Water Management and Conservation Plan

Prepared for

City of Salem, Oregon

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Prepared by

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Appendix

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Acronyms and Abbreviations

ADC	average day consumption
ADD	average day demand
ASR	aquifer storage and recovery
AWWA	American Water Works Association
CAT	Curtailment Action Team
CCR	Consumer Confidence Report
cfs	cubic feet per second
CIP	capital improvement program
City	City of Salem
DEQ	Oregon Department of Environmental Quality
ET	evapotranspiration
FY	fiscal year
gpcd	gallons per capita per day
gpm	gallons per minute
IGA	intergovernmental agreement
MDD	maximum day demand
MG	million gallons
mgd	million gallons per day
mg/L	milligram/liter
MMD	maximum monthly demand
MMW	Miscellaneous Metered Water
MPSF	Minimum Perennial Streamflows
MWU	Miscellaneous Water Use
OAR	Oregon Administrative Rule
ODFW	Oregon Department of Fish and Wildlife
OrWARN	Oregon Water/Wastewater Agency Response Network
OWRD	Oregon Water Resources Department
PVC	polyvinyl chloride
RM	River Mile
SCADA	supervisory control and data acquisition
SKATS	Salem-Keizer Area Transportation Study
SRC	Salem Revised Code
SSF	slow sand filter
TMDL	total maximum daily load
TVWD	Tualatin Valley Water District
UGB	urban growth boundary
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WET	Water Education for Teachers
WMCP	Water Management and Conservation Plan

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Executive Summary

The City of Salem (City), the capital of Oregon, is located in the heart of the Willamette Valley. The City operates a public drinking water system that provides water to a population that was estimated at 187,863 in 2012. This Water Management and Conservation Plan (WMCP or Plan) has been created to guide development, financing and implementation of water management and conservation programs that ensure sustainable water use by the City, as well as to consider the City's future water needs. This WMCP is intended to be a working document, consistent with the City's adopted water and wastewater master plans, which will inform future development of the City's water system.

This WMCP was required by a condition in the final order issued by the Oregon Water Resources Department (OWRD) approving an extension of time for the City's water use permit G-734. The condition required the City to submit a WMCP within three years of the extension. The condition also precluded use of water under Permit G-734 until access to water is authorized by a final order approving the City's WMCP. In addition, this WMCP is an update of the City's 2009 WMCP. The final order approving the 2009 WMCP required the City to submit an updated plan by April 17, 2019, and a progress report by April 17, 2014.

This WMCP fulfills the requirements of the Oregon Administrative Rules (OARs) adopted by the Water Resources Commission in November 2002 (OAR Chapter 690, Division 86) regarding WMCPs. It describes water management, water conservation, and water curtailment programs that foster stewardship of the City's water supply and describes projected water supply needs.

Description of Municipal Water Supplier

The City holds seven surface water rights and 25 groundwater rights for use through its municipal system. The City holds five water right certificates for the use of up to 239 cubic feet per second (cfs) from the North Santiam River for municipal use. The City also holds two municipal water rights for the use of surface water from the Willamette River: a surface water registration for up to 10 cfs and a permit for up to 200 cfs. The City's municipal groundwater rights, which total up to 82.95 cfs, are evidenced by 11 groundwater registrations, 11 water right certificates, two transfers, and one permit. In addition, the City holds a limited license authorizing the use of water for its Aquifer Storage and Recharge (ASR) system.

The City currently relies on surface water from the North Santiam River as its primary source to meet its municipal water supply needs. Water diverted from the North Santiam River is treated at the water treatment facility on Geren Island, and the treated water is conveyed approximately 17 miles to the City in its transmission lines. The City uses groundwater and its ASR system as a back-up water supply when its surface water supply is not adequate to meet demands, either due to limitations on water quantity or water quality. The City intends to use water from the Willamette River to help meet its future water demands and to provide a redundant water supply in the event that its North Santiam River water supply is not available or is insufficient.

The City's water system includes a slow-sand filtration water treatment plant, 22 operating pump stations, 19 reservoirs, approximately 739 miles of pipeline, and groundwater and ASR wells. In FY 2011-2012, the City provided its customers with municipal water through 45,482

service connections. The City classifies its customers within eight customer categories: residential, multifamily, commercial, industrial, public, municipal, irrigation, and wholesale. The City's wholesale customers are Suburban East Salem, the City of Turner, and Orchard Heights Water District.

Section 2 of this WMCP provides more details about the City's historical production and consumption, water system, and water rights.

Water Conservation

OWRD's WMCP rules require municipal water providers to have five-year benchmarks for initiating or expanding conservation measures related to required conservation programs. The following is a summary of the City's activities associated with the required conservation measures and the five-year benchmarks for implementing those measures, which are described in full in Section 3 of this WMCP.

Five-Year Benchmarks for Required Existing or Expanded Conservation Measures

1. **Annual Water Audit.**

   The City conducts a full water audit annually, which includes all metered and unmetered authorized consumption. Production data for finished water leaving Geren Island are compared to both metered and estimated consumption. Production is reported from the City's SCADA database. Consumption data are reported in the "Hansen database," which includes actual metered/billed water use and estimates of authorized/unbilled water used by other divisions within the City. Authorized/unbilled or unmetered water consumption includes fire-fighting, flushing, reservoir draining, street sweeping, and reservoir storage levels including ASR injection. The City's unaccounted for water in FY 2011-2012 was 22.9 percent.

   Five-Year Benchmarks: The City will continue to conduct annual water audits, and evaluate production and consumption data to observe trends for targeting conservation measures. To better account for unmetered, authorized use, the City will continue to coordinate with the following internal departments and divisions to identify and measure the use of the Salem Fire Department, Operations Wastewater Collections, and Operations Stormwater.

2. **System-wide Metering.**

   The City's system is fully metered. Its annual budget includes funding to meter new services.

   Five-Year Benchmarks: The City will continue to require all new connections be metered.

3. **Meter Testing and Maintenance.**

   The City currently implements a program to test and repair or replace meters. Large meters (greater than three-inches in diameter) are tested annually, and repaired or replaced as needed. The City's system has approximately 300 large meters.

   The City's water system also includes approximately 46,000 small meters. The City completed a small meter replacement program in 2005, moving entirely to touch-read or

radio-read meters. Based on accuracy testing of the oldest small meters in the system, the City is expecting a 25-year life cycle for small meters. As the end of the life-cycle approaches, the City will begin random meter testing to ensure continued function and accuracy. Small meters will continue to be tested in response to customer or Customer Services request, and will be replaced or repaired if needed.

Five-Year Benchmarks: The City will continue to test and repair or replace large meters annually, and small meters upon customer or City Customer Services request.

4. Water Rate Structure.

City of Salem water customers are billed a water service charge and consumption charge on a monthly basis. The water service charge is billed at a fixed rate based on meter size. The consumption charge is based on the volume of use and customer class. This rate structure promotes conservation by enabling customers to control the largest portion of their bill: the amount of water consumed.

Five-Year Benchmarks: The City will continue to bill customers, in part, based upon the metered quantity of water use. It will also periodically review the rate structure to determine the size and timing of future rate increases needed to promote water conservation, fund capital and operating costs, and to achieve other utility objectives.

5. Leak Detection Program.

The City's unaccounted for water in FY 2011-2012 was 22.9 percent. The City has a systematic program to detect and repair leaks in its transmission and distribution system. The City implements a multi-point leak detection and repair program for its storage and distribution system. Select finished water reservoirs are evaluated annually for structural integrity and leakage. Leak loggers are used to conduct leak surveys of distribution lines. Ten percent of the system is surveyed annually, with the entire system surveyed every ten years. The City purchased additional leak loggers in 2013 to survey greater areas and increase accuracy in pinpointing leaks. Potential leaks on the customers' side of the meter are identified during routine customer meter reading. When meter readings record an abnormal increase in water usage from the prior month, City staff notifies the customer of a potential leak and provides technical and financial assistance and/or education measures. In addition to the logger surveys, Water Services has increased its inter-division coordination to identify additional potential problem areas

Five-Year Benchmarks: The City will continue to survey 10 percent of the system annually, resulting in the entire system surveyed every ten years. Repairs of all reported and detected leaks will continue to be performed in a timely manner. After the new loggers have been installed, the City will evaluate their performance in reducing water loss and investigate the feasibility of purchasing and installing additional equipment for this purpose. The City will also look for additional internal and external coordination opportunities to increase the cost-effectiveness of leak detection. The City's goal is to attain a leakage rate below 10 percent.

6. **Public Education.**

   The City provides water conservation information to its customers through various programs to encourage efficiency, such as low water use landscaping. To reach a range of customer ages and incomes, the City communicates information using the following media: the City's website (which is currently undergoing upgrades), telephone hotline, local newspaper, topic-specific brochures, bill inserts, and in-person conversations at festivals (at least two are held annually). Between 2008 and 2013, the City conducted or participated in 24 outreach events and festivals, 49 school presentations, and provided nine water facility tours. The City supports school curriculums by providing the following upon request: Water Education for Teachers (WET) books, various water conservation and source water protection videos, school presentations, and water facility tours.

   The City's successful One Inch per Week lawn watering program began in 2003 and has been an ongoing program due to significant residential summer water use. The City provides lawn watering measuring gauges upon request. Additional outdoor water use information is provided in the Water Efficient Plant guide.

   Five-Year Benchmarks: Public outreach has been incrementally reduced due to limited staff resources. The City will continue to implement a small-scale public education program, focused primarily on providing educational materials for residential customers and schools upon request, and at a limited number of annual festivals.

In addition to these required measures, Section 3 of the WMCP highlights additional conservation measures implemented by the City including: technical and financial assistance, retrofit/replacement of inefficient fixtures, water rate structure and billing schedule, and reuse, recycling, and non-potable water opportunities.

Water Curtailment

The City developed its curtailment plan to describe the standards and procedures that will be employed in the event of a water shortage. The multi-level curtailment plan is designed to ensure that essential water delivery can be maintained in the event of limited water supply. The plan includes both voluntary and mandatory rationing depending on the cause, severity, and anticipated duration of the shortage. The curtailment stages and potential initiating conditions are summarized in Exhibit ES-1. Initiating conditions and response actions are detailed in Section 4 of this WMCP.

Exhibit ES-1. Curtailment Levels 1 through 4.

Curtailment Stages	Initiating Conditions: If minimum available storage is below 85 million gallons and there is a:
Level 1: Alert	• Rolling five-day average when supply is 90% to 95% of demand
Level 2: Voluntary Curtailment	• Rolling five-day average when supply is 80% to 89% of demand
Level 3: Mandatory Curtailment	• Rolling five-day average when supply is 70% to 79% of demand
Level 4: Severe Curtailment	• Rolling five-day average when supply is below 69% of demand

Water Supply

The City's future water service area includes areas within the City's Urban Growth Boundary (UGB). (Although the City of Keizer is within the UGB, it is not considered a part of the City's future water service area.) The City's projected population in ten years (2024) is 220,790 and in 20 years (2034) is 253,200. The City's population projections were developed by applying constant growth rates to existing populations within three areas served by the City: west Salem, east Salem, and the City of Turner. Population estimates used existing population data and population growth rate data provided by the Salem-Keizer Area Transportation Study (SKATS), as cited in the "City of Salem 2013 Water Demand Analysis and Projection" draft report.

The City has a range (+/- 15 percent) of projected maximum day demand (MDD) to account for variability in MDD that the City has experienced to date and to include an industrial reserve of 5 mgd to allow for new industries. The City's projected MDD in ten years (2024) and 20 years (2034) are shown in Exhibit ES-2.

Exhibit ES-2. Projected Future MDD.

Year	MDD		MDD + Industrial Reserve		-15% of MDD		+ 15% of MDD	
	mgd	cfs	mgd	cfs	mgd	cfs	mgd	cfs
2024	61.6	95.3	66.6	103.0	52.4	81.0	70.8	109.6
2034	67.1	103.9	72.1	111.6	57.1	88.3	77.2	119.4

The maximum authorized rates of the City's North Santiam surface water rights are sufficient to meet the projected MDD in 2034, but the transmission capacity from Geren Island is currently limited to 102 cfs. The City can also obtain approximately 7 to 12 cfs from its ASR system, which results in a current total supply of 109 to 114 cfs. Thus, the City's current supply could be insufficient to meet its projected 2034 MDD with the 15 percent variance (119.4 cfs). However, the City will seek to expand the capacity of its transmission lines from Geren Island when MDD approaches the limitations on its system capacity. To increase its redundant groundwater supply from Geren Island and to help meet the City's MDD during an algal fouling or high turbidity event in the North Santiam River, the City is requesting access to 30.0 cfs of "green light water" under *extended permit* G-734. In addition, the City will meet its needs

for redundancy and additional supply to meet future demands by incrementally developing Permit S-45565, which authorizes the use of up to 200 cfs from the Willamette River.

The City's projected population, demand, and schedule for using water rights are described in greater detail in Section 5.

1. Municipal Water Supplier Plan Elements

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

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

Introduction

The City of Salem (City or Salem) primarily relies on the North Santiam River as its water source. The North Santiam River basin is approximately 766 square miles, and is characterized by steep forested uplands and flat alluvial lowlands.[1] Surface water is conveyed by gravity from the North Santiam River to the water treatment facility on Geren Island, a 250-acre island located in the North Santiam River, upstream from the City of Stayton. Finished water is then conveyed approximately 17-miles from the treatment facility to the City's distribution system. The City also holds two water rights to appropriate water from the Willamette River.

The City also appropriates groundwater and uses its aquifer storage and recovery (ASR) system during emergencies, high turbidity events, and peak demands to supplement surface water. Groundwater is available from wells on Geren Island and within the City's service area. The ASR wells store treated drinking water from the North Santiam, which is injected into the Columbia River basalt aquifer and stored for later recovery.

The purpose of this Water Management and Conservation Plan (WMCP or Plan) is to guide development, financing, and implementation of water management and conservation programs that ensure sustainable water use, as well as to consider the City's future water needs. The goal in preparing this WMCP is to establish a working document, consistent with the City's adopted water and wastewater master plans, which will guide the City's water system development in future years.

The City submitted to the Oregon Water Resources Department (OWRD) a draft WMCP in February 2007 and a revised WMCP in April 2009. On June 8, 2009, OWRD issued a final order approving the City's first WMCP. The City was required to submit an updated plan by April 17, 2019, and a progress report by April 17, 2014.

On March 7, 2014, OWRD issued a final order approving the City's application for an extension of time for Permit G-734 to October 1, 2020. The extension included a condition requiring the City to submit a WMCP within three years, and precluding use of water under the permit until access to water is authorized by a final order approving the City's WMCP.

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[1] E&S Environmental Chemistry, Inc.'s *North Santiam River Watershed Assessment*, 2002, located at: http://www.nsantiamwatershed.org/wp-content/uploads/2009/09/NSW_Assessment.pdf

Plan Organization

This WMCP fulfills the requirements of the Oregon Administrative Rules (OAR) adopted by the Water Resources Commission in November 2002 (OAR Chapter 690, Division 86) regarding WMCPs. It describes the water management, water conservation, and curtailment programs to guide the wise use and stewardship of the City's water supply.

The plan also fulfills the requirements of OAR 690-315-0090(3) because access to additional water under "extended permit" G-734 is requested by the City.

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.

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

Affected Local Governments

OAR 690-086-0125(5)

The following local governmental agencies may be affected by this WMCP:

- City of Salem
- City of Keizer
- City of Turner
- City of Stayton
- Marion County
- Polk 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 and any comments received are in Appendix A.

In addition, the City provided the Suburban East Salem Water District and the Orchard Heights Water District with notice of the draft 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. As required by OAR Chapter 690, Division 86, a progress report will be submitted within five years of the final order.

Time Extension

OAR 690-086-0125(7)

The City is not requesting additional time to implement metering or any other previous benchmarks.

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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)

Surface Water

The North Santiam River is the City's primary water source. Water is diverted from the north channel of the river at approximately river mile (RM) 20 and is treated at the adjacent Geren Island Water Treatment Facility (Geren Island.)

The City also holds two water rights to appropriate water from the Willamette River. The City is in the midst of planning efforts to develop infrastructure to use its Willamette River water source.

Groundwater

In addition to surface water, the City can also appropriate and treat groundwater at Geren Island. The facility was initially constructed in the 1930s as an infiltration gallery and a water collection chamber (the collector well), where surface and groundwater are mixed to feed one 36-inch diameter transmission line. Over time, the infiltration gallery was converted and the system expanded to the present day treatment facility. The City can also appropriate groundwater from three additional wells (the Middle, East, and West wells) on the island. Finally, a limited amount of groundwater is available from wells within the City's service area. The City's groundwater sources supplement surface water during emergencies, high turbidity events, and periods of peak demand.

Aquifer Storage and Recovery

The City's ASR system provides a supplemental water supply during periods of peak demand or emergencies. Treated drinking water from the North Santiam River is injected into the Columbia River basalt aquifer via the ASR wells. The injected water is stored in the aquifer for later recovery. The City currently has four active ASR wells.

Intergovernmental and Wholesale Agreements

OAR 690-086-0140(1)

The City has intergovernmental agreements (IGA) with two other municipal drinking water systems: the City of Stayton and City of Keizer. The City of Stayton is located southeast of Salem, near Geren Island. The City's agreement with the City of Stayton is effective through 2037. The City of Keizer is adjacent to and north of Salem and is located within the Salem-Keizer Urban Growth Boundary. The City's agreement with the City of Keizer does not have a termination date. Under each of these agreements, the Cities of Stayton and Keizer can obtain water from the City during emergencies if surplus water is available. In addition, the City of Stayton must follow Salem's curtailment plan if the plan is in effect at the time emergency supply is requested. Both agreements allow for either city to provide water to Salem.

The City also provides water to three wholesale customers: the City of Turner, Suburban East Salem Water District, and Orchard Heights Water District.

- **City of Turner**. The agreement with the City of Turner is effective until May 24, 2027, with an option to renew for two successive 10-year terms. The agreement will terminate if the North Santiam River ceases to be the primary water source for Salem. The agreement states that Salem shall not limit water available to the City of Turner unless Salem is limiting water to all of its customers.
- **Suburban East Salem Water District**. The agreement with the Suburban East Salem Water District is effective through December 31, 2017. The agreement states that the City will "use its best efforts" to supply water. The agreement also requires the Suburban East Salem Water District to implement conservation or curtailment measures at the City's request. The agreement does not limit the amount of water available to the Suburban East Salem Water District. The agreement recognizes that the City may annex the Suburban East Salem Water District's water service area at some time in the future. If annexation occurs, the District's customers will become the City's retail customers.
- **Orchard Heights Water District**. The agreement with the Orchard Heights Water District is effective through April 29, 2018. The agreement does not obligate the City to meet the Orchard Heights Water District's water needs and the City can limit supply to Orchard Heights if the City is limiting water to all of the City's customers.

Each of these wholesale customers owns, maintains, and operates its own water system, and bills its own customers.

Interconnections with Other Systems
OAR 690-086-0140(7)

The City has the following interconnections with other municipal water supply systems:

- The City of Stayton and Salem have an intertie in Transmission Line 2, near the intersection of W. Water Street and N. Holly Avenue, in Stayton. Through this interconnection Salem can provide up to 7 cfs (5 mgd) of treated water to the City of Stayton. The City of Stayton can also supply a limited amount of water to Salem through this connection.
- The City of Keizer and Salem have an intertie located near the intersection of Cherry Avenue NE and Manbrin Drive NE, in Keizer. This interconnection is capable of providing up to 7 cfs (5 mgd) of water to the City of Keizer. The interconnection also allows the City of Keizer to supply a limited amount of groundwater to Salem.
- The City of Turner is supplied primarily by three meters, located at Val View Drive and Third Street, School Street SE and Chicago Street SE, and Boise Street SE and First Street.
- Suburban East Salem Water District is supplied by three meters, located near Arabian Avenue SE and Clydesdale Drive SE, State Street and 37th Avenue SE, and Center Street NE and 36th Avenue NE.
- Orchard Heights Water District is supplied by three meters, located at Landaggard Drive NW and Orchard Heights Road NW, Doaks Ferry Road NW and Emerald Drive NW, and 3017 Orchard Heights Road NW.
- The Illahee Acreage Water Association is connected to the City system near the intersection of Cheviot Way South and Corredale Drive South.

Service Area Description and Population
OAR 690-086-0140(2)

Exhibit 2-1 shows the City's current service area and wholesale customers. The City provides water to its retail customers and three wholesale customers (Suburban East Salem Water District, City of Turner, and Orchard Heights Water District). The City's retail customers include customers within city limits as well as customers outside city limits, such as the Jan Ree area located within the northeast portion of the service area.

As of July 1, 2012, the City's water service population was estimated to be approximately 187,863. The water supply population includes figures from within the UGBs of the City of Salem (retail and wholesale customers)[2] and the City of Turner. Populations were calculated from data provided by the Mid-Willamette Valley Council of Governments, the Salem-Keizer Area Transportation Study (SKATS)[3], and Portland State University's Center for Population Research[4].

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[2] Population estimates for all areas with the exception of the cities of Salem and Turner were calculated at 2.5 people per unit based on residential account and unit information as of July 2010, the latest available.

