
- Increased capacity at the Division Street Pump Station

Henrici Reservoir Operations

Based on existing transmission capacity, the City has difficulties keeping the Henrici Reservoir filled and the Boynton Standpipe from overflowing. Both reservoirs provide storage for the Upper Zone and are simultaneously filled by the Mountainview Pump Station. The Boynton Standpipe is centrally located while the Henrici Reservoir is located beyond the perimeter of the Upper Zone to the southeast. When the Mountainview Pump Station output is increased to fill the Henrici Reservoir, high pressure issues are seen near the pump station. This is especially problematic in summer months when the pump station must operate at a higher flow rate to keep up with Upper Zone demands.

Project constraints and opportunities include:

- Existing transmission main(s) in heavily trafficked Beavercreek Road
- Secondary transmission route(s) in backyards and other difficult to access locations
- Concurrent streetscape improvement project along Molalla Avenue
- Additional transmission and distribution requirements for growth including the expanded Fairway Downs Zone

After evaluating alternatives, a parallel transmission route was identified along Molalla Avenue, and a new transmission line was identified between Glen Oak Road and the Henrici Reservoir. The combined improvements provide additional capacity and improved transmission to and from the Henrici Reservoir. The projects will likely be constructed in multiple phases with the Molalla Avenue portion of the project constructed first to align with the streetscaping work. Both improvements are required to provide the full operational benefits. Table 9 presents a flow split analysis between Boynton and Henrici Reservoirs under existing ADD. Without improvements, approximately 67% of the available excess flow from the Mountain View Pump Station is conveyed to the Boynton Standpipe and 33% is conveyed to Henrici. With all improvements, the flow split is approximately 50% between the reservoirs.

Table 9
Reservoir Filling Rates - Mountainview to Henrici Transmission Upsizing

Scenario	Boynton Standpipe (gpm)[1]	Henrici Reservoir (gpm)[1]
No Improvements	4,200	2,100
Parallel Main on Molalla Ave	4,200	2,500
Upsize Beavercreek Transmission from Glen Oak Road to Henrici Reservoir	3,600	2,900
Both improvements: Parallel Main on Molalla Ave and Upsize Beavercreek Transmission	3,500	3,500

Note:
1 Filling rates during existing ADD, 2 pumps on at Mountainview Pump Station, reservoirs at low set points.

Development and Growth Projects

Development improvements were identified through a variety of means including discussions with the City and reviewing existing concept plans. Most projects include only the main line infrastructure required to serve the development areas, and do not include full distribution piping. Pipe layouts were based on either proposed street networks or additional studies, if available. Unless otherwise noted, development areas can be served by extending existing transmission and distribution piping.

Park Place Development

The Park Place Concept Area is located east of Oregon City and Highway 213, north and south along S Redland Road, and east and west along S Holly Lane. Portions of the area are currently served by CRW and development is described in the *Park Place Concept Plan* (2008). Proposed improvements for the area include pipe looping into the existing City system at the Park Place Intermediate and the Park Place Lower zones, a new 1.0MG reservoir and pump station, and intermediate PRV's.

Joint transmission along S Redland Road to CRW's Holly Lane and Redland Pump Stations has been discussed between the City and CRW. This is advantageous to both providers as it limits unnecessary parallel infrastructure, provides emergency connections between both systems and provides a secondary supply to the City via CRW.

Details of the pressure zone delineation for the Park Place Concept Area are presented in Table 10.

Table 10
Park Place Concept Area Supply

Location	Ground Elevation (ft)	HGL (ft)	Supply	Storage
East of Trail View Dr	>400	794	CRW via Barlow Crest PS	CRW Hunter Heights Reservoir
North of S Redland Rd	>310	549	New transmission piping from Park Place Intermediate	Barlow Crest Reservoir
North of S Redland Rd	200-310	430	PRV'd from Park Place Intermediate	Barlow Crest Reservoir
Along S Redland Rd	40-200	320	Master Meter from SFWB supply at Redland Rd and Anchor Way	SFWB WTP Clearwell
South of S Redland Rd	>200	350	New Park Place PS	New Holly Lane Reservoir

Beavercreek Road Development

The Beavercreek Road Concept Area is located within the existing UGB, northeast of Beavercreek Road. The area will require service to the City's Upper and Fairway Downs Zone pressure zones. The City and CRW have discussed service in this area extensively in the *Joint Engineering Study Technical Memorandum* (Appendix D) and the prior meetings leading up to that document. Various alternatives were explored, including joint construction of a reservoir to serve both CRW and the Fairway Downs Zone. City staff reviewed the alternative approaches with the City Commission and confirmed the City's desire to pursue development of City-owned infrastructure, independent of CRW, to serve the Beavercreek Road Concept Area within the UGB. The capital improvements presented in this 2012 WDSMP Amendment reflect this direction.

