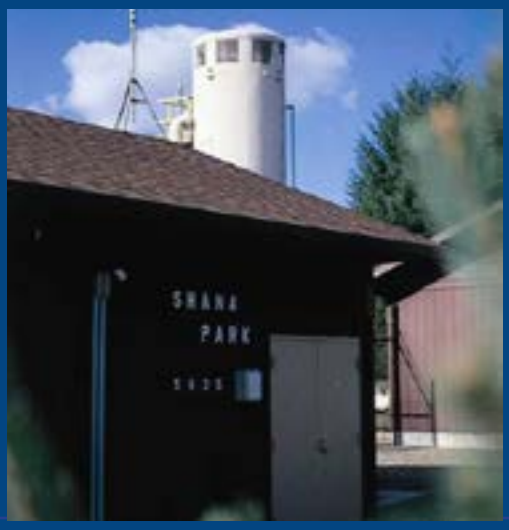
Olympia

2021-2026 Water System Plan

March 2024







olympiawa.gov

2021-2026 Water System Plan

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Executive Summary

Every day, the City of Olympia Drinking Water Utility (Utility) delivers affordable, high-quality drinking water to over 66,000 people through approximately 21,000 connections. This water consistently meets 100 percent of US Environmental Protection Agency (USEPA) standards for safe drinking water, and it is pumped to everyone's homes at a fraction of the cost some will pay for bottled water.

This Water System Plan serves as a guide for Utility staff to use in achieving objectives and implementing strategies over the next six years and provides benchmarks against which progress toward the Utility's goals can be measured.

This Water System Plan has been prepared in accordance with WAC 246-290-100, which requires public water systems with more than 1,000 connections to submit a water system plan every six years (or up to ten years if desired) for review and approval by the Washington State Department of Health (DOH). This Water System Plan demonstrates the Utility's operational, technical, managerial and financial capability to achieve and maintain compliance with relevant local, state and federal regulations, and how the Utility will address present and future needs. As such, this Water System Plan is an update of the Utility's 2015 Water System Plan and provides a 6 and 20-year roadmap for the Utility.

Overall Vision

The Utility's mission is to provide and protect healthy drinking water for the community, with a long-term vision that the Utility sustains present and future water supplies for our community while protecting the environment. This mission and vision have been developed in the context of the City of Olympia's commitment to sustainability.

This Water System Plan evaluates the City of Olympia's water system from the perspective of the full hydrologic cycle, not solely from the traditional perspective of source, storage and distribution. It recognizes the connection between groundwater and surface water, and the effect that the City of Olympia's groundwater-dependent water system may have on surrounding surface water bodies.

Additionally, this Water System Plan helps carry out the vision and goals stated in the Olympia Comprehensive Plan. In particular, the following chapters of the Comprehensive Plan give guidance to this strategic management plan for the Utility:

- Community Values & Vision
- Public Participation and Partners
- Utilities
- Natural Environment
- Capital Facilities Plan

Accomplishments Since the 2015 Water System Plan

The 2015 Water System Plan identified capital projects planned for implementation between 2015 and 2034. Among the largest and most significant capital projects completed under the 2015 Water System Plan include the following:

2017 – Fones Road Booster Pump Station: This project replaced an old booster pump station which had a deficient electrical system, confined space entry constraints, and aging ventilation and pumping equipment.

2018 – Meridian Corrosion Control: This project constructed 3 corrosion control treatment facilities at the Meridian Tanks to raise the pH of water withdrawn from the McAllister Wellfield, thus maintaining compliance with the Lead and Copper Rule.

2019 - Construction of Log Cabin Storage Tank: This project addresses storage and fire flow deficiencies in Zone 417 and installation of 2,100 ft 16-inch ductile iron water main connecting the new Log Cabin Tank to the distribution system.

2019 – Kaiser Road Extension: This project installed a new 12-inch ductile iron water main extending Kaiser Road water main to Evergreen Park Drive thereby completing a piping loop to the north end of Pressure Zone 298.

2020 – Fir Street Reservior: This project consisted of structural upgrades and seismic retrofits of the Fir Street Storage Tanks to maintain compliance with seismic codes and enhance reliability of these facilities.

2020 – Elliott Storage Tank. This project consisted of structural upgrades and seismic retrofits of the Elliott Storage Tank to maintain compliance with seismic codes and enhance reliability of this facility.

2020 - Completion of Shana Park Well Contingency Plan. This Plan explored options to address ongoing elevated nitrate levels in groundwater and initiated the recommendation to drill a pilot well at the Utility's LBA site as a possible new source/production well relocation site.

2015-2020 – Small Diameter Pipe Replacement. Approximately 3,700 feet of existing small diameter substandard water mains were replaced with larger diameter piping to increase reliability of the distribution system and maintain domestic and fire flows at required minimum pressures.

2015-2020 – Aging Pipe Replacement. Approximately 4,400 feet of aging and asbestos cement pipe was replaced to increase the reliability of the distribution system and reduce the potential for leaks in older parts of the system.

Additional Utility accomplishments under the 2015 Water System Plan include:

America's Water Infrastructure Act (AWIA). Passed by Congress in 2018, the AWIA required the Utility to conduct a Risk and Resilience Assessment and revise our Emergency Response Plan to be consistent with the findings of the Risk and Resilience Assessment. The Utility completed both requirements and submitted the certifications of completion for each by the required deadlines.

New Helping Neighbors Program. In July 2021, the City launched the Helping Neighbors program that collects voluntary donations to help low-income customers pay their utility costs. The program is a partnership with the Community Action Council, a local non-profit, that will determine eligibility and administer funds to qualified low-income households. The funds are used to pay for City of Olympia utility services. Eligible customers can receive a $75 voucher twice per calendar year. Funds are available on a first come, first serve basis. The new program is intended to help City of Olympia utility customers that would not otherwise qualify for the City's other low-income utility assistance program, Lifeline Rates, where citizens must meet disability and age criteria.