[3] SKATS is the designated Metropolitan Planning Organization for the Salem-Keizer area.

[4] Population data come from the "City of Salem 2013 Water Demand Analysis and Projection" draft report.

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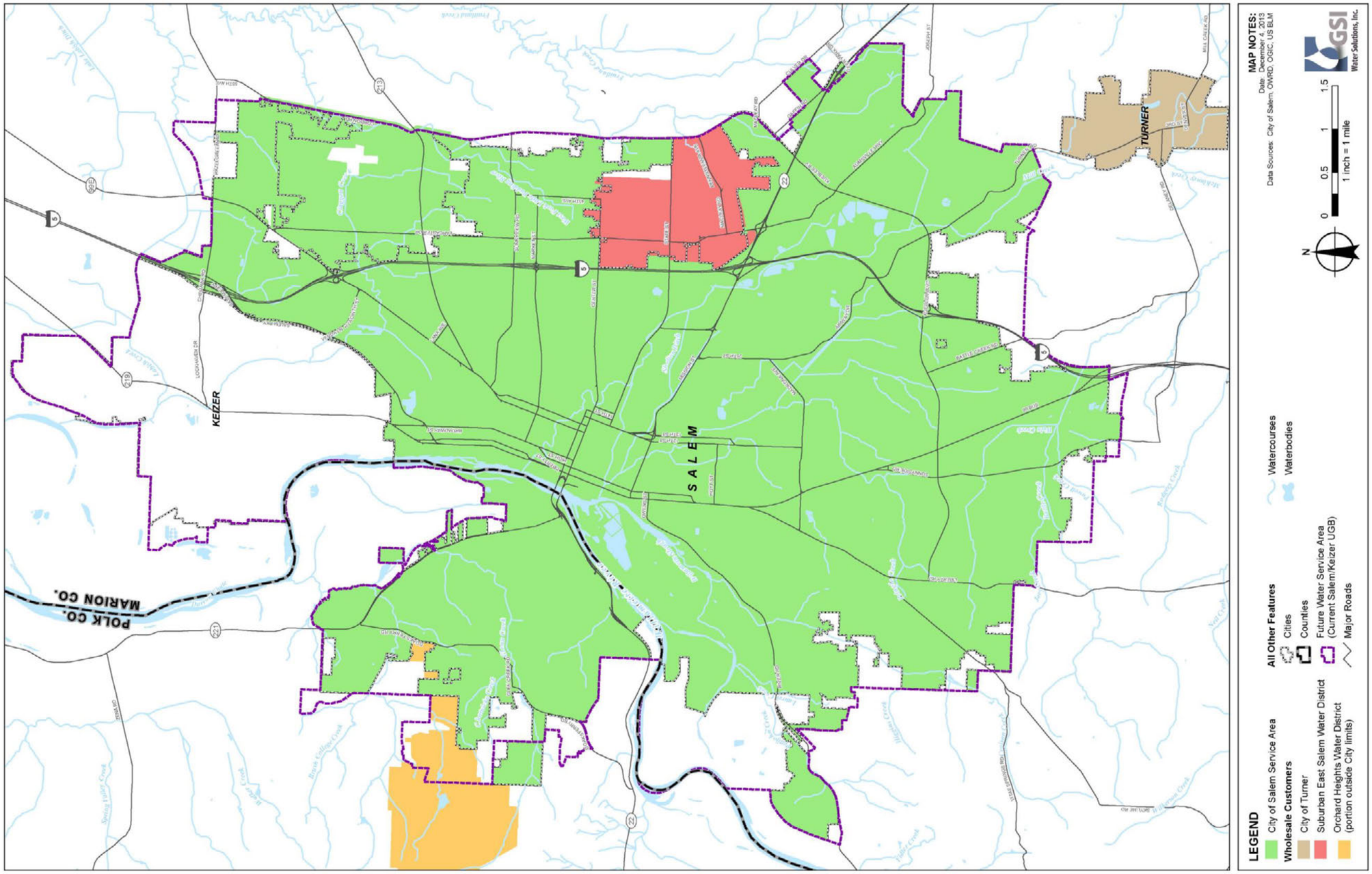
Exhibit 2-1. City of Salem Current and Future Service Area and Wholesale Customers Map



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Records of Water Use

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

Terminology

Demand, or production, is the amount of water entering the City's water system to meet the water needs of various users. Consumption is the amount of water sold. Generally, demand and consumption in municipal systems are expressed in units of million gallons per day (mgd), though they may also be expressed in cubic feet per second (cfs) or gallons per minute (gpm). For annual or monthly values, a quantity of water is typically reported in million gallons (MG). Water use per person (per capita use) is expressed in gallons per person (per capita) per day (gpcd).

The following terms are used to describe specific values of system demands:

- Average day demand (ADD) equals the total annual system input (demand) divided by 365 days.
- Maximum day demand (MDD) equals the highest system demand that occurs on any single day during a calendar year. It is also called the one-day MDD.
- 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 one month with the highest total demand of the 12 months of a calendar year.
- Peaking factors are the ratios of one demand value to another. The most common peaking factor is the ratio of the MDD to the ADD.

MDD is an important value for water system planning. The supply facilities (treatment plants, pipelines, reservoirs) and water rights must be capable of meeting the MDD. If the MDD exceeds the combined supply capacity on any given day, finished water storage levels will be reduced. Consecutive days at or near the MDD may result in a water shortage.

Historical Water Demands

Annual Demands

This WMCP draws from the City's 2013 Water Demand Analysis and Projection report, which describes the City's production data. Raw water is the water diverted at the Geren Island intake. Finished water is the treated water leaving Geren Island and entering the transmission system. The difference between the amount of raw water diverted and the amount of finished water leaving Geren Island is the process water used during water treatment. The City uses slow sand filtration as the primary treatment process. This process is manually controlled and can require process water that results in return flows. The City's system returns the majority of the process water to the North Santiam River within 500 feet of the Geren Island intake.

Exhibit 2-2 summarizes the City's historic raw water demands. During the period from July 2007 through June 2012, the City's annual[5] volume of raw water diverted averaged 16,253 MG, and the maximum volume of raw water diverted was 19,395 MG in FY 2009-2010. The City's ADD averaged 44.55 mgd during the same period and its MDD peaked at 89.03 mgd in 2009-2010. The maximum three-day MDD was 85.34 mgd. The maximum three-day MDD percentage of MDD was 99.3 percent, which means that if MDD equals 80 mgd, the City can be expected to experience three consecutive days with a maximum demand of approximately 79.4 mgd (99.3 percent of 80 mgd).

Exhibit 2-2. Raw Water (Intake at Geren Island Treatment Facility) Historical Annual Volumes, Average Day, Maximum Day, 3-day Maximum Day Demands, and Peaking Factors.

	Raw Water (Intake)							
Fiscal Year	Annual Volume (MG)	ADD (mgd)	MDD (mgd)	3-day MDD (mgd)	3-day MDD Percentage of MDD (%)	MMD (MG)	MMD (mgd)	Peaking Factor
2007-2008	16,232	44.47	74.49	73.49	98.7	2,095	67.58	1.7
2008-2009	16,316	44.82	70.10	69.63	99.3	1,897	61.20	1.6
2009-2010	19,395	53.14	89.03	85.34	95.9	2,459	79.32	1.7
2010-2011	14,290	39.15	67.75	65.96	97.4	1,844	59.49	1.7
2011-2012	15,033	41.19	67.73	66.08	97.6	1,761	56.80	1.6
Average	16,253	44.55	73.82	72.10	97.8	2,011	64.88	1.7
Maximum	19,395	53.14	89.03	85.34	99.3	2,459	79.32	1.7

[5] References to annual water use throughout this WMCP refer to fiscal years running from July through June.

Exhibit 2-3 summarizes the City's finished water demands. During the period July 2007 through June 2012, the City's annual volume of finished water produced averaged 10,094 MG and the maximum volume of finished water produced was 10,753 MG in FY 2007-2008. ADD averaged 27.66 mgd during the same period and MDD peaked at 54.07 mgd in 2007-2008. The maximum three-day MDD was 52.68 mgd and the maximum three-day MDD percentage of MDD was 99.0 percent. Demand analyses hereafter are based on finished water demand.

Exhibit 2-3. Finished Water (Leaving Geren Island Treatment Facility to the Transmission System) Historical Annual Volumes, Average Day, Maximum Day, 3-day Maximum Day Demands, and Peaking Factors.

	Finished Water							
Fiscal Year	Annual Volume (MG)	ADD (mgd)	MDD (mgd)	3-day MDD (mgd)	3-day MDD Percentage of MDD (%)	MMD (MG)	MMD (mgd)	Peaking Factor
2007-2008	10,753	29.46	54.07	52.68	97.4	1,399	45.14	1.8
2008-2009	10,462	28.66	47.12	46.01	97.6	1,272	41.02	1.6
2009-2010	10,217	27.99	45.74	44.66	97.6	1,186	38.27	1.6
2010-2011	9,684	26.53	47.64	47.18	99.0	1,258	40.57	1.8
2011-2012	9,357	25.64	42.19	41.43	98.2	1,128	36.40	1.6
Average	10,094	27.66	47.35	46.39	98.0	1,249	40.28	1.7
Maximum	10,753	29.46	54.07	52.68	99.0	1,399	45.14	1.8

MDD is strongly influenced by weather patterns and the economy. Weather patterns often cause fluctuations in MDD from year to year, which in the City's case, can fluctuate by over 15 percent. Weather patterns that influence MDD 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, as well. Customers may choose to irrigate less to save money in an economic downturn. The economy also influences 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.

Exhibit 2-4 shows the City's annual production from FY 2007-2008 to FY 2011-2012. During this period, annual finished water production steadily decreased.

Exhibit 2-4. Annual Water Production (MG), Fiscal Year 2007-2008 to 2011-2012.

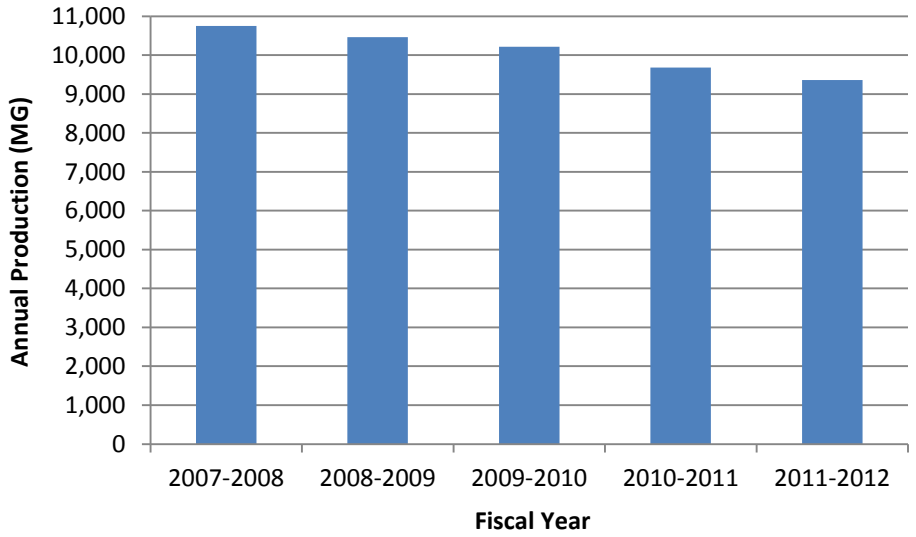
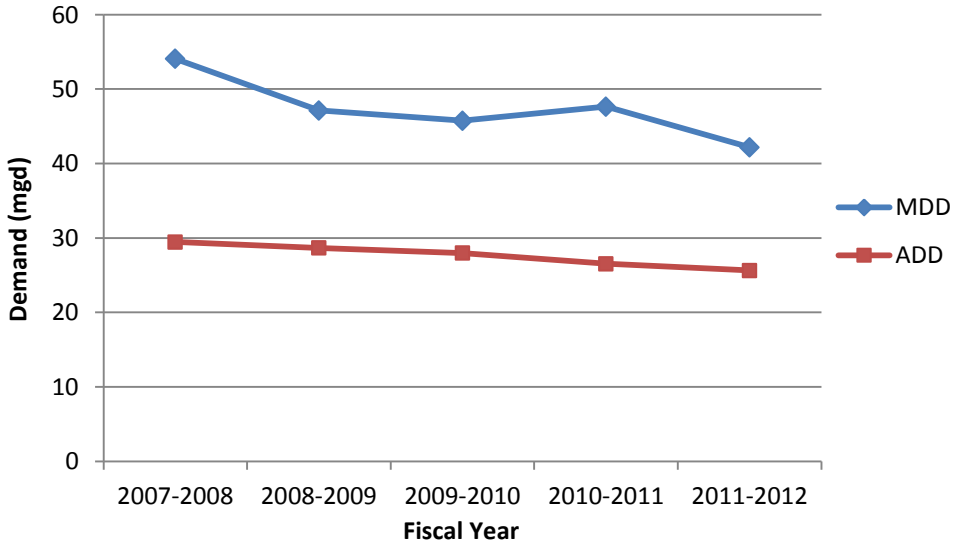


Exhibit 2-5 shows the City's ADD and MDD from FY 2007-2008 to FY 2011-2012. During this period, ADD steadily declined. MDD continuously declined over the past five fiscal years with the exception of FY 2010-2011, which increased slightly over the previous two years.

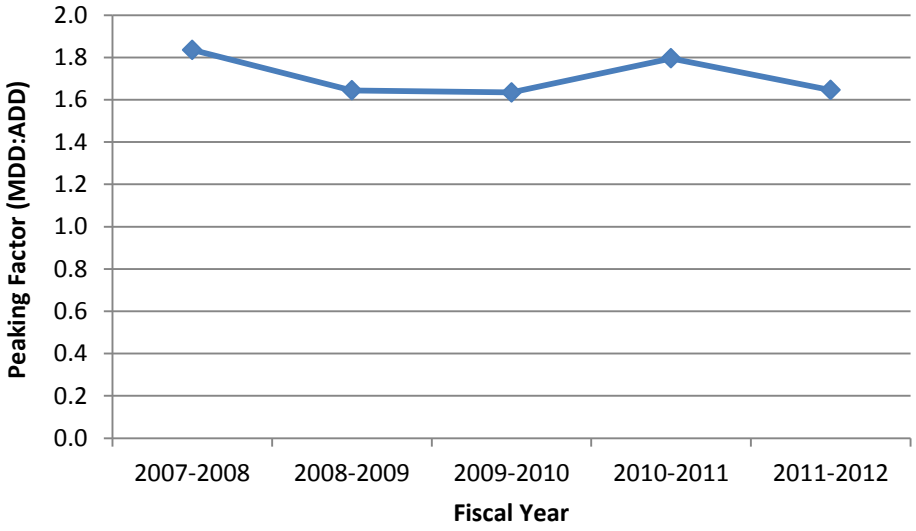
Exhibit 2-5. Average Day Demand (ADD) and Maximum Day Demand (MDD), Fiscal Year 2007-2008 to 2011-2012.



Peaking Factors

Peaking factors are the ratios of one demand value to another; the most common peaking factor is the ratio of the MDD to the ADD. This ratio often is used for estimating peak demands when only ADDs are known or measured, as well as for hydraulic modeling of the system and demand forecasting. From FY 2007-2008 to FY 2011-2012, the City's MDD to ADD peaking factor averaged 1.7 and ranged from approximately 1.6 to 1.8, as shown in Exhibit 2-6. This average value is slightly less than the typical value for Willamette Valley water utilities, which generally ranges between 1.9 and 2.2.

Exhibit 2-6. Peaking Factors (MMD: ADD), Fiscal Year 2007-2008 to 2011-2012.

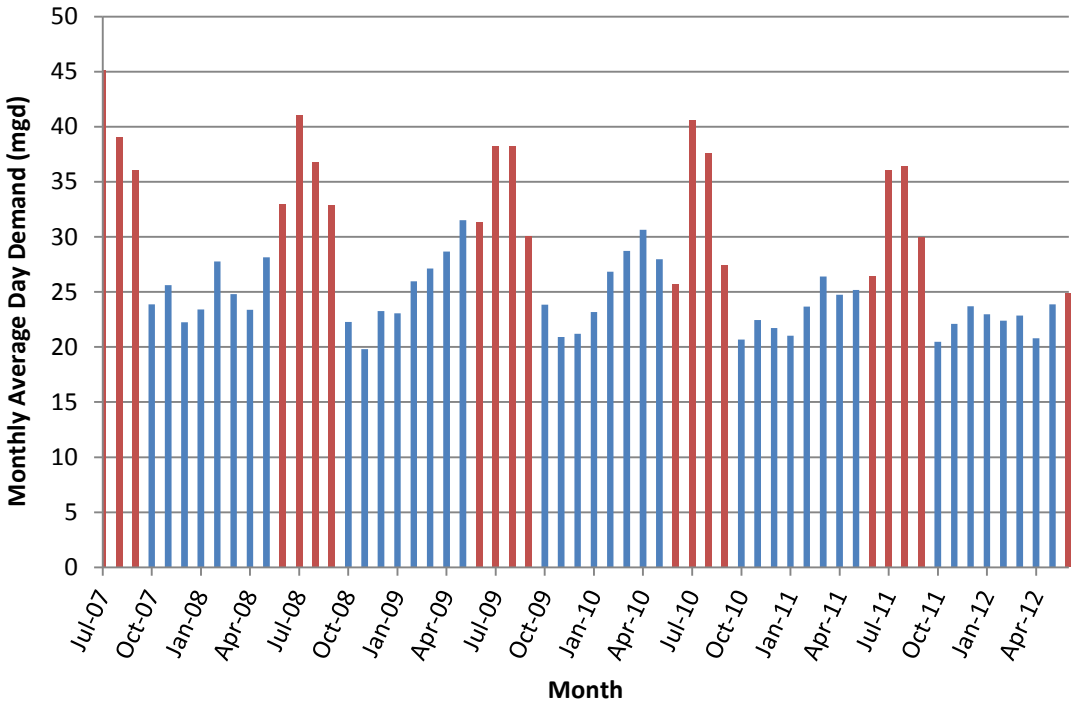


Monthly Demand

The City's MMD occurred in July each fiscal year from 2007-2008 through 2010-2011, and in August during FY 2011-2012. The MMD average volume was 1,249 MG, and the greatest volume was 1,399 MG in July 2008.

Exhibit 2-7 shows monthly demand data from July 2007 through June 2012 expressed as an average daily demand for the month, with the peak season months of June through September in red. During this period, the highest monthly ADD recorded was 45.1 mgd in July 2007. This exhibit highlights the seasonal change in demand that the City experienced and the months with the greatest demand: July and August. Consequently, these months should be the focus of water conservation efforts.

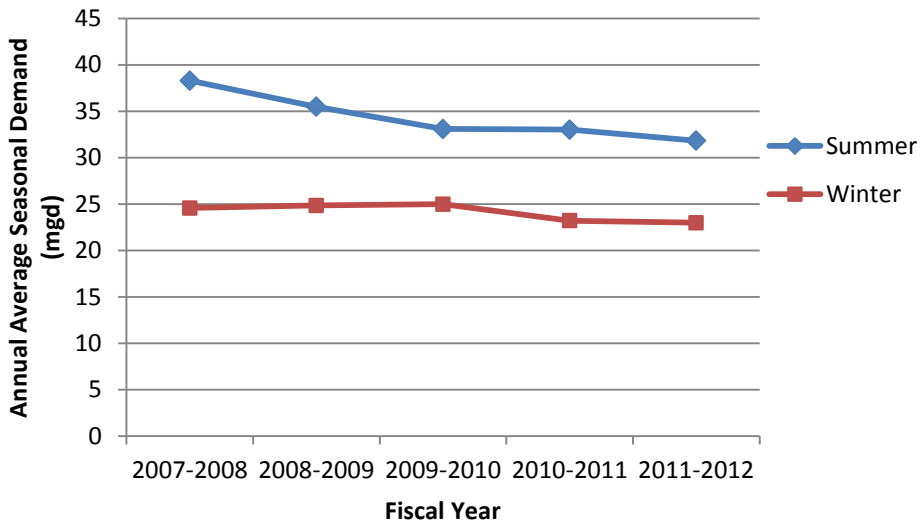
Exhibit 2-7. Monthly Average Day Demand (mgd), July 2007-June 2012. Red indicates peak season months (June through September) while blue indicates non-peak season months.



Seasonal Demands

Exhibit 2-8 illustrates the summer period (defined as June through September) and winter period (December through March) ADDs for FY 2007-2008 through FY 2011-2012. During this period, winter ADD decreased slightly during the last two years while summer ADD continuously decreased over the same time period. As illustrated, the City's ADD is notably greater during the summer months, which is primarily a result of outdoor water use for irrigation. Summer ADD ranged from 31.83 mgd to 38.29 mgd and winter ADD ranged from 22.97 mgd to 24.99 mgd.

Exhibit 2-8. Historical Seasonal Demand (mgd), Fiscal Year 2007-2008 to 2011- 2012. Summer = June to September. Winter = December to March.