Pipe networks were based approximately on planned street alignments, as presented in the *Beavercreek Road Concept Plan* (Otak 2008). The Fairway Downs Zone is expected to serve areas above 480-feet elevation, within the UGB at a pressure zone hydraulic gradeline of 650-feet. Pumps will be sized to meet MDD demands, with additional peak hour or fire flow supply available from the new 1.75 MG reservoir.

Repair and Replacement Projects

Significant investment in infrastructure repair and replacement will be required as infrastructure reaches the end of its useful life. A Repair and Replacement Program is intended to apply proactive investment for reservoir coatings, PRV repair/replacement, pump station mechanical/electrical replacement, and pipeline repair/replacement. The program priorities are established based on

condition assessments with funding established based on standard life spans for facility types as shown in Table 11.

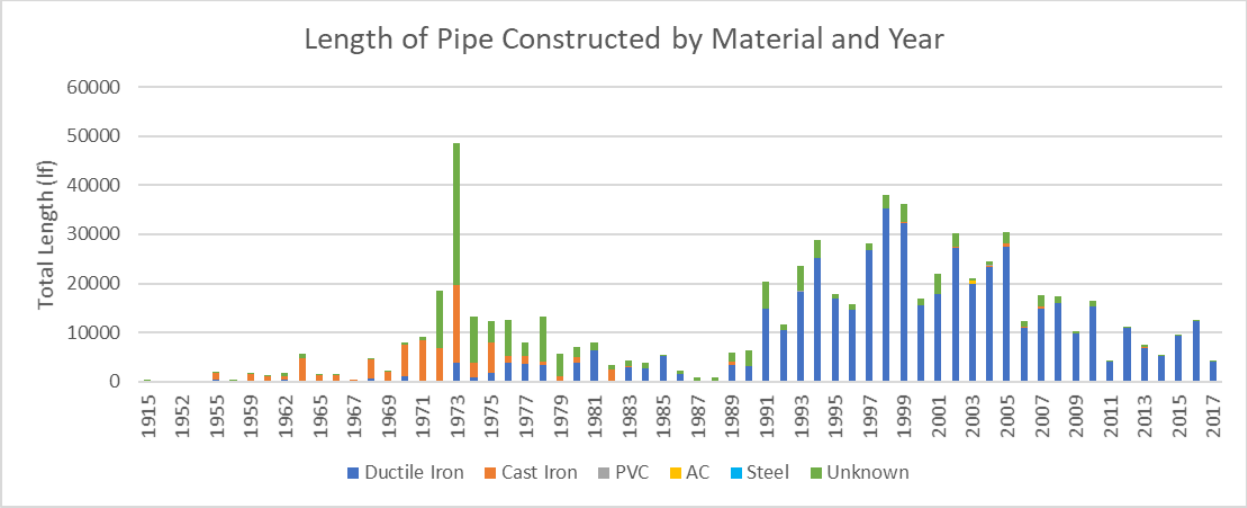
Table 11
Repair and Replacement Summary

Facility	Work Required	Frequency
Pipeline	Repair or Replacement	75 years
PRV	Inspection	Annual
	Major Rehabilitation and Rebuild	5 years
	Replacement	25 years
Reservoir – Steel	Exterior Overcoat	15 years
	Interior Removal and Recoat	30 years
	Exterior Removal and Recoat	30 years
Reservoir – Concrete	Minor Touch Up Rehabilitation	Annual
	Major Rehabilitation and Repairs	25 years
Pump Station - Mountainview	Pump, Mechanical & Electrical Replacements	10 years
Pump Station – Hunter Ave	Pump, Mechanical & Electrical Replacements	20 years
Pump Stations - Other	Pump, Mechanical & Electrical Replacements	20 years