Per Capita Demand

Per capita demand, expressed in gallons per capita per day (gpcd), is the City's total demand, divided by the estimated water delivery area population. Consequently, the calculated per capita demand values exceed the amounts of water actually used by a typical individual. In addition, per capita demand may not accurately portray year-to-year water use, because the calculation does not account for the difference in customer demographics, climate, rainfall, and current economic conditions. The calculation also does not account for specifics, such as changes in hotel occupancy or in large commercial or industrial uses, which may not have any relationship to population or actual efficiency of use. Nevertheless, per capita demands may show year-to-year trends and can be used to compare water use by the City's customers to that of other communities.

The City's estimated average day per capita demand in FY 2011-2012 was 136.5 gpcd, based on the FY 2011-2012 finished water ADD of 25.64 mgd and estimated water delivery population of 187,863. Exhibit 2-9 presents average day per capita demands of the City and other water providers in the Willamette Valley. However, direct comparison of average day per capita demands between cities is not always appropriate given that some cities have unique circumstances that influence demand values.

Exhibit 2-9. Average day per capita demands of water providers in the Willamette Valley.

Water Provider	Average day per capita demand (gpcd)	Source
City of Salem	136.5	*City of Salem 2014 WMCP*
City of Corvallis	144	*City of Corvallis, 2010 Water Use and Water Conservation Project*
City of Veneta	110	*City of Veneta 2012 WMCP*
City of Beaverton	120	*Joint Water Commission 2010 WMCP*
City of Forest Grove	150	*Joint Water Commission 2010 WMCP*
City of Hillsboro	170	*Joint Water Commission 2010 WMCP*

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)

The City has eight customer categories: residential, multi-family, commercial, industrial, public, municipal, irrigation, and wholesale. Exhibit 2-10 describes each customer category.

Exhibit 2-10. Customer Category Definitions.

Customer Category	Definition
Residential	Any connection that serves one residential unit per connection (a house or duplex with one connection per unit).
Multifamily	Any connection that serves greater than one residential unit (apartment complex with one connection for two or more units).
Commercial	Any commercial or industrial customer whose wastewater is not metered (retail, institutions, correctional facilities, offices). Also includes any connection that is dedicated to fire flow.
Industrial	Any commercial or industrial customer whose wastewater is metered (food processing, computer parts manufacturing).
Public	Any connection that serves local, state, or federal offices (school districts, state and federal administrative offices).
Municipal	Any connection that serves the City of Salem (administrative offices, operation centers, parks). These connections are metered, but not billed.
Irrigation	Any connection for commercial, industrial, or multifamily classes that is solely dedicated for irrigation.
Wholesale	Multiple connections with Suburban East Salem Water District, the City of Turner, and Orchard Heights Water District.

Exhibit 2-11 shows the average number of customer service connections by customer category for FY 2011-2012. The exhibit does not include the number of Fire service connections because the City does not actively record the amount of water used by Fire customer connections. Municipal connections are contained in the count of Public service connections.

Exhibit 2-11. Number of Service Connections, Fiscal Year 2011-2012.

Fiscal Year	Residential	Multi-Family	Commercial & Public	Irrigation	Industrial	Wholesale	Total
2011-2012	40,225	2,218	2,988	625	48	3	46,107

The City utility billing system collects monthly consumption data. Billing data lags behind the actual consumption for each month and an adjustment is made to align consumption with production. This adjustment simply moves the billing data back one month to reflect the time period during which the water was actually consumed. For example, water use reported by June's billing data is labeled as May consumption.

The annual metered consumption by customer category for FY 2007-2008 through 2011-2012 is shown in Exhibit 2-12. Residential, commercial, wholesale, and irrigation water uses have been decreasing since 2008-2009. Water use by multi-family and industrial customers was greater in FY 2007-2008 and 2008-2009 than subsequent years, when consumption fluctuated at lower volumes.

Exhibit 2-12. Metered Consumption by Customer Category, Fiscal Year 2007-2008 through 2011-2012.

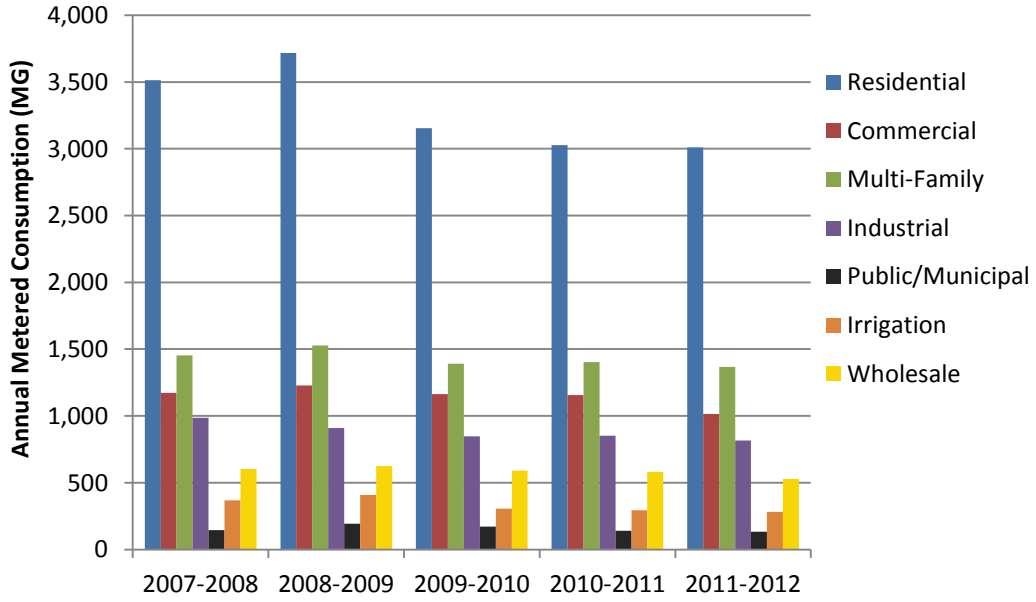


Exhibit 2-13 shows the City's average annual metered consumption by customer category over a five-year period from FY 2007-2008 through FY 2011-2012. The residential customer category showed the greatest average annual water use of 3,284 MG per year.

Exhibit 2-13. Five-Year Average Metered Consumption by Customer Category, FY 2007-2008 through 2011-2012.

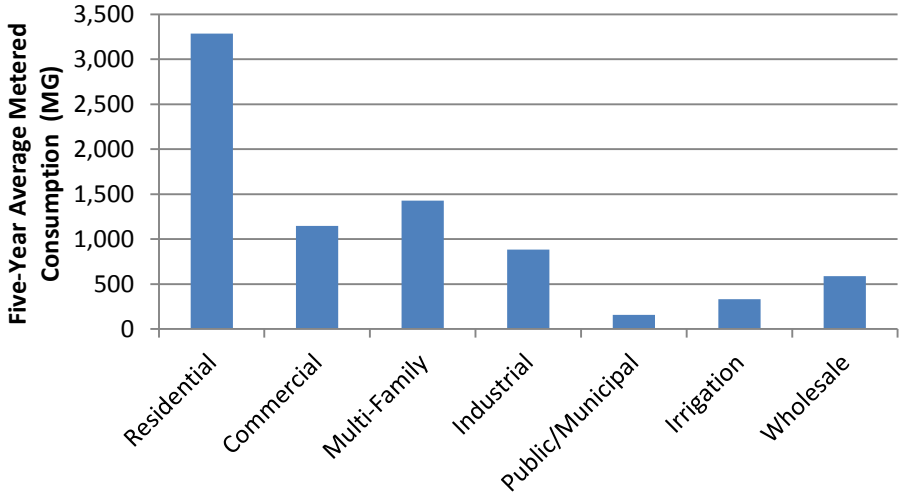


Exhibit 2-14 presents a pie chart illustrating the percentage of water used by each customer category in FY 2011-2012. Residential water use represented 42.1 percent, multi-family residential water use represented 19.1 percent, commercial water use represented 14.2 percent, and industrial water use represented 11.4 percent of total metered consumption. These percentages indicate that the water conservation opportunities may be greatest for residential users.

Exhibit 2-14. Percent Water Use by Customer Category, Fiscal Year 2011-2012.

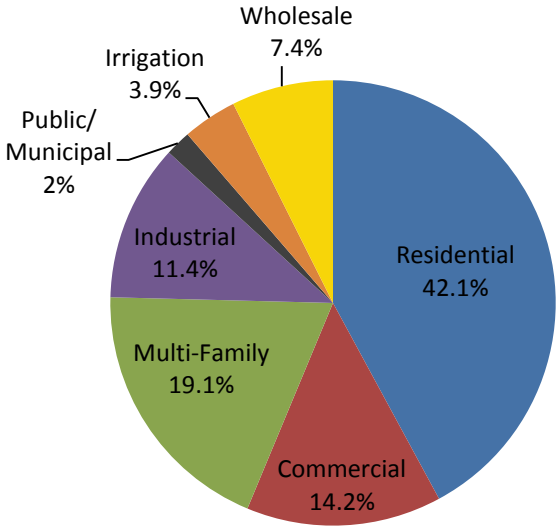


Exhibit 2-15 presents annual average day consumption (ADC), the average amount of water consumed each day, from FY 2007-2008 through 2011-2012. The average ADC during this period was 21.41 mgd. The City uses ADC by class and in total for its revenue and demand projection calculations.

Exhibit 2-15. Average Day Consumption, Fiscal Year 2007-2008 through 2011-2012.

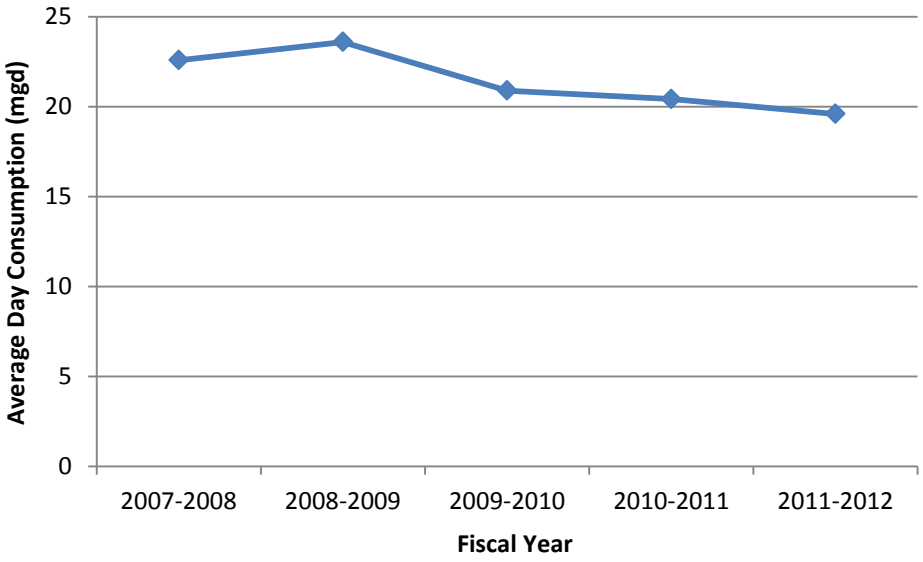
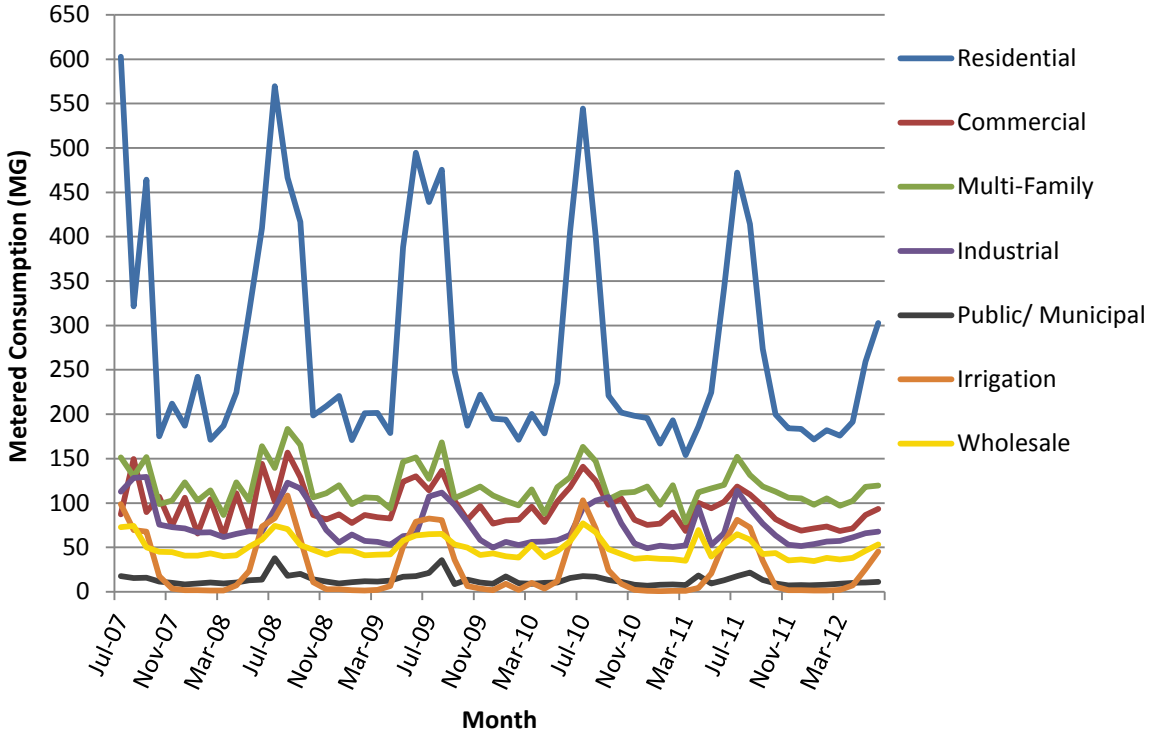


Exhibit 2-16 shows the estimated monthly consumption by customer category for July 2007 through June 2012. As expected, consumption increased in the summer months on an annual basis, which can be attributed to outdoor water use for irrigation. The highest monthly consumption was 602.6 MG in July 2007 for residential water users.

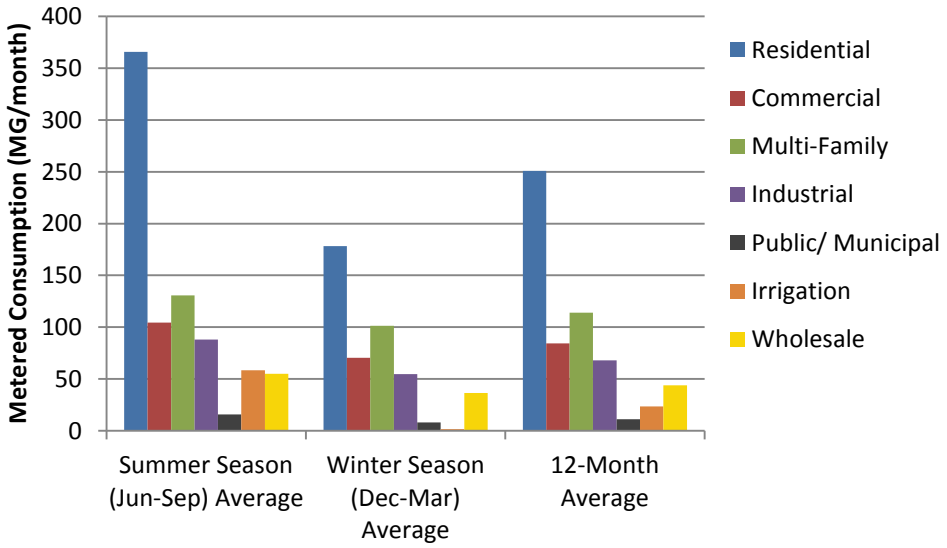
Exhibit 2-16. Monthly Metered Consumption by Customer Category, July 2007-June 2012.



Seasonal Water Use

Exhibit 2-17 shows the average monthly consumption by season and customer category for FY 2011-2012. For the purposes of this WMCP, the summer months are defined as June through September and the winter months are defined as December through March. The ratio of the City's total summer season use to total winter season use was 1.8, which shows that water use during the summer season is nearly twice as great as during the winter season. The City's seasonal water use ratio is less than the City of Corvallis with 2.0 (*City of Corvallis 2012 WMCP*) and Eugene Water and Electric Board with 2.2 (*Eugene Water and Electric Board 2011 WMCP*).

Exhibit 2-17. Seasonal Water Consumption by Customer Category, Fiscal Year 2011- 2012.



Largest Users

Exhibit 2-18 lists the City's top 25 water consumers. These customers were responsible for use of 1,681.8 MG during the 2011-2012 fiscal year, which is 23.5 percent of the total water consumption during that fiscal year. Water conservation efforts targeting these customers could result in significant water savings.

Exhibit 2-18. Top 25 Users, Fiscal Year 2011-2012.

Customer Class	Volume Used (MG)
Wholesale	460.1
Institutional*	279.8
Public	87.9
Industrial	87.3
Industrial	71.3
Wholesale	65.3
Industrial	63.2
Industrial	54.8
Commercial	46.9
Commercial	44.9
Multifamily	43.8
Industrial	39.6
Commercial	37.0
Multifamily	33.4
Institutional*	33.3
Irrigation	32.9
Industrial	29.3
Public	27.1
Multifamily	25.7
Multifamily	22.2
Multifamily	21.3
Public	19.8
Multifamily	19.3
Commercial	19.2
Commercial	16.3
Total	1,681.8

*An "Institutional" customer is an industrial customer with a special wastewater charge.

Water Losses and Non-Revenue Water

OAR 690-086-0140(9)

The City defines non-revenue water in the distribution system as Miscellaneous Metered Water (MMW), Miscellaneous Water Use (MWU) and Unaccounted for Water. MMW represents unbilled, but authorized metered consumption, such as water used by City facilities, and some metered fire hydrant uses. MMW is included in consumption values. MWU represents authorized non-metered uses of water from fire hydrants and blow-offs for activities such as firefighting, water main flushing, hydro-truck filling, street sweepers, and water main testing. MWU also includes a factor to account for inaccurate metering. Although MWUs are not metered, MWU values were estimated based on day-to-day operational activities. Exhibit 2-19 enumerates the MWUs and their estimated annual water use.

Exhibit 2-19. City of Salem Miscellaneous Water Uses and Estimated Annual Water Use.

Miscellaneous Water Use	Annual Volume (MG/Fiscal Year)
Fire Hydrants	5
Fire Fighting	5
Mains Flushing	50
Hydro Truck	4
Street Sweepers	0.5
Construction Testing	0.5
Total	65.0

Unaccounted for water represents the finished water production leaving Geren Island minus metered water consumption by customers and MWUs. Thus, unaccounted for water, or water loss, consists of system leakage and all unmetered uses (authorized and unauthorized) not identified as an MWU. System leakage, as the name implies, is water lost for any reason, including deteriorating pipe, or compromised pipe joints, service connections, or valves. With proper record keeping and metering of water, the percentage of unaccounted for water approaches the net volume lost to actual leakage.

Exhibit 2-20 lists total finished water leaving Geren Island, total metered consumption, and MWUs, and illustrates the unaccounted for water quantity and percentage for FY 2007-2008 through FY 2011-2012. During this period, the City's average unaccounted for water was 22.0 percent. The City's unaccounted for water in FY 2011-2012 was 22.9 percent. The City estimates that approximately one-fifth of the City's unaccounted for water is attributed to leaks in the transmission line between the Geren Island WTP and Turner Control.

Exhibit 2-20. Historical Unaccounted for Water

Fiscal Year	Finished Water Production (MG)	Metered Consumption (MG)	Misc Uses (MG)	Unaccounted for Water (MG)	Unaccounted for Water (%)
2007-2008	10,753	8,241	65	2,447	22.8
2008-2009	10,462	8,610	65	1,787	17.1
2009-2010	10,217	7,623	65	2,529	24.8
2010-2011	9,684	7,452	65	2,167	22.4
2011-2012	9,357	7,149	65	2,143	22.9
Average				2,215	22.0

Water Rights

OAR 690-086-0140(5)

Exhibit 2-21 provides detailed information about the City's municipal water rights that supply potable water through its publically owned municipal distribution system. The City holds seven surface water rights and 25 groundwater rights for use through its municipal system. In addition, the City holds a limited license authorizing the use of water for its ASR system. These water rights are described in more detail below.

Information about the City's non-municipal water rights is provided in Exhibit 2-22. The City's 13 non-municipal use water rights (six surface water and seven groundwater rights) authorize the use of non-potable water for a variety of purposes including aesthetics, recreation, public park use, and irrigation. Many of these water rights are held by the City's Parks Division of Public Works. The City does not deliver water through its municipal distribution system for municipal customer supply under any of these water rights.

Surface Water

The City holds seven municipal surface water rights that authorize the use of up to a total of 449 cfs (290 mgd) from the North Santiam River and the Willamette River. The City's surface water rights are evidenced by one surface water registration, one permit, and five water right certificates.

The City primarily relies on surface water rights from the North Santiam River to meet its municipal water supply needs. The City holds five water right certificates (Certificates 87958, 87959, 88641, 88871, and 88872) for the use of up to 239 cfs (154 mgd) from the North Santiam River for municipal use. Four of the five water rights were originally issued following the adjudication of the North Santiam River and issuance of the North Santiam River Decree confirming the claimed water rights. These water rights have priority dates of 1856 or 1866. The City's remaining North Santiam River water right (Certificate 88872) has a 1923 priority date.

The City also holds two municipal water rights for the use of surface water from the Willamette River, which are evidenced by a surface water registration and a permit. The City's surface water registration (SW-626) is a claim for the use of surface water before Oregon enacted its water code in 1909. According to SW-626, this water use was developed in 1870 for municipal purposes. An adjudication of the Willamette River must be conducted before this right is confirmed. In the meantime, SW-626 provides the City with the authorization to use up to 10 cfs (6.5 mgd) from the Willamette River for municipal use. The City also holds Permit S-45565, which authorizes the use of up to 200 cfs (129 mgd) from the Willamette River. The priority date of this water right is December 6, 1976. The City has a permit extension application pending with OWRD for this permit. The City intends to use water from the Willamette River to help meet its future water demands and to provide a redundant water supply in the event that its North Santiam River water supply is not available or insufficient.

Groundwater

The City holds 25 municipal groundwater rights that authorize the use of up to a total of 82.95 cfs (53.59 mgd). The City's municipal groundwater rights are evidenced by 11 groundwater registrations, 11 water right certificates, two transfers, and one permit. The City uses these groundwater rights primarily as a back-up water supply when its surface water supply is not adequate to meet demands, either due to limitations on water quantity or water quality.

The City's 11 groundwater registrations are claims for the use of groundwater initiated before the enactment of Oregon's groundwater code in 1955. OWRD must conduct an adjudication of the claims and the circuit court must issue a decree before OWRD can issue water right certificates confirming the groundwater uses claimed in these groundwater registrations. A groundwater adjudication for this area has not yet been initiated. Meanwhile, the City's groundwater registrations provide authorization to appropriation of up to 29.44 cfs (19.03 mgd) of groundwater. Four of the groundwater registrations (GR-3502, GR-3507, GR-3509 and GR-3510) allow the use of up to 22.23 cfs (14.37 mgd) from three wells and the infiltration gallery at Geren Island. Many of the City's other water rights evidenced by groundwater registrations are not currently in use.

In addition to the groundwater registrations, the City holds a groundwater permit (G-734) at Geren Island. This permit authorizes the use of up to 30 cfs (19 mgd) for withdrawal via a collector well. A permit extension to October 1, 2020 was recently granted for this permit. This permit is generally used when turbidity in the North Santiam River is high, or when algal fouling occurs, and surface water treatment is not feasible.

The City also holds 11 water right certificates for the use of groundwater, which authorize the use of up to 22.4 cfs (14.5 mgd). Six of these water rights are associated with wells acquired from the Jan Ree Water District. Although not all of the wells are currently functional, the City could use these groundwater rights to provide water in extreme emergency conditions.

Finally, the City holds two rights that are currently evidenced by water right transfer T-10263. These rights authorize the use of up to 1.11 cfs (0.72 mgd) of groundwater. Transfer T-10263 allows the City to change the points of appropriation and place of use, and to change the character of use to municipal purposes for these rights. The changes are to be completed by October 1, 2032.

City of Salem ASR System

OWRD issued the City's ASR Limited License #001 (LL-001) on March 6, 1997. The ASR limited license authorized ASR pilot testing for five years. Since LL-001 was issued, three modifications (renewals) have been approved (March 2002, March 2007 and June 2012) that extended LL-001 to March 6, 2017. In its current form, LL-001 authorizes the use of up to 26.0 cfs (16.8 mgd) from the North Santiam River for injecting into a maximum of 15 ASR wells. The use is limited to a maximum storage volume of one billion gallons, and a maximum combined recovery rate of 13,800 gpm (30.7 cfs). The rate at which the City currently recovers stored water generally decreases during the recovery period in response to water level declines in the aquifer as the ASR storage volume is depleted. Typically, the City begins pumping water at rates of 11 to 12 cfs at the beginning of the recovery period but the rate is generally reduced to the range of 7 to 8 cfs by the end of the recovery period.

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Exhibit 2-21. City of Salem Municipal Water Rights

Source	Application	Permit	Claim, Transfer or Limited License	Certificate	Priority Date	Type of Beneficial Use	Authorized Rate (cfs)	Authorized Date for Completion	Maximum Rate of Withdrawal to Date		2011 Average Withdrawal	2011 Average Withdrawal	Five-Year (2007-2011) Average Withdrawal	Five-Year (2007-2011) Average Withdrawal	Comments
									Instantaneous (cfs)	Annually (MG)	Monthly (MG)	Daily (mgd)	Monthly (MG)	Daily (mgd)	
Surface Water															
North Santiam River	--	--	~~T-7928~~	88641	1856	Municipal	60	N/A	60		1,276.5	41.97	1363.6 (4-year Average, 2008-2011)	44.80 (4-year Average, 2008-2011)	
North Santiam River	--	--	~~T-7928~~	88871	1866	Municipal	50	N/A	50						
North Santiam River	S-9056	S-12033	~~T-7928~~	88872	7/5/1923	Municipal	12	N/A	12						
North Santiam River	--	--	~~T-5476~~	87959	1856	Municipal	55	N/A	55						
North Santiam River	--	--	~~T-3999~~	87958	1856	Municipal	62	N/A	62						
Willamette River	--	--	SW-626		1870	Municipal	10	N/A	10		0	0	0	0	Not currently in use.
Willamette River	S-55010	S-45565			12/6/1976	Municipal	200	10/1/1997	0	0	0	0	0	0	Not currently in use. Extension application pending with OWRD.
ASR															
ASR #1, ASR #2, ASR #3, ASR #4, ASR #5, ASR #6, ASR #7, ASR #8, ASR #9, ASR #10, ASR #11, ASR #12, ASR #13, ASR #14, ASR #15	--	--	LL#001	--	N/A	Aquifer Storage and Recovery for Municipal Use	Divert 26 cfs for injection; store 1 billion gallons; recover at 30.7 cfs	3/6/2017		565.4 MG injected (2010); 527.1 MG recovered (2009)	43.4 MG injected; 20.8 MG recovered	1.43 mgd injected; 0.68 mgd recovered	36.2 MG injected; 32.5 MG recovered (2009-2012)	1.19 mgd injected; 1.06 mgd recovered (2009-2012)	Used to meet peak demands. Limited by finite storage capacity in the aquifer.

Exhibit 2-21 Continued. City of Salem Municipal Water Rights

Source	Application	Permit	Claim, Transfer or Limited License	Certificate	Priority Date	Type of Beneficial Use	Authorized Rate (cfs)	Authorized Date for Completion	Maximum Rate of Withdrawal to Date		2011 Average Withdrawal	2011 Average Withdrawal	Five-Year (2007-2011) Average Withdrawal	Five-Year (2007-2011) Average Withdrawal	Comments
									Instantaneous (cfs)	Annually (MG)	Monthly (MG)	Daily (mgd)	Monthly (MG)	Daily (mgd)	
Groundwater															
Middle Well at Geren Island			GR-3507		12/31/1940	Municipal	3.45	N/A	3.45		0	0	0	0	Currently not in use
East Well at Geren Island			GR-3509		12/31/1940	Municipal	2.45	N/A	2.45		0.40	0.01	0.12	0.004	Used during high turbidity events in North Santiam River, algal fouling events, flooding, etc.
West Well at Geren Island			GR-3510		12/31/1939	Municipal	3.95	N/A	3.95		0.12	0.004	0.05	0.002	Used during high turbidity events in North Santiam River, algal fouling events, flooding, etc.
Infiltration Gallery (Geren Island)			GR-3502		12/31/1936	Municipal	12.38	N/A	12.38		125.26	4.12	62.4	2.05	Typically used during periods of high turbidity in the North Santiam River.
Collector Well (Geren Island)	G-834	G-734			01/02/1958	Municipal	30	10/01/2020	30						Typically used during periods of high turbidity in the North Santiam River.
Orchard Heights Well			GR-3503		12/31/1930	Irrigation/ Municipal	0.89	N/A	0.89		0	0	0	0	Currently not in use.
Wallace Road Well			GR-3504		12/31/1944	Municipal	0.89	N/A	0.89		0	0	0	0	Currently not in use.
West Salem City Hall West Well			GR-3505		12/31/1936	Municipal	0.56	N/A	0.56		0	0	0	0	Currently not in use.
Market Street Well			GR-3506		12/31/1930	Municipal	0.98	N/A	0.98		0	0	0	0	Currently not in use due to a contamination issue
West Salem City Hall East Well			GR-3508		12/31/1936	Municipal	0.45	N/A	0.45		0	0	0	0	Currently not in use
Jan Ree Wells 1-8, Hayesville Wells 1&2	G-9224	G-8558		66077	05/03/1979	Municipal	12.06	N/A	12.06		0	0	0	0	For emergencies only due to high manganese and iron levels.
Jan Ree Wells 5&6	G-5777	G-6836		57917	4/14/1972	Municipal	2.16 Well 5 - 0.83 Well 6 - 1.33	N/A	2.16		0	0	0	0	For emergencies only due to high manganese and iron levels.
Jan Ree Well 3	G-137	G-40		42199	09/23/1955	Quasi-Municipal	0.05	N/A	0.05		0	0	0	0	For emergencies only due to high manganese and iron levels.
Jan Ree Wells 1,2,3	G-3388	G-3183		42202	02/16/1966	Quasi-Municipal	1.08	N/A	1.08		0	0	0	0	For emergencies only due to high manganese and iron levels.
Jan Ree Well 4	G-4596	G-4321		42222	09/13/1968	Supplemental Domestic	1.08	N/A	1.08		0	0	0	0	For emergencies only due to high manganese and iron levels.

Exhibit 2-21 Continued. City of Salem Municipal Water Rights

Source	Application	Permit	Claim, Transfer or Limited License	Certificate	Priority Date	Type of Beneficial Use	Authorized Rate (cfs)	Authorized Date for Completion	Maximum Rate of Withdrawal to Date		2011 Average Withdrawal	2011 Average Withdrawal	Five-Year (2007-2011) Average Withdrawal	Five-Year (2007-2011) Average Withdrawal	Comments
									Instantaneous (cfs)	Annually (MG)	Monthly (MG)	Daily (mgd)	Monthly (MG)	Daily (mgd)	
Groundwater (continued)															
Jan Ree Well 1	G-1979	G-1815		42200	04/07/1961	Group Domestic	0.37	N/A	0.37		0	0	0	0	For emergencies only due to high manganese and iron levels.
Hemlock Well	G-1853	G-1714		34803	10/03/1960	Group Domestic	0.15	N/A	0.15		0	0	0	0	For emergency use for West Salem.
Friendship (Goff) Well-SHWD Well #3, Woodmansee Park Well #1 (SHWD Well #6), ASR #1, ASR #2, ASR #4, & ASR #5			GR-14		03/02/1953 (0.50 cfs); 01/06/1954 (0.22cfs); 02/28/1952 (0.22 cfs); 04/18/1952 (0.19 cfs); 05/12/1954 (1.64 cfs)	Municipal	2.77	N/A	2.77		0	0	1.09	0.04	Limited use because wells are also used for ASR, and the ASR limited license requires recovery of stored water before use of native groundwater. A November 21, 2005 letter to OWRD documented the following changes to GR-14: Removal of 4 of the 6 original points of appropriation (Doege (Well 1), Butler (Well2), Dietz (Well 3), and Gardner (Well 4); addition of four new points of appropriation (ASR #1, ASR #2, ASR #4, and ASR #5); and revision of the authorized place of use. GR-14 was assigned to the City on September 14, 2012.
ASR #1, ASR #2, ASR #4, & ASR #5	G-116	G-9		87902	09/08/1955	Municipal	1.12	N/A	1.12						Limited use because wells are also used for ASR, and the ASR limited license requires recovery of stored water before use of native groundwater.
ASR #1, ASR #2, ASR #4, & ASR #5	G-135	G-39		87903	09/23/1955	Municipal	1.00	N/A	1.00						
ASR #1, ASR #2, ASR #4, & ASR #5	G-871	G-770		87904	02/21/1958	Municipal	1.33	N/A	1.33						
ASR #1, ASR #2, ASR #4, & ASR #5	G-1006	G-898		87905	06/16/1958	Municipal	2.00	N/A	2.00						
Proposed Wells 1, 2, 3, 4, 5 & 6			GR-493; T-10264		12/31/1940	Municipal	0.67	N/A	0.67		N/A	N/A	N/A	N/A	Limited to a volume of 25,000 gallons per day. Currently not used because the proposed points of appropriation are not yet developed. Will provide redundant supply for NE Salem and Keizer.
Proposed Wells 1, 2, 3, 4, 5 & 6	G-1096	G-912	T-10263	~~30189~~	07/28/1958	Municipal	0.55	10/01/2032	0.55		N/A	N/A	N/A	N/A	Currently not used because the proposed points of appropriation are not yet developed. Will provide redundant supply for NE Salem and Keizer.
Proposed Wells 1, 2, 3, 4, 5 & 6	G-3642	G-3422	T-10263	~~34918~~	03/24/1967	Municipal	0.56	10/01/2032	0.56		N/A	N/A	N/A	N/A	

Exhibit 2-22. Non-Municipal Water Rights Held by the City of Salem

Application	Permit	Certificate	Source	Use	Priority Date	Authorized Rate (cfs)	Authorized Volume (acre feet)	Acres to be irrigated
Surface Water								
--	--	38655	North Santiam River	"Recreation within Mill Creek channel"	1856	22	--	N/A
--	--	45786	North Santiam River	"Beautification purposes at Civic Center site"	1856	10	--	N/A
S-68610	S-50015	65400	North Santiam River	Aesthetic	11/6/1985	70	--	N/A
S-43731	S-32148	79837	Willamette River	Irrigation, Supplemental Irrigation – Minto Brown Park Cropland. (A 0.02 cfs portion is leased instream until 10/31/2016.)	6/16/1967	3.42*	--	Irrigation of 208.8 Ac Supp. Irrigation of 93.4 Ac
S-43731	S-32148	80154	Willamette River	Irrigation – Minto Brown Park Cropland	6/16/1967	0.08*	--	6.6 Ac
R-48501	R-6761	57946	Pringle Creek	"Recreation (Beautification)"	7/27/1971	N/A	4.5	N/A
Groundwater								
G-2383	G-2192	32221	Cascades Gateway Park Well	"Public Park Use, including chlorinization vehicle for bathing lake"	07/16/1962	0.22	--	N/A
G-3057	G-2853	35773	A well (at Cascades Gateway Park)	Public Park Use	03/26/1965	0.11	--	N/A
G-7317	G-6761	56361	Well #3 (at Cascades Gateway Park)	Park Use	03/31/1976	0.07	--	N/A
G-8928	G-8320	61380	A well (at Cascades Gateway Park)	Public Park Use (Potable Water)	08/15/1978	0.07	--	N/A
G-1602	G-1474	79847	Well 2 (Minto-Brown Park)	Irrigation	10/14/1959	0.99*	--	96.0 Ac
G-13282	G-12165	75923	Willow Lake WPCF Wells 1&2	Industrial	02/05/1993	0.031	--	N/A
G-16201	G-15846	--	Willow Lake WPCF Wells 1&2	Irrigation	03/05/2004**	0.31*	--	25.1 Ac

* Limited to one-eightieth of one cfs per acre and 2.5 acre-feet per acre.

** The City is the process of developing an application for an extension of time for Permit G-15846.

Aquatic Resource Concerns

Water Quality

The City's North Santiam River water rights authorize diversion at approximately RM 20. At the authorized diversion, the North Santiam River is identified by the Oregon Department of Environmental Quality (DEQ) as being water quality limited for dissolved oxygen, temperature, mercury, and flow modification. DEQ has approved a Total Maximum Daily Load (TMDL) for temperature and for mercury in the North Santiam River.

The City's Willamette River water rights authorize diversion at approximately RM 85. At the authorized diversion, DEQ has identified the Willamette River as being water quality limited for the following parameters: *E. coli*, temperature, bacteria, and mercury. DEQ has approved TMDLs for temperature, bacteria, and mercury in the Middle Willamette River.

The list of water quality impairments in the North Santiam and the Willamette River can be found on DEQ's Web page for "Oregon's 2010 draft Integrated Report Database" at http://www.deq.state.or.us/wq/assessment/rpt2010/search.asp.

Listed Streamflow-dependent Species

Exhibit 2-23 shows the listed fish species in the North Santiam River and Willamette River within the reach of the POD.

Exhibit 2-23. Fish Species occurring within the North Santiam River (approx. RM 20) and Willamette River (approx. RM 85) that are listed under the Oregon Sensitive Species List or Federal Endangered Species Act.

Species	Common Name	Evolutionarily Significant Unit (ESU) (if applicable)	Federal Listing	State Listing
Oregonichthys crameri	Oregon chub	Not applicable	Threatened	Sensitive "Critical"
Oncorhynchus mykiss	Winter Steelhead	Upper Willamette River ESU	Threatened	Sensitive "Vulnerable"
Oncorhynchus tshawytscha	Spring Chinook salmon	Upper Willamette River ESU	Threatened	Sensitive "Critical"
Oncorhynchus tshawytscha	Fall Chinook salmon	Lower Columbia River ESU; Upper Willamette River ESU	Threatened	Not applicable (Not Listed)
Salvelinus confluentus	Bull trout	Willamette River Bull Trout Species Management Unit (SMU)	Threatened	Not applicable (Not Listed)
Lampetra tridentata	Pacific lamprey	Not applicable	Not applicable (Species of Concern)	Sensitive "Vulnerable"
Lampetra richardsoni	Western Brook lamprey	Not applicable	Not applicable	Sensitive "Vulnerable"

Sources:
Federal ESA listed species (T&E), from NOAA Fisheries Office of Protected Resources: http://www.nmfs.noaa.gov/pr/species/esa/fish.htm
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
Oregon Department of Fish and Wildlife's (ODFW) Division 315 Revised Evaluation of Fish Persistence for Municipal Extension, City of Salem Application #S-55010. March 20, 2009.
ODFW's Division 315 Evaluation of Fish Persistence for Municipal Extension, City of Salem Application #G-834. November 21, 2011.

Critical Groundwater Area

None of the City's groundwater sources are located within the boundaries of a designated critical groundwater area.

Evaluation of Water Rights/Supply

OAR 690-086-0140(3)

As described above, the City holds municipal water rights authorizing the use of water from the North Santiam River, the Willamette River, and groundwater. The following provides a discussion of the reliability of the water rights from each of these sources.

North Santiam River

The City holds municipal water rights on the North Santiam River authorizing the use of up to 239.0 cfs. The amount of water available to satisfy the City's water rights is a function of water right priority date (seniority) and streamflow. The relative priority of the City's North Santiam River surface water rights is a key factor in water reliability.

The North Santiam River Basin produces a significant quantity of water even during the driest months. According to streamflow records on the North Santiam River at Mehama, which is upstream from the City's authorized points of diversion, (U.S. Geological Survey [USGS] gage # 14183000 for the period 1954-1987 (after the completion of Detroit and Big Cliff Dams)), 95 percent of the time flows at Mehama were greater than 992 cfs in July, 957 cfs in August, 1070 cfs in September, and 1730 cfs in October.

Based on priority date and abundant streamflow, the City's water right Certificates 87958, 87959, and 88641, which have priority dates of 1856, are highly reliable. These water rights are senior in priority to all other water rights for the use of water from the North Santiam River, except for a 50.0 cfs instream flow established in the North Santiam River decree, and would be met even during the lowest flows.

The City's water right Certificate 88871, which authorizes the use of up to 50 cfs from the North Santiam River and has a priority date of 1866, is also expected to be highly reliable. This water right shares a priority date with Certificate 30336, which authorizes the use of up to 762 cfs for power uses. With the exception of one other small water right, the only water rights on the North Santiam River that are senior in priority to Certificate 88871 are those described above. Accordingly, Certificate 88871 is expected to be fully met except during the very lowest flows.

The City's final North Santiam River water right is Certificate 88872, which authorizes the use of up to 12 cfs and has a priority date of 1923. Although this right is junior to the City's other water rights, it is expected to be reliable during most times of the year.

In addition to considering existing water rights, an evaluation of the reliability of the City's North Santiam River water rights must also consider that Minimum Perennial Streamflows (MPSF) were established for the river on June 22, 1964. The MPSFs are composed of natural flow and released stored water components. The natural flow portion (live flow) of the MPSF at Mehama is 580 cfs and the released stored water component is up to 640 cfs. If the live flow portion of the MPSF is converted to an instream water right, it is expected to have a June 22, 1964 priority date and would, therefore, be junior in priority to the City's North Santiam River water rights. On the other hand, if the released stored water portion of the MPSF was converted to an instream water right, it could potentially affect the reliability of the City's water rights despite its junior priority date. The stored water released from Detroit Reservoir would be a different source from the natural flow to which the City is entitled. In other words, the City would not be authorized to use the 640 cfs of released stored water to meet its water needs.