Pipe Replacement

An evaluation was performed to identify the length of pipeline reaching the end of its useful life within the year 2035, 20-year planning horizon. An age distribution for piping was extracted from the City GIS and is presented in Figure 4. Pipe installations older than 75-years or with known leakage issues were identified for the 20-year planning horizon. This amounts to 90,000 linear-feet of pipe or approximately 4,500 linear-feet of pipe per year over 20-years as shown in Table 12. Specific pipe segments were identified for the 0 to 5-year time frame by City staff based on the known condition and leak issues. These include pipelines located along Main Street between 10th Street and 15th Street, between the Mountainview Reservoirs and Gaffney Lane to the south, crossing I-205 near the intersection of Agnes Avenue and Main Street, and those listed in the CIP Table 17 as an "Oregon City Operations – Small Waterline Replacement" project. Specific information on small water projects are also summarized in Appendix G.

Figure 4
Pipe Distribution by Age and Material



Note:

1 Approximately 18 percent of pipe has unknown installation date, not shown in **Figure 4**. The pipe construction material is approximately evenly split between Ductile Iron, Cast Iron, and Unknown. Installation dates were assumed evenly distributed over 50 years between 1943 and 1993.

Table 12
Pipe Replacement Projects

Timeframe	Length of Pipe for Repair and Replacement (linear-feet) [1]	Location Description
0 – 5 Years	29,000	Including but not limited to: - Main Street between 10th Street and 15th Street - Between Mountainview Reservoir and Gaffney Lane - I-205 crossing near Agnes Avenue and Main Street - OC Operations, Small Waterline Replacement Projects
6 – 10 Years	17,000	3,500 linear-feet per year based on pipe condition assessments
11 – 20 Years	43,000	4,500 linear-feet per year based on pipe condition assessments
TOTAL	**89,000**	

Notes:

1 Approximately 18-percent of pipe has unknown installation date. Assumed replacement of those pipes to be evenly distributed over 50 years.

Pressure Reducing Valve Station Rehabilitation, Repair, and Recommended Settings

Pressure Reducing Valve (PRV) stations are vital for supply to zones without gravity storage. The PRVs should be inspected and maintained annually with major rehabilitation scheduled every 5 years, and replacement scheduled every 25 years. **Table 13.1** lists the approximate condition and year slated for rehabilitation for the PRV stations throughout the system.

Table 13.1
Pressure Reducing Valve Rehabilitation Schedule

Pressure-Reducing Valve Station	Installation Year	Condition	Notes	Expected Rehabilitation and Rebuild (scheduled every 5 years)	Expected Replacement (scheduled every 25 years)
11th St & Washington St	1993	Fair / Dirty	Cleaning required	2021/2022	2026/2027
15th St & Madison St	2016	New		2021/2022	2041/2042
16th St & Division St	1971	Bad	Used to buffer intermediate zone from high pressures caused by the Division Street Pump Station. Small diameter valve inoperable.	Needs Replacement	2019/2020
18th St & Anchor Way	1992	Bad/Fair		Needs Replacement	2019/2020
3rd St & Bluff	2018	New		2023/2024	2043/2044
4th Ave & Jerome St	1958	Bad	Redundant to 3rd & Ganong, for high demand both PRVs required	Needs Replacement	2019/2020
5th Ave & Canemah	1958	Bad	Required to adequately supply Canemah Zone	Needs Replacement	2019/2020 and add power
99E & Main St	1997	Out of service	Abandon and remove the 99E and Main PRV Station, replace with pipe connection between the Paper Mill Zone and Lower Zone that results in eliminating the Paper Mill Zone and expands the Lower Zone (Appendix H)	NA	NA
Abernethy Rd & Redland Rd	1963	Bad	Required based on location and distance from redundant PRVs	Needs Replacement	2019/2020
Apperson Blvd & La Rae Rd	1999	Fair		2022/2023	2027/2028