However, serious concerns have been raised about the consequences of converting the MPSFs, and significant uncertainty is associated with the ultimate "conversion" of the stored water component of the minimum perennial streamflows to instream water rights.

Despite the apparent reliability of the City's water rights from the North Santiam River, constraints in the conveyance capacity from Geren Island to the City's distribution system limit the actual water supply to 102 cfs.

Willamette River

There is ample water available on the Willamette River to satisfy the City's Permit S-45565 and surface water registration SW-626. After considering all existing consumptive use and non-consumptive use water rights (including instream water rights), OWRD's online water availability database indicates that water is available for appropriation from the Willamette River above Mill Creek every month of the year based on an 80 percent exceedance probability.

Based on priority date and abundant streamflow, the City's Willamette River water rights would be expected to be highly reliable. However, other circumstances create uncertainty about the reliability of both of the City's Willamette River water rights.

The ultimate reliability of SW-626 cannot be determined because the right is currently evidenced by a surface water registration. As previously described, OWRD must conduct an adjudication of surface water rights on the Willamette River before the City has certainty as to this surface water right.

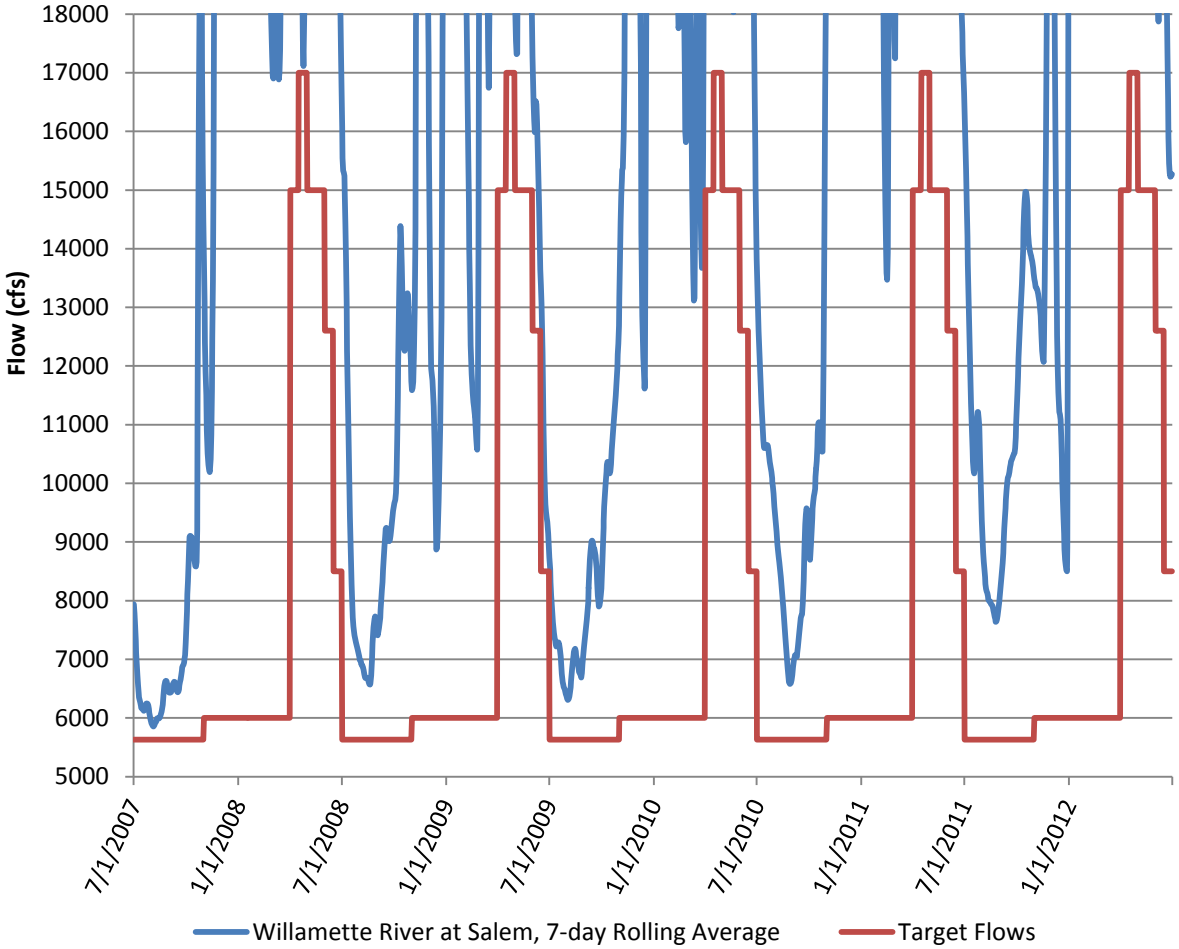
The City's reliability of Permit S-45565 is also uncertain because it is subject to proposed permit extension conditions. The most recent date by which the City was to complete development of this permit was October 1, 1997. The City filed an application for an extension of time requesting to extend this date. As part of the municipal permit extension process, the Oregon Department of Fish and Wildlife recommended conditions to OWRD intended to "maintain the persistence of listed fish." The recommended conditions include flow targets on the Willamette River, which are shown in Exhibit 2-24. If the flow targets are not met, the City's use of water under Permit S-45565 would be reduced in proportion to the amount by which the minimum flow is not met (based on a seven-day rolling average of mean daily flows). The overall reduction would not exceed 20 percent of the undeveloped portion of the permit.

Exhibit 2-24. Oregon Department of Fish and Wildlife (ODFW) Recommended Fish Flow Targets in the Willamette River, Measured at U.S. Geological Survey (USGS) Gage 14191000.

Month	Recommended Fish Flow Targets (cfs)
July 1 – October 31	5,630
November 1 – March 31	6,000
April 1 – April 15	15,000
April 16 – April 30	17,000
May 1 – May 31	15,000
June 1 – 15	12,600
June 16 – 30	8,500

The U.S. Army Corps of Engineers (USACE) has managed its thirteen reservoirs within the Willamette Basin to meet the fish flow targets at the City of Salem gage (USGS Gage 14191000) since the early 2000s. Analysis of 7-day rolling average streamflow records at USGS Gage 14191000 from January 2000 through December 2012 shows that flow targets on the Willamette River were missed on 143 days, or 3 percent of the time. Of the 143 days that the flow targets were missed, 80 days were in 2001 (April through August), 25 days were in 2004 (April and May), and 20 days were in 2007 (May and June). From July 2007 through June 2012, the flow targets on the Willamette River were met every day. Exhibit 2-25 compares the 7-day rolling average at the City of Salem gage (in blue) to target flows (in red) for the period July 2007 through June 2012.

Exhibit 2-25. Willamette River 7-day Rolling Average and Flow Targets, July 2007-June 2012.



Similar to the North Santiam River, the Willamette River has unconverted MPSFs with both natural flow and released stored water components. The natural flow component of the unconverted MPSF at Salem is 1,300 cfs, and the released stored water component is up to 4,700 cfs. Since these flows are, for the most part, lower than the target flows for which the USACE is already managing the reservoirs, it appears that the MPSFs will not likely impact the reliability of the City's Willamette River water rights; however, the City should continue to track the conversion process.

Finally, use of the City's Willamette River water rights will require a capital investment to construct a diversion structure, water treatment plant, pumping facilities and pipelines needed to convey this water to the City service area.

Groundwater

The City holds 25 groundwater rights that provide authorization to appropriate up to 82.95 cfs of groundwater for municipal use. The City primarily uses its groundwater supply for emergency use and supply redundancy. The City's groundwater rights on Geren Island are typically used during high turbidity events or other times when the surface water supply from the North Santiam River needs to be supplemented. Five of the City's groundwater registrations (GR-3503, GR-3504, GR-3505, GR-3506 and GR-3508), which authorize the use of up to 3.77 cfs, are currently not in use. An additional six groundwater right certificates (associated with the Jan Lee wells), which authorize use of up to 16.8 cfs, are only used for emergency purposes due to water quality concerns. Certificate 34803, which authorizes the use of up to 0.15 cfs, is utilized in west Salem as needed for supplemental supply. Additionally, the groundwater registration and four water right certificates that have ASR wells 1 through 5 as their authorized points of appropriation are used only on a limited basis. The City's ASR limited license requires recovery of the stored water before the City pumps native groundwater from these wells. Since the City is typically ready to begin injection after it has completed pumping stored water, native groundwater is rarely appropriated from these wells. Finally, the City has not yet developed the proposed points of appropriation for GR-493, and T-10263, and is not, therefore, currently using these water rights. Once the wells are developed, the groundwater will be used for redundant supply for NE Salem.

Aquifer Storage and Recovery

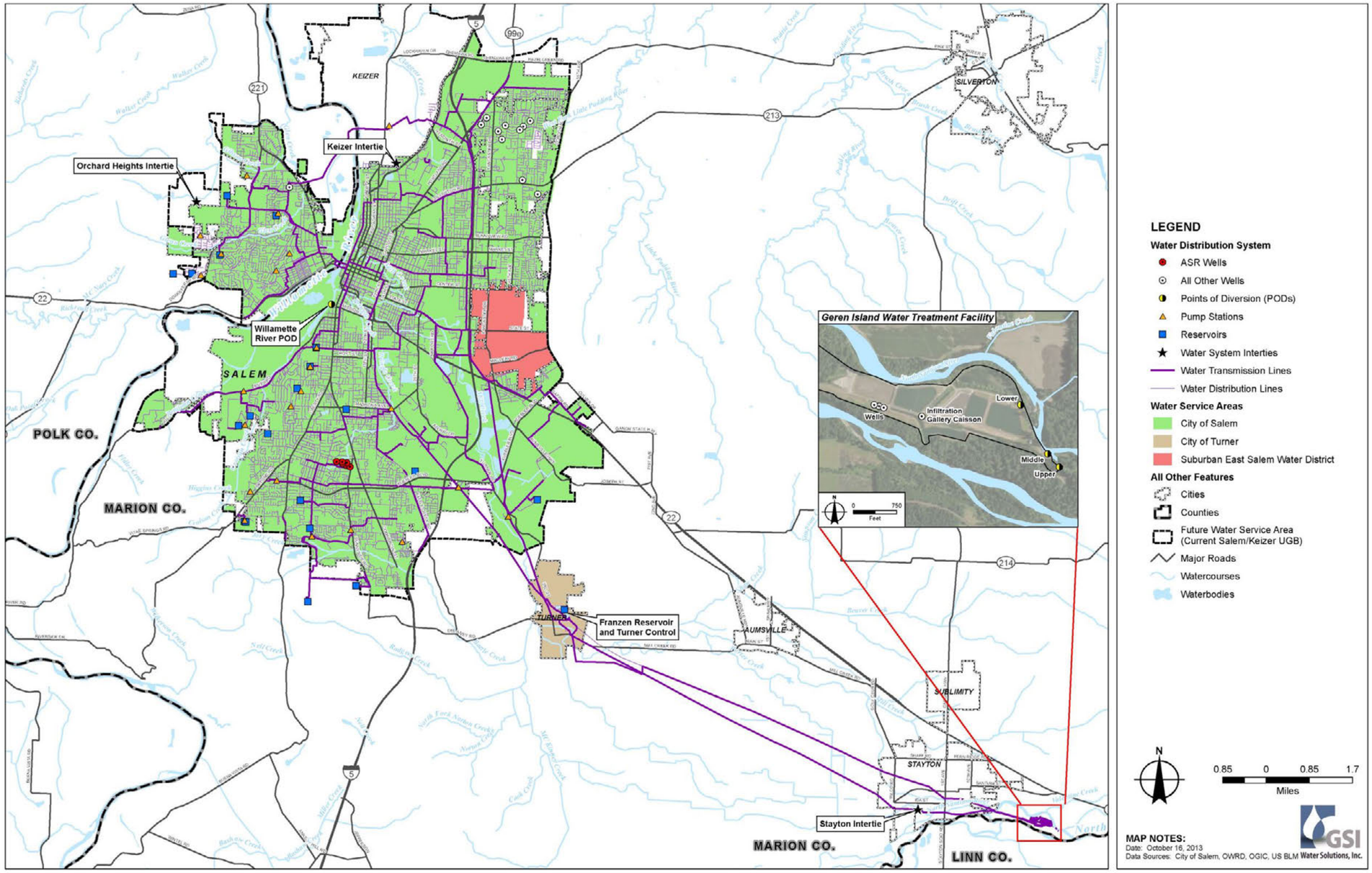
The City uses its ASR system to meet peak demands. Recovery rates typically decline from 11 to 12 cfs at the beginning of the recovery period to the range of 7 to 8 cfs by the end of the recovery period. The City's ASR system is also limited by the finite storage capacity of the aquifer.

System Description

OAR 690-086-140(8)

The City operates a public drinking water system (Public Water System Identification Number OR4100731). The City's water system includes a slow-sand filtration water treatment plant, 19 operating pump stations, 17 reservoirs, approximately 739 miles of pipeline, and groundwater and ASR wells. Exhibit 2-26 presents a schematic of the City's existing water distribution system.

Exhibit 2-26. City of Salem Water Distribution System Schematic



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North Santiam River Intakes

The City has three intakes on the North Santiam River: the Upper, Middle, and Lower intakes. The Middle Intake is the primary intake and has a capacity of 227 cfs (146.7 mgd). The Upper Intake is used as needed to meet peak or emergency demands. The Lower Intake is used to maintain water in habitat dedicated to the threatened Oregon chub and is no longer used for potable water production.

Geren Island Water Treatment Facility

Water diverted from the North Santiam River is treated at the water treatment facility on Geren Island, a 250-acre island in the North Santiam River, located upstream from the City of Stayton and approximately 17 miles from Salem. The primary water treatment process on Geren Island is slow sand filtration.

Water treatment on Geren Island started in the 1930s with an infiltration gallery and a water collection chamber feeding Transmission Line 1 (36 inch diameter). In the 1950s, the infiltration gallery was upgraded and one slow sand filter (SSF 1) was added. Along with the construction of the slow sand filter, a 54-inch transmission line (Line 2) was added to the system to increase conveyance capacity. In 1970, a second filter (SSF 2) was added, effectively doubling the treated water capacity. The water treatment facility remained unchanged until after 1996 when the facility was upgraded by the addition of a screened intake structure, two new slow sand filters, a pretreatment facility, and the addition of the process pump station.

The five-pump process pump station improves reliability and operational flexibility during a high turbidity event on the river or other events that diminish the ability to treat water coming directly from the North Santiam River. Capable of pumping up to 77 cfs (50 mgd), the pump station allows the City to collect water that has been through the roughing filter or directly from the caisson and infiltration gallery. The water is then pumped onto the slow sand filter beds for final treatment. In addition, the East and West wells are capable of delivering groundwater to the slow sand filters for treatment.

The treatment facility has a theoretical peak capacity of 195 cfs (126 mgd), with a safe yield of approximately 112 cfs (72 mgd) when one filter bed is out of service for cleaning, one in the ripening phase of operation, and the other beds are in declining rates prior to cleaning.

Transmission

The City's transmission system is composed of an upper and lower system. The upper system starts at Geren Island and ends at the Turner Control master meter located near the City of Turner. From Geren Island, treated water is delivered into twin 69-inch mains that run west on the island. The lines then cross the North Santiam River and terminate at a connection manifold that links the 69-inch mains with transmission lines No. 1 and No. 2. Crossovers between the transmission lines allow either transmission line to feed the twin-cells of Franzen Reservoir, located in the City of Turner. Upper Transmission Line No. 2 also provides service to the City of Turner. The upper system is approximately 9.5 miles long and can deliver a maximum of 113 cfs (73 mgd) to Turner Control.

The lower transmission system starts at Turner Control, which houses the master meters and flow control valves to regulate and distribute flow to the two lower transmission pipelines. The

longer main is approximately 14.7 miles long and terminates at Mountain View Reservoir in west Salem; the shorter main is approximately 7.3 miles long and terminates at Fairmont Reservoir in south Salem. Combined, the lower transmission system can deliver a maximum of 139 cfs (90 mgd), assuming a consistent hydraulic grade line from Franzen Reservoir to Mountain View Reservoir.

Storage

There are 17 reservoirs within the City of Salem service area, as shown in Exhibit 2-27. The reservoirs provide a total storage capacity of approximately 135 MG. Franzen Reservoir contributes 92 MG to the total capacity.

Exhibit 2-27. Summary of System Reservoirs

Reservoir	Max Volume (MG)	Overflow Elevation (feet)	Reservoir Type	Service Level
Franzen[1]	92.0	414.0	Floating Cover	G-0
Fairmont	9.9	333.7	Concrete Tank	G-0
Mountain View	9.9	333.7	Concrete Tank	G-0
Candalaria	0.5	444.0	Concrete Tank	S-1
Mader	1.5	444.0	Steel Tank	S-1
Seeger	1.6	599.0	Steel Tank	S-2
Kurth	1.6	599.0	Steel Tank	S-2
Chacarun	2.0	599.2	Concrete Tank	S-2
Croisan Upper	0.8	599.0	Concrete Tank	S-2
Lone Oak	5.6	599.0	Concrete Tank	S-2
Skyline	1.2	729.0	Concrete Tank	S-3
Glen Creek	2.2	503.0	Concrete Tank	W-1
Grice Hill	2.3	503.0	Concrete Tank	W-1
Eola #1b	0.9	651.0	Concrete Tank	W-2
Eola #2	0.2	780.0	Concrete Tank	W-3
College	0.5	482.0	Steel Tank	T
Champion Hill	2.3	729.0	Concrete Tank	S-3
Total Storage Capacity	135.0			

[1]*Franzen Reservoir was reconstructed in 2004*
Source: City Records

Wells

The City has 20 groundwater wells and four ASR wells, as shown in Exhibit 2-28.

Exhibit 2-28. Municipal Well Characteristics

Well Name	Depth (ft)	Well Diameter (in)	Estimated Pumping Capacity (gpm)
Geren Island Wells			
East Well at Geren Island	60	12	1,250
Middle Well at Geren Island	60	14	not available
West Well at Geren Island	60	16	1,250
Collector Well (Geren Island)	29	n/a	n/a
Infiltration Gallery (Geren Island)	not available	not available	not available
Jan Ree Wells			
Haysville No. 1	N/A	N/A	400[1]
Haysville No. 2	163	10	500
Jan Ree No. 1	220	10	700[1]
Jan Ree No. 2	223	12	700
Jan Ree No. 3	135	8	400
Jan Ree No. 4	215	12	600
Jan Ree. No. 5	190	8	500
Jan Ree No. 6	190	12	700
Jan Ree No. 7	246	10	300[1]
Jan Ree No. 8	201	10	500
West Salem Wells			
Hemlock	270	10	250
Orchard Heights Well	165	8	400
Wallace Road Well	389	12	400
West Salem City Hall Well – West	303	not available	250
West Salem City Hall Well - East	135	not available	200
ASR Wells			
ASR Well #1	315	12	1032[2]
ASR Well #2	330	16	1700-1750[3]
ASR Well #4	327	16	1770-1900[3]
ASR Well #5	350	16	1400-1540[3]

[1]*Lower priority wells to re-activate due to poor accessibility at Haysville No. 1 and higher sand content in Jan Ree No. 1 and Jan Ree No. 7.*

[2]*2009 data*

[3]*Data range indicates ASR well when fully charged at the beginning of the season, to the end of the season, as reported in the 2012 ASR Annual Report.*

Source: Jan Ree and Hemlock wells from City records, all other wells from well logs and registration statements maintained on OWRD website at http://apps.wrd.state.or.us/apps/gw/well_log/Default.aspx

Pump Stations

The City has 19 pump stations, as shown in Exhibit 2-29.

Exhibit 2-29. Summary of Existing Pump Stations

Pump Station	Service Level	# of Pumps	Maximum Capacity (gpm)	Firm Capacity (gpm)
Keizer Intertie	G-0	1	3,500	0
Edwards S1	S-1	3	2,400	1,600
Edwards S2	S-2	3	5,000	3,000
Fairmount S1	S-1	2	1,500	500
Fairmount S2	S-2	2	2,000	1,000
S. River Rd	S-1	4	3,500	2,500
Boone	S-2	3	8,000	4,000
Croisan Lower	S-2	2	430	215
Creekside	S-3	3	4,200	2,800
Skyline	S-3	3	5,400	3,600
Croisan Upper	S-3	3	2,290	490
Skyline #4	S-4	2	180	50
Deer Park	T	3	1,700	850
Jefferson	W-1	2	2,000	1,000
Mountain View	W-1	4	5,200	5,000
Limelight	W-2	3	3,000	2,000
Chatnicka	W-3	3	380	80
Eola #2	W-3	2	850	370
Rockridge	S-3	4	850	450

Distribution System Pipe Sizes

Within the City's service area, water is distributed through a distribution system network consisting of approximately 739 miles of pipe. The distribution system consists of pipe diameters that range from 0.75-inch to 69-inch. Pipe materials are asbestos cement, cast iron, concrete cylinder pipe, ductile iron, polyvinyl chloride (PVC), and steel. The standard for new pipe installed since 1982 is ductile iron. A summary of the pipe inventory is shown in Exhibit 2-30.