Pressure-Reducing Valve Station	Installation Year	Condition	Notes	Expected Rehabilitation and Rebuild (scheduled every 5 years)	Expected Replacement (scheduled every 25 years)
Harley Ave & Forsythe Rd (North)	1988	Fair	Remove South PRV, reconfigure piping as needed for continued operation of North PRV. Relief valve settings need updating. Individual Customer PRV's required on service lines as needed for service pressures exceeding 70psi per City Standard.		2021/2022
Harley Ave & Forsythe Rd (South)	1973	Bad	Remove South PRV and coordinate project with improvements to North PRV as noted above.	Removal 2021/2022	Removal 2021/2022
Jennifer Estates	2002	Fair	Ground settling around vault.	2022/2023	2027/2028
Swan Ave & Holcomb Blvd	1999	Fair		2022/2023	2027/2028
View Manor	1999	Fair	Remove PRV with property redevelopment. Existing piping in poor condition – PRV settings updated to minimize pressure impacts on the local pipe.	Maintain until PRV removal with property redevelopment	Removal with redevelopment
3rd Ave & Ganong St	2008	Good		2028/2029	2033/2034
Hunter Ave Pump Station	1998	Good		2022/2023	2027/2028
East St & Maple St	2015	Good		2021/2022	2040/2041

Table 13.2 lists the valve diameters and settings for existing City PRVs. Photo documentation of PRV stations by the City is included in Appendix G. Additional analysis for redevelopment of the Paper Mill Zone and related PRV stations is provided in Appendix H, *Mill Redevelopment Water Distribution Analysis* (Murraysmith, 2018).

Table 13.2
Pressure Reducing Valve Recommended Settings

Pressure Reducing Valve Station	Valve 1 Size	Valve 2 Size	Valve 3 Size	Valve 1 Setting	Valve 2 Setting	Valve 3 Setting
11th St & Washington St[1]	3	10		67	58	
15th St & Madison St[1]	2	6		61	56	
16th St & Division St	1.252	6		na	100	
18th St & Anchor Way	4	8		53	48	
3rd St & Bluff[1]	3	8		42	39	
4th Ave & Jerome St	2	6		55	50	
5th Ave & Canemah	1.25	4		83	78	
99E & Main St			To be removed			
Abernethy Rd & Redland Rd[1]	4	8		102	97	
Apperson Blvd & La Rae Rd[1]	2	4	6	84	79	77
Harley Ave & Forsythe Rd (North)[1]	12			61		
Harley Ave & Forsythe Rd (South)			To be removed			
Jennifer Estates	4	8		51	46	
Swan Ave & Holcomb Blvd	4	8		65	55	
View Manor	4	8		40	35	
3rd Ave & Ganong St	2	6		79	79	
Hunter Ave Pump Station	3	6		45	51	
East St & Maple St	6			46		

Notes:
Updated PRV settings recommended in the *Mill Redevelopment Technical Memorandum* (Murraysmith, 2018) (Appendix H).
Valve is not currently functioning.

Facility Rehabilitation and Repair

The lifespan of system reservoirs and pump stations can be significantly increased if regular rehabilitation and repairs are made. It is recommended that regular maintenance on Oregon City's steel tanks (Barlow Crest, Boynton, and Henrici) include periodic exterior overcoats, and less frequent complete exterior and interior removal and recoat. Regular maintenance on the concrete tanks (Mountainview 1 & 2) is recommended to include frequent touch up and rehabilitation, and major repairs when needed. Costs for this rehabilitation are dependent on facility condition, age, material, and size. Table 14 includes an approximate schedule for rehabilitation of existing reservoirs. Table 15 includes an approximate schedule for safety and seismic upgrades, and suggested improvements. When new reservoirs are constructed, they will need to be added to the rehabilitation schedule.

Pump stations require annual inspection and maintenance with pump, mechanical, and electrical replacement generally every 20 years, with the exception being Mountainview pump station replacement schedule every 10 years. Costs for pump replacement depend on pump size and condition. **Table 16** includes an approximate schedule for pump station improvements.

Table 14
Reservoir Coating and Rehabilitation Schedule

Facility		Concrete	Steel		
Name	Construction/ Rehab Year	Major Repairs	Exterior Overcoat	Interior Removal and Recoat	Exterior Removal and Recoat
Barlow Crest	1999	-	2024	2024	2039
Mountainview 1	2007	2032	-	-	-
Mountainview 2	1952/2007[1]	2032	-	-	-
Boynton	1984	-	-	-	2028
Henrici	1994	-	2019/2020	2019/2020	2035

Notes:
1 Mountainview 2 built in 1916 and expanded in 1952, underwent seismic upgrades and rehabilitation in 2007.
2 Limited redundancy for Barlow Crest Reservoir means it is difficult to take offline. Coordination with CRW to PRV water from Hunter Heights
3 Biannual minor repairs for Concrete tanks, annual exterior touch-up for steel tanks. Assumed within O&M budget, separate from CIP budget.

Table 15
Reservoir Seismic and Safety Improvements

Facility	Seismic Analysis/Seismic Upgrades	Safety Upgrades
Barlow Crest	2019/2020	2024
Mountainview 1	-	-
Mountainview 2	-	2020
Boynton	2022/2023	-
Henrici	2019/2020	2019/2020

Table 16
Pump Station Rehabilitation and Maintenance Schedule

Pump Station	Pump Install Year	Replacement Year	Pump, Mechanical, and Electrical Rehab or Replacement
Hunter Ave	1999	2019/ 2022	Drives, PLC/ Pumps, SCADA electrical, transfer switch generator
Mountainview	2018	2023/ 2028	Drives/ Pumps, SCADA electrical
Fairway Downs	2018	NA	Pump station to be removed with Beavercreek Road Concept Area Development
Boynton	1984	Removal Project 2022	Remove pumps (non-operational), decommission pump station
Livesay	2012	NA	Decommission pump station when Park Place Concept Area Develops

Capital Improvement Program Summary

The capital projects are described in **Table 17,** "Capital Improvement Program" including project descriptions, priorities, and Class 5 costs estimates. Projects are illustrated in **Figure 5**. A summary of total CIP costs is presented in **Table 18**.

Table 17
Capital Improvement Program

Improvement Category	Project Type	MAP ID	Timeframe	Facility Type	Description	Length (lf)	Dia (in)	Capacity	SDC Eligible	Cost Estimate[1]
Central Point	Development	1	Project recently completed by development	Pipe	New 8” looped distribution pipe along Skellenger/Orchard Grove area		8			Developer-constructed project
Leland McCord	Development	2	2-5	Pipe	New transmission along Leland Rd	1300	12		100%	$370,000
	Development	3	2-5	Pipe	New distribution along McCord Rd	2,400	12		100%	$681,500
	Operations (City/CRW)	4	2-5	Master Meter	Move the Master Meter, MM08, to the UGB and update CRW connection, timing based on development				0%	$200,000
South End	Development	5	15-20	Pipe	New distribution within development - backbone only	19,000	12		100%	$5,394,500
	Operations (City/CRW)	6	15-20	Master Meter	Move the Master Meter, MM09, to the UGB and update CRW connection, timing based on development				0%	$200,000
Upper Zone	Development	7	2-5	Pipe	New distribution loop North of Beavercreek and South of Hilltop	2,200	12		100%	$624,500
	Capacity	8	5-10	Pipe	Finish looping along Maplelane Road to increase transmission to existing area	1,600	12		26.89%	$454,500
	Pipe Replacement	34	0-5	Pipe	Replace aging 16" piping near Molalla Ave (replacement size may be 12-inch or smaller if MAP ID 22 is implemented prior to MAP ID 34)	8,800	12 to 16-inch		26.89%	$2,498,500
	Operations	37	0-5	PRV	New PRV on Newell Ct to manage high pressures				26.89%	$200,000
Lower Zone	Capacity	9	0-5	Pipe	Upsize existing I-205 crossing to improve fire flow and distribution looping	700	12		26.89%	$199,500
	Capacity	35	5-10	Pipe	Upsize existing piping on Abernethy Road for fire flow supply to Lower Zone	2,600	12		100%	$738,000
	Pipe Replacement	36	0-5	Pipe	Replace aging pipe on Main between 10th and 15th	1,400	12			$397,500
Park Place Concept Area	Development	10	0-5	Pipe	Joint OC/CRW transmission from SFWB along Redland Rd for replacement of aging pipe and new transmission to Park Place Concept Area	6,900	24		100%	$3,538,000
	Development	11	2-5	Pipe	Transmission at the Park Place Intermediate Level (above 310')	1,300	12		100%	$370,000
	Development	12	2-5	Pipe	Transmission from the 16" Barlow Crest Transmission to PP Int Concept (above 310') - redundant transmission and adequate fire flow above 200'	2,600	12		100%	$738,000
	Development	13	2-5	PRV	New PRV from 550' to 430' (supply to area between 200' and 310'). Note: Livesay Pump Station shall be removed with redevelopment of this area along S Livesay Rd				100%	$200,000
	Development	14	4-6	Pipe	New 430' distribution piping (supply to area between 200' and 310')	1,700	12		100%	$483,500
	Development	15	5-10	PRV	New PRV from 430' to 320' (alternate emergency supply and fire flow to PP Concept Area)				100%	$200,000
	Development	16	5-10	Pipe	New 320' distribution piping (supply to area below 200')	6,200	12		100%	$1,760,500
	Development	17	5-10	Pipe	Replace existing 320' distribution piping (supply to area below 200')	2,100	12		100%	$597,000
	Development	18	15-20	Reservoir	New 350' Reservoir (supply to area above 110')			1MG	100%	$2,000,000
	Development	19	15-20	Pump Station	New Pump Station from 320' to 350' (supply to area above 110')			100 GPM	100%	$1,194,000
	Development	20	15-20	PRV	New PRV from 350' to 320' (emergency fire flow to PP Concept Area from new reservoir)				100%	$200,000
	Development	21	15-20	Pipe	New 350' transmission and distribution (supply above 350' and transmission to new Holly Lane PS)	10,000	12		100%	$2,839,000