Exhibit 2-30. Summary of Pipeline Sizes

Nominal Pipe Size (in)	Total Length (miles)
2	17.9
3	0.7
4	70.1
6	167.8
8	229.9
10	45.8
12	73.1
14	5.0
16	30.2
18	13.6
20	9.2
24	23.2
27	0.3
30	3.7
36	17.4
42	6.0
48	8.3
54	10.2
64	0.5
69	5.1
Total	**738.1**

Source: City draft Water System Master Plan, 2013

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3. Water 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)

Progress Report

The City submitted a WMCP in February 2007 that was approved by the OWRD on June 8, 2009. Exhibit 3-1 shows the conservation measures required by OAR 690-086-0150(4)-(6), the City's five-year benchmarks as described in its 2009 approved WMCP, as well as a progress report for each benchmark.

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Exhibit 3-1. City of Salem Previously Approved 5-year Benchmarks

Conservation Measure	2009 5-year Benchmark	Progress Report
Annual water audit	Conduct a full water audit annually to assess water loss	The City conducts a full water audit annually to assess water loss. Production data for finished water leaving Geren Island are compared to both metered and estimated consumption data. Production data are reported from the SCADA database. Actual metered/billed water and estimates of authorized metered/unbilled and unmetered water consumption are reported in the Hansen database.
	Improve accounting of water uses and losses	The City's water audit calculation and the AWWA methodology for water loss calculations are comparable. Estimates of unmetered use have been improved by increasing coordination with other City Departments and Divisions including the Salem Fire Department, Operations Wastewater Collections, and Operations Stormwater, to track water uses and losses.
System metering		The system is fully metered. The annual budget includes funding for metering new services.
Meter testing and maintenance	Testing, repair or replacement of small meters (i.e., less than 3-inches in diameter) in response to customer complaints or Customer Services requests.	The City tests repairs or replaces small meters in response to customer complaints or Customer Services requests.
	Large meter program to test and repair all large meters	The City tests large meters annually, and repairs or replaces meters as appropriate.
Rate structure based on quantity of water metered	The City rate structure is based in part on the quantity of water metered at service connections.	The City's rate structure continues to be based in part on the quantity of water metered at service connections.
Leak detection program	Conduct leak detection surveys of approximately 20% of the system every year (fully completing the system every five years).	The City has conducted leak detection surveys of 10% of its system every year, fully completing the system every ten years. In 2013, it purchased additional data loggers to survey larger areas and increase accuracy in pinpointing leaks.
Public education	Upgrade website with new conservation information	Website upgrade is currently in progress.
	Continue water conservation and water quality hotline	The City maintains a water quality hotline.
	Attend or sponsor at least two outreach events	Over the last five years, the City has participated in an average of three (non-school related) outreach events per year, including Public Works Day, and the Oregon Groundwater Association's Clean Water Festival.
	Advertise water conservation program	To date, the City has not advertised water conservation programs due to budget restrictions.
	School presentations and tours of water facilities	Over the last five years, the City has provided an average of 10 school presentations and two water facility tours per year upon request.
	One Inch per Week campaign and gauge distribution	The City's successful One Inch per Week lawn watering program is advertised through the Annual Water Quality Report and on the City's website[1]. The program provides lawn watering measuring gauges upon request.
	Include conservation information in the Consumer Confidence Report	Water conservation information is provided in the CCR, which is mailed to all water customers in the City's annual Drinking Water Report.
	Sponsor water conservation calendar and bus ad artwork contests	The calendar contest and the bus ad artwork contest have been discontinued due to lack of participation from the local school district, budget restraints and staffing issues.
	Update portable display for outreach events	The City has not yet completed updating its portable outreach display.
	Distribute information to customers through press releases	The City distributes conservation information through press releases as needed.
	Provide conservation information as bill inserts	The City includes conservation information in bill inserts on an ad hoc basis.
	Develop conservation curriculum for teachers	The City makes Water Education for Teachers (WET) Curriculum books available to teachers in the City's school district.
	Develop conservation materials for businesses	The City has not yet developed conservation materials for businesses.
	Distribute water conservation videos	Two water conservation videos are available upon request: *Saving Tomorrow's Drinking Water Today*, and *Salem's Underground Drinking Water Reserve: Aquifer Storage and Recovery* (which addresses the need for conservation).
	Distribute water conservation brochures	Water conservation brochures are available upon request.
	Distribute student water audit kits to interested classes	Student water audit kits are available upon request.
	Provide a free Water Efficient Plant guide to customers	Water Efficient Plant guides are available upon request.
	Develop partnerships with key stakeholders to combine resources	The City has not yet developed partnerships with conservation-based stakeholders, because of lack of available staff time.
	Develop a demonstration garden at a City park	The City has not yet developed a demonstration garden in a City park.
	Develop Evapotranspiration (ET) educational training program	The City has not yet developed an ET educational training program.
	Distribute meter reading staff door hangers[2]	Customer Services' meter readers leave a door hanger for customers when routine meter reading indicates a possible leak. Door hangers instruct customers to call for more information.
	Distribute leak detection brochures[2]	The City distributes leak detection brochures at outreach events and upon request.
Leak repair or line replacement program	Use Capital Improvement Program (CIP) funds to replace steel or asbestos cement lines	The City continues to prioritize and replace pipe based on numerous criteria. Steel and asbestos cement pipe are the current focus of the program.
	Leak repair and line replacement	Leaks identified by the leak detection program are placed on a schedule to be repaired as a CIP project or by an operations repair crew. (Large-volume leaks are repaired by field crews immediately.)

Conservation Measure	2009 5-year Benchmark	Progress Report
Technical and financial assistance programs	Provide financial rebates for water efficient landscaping tools	Water efficient landscaping tool (e.g., drip irrigation, mulch) rebates have not been provided due to budget constraints and staffing issues.
	Offer irrigation audits to residential customers	Irrigation audits have not been conducted due to budget constraints and staffing issues.
	Sponsor or host landscaping workshops	Landscaping workshops have not been conducted due to budget constraints and staffing issues.
	Provide free publications to water customers	The City provides publications on water-efficient landscaping and watering practices upon request and at outreach events.
	Offer cost-share programs to commercial/industrial customers	Cost-share programs have not been offered due to budget constraints and staffing issues.
	Distribute leak detection surveys[3]	To date, the City has not distributed residential leak detection surveys.
	Distribute leak detection dye tablets [3]	The City provides toilet leak detection dye tablets upon request and at outreach events.
	Distribute drip gauges[3]	The City provides drip gauge cylinders upon request and at outreach events.
	Provide water audit kits to interested residential customers[3]	Residential water audit kits are provided upon request.
Retrofit/ replacement of inefficient fixtures	Offer residential indoor conservation kits	Residential indoor conservation kits are available upon request. Kits may include a flowmeter bag (to measure gallons per minutes used), low-flow showerhead, low-flow kitchen and bathroom faucet aerators, toilet leak detection dye tablets, and an adjustable toilet flapper.
	Offer residential outdoor conservation kits	Residential outdoor conservation kits are available upon request.
	Offer garden hose nozzles at outreach events	The City no longer provides garden hose nozzles at outreach events.
	Offer cost-share program for commercial/industrial	Cost-share programs are not budgeted on a yearly basis, but are available on a case-by-case basis.
	Offer audits for commercial or industrial customers	The City does not offer audits for commercial or industrial customers due to budget constraints and staffing issues.
	Offer retrofit program to multifamily property owners	A retrofit program is available to multifamily property owners upon request. Showerhead and/or aerators are available for smaller multifamily property owners.
Water reuse, recycling, non potable opportunities	Use the Willow Lake Water Pollution Control Facility Natural Reclamation System as a pilot project to determine whether a constructed wetland can provide reuse water for multiple uses	The City used constructed and habitat wetlands to treat approximately 1 MGD of wastewater, which was reused as irrigation water for two seasons.
Rate structure and billing practices to encourage conservation	Utilize customer bills to communicate water conservation information via bill insert	The City provides conservation information on bill inserts on an ad hoc basis.
	Review rate structures that promote water conservation	To date, the City has not reviewed rate structures to promote water conservation.
	Include customer usage history on bills	The City includes water usage history on customer bills.
	Conversion from bi-monthly to monthly billing	The City completed conversion from bi-monthly to monthly billing in 2009.
	Include conservation message on customer bill	The City includes conservation information on customer bills as needed.
Other conservation measures	Conservation staffing	Due to budget issues, the City does not currently have staff dedicated to conservation. Approximately 5 percent of overall department staff time is spent on conservation activities.

[1] http://www.cityofsalem.net/Departments/publicworks/administration/utilityplanning/salemwaterplans/pages/waterconservation.aspx and http://www.cityofsalem.net/Departments/PublicWorks/Operations/Water%20Services/Pages/LawnWatering.aspx
[2] This leak detection conservation measure, as described in the 2009 WMCP, has been reassigned as a public education measure.
[3] This leak detection conservation measure, as described in the 2009 WMCP, has been reassigned and discussed as a technical assistance measure.

Additional Conservation Programs

OAR 690-086-0150(3)

In addition to the above described conservation measures, the City has initiated the following leak detection measures since the 2009 WMCP was approved:

- Increase internal coordination with Wastewater Collections and Stormwater Services:
    - Wastewater Collections utilizes a television inspection crew to inspect sewer mains. When the crew sees infiltration into the pipe that is indicative of a water main leak, the video and location of the infiltration are shared with Water Services for further investigation.

    - Stormwater Services reports areas where stormwater drainage sampling shows a significant presence of fluoride. This information is shared with Water Services for further investigation.
- Internal coordination with Street Bonds Projects. In 2008, the citizens of Salem passed a street/bridge improvement and repair bond. All drinking water pipes below the streets scheduled for repair were evaluated and prioritized based upon size, age, capacity, and known leaks. Main pipes known to leak were included in the high priority category. This coordination effort enabled project funds to be used on pipe repair, since street repair was funded by the bond measure.
- Transmission line surveys. Surveys of the two transmission lines between Geren Island and Turner Control were conducted to evaluate their condition. Approximately one-dozen repairs were initiated following the surveys, and comprehensive rehabilitation of the lines (i.e., slip-lining) is planned. Repairs are estimated to have reduced leakage by 0.2 mgd.
- Isolation valves installed on the 36-inch (Line 1) and 54-inch (Line 2) transmission lines. Prior to installing these isolation valves, whenever maintenance was needed on these transmission lines, they had to be drained along the entire length from Geren Island to Turner Control. The valves provide the ability to dewater only a portion of the lines, thus reducing the need to evacuate the lines. Line 1 was completed in September 2013; Line 2 was completed in November 2013.
- Structural evaluations of finished water reservoirs. Evaluations are conducted annually to confirm structural integrity and include a 48-hour leak test. Recommended repair projects are added into the City's Capital Improvement Program (CIP).

- Relocation of lower transmission line 1. The City relocated a portion of Line 1 under I-5, which had been leaking. The cost for this project was $1.8 million.

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 the amount of water diverted from the North Santiam River using an in-channel flow meter located immediately downstream of the City's water intake. Treated water is measured directly downstream of Geren Island. Additional flow meters measure water within the transmission system, ending at Turner Control.[6] Ground-water use is calculated based upon the pump rating and duration of pumping; ASR well water use is measured by flow meters located at each well.

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 690-086-150(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

During the next five years, the City plans to initiate, continue, or expand the following conservation measures that are required of all municipalities:

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 a full water audit annually, which includes all metered and unmetered authorized consumption. Production data for finished water leaving Geren Island are compared to both metered and estimated consumption data. Production is reported from the City's SCADA database. Consumption data are reported in the "Hansen database," which includes actual metered/billed water use and estimates of authorized/unbilled water used by other divisions within the City. Authorized/unbilled or unmetered water consumption includes fire-fighting, flushing, reservoir draining, street sweeping, and reservoir storage levels including ASR injection. The City's unaccounted for water in FY 2011-2012 was 22.9 percent.

   Water audit calculations are based on the AWWA guidance manual, *Water Audits and Leak Detection*. The manual provides a water audit worksheet to evaluate system water

[6] Meters include: one magnetic flow meter on each of the twin 69-inch water mains, magnetic flow meters on the inlet and outlet pipes measuring water entering and exiting Franzen Reservoir, and three magnetic meters measuring water conveyed through Turner Control. Total flow at Turner Control is calculated by summing the flow from the last three meters.

loss, which ensures that the same method is used annually to provide comparable results.

Five-Year Benchmarks: The City will continue to conduct annual water audits, and evaluate production and consumption data to observe trends for targeting conservation measures. To better account for unmetered, authorized use, the City will continue to coordinate with the following internal departments and divisions to identify and measure the use of the Salem Fire Department, Operations Wastewater Collections, and Operations Stormwater.

2. System-wide Metering.

The City's system is fully metered. Its annual budget includes funding to meter new services.

Five-Year Benchmarks: The City will continue to require all new connections be metered.

3. Meter Testing and Maintenance.

The City currently implements a program to test and repair or replace meters. Large meters (greater than three-inches in diameter) are tested annually, and repaired or replaced as needed. There are approximately 300 large meters within the City's system.

The City's water system also includes approximately 46,000 small meters. The City completed a small meter replacement program in 2005, moving entirely to touch-read or radio-read meters. Based on accuracy testing of the oldest small meters in the system, the City is expecting a 25-year life cycle for small meters. As the end of the life-cycle approaches, the City will begin random meter testing to ensure continued function and accuracy. Small meters will continue to be tested in response to customer or Customer Services request, and will be replaced or repaired if needed.

Five-Year Benchmarks: The City will continue to test and repair or replace large meters annually, and small meters upon customer or City Customer Services request.

4. Water Rate Structure.

City of Salem water customers are billed a water service charge and consumption charge on a monthly basis. The water service charge is billed at a fixed rate based on meter size. The consumption charge is based on the volume of use and customer class. This rate structure promotes conservation by enabling customers to control the largest portion of their bill: the amount of water consumed. A description of the City's monthly service and consumption charges are provided in Exhibit 3-2.

Exhibit 3-2. Monthly Water Service and Consumption Charges, Effective January 1, 2014.

Service Charge (By Meter Size per Connection)	
5/8-3/4"	$ 6.14
1"	$ 6.70
1-1/2"	$ 10.61
2"	$ 15.29
3"	$ 27.78
4"	$ 41.83
6"	$ 80.86
8"	$276.01
10"	$432.13
Consumption Charge (by Customer Class per 100 Cubic Feet)	
Residential (Single Family)	$ 2.50
Multiple Dwelling Units - Individual Meters	$ 2.50
Multiple Dwelling Units - Shared Meter	$ 2.02
Irrigation	$ 4.00
Commercial (Including Fire)	$ 2.06
Industrial	$ 1.45
Institutional	$ 1.75
Public	$ 2.43

Five-Year Benchmarks: The City will continue to bill customers, in part, based upon the metered quantity of water use. It will also periodically review the rate structure to determine the size and timing of future rate increases needed to promote water conservation, fund capital and operating costs, and to achieve other utility objectives.

5. Leak Detection Program.

The City's unaccounted for water in FY 2011-2012 was 22.9 percent[7]. The City has a systematic program to detect and repair leaks in its transmission and distribution system.

The City implements a multi-point leak detection and repair program of its storage and distribution system. Select finished water reservoirs are evaluated annually for structural integrity and leakage. Leak loggers are used to conduct leak surveys of distribution lines[8]. The loggers can also be used to confirm whether leak repairs were performed correctly by immediately testing repaired lines for leakage. Ten percent of the system is surveyed annually, with the entire system surveyed every ten years. The City purchased additional leak loggers in 2013 to survey greater areas and increase accuracy in pinpointing leaks. Loggers record the estimated loss in gallons per minute, the pipe material and size, the location, and the dates the leak was found and repaired.

Potential leaks on the customers' side of the meter are identified during routine customer meter reading. When meter readings record an abnormal increase in water usage from the prior month, City staff notifies the customer of a potential leak and provides technical and financial assistance and/or education measures (see discussion below).

In addition to the logger surveys, Water Services has increased its inter-division coordination to identify additional problem areas. If evidence of infiltration into the sewer is suspected due to a water main break during TV inspections, Wastewater Collections will share this information with Water Services for further investigation. If analyses of stormwater drainage show elevated fluoride concentrations (fluoride is added to the City's drinking water at 0.7 mg/L; it is not found naturally in regional groundwater or surface water), Stormwater Services will share this information with Water Services for further investigation.

Five-Year Benchmarks: The City will continue to survey 10 percent of the system annually, resulting in the entire system surveyed every ten years. Repairs of all reported and detected leaks will continue to be performed in a timely manner. After the new loggers have been installed, the City will evaluate their performance in reducing water loss and investigate the feasibility of purchasing and installing additional equipment for this purpose. The City will also look for additional internal and external coordination opportunities to increase the cost-effectiveness of leak detection. The City's goal is to attain a leakage rate below 10 percent.

6. Public Education.

The City provides water conservation information to its customers through various programs to encourage efficiency, such as low water use landscaping. To reach a range of customer ages and incomes, the City communicates information using the following

[7] As discussed in Section 2, Unaccounted Water in the distribution system consists of system leakage and all unmetered uses not identified as Miscellaneous Water Use (i.e. Finished Water Produced minus Metered Water Consumption by customers and identified Miscellaneous Water Use).

[8] Two loggers are temporarily placed on a pipeline approximately 400 feet apart to detect atypical sounds. Sounds are automatically downloaded to record general trouble areas, and staff use correlators to pinpoint the location of the sound for repair.

media: the City's website (which is currently undergoing upgrades), telephone hotline, local newspaper, topic-specific brochures, bill inserts, and in-person conversations at festivals (at least two are held annually). Between 2008 and 2013, the City conducted or participated in 24 outreach events and festivals, 49 school presentations, and provided nine water facility tours. The City supports school curriculums by providing the following upon request: Water Education for Teachers (WET) books, various water conservation and source water protection videos, school presentations, and water facility tours.

The City's successful One Inch per Week lawn watering program began in 2003 and has been an ongoing program due to significant residential summer water use. As shown in Exhibit 2-15 in Section 2, residential summer water consumption in FY 2011-2012 was 365.7 MG/month, as compared to 178.2 MG/month during winter, and residential consumption was greater than all other customer classes in summer. The program is advertised on the City's website and through the Annual Water Quality Report (which is delivered to all water customers). The City provides lawn watering measuring gauges upon request. Additional outdoor water use information is provided in the Water Efficient Plant guide.

Five-Year Benchmarks: Public outreach has been incrementally reduced due to limited staff resources. The City will continue to implement a small-scale public education program, focused primarily on providing available educational materials for residential customers and schools upon request, and at a limited number of annual festivals.

Expanded Use under Extended Permits

OAR 690-086-0150(5)

Under OAR 690-086-0150(5), any municipal water supplier that proposes to expand or initiate the diversion of water under an extended permit for which resource issues have been identified shall include a description of activities and five-year implementation schedule for a system-wide leak repair or line replacement program to reduce system leakage to no more than 15 percent.

The City intends to initiate diversion of water under extended Permit G-734 for which resource issues have been identified. As previously stated, the City has a system-wide leak repair or line replacement program. The City's unaccounted for water was 22.9 percent. System leakage, however, is less than this amount because unaccounted for water also includes unmetered uses (authorized and unauthorized) that are not identified as miscellaneous water uses. The City's existing leak repair and line replacement program is described in the following section.

Additional Conservation Measures

OAR 690-086-0150(6)

OAR 690-086-0150(6) requires municipal water suppliers that either: (a) serve a population greater than 1,000 and propose to expand or initiate diversion of water under an extended permit for which resource issues have been identified, or (b) serve a population greater than 7,500, to provide a description of the specific activities, along with a five-year schedule to implement several additional conservation measures.

In this case, the City serves a population greater than 7,500. As a result, the City is required to provide activities and five-year benchmarks related to the following additional measures:

1. Leak repair or line replacement program
2. Technical and financial assistance programs
3. Supplier financed retrofit or replacement of inefficient fixtures
4. Rate structure and billing practices that encourage conservation
5. Water reuse, recycling, and non-potable opportunities
6. Other conservation measures

A summary of the City's five-year benchmarks for additional conservation measures is provided below.

1. Leak Repair or Line Replacement Program

Under this requirement, in addition to detecting leaks, the City must implement a system-wide leak repair program or line replacement program to reduce system leakage to 15 percent, and if feasible to 10 percent. The City's unaccounted for water in FY 2011-2012 was 22.9 percent, and system leakage is less than this amount. (Unaccounted for water also includes unmetered and/or unauthorized water uses that are not identified as MWUs.) The City's leak detection program is described above in *Required Conservation Programs.* Once a leak is detected, field crews repair large-volume leaks immediately. Smaller- volume leaks are placed on a schedule to be repaired as a CIP project or by an Operations repair crew. Leaks are prioritized for repair based upon number, size, and severity.

The City continues to replace pipes annually, prioritized by leak history, material type, system vulnerability, pipe size, and intra-utility activities. In the absence of other issues, replacement of steel and asbestos cement pipe is the current focus of the program. Pipes are immediately replaced when failure occurs or during coordination efforts with other City activities, such as with the Street Bond Projects. All pipes are replaced with ductile iron.