Improvement Category	Project Type	MAP ID	Timeframe	Facility Type	Description	Length (lf)	Dia (in)	Capacity	SDC Eligible	Cost Estimate[1]
Henrici Transmission Improvements	Capacity	22	5-10	Pipe	Parallel transmission line between Mountainview Reservoirs and Beavercreek Rd - Increase transmission to Henrici Reservoir	4,200	24		100%	$2,153,500
	Capacity	23	0-5	Pipe	Parallel transmission line between Beavercreek Rd and Glen Oak Rd along Streetscape improvements - Increase transmission to Henrici Res	7,300	18		100%	$2,963,000
	Capacity	24	0-5	Pipe	New crossing north of Glen Oak Rd from Molalla to OC Public Schools property - distribution for development, increase transmission to Henrici	2,600	12		100%	$738,000
	Capacity	25	5-10	Pipe	OC HS crossing to Beavercreek Rd - Increase looping and transmission to Henrici	3,000	12		100%	$852,000
	Capacity	26	0-5	Pipe	New parallel transmission between Fairway Downs and Henrici Reservoir	4,000	24		100%	$2,051,500
Beavercreek Road Concept Area	Development	27	5-10	Pipe	New Upper Zone distribution - supply new development below 480', improve transmission	11,900	12		100%	$3,379,500
	Development	28	5-10	Pipe	New Fairway Downs distribution - supply new development below 480'	13,700	12		100%	$3,890,500
	Development	29	5-10	PRV	New PRV between Fairway Downs and Upper Zone - emergency fire flow				100%	$200,000
	Development	30	0-5	Reservoir	New Fairway Downs Reservoir - supply new development			1.75 MG	80%	$3,500,000
	Development	31	0-5	Pump Station	New Fairway Downs Pump Station - supply new development			250 GPM	80%	$1,194,000
	Development	32	0-5	Pipe	New Fairway Downs Transmission - supply new development	5,000	16		80%	$1,654,000
	Development	33	0-5	Pipe	Transfer existing Henrici transmission to Fairway Downs transmission - supply new development				80%	$200,000
Oregon City Operations – Small Waterline Replacement List [2]	Pipe Replacement		0-5	Pipe	S. Center St from S. 2nd to 1st St	700	8		0%	$134,000
	Pipe Replacement		0-5	Pipe	Barker Ave from South End Rd to Barker Rd	800	8		0%	$154,500
	Pipe Replacement		0-5	Pipe	Warner-Parrott Rd from King Rd to Boynton St	1,100	12		0%	$313,000
	Pipe Replacement		0-5	Pipe	Belle Ct and Glenwood Ct from Holmes Ln to Linn Ave	1,500	8		0%	$288,500
	Pipe Replacement		0-5	Pipe	Valley View Dr from Park Dr to McCarver Ave	1,000	8		0%	$192,000
	Pipe Replacement		0-5	Pipe	Canemah Ct from Canemah Rd to Telford Rd	1,700	8		0%	$326,000
	Pipe Replacement		0-5	Pipe	Randall St from Canemah Rd to Hartke Lp	700	8		0%	$134,000
	Pipe Replacement		0-5	Pipe	Hartke Lp and Alderwood Pl	3,700	8		0%	$712,000
	Pipe Replacement		0-5	Pipe	Harrison St from 7th St to Division St	600	8		0%	$115,000
	Pipe Replacement		0-5	Pipe	Division St from Harrison St to 13th/14th St	4,300	8		0%	$827,000
	Pipe Replacement		0-5	Pipe	Division St from Anchor Way PRV Station to Davis Rd	1,300	8		0%	$250,500
Maintenance and Repair Projects	Pipe Replacement		0-5	Pipe	Repair and Replacement Program	18,000	8-12			$3,699,000
			5-10	Pipe	Repair and Replacement Program	14,500	8-12		26.89%	$2,996,500
			10-20	Pipe	Repair and Replacement Program	41,000	8-12		26.89%	$8,033,500
	Facility Rehabilitation (PRV Rebuild and Replacement)		0-5	PRV Rebuild	11th St & Washington St, 15th St & Madison St, 3rd St & Bluff, Apperson Blvd & La Rae Rd, Jennifer Estates, Swan Ave & Holcomb Blvd, Hunter Ave Pump Station, East St & Maple St, View Manor – continue to schedule rehabilitation and rebuilds every 5 years until the PRV is removed with redevelopment, 99E & Main St – removal of PRV Station with re-zoning the Paper Mill Zone to the Lower Zone	10			26.89%	$100,000

Improvement Category	Project Type	MAP ID	Timeframe	Facility Type	Description	Length (lf)	Dia (in)	Capacity	SDC Eligible	Cost Estimate[1]
Maintenance and Repair Projects			0-5	PRV Replacement	16th St & Division St, 18th St & Anchor Way, 4th Ave & Jerome St, 5th Ave & Canemah, Abernethy Rd & Redland Rd, Harley Ave & Forsythe Rd (North) including removal of Harley Ave & Forsythe Rd (South)	6.5			26.89%	$1,300,000
			5-10	PRV Rebuild	3rd Ave & Ganong St	1			26.89%	$10,000
			5-10	PRV Replacement	11th St & Washington St, Apperson Blvd & La Rae Rd, Jennifer Estates, Swan Ave & Holcomb Blvd, Hunter Ave Pump Station	5			26.89%	$1,000,000
	Facility Rehabilitation (Reservoir Coating/Rehab, Seismic/Safety)	Barlow Crest	0-5	Reservoir	Barlow Crest Reservoir- Exterior Overcoat				62.86%	$722,000
		Barlow Crest	0-5	Reservoir	Barlow Crest Reservoir-Safety Upgrades				62.86%	$100,000
		Barlow Crest	0-5	Reservoir	Barlow Crest Reservoir-Seismic Analysis/Seismic Upgrades[3]				62.86%	$975,000
		Barlow Crest	0-5	Reservoir	Barlow Crest Reservoir-Steel Interior Removal and Recoat				62.86%	$789,000
		Barlow Crest	10-20	Reservoir	Barlow Crest Reservoir-Steel Exterior Removal and Recoat				62.86%	$1,059,000
		Boynton	0-5	Reservoir	Boynton Reservoir-Seismic Analysis/Seismic Upgrades (may require new reservoir)[3]				0%	$975,000
		Boynton	10-20	Reservoir	Boynton Reservoir-Steel Exterior Removal and Recoat				0%	$1,059,000
		Henrici	0-5	Reservoir	Henrici Reservoir- Exterior Overcoat				0%	$722,000
		Henrici	0-5	Reservoir	Henrici Reservoir-Safety Upgrades				0%	$100,000
		Henrici	0-5	Reservoir	Henrici Reservoir-Seismic Analysis/Seismic Upgrades[3]				0%	$975,000
		Henrici	0-5	Reservoir	Henrici Reservoir-Steel Interior Removal and Recoat				0%	$789,000
		Henrici	10-20	Reservoir	Henrici Reservoir-Steel Exterior Removal and Recoat				0%	$1,059,000
		Mountainview	0-5	Reservoir	Mountainview 2 Reservoir-Safety Upgrades				53%	$100,000
		Mountainview	10-20	Reservoir	Mountainview 1 Reservoir-Concrete Major Repairs				53%	$200,000
		Mountainview	10-20	Reservoir	Mountainview 2 Reservoir-Concrete Major Repairs				53%	$200,000
	Facility Rehabilitation (Pump Stations)	Hunter Ave	0-5	Pump Station	Hunter Ave PS - PLC, Pumps, drives, SCADA/ electrical, transfer switch generator				26.89%	$375,000
		Mountainview	0-5	Pump Station	Mountainview PS - Drives				26.89%	$95,000
		Mountainview	5-10	Pump Station	Mountainview PS - Pumps, SCADA/electrical				26.89%	$380,000
	Facility Rehabilitation (Decommission)	Fairway Downs	5-10	Pump Station	Decommission				0%	$50,000
		Boynton	0-5	Pump Station	Decommission				0%	$50,000
		Livesay	5-10	Pump Station	Decommission				0%	$50,000