Five-Year Benchmarks: The City will continue to survey 10 percent of the system annually, resulting in the entire system surveyed every ten years. Large leaks and failed pipes will be repaired or replaced immediately. Repairing smaller leaks and replacing aging pipes will occur, as needed, based on budget and staff availability. The City will continue to look for internal coordination opportunities to increase the cost-effectiveness of leak detection and repairs. The City's goal is to attain a leakage rate below 10 percent.

2. Technical and Financial Assistance Programs

The City currently provides technical assistance to its customers to help them identify and quantify leaks. Water audit kits are available to residential customers, which include step-by-step guides on calculating water use, toilet leak detection dye tablets, a flow meter bag, and a drip gauge cylinder. Dye tablets demonstrate whether a toilet has a leak, and flow meter bags calculate gallon per minute of water used. Drip gauge cylinders placed under faucets or pipe connections collect and measure dripping water. Based upon the volume of water drops collected over time, the cylinders indicate how much water would be wasted each year if the leak were not repaired. These tools and kits are provided upon request and at outreach events.

In the past, the City sponsored a water conservation grant program to provide a cost-share to match local businesses implementing conservation measures. In 2002, one grant to reclaim and recirculate noncontact cooling water that had been routinely discharged to the City sanitary sewer system yielded an estimated annual water savings of 25-30 million gallons.

Five-Year Benchmarks: During the next five years, the City will continue to provide water audit kits and individual conservation tools upon request. Although the City does not budget funds specifically for the water conservation grant program, proposed projects are evaluated on a case-by-case basis and funded if the project has demonstrable benefits to the City and customer.

3. Supplier Financed Retrofit or Replacement of Inefficient Fixtures

Residential indoor and outdoor water conservation kits are provided to City customers upon request. The kits are advertised on the City's website, at outreach events, and in the Annual Water Quality Report and other City publications. Indoor kits may include water-efficiency tools and fixtures, such as a flow meter bag (to calculate gallons per minute of water used), low-flow showerheads, low-flow kitchen and bathroom faucet aerators, toilet leak detection dye tablets, and an adjustable toilet flapper. Low-flow showerheads and faucet aerators are also offered upon request to small multi-family property owners. Outdoor conservation kits may include garden hose repair ends, a lawn watering gauge, and a garden hose nozzle seal.

Five-Year Benchmarks: During the next five years, the City will continue to provide residential indoor and outdoor conservation kits upon request. The City will evaluate the feasibility of resuming cost share programs for replacing inefficient fixtures for commercial/industrial customers or multifamily property owners, if budget and staff availability permit.

4. Rate Structure and Billing Practices that Encourage Conservation

As previously described, the City's billing consists of a water service charge that is a fixed rate based on meter size and a water consumption charge based on customer class and the volume consumed. The City converted from bi-monthly to monthly billing in 2009, providing customers with timely feedback on their water consumption and related cost savings. Monthly billing allows customers to potentially change their water usage within a relatively short period.

The City implements the following additional billing practices to encourage water conservation:

- Reporting customer water use history on monthly bills to compare usage over the course of the current year and previous years
- Periodically including bill inserts to communicate conservation information
- Printing short water-saving messages on the bills

Water use history can raise awareness about potential leaks because they can reveal unexplained increases in water use. Bill inserts and other forms of communication provide the opportunity for consistent reminders to conserve.

Five-Year Benchmarks: The City will continue to bill customers using a rate structure based in part on water use. The City will continue to bill its customers on a monthly schedule and to include water use histories in those bills. The City will continue to periodically include water conservation-themed bill inserts and messages.

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

The City uses untreated well water, instead of treated potable water, to irrigate a golf course driving range on City property. Approximately 5.0 to 5.5 million gallons of treated water are conserved each season through use of this non-potable water supply. The City also uses groundwater from wells located at two City parks for irrigation purposes.

Five-Year Benchmarks: The City will continue to use untreated groundwater to irrigate the driving range and the two City parks.

6. Other Conservation Measures

Other conservation measures the City implements are:

- *Conservation staffing*. The City allocates approximately five percent of its department-wide staff resources toward implementing conservation measures.
- *Evapotranspiration modeling*. The City Parks Department uses a computer model to determine evapotranspiration rates and help direct the amount of irrigation water that should be applied to its grounds.

Five-Year Benchmarks: The City will consider requiring its wholesale customers to develop WMCPs, or in the case of Suburban East Salem Water District, to update its WMCP, before renewing their wholesale agreements to encourage them to conserve water. Due to budget limitations, the City will continue to allocate resources at current levels toward implementing conservation measures, focusing primarily on leak detection, line and meter repair and replacement, and the annual water audit. The City will also continue to provide resources on residential water use education, particularly related to peak season outdoor water use.

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4. Municipal Water Curtailment Element

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 supplies during short-term water supply shortages. The intent of water curtailment planning is to minimize the impacts of water supply shortages, which may result from incidents such as: prolonged drought, mechanical or electrical equipment failure in the system, unanticipated catastrophic events (flooding, landslides, earthquakes and contamination), or events not under control of the water supplier (e.g., localized or area-wide power outages and intentional malevolent acts).

History of System Curtailment Episodes

OAR-690-086-0160(1)

Over the last ten years, Salem has experienced one curtailment episode that stemmed from a series of events. The curtailment event occurred in July 2009 and was caused by the following conditions and events: typical high summer water demands; reduced storage capacity as a result of required reservoir repairs; reduced production at Geren Island as a result of an algae bloom in Detroit Reservoir on the North Santiam River; and reduced supply (i.e., flow) as a result of gate failures at Big Cliff Dam (also on the North Santiam River). A Level 2 curtailment was issued on July 28, 2009 and lasted through August 2, 2009. The following measures were implemented:

1. Customers were requested to suspend outdoor water uses, including car washing, sidewalk and patio cleaning, and residential lawn and turf watering. Garden watering was permitted.
2. The City suspended irrigation at City parks. Watering of sensitive areas and areas actively being used for tournaments was permitted.
3. The City suspended water supply to decorative fountains. Splash pads were kept in operation for recreation, to encourage citizens to use these facilities rather than residential irrigation systems.

Backup water supplies exist in the form of interties with other water providers, groundwater and the City's ASR system. Interties with the Cities of Stayton and Keizer can provide up to 10 cfs (6.5 mgd) to the City of Salem; however, agreements with the cities do not guarantee water during an emergency event. ASR wells can provide up to 12.7 cfs (8.2 mgd) of treated drinking water, and local wells can provide up to an additional 1.55 cfs (1 mgd). The Jan Ree well field has a maximum capacity of approximately 12 cfs (7.8 mgd), but would require three to four weeks to activate the wells. Utilizing all of these available backup resources, the City could

produce up to 36.25 cfs (23.5 mgd) (including the Jan Ree wells). This is compared to an average day demand of finished water over the five-year period from 2007-2012 of 27.7 mgd.

Future curtailment episodes could occur as a result of significant drought affecting North Santiam River flow, failure of aging infrastructure, flooding and high turbidity events affecting filtration at Geren Island, system wide earthquake damage, or other catastrophic events that may affect water supply.

Curtailment Event Triggers and Stages

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

The City developed a multi-level curtailment plan to describe the standards and procedures that will be employed in the event of a water shortage. The curtailment plan is designed to ensure that essential water delivery can be maintained in the event of limited water supply.

The levels are designed to be initiated and implemented in progressive steps. The plan includes both voluntary and mandatory rationing depending on the cause, severity, and anticipated duration of the shortage.

Exhibit 4-1 presents the four curtailment levels and their initiating conditions (i.e. triggers). The City's initiating conditions focus on a minimum available storage (85 million gallons), and a descending supply to demand ratio. If minimum available storage falls below 85 million gallons, the following curtailment stages are triggered based upon the supply to demand ratio.

Exhibit 4-1. Curtailment Levels 1 through 4.

Curtailment Stages	Initiating Conditions: If minimum available storage is below 85 million gallons and there is a:
Level 1: Alert	• Rolling five day average when supply is 90% to 95% of demand
Level 2: Voluntary Curtailment	• Rolling five day average when supply is 80% to 89% of demand
Level 3: Mandatory Curtailment	• Rolling five day average when supply is 70% to 79% of demand
Level 4: Severe Curtailment	• Rolling five day average when supply is below 69% of demand

Curtailment may also be triggered by a catastrophic event such as toxic contamination of the City's surface water supply, or a natural disaster or similar event that prevents Geren Island or the transmission system from operating for an extended period of time. If such an event occurs, the City will implement its Emergency Operations Plan (2004). This plan also covers other significant water supply issues such as treatment plant flooding and pipeline breaks.

Authority and Enforcement

When the City approaches curtailment-initiating conditions, the Curtailment Action Team (CAT) convenes to assess the significance of the conditions and the need for curtailment. The CAT makes recommendations regarding curtailment implementation, including the curtailment level, amount of time curtailment, and curtailment measures. These recommendations are

provide to the Director of Public Works (Director), who is authorized to implement the curtailment plan. Measures within the plan may be applied to the entire system, or only to specific water-use sectors or geographic areas that are affected by any water supply shortage. All plan provisions remain in effect until the Director terminates the curtailment measure(s). The Director has the authority to enforce the plan and may suspend water service to any customer that fails to abide by its provisions. The Director will consult with the City Manager before implementing certain actions, as noted in the following section.

Curtailment Plan Implementation

OAR-690-086-0160(4)

Under the authority of the Director, the City notifies affected parties that curtailment measures are to be implemented. Generally both retail and wholesale customers are notified, as well as City staff charged with managing water use. Under the City's IGAs with the City of Turner and Orchard Height Water District, the City can limit supply to these wholesale customers when it is limiting water supply to its retail customers, thereby requiring curtailment by all of these customers. Curtailment measures include three components: public education, actions by the City, and actions by customers.

Level 1: Alert

When a Level 1 Alert is activated, as defined by the conditions in Exhibit 4-1, retail and wholesale customers are notified of a potential water supply shortage. If conditions persist, customers may be asked to voluntarily reduce their water use. Notifications are made using various media methods as indicated below. Potential curtailment measures include:

- Public education
  - Utilize the City website and water quality hotlines to disseminate information about potential water shortage issues.
- City actions
  - Activate the Curtailment Action Team (CAT).
  - Develop messages for water conservation and media outreach materials including press releases and website information.
  - Provide conservation brochures at key City offices.
  - Begin preparations for possible operational changes to supplement water supply.
- Customer actions
  - Encourage customers to use water wisely. Provide messages through television, local news, the conservation and water quality hotlines, website, radio, social media, and town meetings, as needed.

Level 2: Voluntary Curtailment

Activation of Level 2 Voluntary Curtailment escalates notification messages from a potential shortage to an actual shortage, although the messages continue to focus on voluntary measures for customers. City water customers are notified of voluntary curtailment measures using various media methods as indicated below. Wholesale customers, top water users, City Council members, and the Oregon Water/Wastewater Agency Response Network (OrWARN) are also notified. Potential curtailment measures include:

- Public education
    - Update the City of Salem website, and water conservation and water quality hotlines to notify customers of voluntary curtailment and to disseminate water conservation information.
    - Coordinate with various media sources to provide current information on the water supply shortage; deliver media releases to appropriate media sources.
    - Remind water customers of Salem's water waste ordinance, as detailed in SRC 72.240.
- City actions
    - Reduce watering at City facilities and/or parks as determined by the City Manager.
    - Discontinue operating City decorative fountains that do not recirculate water.
    - Reduce operating hours of the City's splash fountains.
    - Limit City hydrant and water line flushing to essential needs for safety and human health.
    - Prohibit City-staff from washing sidewalks, walkways, streets, driveways, parking lots, or other hard surfaces except where necessary for public health or safety.
    - Discontinue washing City vehicles.
    - Restrict using City-supplied water for street sweeping.
    - Activate available backup water supplies.
- Customer actions
    - Request that City water customers voluntarily reduce outdoor water uses such as lawn watering, car washing, patio cleaning, etc.

Level 3: Mandatory Curtailment

Implementation of a Level 3 Mandatory Curtailment indicates a critical water supply shortage. The Director has the authority to activate mandatory restrictions. City water customers are notified of mandatory curtailment requirements using all major media sources and are updated regularly. Wholesale customers, top water users, City Council members, and OrWARN are also notified, and the City's Emergency Operations Center is prepared for activation. Potential curtailment measures include:

- Public education
    - Provide updates on the status of the water situation to the media daily until the Level 3 alert is canceled.
    - Update the City website, including the water quality and water conservation hotlines, with current water situation updates.
    - Remind water customers of Salem's regulation that prohibits water waste.

- City actions
    - Further reduce/restrict watering City facilities and/or parks as determined by the City Manager.
    - Discontinue operating all City decorative and splash fountains.
    - Restrict City hydrant and water line flushing to emergency use only.
    - Restrict City Fire Department training exercises to those that do not use water.
- Customer actions
    - Enact mandatory restrictions on all lawn watering and other non-essential water uses.
    - Prohibit use of City-supplied water to wash sidewalks, walkways, streets, driveways, parking lots, or other hard surfaces except where necessary for public health or safety.
    - Prohibit use of City-supplied water to wash vehicles and boats.
    - Prohibit use of City-supplied water for cleaning, filling, or maintaining levels in decorative fountains.
    - Prohibit use of City-supplied water to fill swimming pools or other pools.
    - Prohibit use of City-supplied water on all golf courses, except as needed to keep greens and tee boxes alive.

Level 4: Severe Curtailment

Implementation of a Level 4 Severe Curtailment also indicates a critical water supply shortage and activates mandatory restrictions to limit water use to only essential uses. City water customers are notified using all major media sources. Wholesale customers, top water users, and City Council members are also notified. Wholesale customers are asked to comply with curtailment measures. The Emergency Operations Center is activated if determined necessary by the City Manager. Potential curtailment measures include:

- Public education
    - Provide updates on the status of the water situation to the media daily until the Level 4 alert is canceled.
    - Update the City website, and water quality and water conservation hotlines with current water situation updates.
    - Notify customers regarding Salem's waste water ordinance. Prohibit all non-essential water use according to SRC 72.250. Violators may be cited and water service may be interrupted for repeat violations per SRC 72.260.
- City actions
    - Restrict all uses of City -supplied water to essential uses only, such as consumption, maintaining human health, and fire-fighting. Prohibit all non-essential uses and enforce under the City's ordinances.
- Customer actions
    - Restrict all uses of City -supplied water to essential uses only, such as consumption, maintaining human health, and fire-fighting. Prohibit all non-essential uses and enforce under the City's water waste ordinance.
    - Restrict water usage by large industrial and institutional customers, except for fire protection and other critical functions as determined by the City Manager.

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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 their 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 future water service area, which includes areas within the City's Urban Growth Boundary (UGB). The exhibit also shows the City of Keizer, which is within the UGB but is not considered a future water service area.

Population Projections

OAR 690-086-0170(1)

The City's population projections were developed by applying constant growth rates to existing populations within three areas served by the City: west Salem, east Salem, and the City of Turner. The population within west Salem was increased using an annual growth rate of 2.36 percent, and the east Salem population was increased by 1.18 percent annually. (The Willamette River divides the City's UGB between west Salem and east Salem.) Finally, the City of Turner's population was increased by 3.63 percent each year. Population estimates utilize existing population data and population growth rate data provided by the SKATS, as cited in the "City of Salem 2013 Water Demand Analysis and Projection" draft report.

Exhibit 5-1 presents the current populations of the three major areas served by the City, as described above, and their projected growth rates.

Exhibit 5-1. Current Population Distribution and Projected Growth Rates, as of July 1, 2012.

Salem-Keizer Area Transportation Study (SKATS) Population Distribution			*Growth Rate*
Area	**% City Population**	**Estimated Population**	**2010-2035**
West Salem	12%	22,320	2.36%
East Salem	88%	163,683	1.18%
City of Turner[(1)]	--	1,860	3.63%
Total		187,863	

[(1)] Population data from Portland State University's Center for Population Research and Census (www.pdx.edu/prc) as of July 1, 2010 the latest available as of this analysis.

Exhibit 5-2 presents the 10-year and 20-year population estimates.

Exhibit 5-2. Projected Future Water Service Area Population.

Year	West Salem	East Salem	City of Turner	Total
2012	22,320	163,683	1,860	187,863
2013	22,846	165,614	1,928	190,388
2014	23,384	167,568	1,998	192,950
2015	23,935	169,545	2,070	195,550
2016	24,499	171,545	2,145	198,189
2017	25,076	173,569	2,223	200,868
2018	25,667	175,617	2,304	203,588
2019	26,271	177,689	2,387	206,348
2020	26,890	179,786	2,474	209,150
2021	27,524	181,907	2,564	211,994
2022	28,172	184,053	2,657	214,882
2023	28,836	186,224	2,753	217,814
2024	29,515	188,422	2,853	220,790
2025	30,210	190,645	2,957	223,812
2026	30,922	192,894	3,064	226,880
2027	31,651	195,170	3,176	229,996
2028	32,396	197,472	3,291	233,159
2029	33,159	199,802	3,410	236,372
2030	33,941	202,159	3,534	239,634
2031	34,740	204,545	3,662	242,947
2032	35,559	206,958	3,795	246,312
2033	36,396	209,400	3,933	249,729
2034	37,254	211,870	4,076	253,200

Demand Forecast

OAR 690-086-0170(3)

The City developed water demand projections for inclusion in its next update of the Water System Master Plan. These projections are documented in the 2013 Water Demand Analysis and Projection draft report. The City based its demand projections on a five-year rolling average of average day consumption (ADC) for FY 2007-2008 through FY 2011-2012, and incorporated six trends that affect demand, as described below.

Trend 1 - Population Growth. Previously described.

Trend 2 - Industrial Growth

Water demand related to employment is the demand from commercial, industrial, and public customer classes. Mid-Willamette Valley Council of Governments and SKATS provides an annual compounding employment growth rate to 2035.

Trend 3 - Change in Per-Capita Consumption

The per capita water consumption trend used in the determination of projected water demands is the average daily residential winter consumption over five years divided by the total 2010 population. (The trends in water use by non-residential customers are treated separately and have growth figures applied as part of Trend 2.) For the purposes of this demand forecast, indoor residential water consumption is assumed to be reduced by 25 percent over time through 2110.

Trend 4 - Change in Irrigation Use

The City anticipates that the irrigation rate will increase over time, from the estimated average irrigation rate of 0.58 inches of water per week applied on designated irrigable land from FY 2007-2008 through FY 2011-2012 to 0.65 inches of water per week over a 30-year period. This conclusion is primarily based on the increasing use of automated irrigation systems on newly developed property. Automated systems tend to apply more water than non-automated irrigation methods, likely due to their application of consistent irrigation rates and typical installation on properties with larger landscaped areas.

Trend 5 - Miscellaneous Water Use

The quantity of miscellaneous water use (MWU) in the analysis period (FY 2007-2008 through FY 2011-2012) is 0.58 mgd. The ratio of MWU to average day consumption is expected to remain constant during the planning period.

Trend 6 - Unaccounted for water in the delivery system

For projection purposes, unaccounted for water is represented as a percentage of ADC, which equated to a quantity of 5.26 mgd during the period FY 2007-2008 through FY 2011-2012. This value is projected to decrease over the next 30 years to 8.5 percent. This 8.5 percent value is based on a City-goal to attain a leakage rate below 10 percent.

The demand projections were developed using the following process:

1) Apply Trends 1, 2, and 3 to ADC from 2007-2012 then add that value and Trend 4 to produce projected ADC.

2) Add projected ADC to Trends 5 and 6 to produce projected ADD leaving Geren Island.
3) Multiply projected ADD leaving Geren Island and a MDD/ADD peaking factor to produce projected MDD leaving Geren Island and entering the transmission system.