Notes:

1 All project cost estimates are consistent with Class 5 budget estimates, as established by the *American Association of Cost Engineers* (AACE). This preliminary estimate class is used for conceptual screening and assumes project definition maturity level below two percent. The expected accuracy range is -20 to -50 percent on the low end, and +30 to +100 percent on the high end. The cost estimates are consistent with the definition of OAR 660-011-0005(2) and OAR 660-011-035. Cost estimates are intended to be used as guidance in establishing funding requirements at the project planning level based on information available at the time of the estimate. Estimates exclude land acquisition, financing, inflation, and operations. Costs were developed in 2018 dollars with markups for contractor profits, overhead, engineering, and construction contingency.

2 Oregon City Operations – Small Waterline Replacement Projects not shown on CIP map.

3 Seismic upgrade costs are placeholders. Additional evaluations required to refine cost estimates, risk, and improvement strategies for reservoir seismic improvements.

4. The project list may be updated pursuant OAR 660-011-0045 and ORS 223.309

Table 18
Total Water CIP Summary Costs

Year	Development, Capacity & Operations Costs[1]	Pipe Replacement Costs[1]	Facility Rehabilitation Costs[1]	Total CIP Project Costs[1]
0 – 5 Years	$19,905,500	$10,041,500	$8,167,000	$41,010,000
5 – 10 Years	$14,225,500	$2,996,500	$1,490,000	$18,712,000
10 – 20 Years	$11,827,500	$8,033,500	$3,577,000	$23,438,000
TOTAL	**$45,958,500**	**$18,175,500**	**$13,234,000**	**$80,264,000**

Notes:

1 All project cost estimates are consistent with Class 5 budget estimates, as established by the *American Association of Cost Engineers* (AACE). This preliminary estimate class is used for conceptual screening and assumes project definition maturity level below two percent. The expected accuracy range is -20 to -50 percent on the low end, and +30 to +100 percent on the high end. The cost estimates are consistent with the definition of OAR 660-011-0005(2) and OAR 660-011-035. Cost estimates are intended to be used as guidance in establishing funding requirements at the project planning level based on information available at the time of the estimate. Estimates exclude land acquisition, financing, inflation, and operations. Costs were developed in 2018 dollars with markups for contractor profits, overhead, engineering, and construction contingency.

SFWB Intake and WTP

Barlow Crest Pump Station and Reservoir (1.75MG, 549' OF)

Hunter Ave Pump Station

SFWB Division Street Pump Station

New Holly Lane Pump Station and PRV

New Holly Lane Reservoir (1.0MG, 350' OF)

Mountainview Pump Station and Reservoirs 1 & 2 (2.0 & 10.5MG, 490' OF)

Boynton Standpipe (2.0MG, 592' OF)

Fairway Downs Pump Station

Henrici Reservoir (2.0MG, 592' OF)

New Fairway Downs Reservoir (1.75MG, 650' OF)

New Fairway Downs Pump Station

MM01 MM02 MM08 MM09

Clackamas River

Tualatin River

WILLAMETTE FALLS

0 2,000 4,000 Feet

City of Oregon City Water CIP Analysis

Figure 5 CIP Projects

PRESSURE ZONE
- Canemah
- Fairway Downs
- Intermediate
- Lower
- Paper Mill
- Park Place - Intermediate
- Park Place - Livesay
- Park Place - Lower
- Park Place - View Manor
- Upper

CIP Facilities
- PRV
- Tank
- Pump Station
- Emergency PRV

Existing Facilities
- Intake
- Master Meter
- PRV
- Pump Station
- Reservoir
- WTP
- Abandon Pump Station

- CIP Projects
- OC Water Mains
- CRW Water Mains
- SFWB Water Mains
- UGB
- taxlots

murraysmith

August 2020 17-2119

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