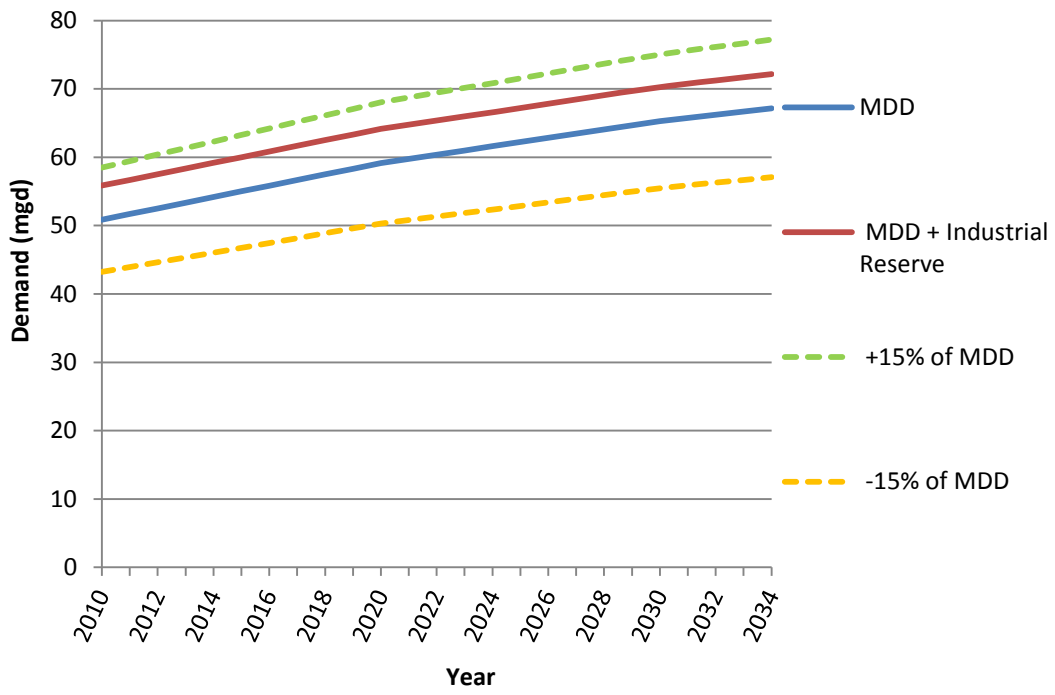
To account for uncertainty in the data and application of the trends, range factors of +/-15 percent of mean demand projection values were calculated to plan for a potential range in future water demands. The City chose this range to capture annual variability in MDD, and based it on observed variability to date, such as when MDD was more than 15 percent greater than the mean in FY 2009-2010. In addition, the City added an Industrial Reserve allowance of five mgd to the demand projections for new industries that the City hopes to attract. The Industrial Reserve is held constant during the planning period. (The addition of the Industrial Reserve to the demand projection falls within the +/- 15 percent range described above; Industrial Reserve was not considered to be additive to the 15 percent variable.) The City intends to ensure the availability of the upper limits of the demand range to ensure that the Industrial Reserve will always be met. The projections represent MDD growth under a relatively steady growth scenario.

Exhibit 5-3 and Exhibit 5-4 present the City's 10-year and 20-year demand projections.

Exhibit 5-3. Projected Future MDD.

Year	Unit	MDD	MDD + Industrial Reserve	-15% of MDD	+ 15% of MDD
2024	mgd	61.6	66.6	52.4	70.8
	cfs	95.3	103.0	81.0	109.6
2034	mgd	67.1	72.1	57.1	77.2
	cfs	103.9	111.6	88.3	119.4

Exhibit 5-4. Projected Future MDD.



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 holds five municipal water rights for use of up to 239 cfs from the North Santiam River, which is diverted at Geren Island. The City also holds five water rights (four groundwater registrations and Permit G-734) authorizing the appropriation of up to 52.23 cfs of groundwater at Geren Island. However, the capacity of the transmission line leaving Geren Island is currently limited to 102 cfs.

In addition, the City holds Permit S-45565 and SW-626 for use of up to 210 cfs from the Willamette River. The City does not currently have the infrastructure in place to utilize the Willamette River source.

The City has an immediate demand for all of the water under Permit G-734. The Geren Island treatment plant cannot effectively treat North Santiam River water during high turbidity events (which primarily occur during winter and spring) or during algal fouling events (which primarily occur during summer). To meet its demands during algal fouling or high turbidity events, the City must use groundwater at Geren Island. Currently, the City only has access to its four Geren Island groundwater registrations, which total 22.23 cfs, to provide supply redundancy. As described in Section 2, the City's other groundwater rights are currently not in use or are used only for emergency purposes due to water quality concerns. These other groundwater rights would not typically be used during a high turbidity or algal fouling event. Further, the City's ASR system presently has pumping rates that range from 7 cfs to 12 cfs during the recovery period. Thus, the City does not currently have access to a sufficient groundwater supply to meet its maximum day demands. (The City's FY 2007-2008 MDD was 54.07 mgd (83.6 cfs).) Consequently, the City needs access to the full 30 cfs under Permit G-734 to increase its redundant groundwater supply from Geren Island to help meet its MDD during an algal fouling event. The City is, therefore, requesting access to 30.0 cfs of "green light water" under *extended permit* G-734.

The City projects that MDD in 2034 will range between the projected MDD of 103.9 cfs and 119.4 cfs, which is the projected demand plus the 15 percent variable. As previously described, the City's demand projections encompass a range based on the annual variability in MDD that the City has experienced to date. This projection is for finished water leaving Geren Island and entering the transmission system. Additional demand at the source (North Santiam River) is required, based on the need for process water at Geren Island.

The North Santiam River is the City's primary water source. Although its North Santiam surface water rights are sufficient to meet the projected MDD in 2034, as described in Section 2, its transmission capacity from Geren Island is currently limited to 102 cfs. The City can also obtain approximately 7 to 12 cfs from its ASR system, which results in a current total supply of 109 to 114 cfs. Thus, the City's current supply could be insufficient to meet its projected 2034 MDD with the 15 percent variance. However, the City will seek to expand the capacity of its transmission lines from Geren Island when MDD approaches the limitations on its system capacity.

The City intends to use its Willamette River supply to provide redundancy for its North Santiam River supply and to meet future demands. Similar to many other municipal water

providers, the City is taking steps to increase the security of its water supply following a large-scale earthquake. The City's extensive transmission system from Geren Island is vulnerable to serious damage by a large-scale earthquake, which would leave the City without sufficient water supply. Having the Willamette River as a redundant source will greatly increase the reliability of the City's water supply.

The City will meet its needs for redundancy and additional supply to meet future demands by developing Permit S-45565 for the use of up to 200 cfs from the Willamette River. Over the long-term, the City intends to develop 102 cfs under Permit S-45565 to provide a redundant water supply for the City's North Santiam River water system. (This development will likely occur in phases, with the initial increment of development likely being in an amount necessary to meet average day demands.) Permit S-45565 will also provide redundancy for the City's ASR system, which the City uses to meet peak demands or during water supply emergencies. (A small portion of Permit S-45565 will also be required for operating the Willamette River water treatment plant.) The City will use the remaining portion of Permit S-45565 to meet additional future water demand.

The City projects that its MDD (with a 15 percent variance) will be approximately 201 cfs by 2086. If the City's North Santiam River supply and its ASR system were not available for use, the City will need to meet this demand by using the entire 200 cfs under Permit S-45565. As a result, the City projects that all of Permit S-45565 will be needed by as early as 2086. (The City does not plan to rely on developing SW-626 initially because the reliability of this surface water registration is not known until the Willamette Basin is adjudicated.) If the City was unable to increase the capacity of the transmission lines leaving Geren Island, it would rely on Permit S-45565 to meet more of its MDD in the near-term.

To use its Willamette River water rights, the City will need to build a water treatment plant and associated infrastructure. During this 20-year planning period, the City will be taking steps towards developing the Willamette River as a water supply source, including planning for the required funding resources, and developing water treatment plant options and alternatives, and evaluating other engineering considerations.

Alternative Sources

OAR 690-086-0170(5)

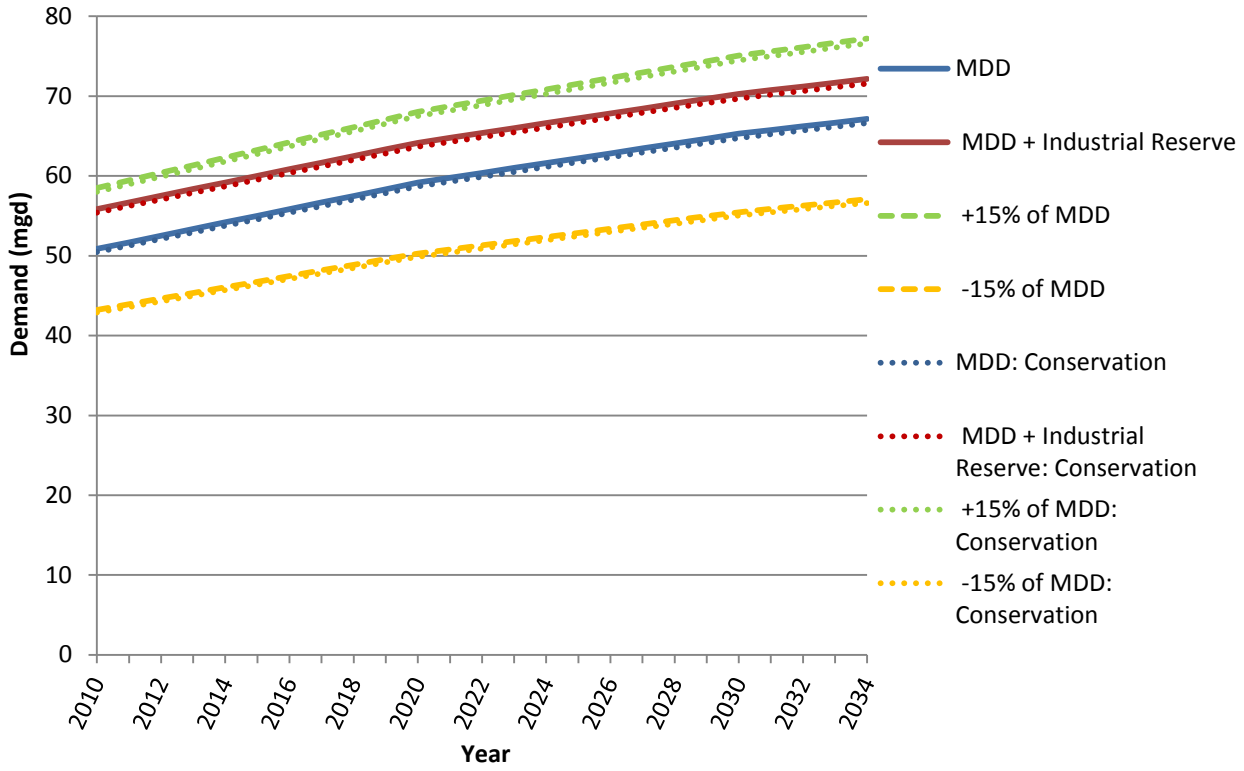
OAR 690-086-0170(5) requires an analysis of alternative sources of water if any expansion or initial diversion of water allocated under existing permits is necessary to meet future water demand. During the 20-year planning period, the City intends to expand diversion of Permit G-734. The following subsections analyze the extent to which the projected water needs can be met through other alternatives.

(a) Conservation Measures

As described in Section 3, the City has been implementing a variety of water conservation measures to increase water conservation by its customers. ADD, MDD, and seasonal water demand in summer months have shown a decreasing trend over the past five years, which is attributable to some extent to the City's conservation measures. The City plans to continue its conservation programs and to monitor water use by customers. For demonstration purposes for this WMCP, the City has estimated how conservations savings of up to 0.8 percent could

affect future demand. The City's estimate of 0.8 percent conservation is based on Tualatin Valley Water District's (TVWD) conservation savings goal, which was derived from observed results of TVWD's aggressive, well-funded conservation program. Exhibit 5-5 presents demand projections when 0.8 percent conservation is achieved annually.

Exhibit 5-5. Projected MDD with 0.8 Percent Conservation



Water conservation may delay the need for additional future water supply, but it cannot address the City's immediate need to use groundwater under Permit G-734 as a redundant supply when high turbidity in the North Santiam River precludes the City's use of its surface water rights.

(b) Interconnections

As described in Section 2, the City has interconnections with the City of Stayton and the City of Keizer. However, these connections only allow the Cities of Stayton and Keizer to provide a limited amount of water to the City when there is surplus water available. There are no other neighboring municipalities that could provide water to meet the City's future water demands. Consequently, the City cannot rely on additional interconnections with other water suppliers to increase its system redundancy or to meet its future water demands.

(c) Cost effectiveness

OAR 690-086-170(c) requires an assessment of whether the projected water needs can be satisfied through other conservation measures that would provide water at a cost that is equal or less than the cost of other identified sources.

As described above, conservation, regardless of the cost, cannot meet the City's need to increase its system redundancy during high turbidity events in the North Santiam River. Given that the City has infrastructure in place to use all of Permit G-734, expanding use of Permit G-734 is a cost effective option for meeting the City's need for a redundant water supply.

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. Within the next 20 years, the City is planning to need 30 cfs under Permit G-734 to provide system redundancy. Assuming that the water right is used at 30 cfs (19.4 mgd), 24 hours per day for 31 days during the maximum month (likely July or August), the maximum monthly volume for the water right would be approximately 601.4 MG.

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 required to describe mitigation actions it is taking to comply with legal requirements of the Endangered Species Act, Clean Water Act, and other applicable state and federal environmental regulations. The City currently is not required to take any mitigation actions under state or federal law. However, Permit G-734 is conditioned (based on advice from the Oregon Department of Fish and Wildlife [ODFW]) to maintain the persistence of listed fish in the North Santiam River.

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. As shown in the above analysis, the water rights held by the City are sufficient to meet projected demands during the next 20 years. Consequently, the City does not plan to acquire additional water rights within that timeframe.

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6 References

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APPENDIX A

Local Government Letters and Responses

CITY OF Salem
AT YOUR SERVICE
PUBLIC WORKS DEPARTMENT
555 Liberty Street SE / Room 325 • Salem OR 97301-3513 • Phone 503-588-6211 • Fax 503-588-6025

May 8, 2014

Glenn Gross, Director
Community Development Department
City of Salem
555 Liberty Street SE, Room 305
Salem OR 97301

SUBJECT: **Water Management and Conservation Plan for the City of Salem**

Dear Mr. Gross:

The City of Salem 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, water suppliers must make the Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. The enclosed CD contains the City's Draft WMCP for your review.

Please provide comments within 30 days from the date of this letter. If the plan appears consistent with your agency's Comprehensive Land Use Plan, a written response to that effect would be appreciated. You may send your comments to me.

If you have questions, please contact me at 503-588-6008. Thank you for your interest.

Sincerely,

Peter Fernandez, P.E.
Public Works Director

JP/TLC/:G:\GROUP\DIRECTOR\JUDY\2014 CORRESP\LOCAL GOVT LETTERS.DOCX
Enclosure: City of Salem Draft WMCP (CD)
cc: Jason Pulley, Utilities Planning Manager
File

Engineering Division
Parks and Transportation Services Division
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Salem OR 97301-3513
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Fax 503-588-6025

Operations Division
1410 20th Street SE / Building 2
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CITY OF Salem
AT YOUR SERVICE
PUBLIC WORKS DEPARTMENT
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May 8, 2014

Nate Brown
City of Keizer Planning and Zoning Department
930 Chemawa Road NE
Keizer OR 97303

SUBJECT: **Water Management and Conservation Plan for the City of Salem**

Dear Mr. Brown:

The City of Salem 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, water suppliers must make the Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. The enclosed CD contains the City's Draft WMCP for your review.

Please provide comments within 30 days from the date of this letter. If the plan appears consistent with your agency's Comprehensive Land Use Plan, a written response to that effect would be appreciated. You may send your comments to me.

If you have questions, please contact me at 503-588-6008. Thank you for your interest.

Sincerely,

Peter Fernandez, P.E.
Public Works Director

JP/TLC/:G:\GROUP\DIRECTOR\JUDY\2014 CORRESP\LOCAL GOVT LETTERS.DOCX
Enclosure: City of Salem Draft WMCP (CD)
cc: Jason Pulley, Utilities Planning Manager
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CITY OF Salem
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May 8, 2014

David Sawyer, City Administrator
City of Turner
PO Box 456
Turner OR 9739

SUBJECT: **Water Management and Conservation Plan for the City of Salem**

Dear Mr. Sawyer:

The City of Salem 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, water suppliers must make the Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. The enclosed CD contains the City's Draft WMCP for your review.

Please provide comments within 30 days from the date of this letter. If the plan appears consistent with your agency's Comprehensive Land Use Plan, a written response to that effect would be appreciated. You may send your comments to me.

If you have questions, please contact me at 503-588-6008. Thank you for your interest.

Sincerely,

Peter Fernandez, P.E.
Public Works Director

JP/TLC/:G:\GROUP\DIRECTOR\JUDY\2014 CORRESP\LOCAL GOVT LETTERS.DOCX
Enclosure: City of Salem Draft WMCP (CD)
cc: Jason Pulley, Utilities Planning Manager
File

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May 8, 2014

Dan Fleishman, Planning and Development Director
City of Stayton
362 N 3rd Avenue
Stayton OR 97383

SUBJECT: **Water Management and Conservation Plan for the City of Salem**

Dear Mr. Fleishman:

The City of Salem 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, water suppliers must make the Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. The enclosed CD contains the City's Draft WMCP for your review.

Please provide comments within 30 days from the date of this letter.. If the plan appears consistent with your agency's Comprehensive Land Use Plan, a written response to that effect. would be appreciated. You may send your comments to me.

If you have questions, please contact me at 503-588-6008. Thank you for your interest.

Sincerely,

Peter Fernandez, P.E.
Public Works Director

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Enclosure: City of Salem Draft WMCP (CD)
cc: Jason Pulley, Utilities Planning Manager
File

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CITY OF Salem
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May 8, 2014

Austin McGuigan, Planning Director
Polk County
850 Main Street
Dallas OR 97338

SUBJECT: **Water Management and Conservation Plan for the City of Salem**

Dear Mr. McGuigan:

The City of Salem 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, water suppliers must make the Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. The enclosed CD contains the City's Draft WMCP for your review.

Please provide comments within 30 days from the date of this letter. If the plan appears consistent with your agency's Comprehensive Land Use Plan, a written response to that effect would be appreciated. You may send your comments to me.

If you have questions, please contact me at 503-588-6008. Thank you for your interest.

Sincerely,

Peter Fernandez, P.E.
Public Works Director

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Enclosure: City of Salem Draft WMCP (CD)
cc: Jason Pulley, Utilities Planning Coordinator
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May 8, 2014

Warren Jackson
Marion County Planning Division
5155 Silverton Road NE
Salem OR 97305

SUBJECT: **Water Management and Conservation Plan for the City of Sale**

Dear Mr. Jackson:

The City of Salem 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, water suppliers must make the Draft WMCP available for review by affected local governments and seek comments relating to consistency with the local governments' comprehensive land use plans. The enclosed CD contains the City's Draft WMCP for your review.

Please provide comments within 30 days from the date of this letter. If the plan appears consistent with your agency's Comprehensive Land Use Plan, a written response to that effect would be appreciated. You may send your comments to me.

If you have questions, please contact me at 503-588-6008. Thank you for your interest.

Sincerely,

Peter Fernandez, P.E.
Public Works Director

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cc: Jason Pulley, Utilities Planning Coordinator
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CITY OF Salem
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May 8, 2014

Bruce Carnine, General Manager
Suburban East Salem Water District
3805 LaBranch Street SE
Salem OR 97317

SUBJECT: **Water Management and Conservation Plan for the City of Salem**

Dear Mr. Carnine:

The City of Salem 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 is required to make its Draft WMCP available for review by affected local governments. As a courtesy, the City will send you a Draft WMCP at your request.

If you have questions or would like a copy of the City's WMCP, please contact Jason Pulley, Public Works Utilities Planning Coordinator, at 503-588-6398.

Sincerely,

Peter Fernandez, P.E.
Public Works Director

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cc: Jason Pulley, Utilities Planning Coordinator
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May 8, 2014

Doug Priest, Water Operations Manager
Orchard Heights Water Association
PO Box 5196
Salem OR 97304

SUBJECT: **Water Management and Conservation Plan for the City of Salem**

Dear Mr. Priest:

The City of Salem 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 is required to make its Draft WMCP available for review by affected local governments. As a courtesy, the City will send you a Draft WMCP at your request.

If you have questions or would like a copy of the City's WMCP, please contact Jason Pulley, Public Works Utilities Planning Coordinator, at 503-588-6398.

Sincerely,

Peter Fernandez, P.E.
Public Works Director

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cc: Jason Pulley, Utilities Planning Coordinator
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Marion County
OREGON

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SURVEY

May 16, 2014

Peter Fernandez, P.E.
City of Salem Public Works Director
Via email to: pfernandez@cityofsalem.net

Dear Mr. Fernandez:

Thank you for providing a draft copy of the Water Management and Conservation Plan for the City of Salem. As you point out, Oregon Administrative Rule Chapter 690, Division 86 requires that affected local governments be provided an opportunity to review the plan for consistency with their local comprehensive land use plan prior to the city submitting a draft plan to the Oregon Water Resources Department for review.

The Marion County Comprehensive Plan (MCCP) Urbanization Element, Environmental Goals encourage planning that does not exceed the capacity of water, energy, air and other resources. In addition, the MCCP Environmental Quality and Natural Resources Element, Goal C strives for the provision of an adequate quantity of water for beneficial uses within the county, including water for domestic, municipal, industrial, commercial and recreation uses. Goal D emphasizes the significance of educating property owners about the importance of the use of their property for water quality and quantity and encourages water conservation practices to hold water demand to a minimum through a public information program.

The Water Management and Conservation Plan for the City of Salem is consistent with the Marion County Comprehensive Plan, as both plans recognize water to be a significant resource, encourage the provision of adequate water for residents' use, and support conservation practices when necessary.

Please do not hesitate to contact me if you have any questions.

Sincerely,

Brandon Reich
Senior Planner

Cc: Jason Pulley, City of Salem Utilities Planning Coordinator, jpulley@cityofsalem.net
Matt Knudsen, Marion County, Environmental Specialist, mknudsen@co.marion.or.us