Cross-Connection Program. The Utility added 600 new assemblies to our tracking system (Xc2) because of in-field site survey work.

Percival Utility Bridge Emergency Repairs. The Percival Creek Utility Bridge was severely damaged during a February 7, 2020 windstorm when a tree fell and struck its middle span breaking the existing water (and sewer) mains attached to the underside of the bridge. The Percival Creek Utility Bridge and water (and sewer) mains have been repaired to pre-disaster function.

Water Right Extensions. The Utility received construction notice extensions from the Washington State Department of Ecology for two water rights during the 2015-2020 planning period: The Briggs water right construction notice deadline was extended to July 1, 2024 and the Cities of Olympia, Tumwater and Lacey jointly owned Brewery water right construction notice deadline was extended to April 1, 2041.

McAllister Wellfield Mitigation. As of year-end 2020, the Utility, in concert with the Nisqually Indian Tribe, has completed the bulk of the requirements outlined in the McAllister Wellfield Mitigation Plan. At this time, only the final retirement of the Smith water right and ongoing operations and maintenance obligations remain, including ongoing operations and maintenance of the Woodland Creek Groundwater Recharge Facility in partnership with the City of Lacey. The Utility also continues to be obligated to participate in a Budd Inlet/Deschutes Watershed Environmental Coalition, when formed.

Opportunities and Challenges

While the Utility achieved significant accomplishments during the 2015-2020 planning period, the Utility continues to face opportunities and challenges. The general opportunities and challenges facing the Utility are listed below followed by the Utility's areas of focus for the 2021-2026 planning period.

The general opportunities and challenges facing the Utility during 2021-2026 include:

1. **Aging infrastructure.** Assessment, repair and replacement of existing infrastructure will continue to be a challenge for the Utility.
2. **Changing water quality regulations.** The Utility must be ready to respond to any changes in water quality regulations and treatment requirements imposed by state and federal agencies.
3. **Keeping pace with development.** Fast or slow, the rate of growth will determine how new water sources are developed and when they come online.
4. **Protecting groundwater from contamination.** Risks to groundwater will increase with a growing population, and will require the City to regularly evaluate, monitor, and take action to control sources of pollution.
5. **Equitable and predictable rates and fees.** Creating predictability for customers and developers is difficult in a complex economic and regulatory environment.
6. **Public education and involvement.** Keeping customers and the community involved and informed about challenges, needs, plans and proposals can help ensure that programs and projects are responsive to customer needs and community values.
7. **Climate change.** Changing climate in the Pacific Northwest likely will result in milder, wetter winters and hotter, drier summers. Direct impacts on the Utility could result from projected increases in summer temperatures causing a corresponding increase in water use. Although thought to be at a low risk, saltwater intrusion from rising sea level could impact the Allison Springs source. Additionally, the Percival Pump Station, becomes vulnerable to flooding at 24-inches of sea level rise. Efforts made by the Utility such as reducing its energy use and promoting water conservation activities could assist the community in its efforts to mitigate climate change.
8. **Incorporating equity (fairness) in utility decisions.** The Utility must ensure all people benefit from the Utility's work equitably and have opportunities to inform decision-making through inclusive engagement.

The Utility will focus on addressing the following detailed opportunities and challenges during the 2021-2026 planning period:

1. **Southeast Olympia groundwater sources**. During the 2021-2026 planning period, the Utility will focus on evaluating the Southeast Olympia wells and water rights to determine if changes to water rights and well locations may be beneficial to the operation of the water system.
2. **Reservoir upgrades.** In recent years, the Utility has conducted seismic and condition evaluation of our reservoirs and storage tanks. Upgrades to Fir St and Elliot reservoirs have been made, with upgrades

to Boulevard Tank expected to begin in 2022. During the 2021-2026 planning period, the Utility expects to address upgrades (or replacements) of other reservoirs/tanks.

3. **Asset Management Strategy.** The Utility has made progress in implementing its asset management strategy. During 2021-2026, the Utility will focus on refining effective useful life estimates and 50-year infrastructure renewal/replacement cost projections to inform, educate and engage our Utility Advisory Committee, City Council and community about the Utility's infrastructure investment needs.
4. **Uncertainty of changing demands.** Uncertainty in future water demand from the impact of the COVID-19 pandemic and its associated changes in where and how people work is a newly emerging challenge for the Utility. The commercial, state, and political subdivision customer categories contain accounts that were notably affected by these changes, seeing an annual usage decline of 16 percent, 27 percent and 21 percent respectively from 2019 to 2020. It is unknown if this shift in demands will continue in the future.

2021-2026 Drinking Water Utility Goals

The primary framework for this Water System Plan is the Utility's long-term vision that the Utility sustains present and future water supplies for our community while protecting the environment. The Utility sees itself as a steward of water resources and therefore takes a broad view of the entire hydrologic cycle, rather than focusing narrowly on system infrastructure.

Table ES1 defines the key planning terms used in this Water System Plan. Understanding them will make it easier to see how specific elements of this Water System Plan relate to each other.

Table ES1 Key Planning Terms

Goals[1]	Broad, qualitative statements of what the Drinking Water Utility intends to achieve.
Objectives	Specific, measurable statements of what will be done to achieve the Goals within a particular time frame.
Strategies	General approaches or methods for achieving Objectives and resolving specific issues. Strategies speak to the question "How will we go about accomplishing our Objectives?"

1. Definitions are adapted from EPA's Planning for Sustainability: A Handbook for Water and Wastewater Utilities, EPA-823-R-12-001, February 2012.

The goals, objectives and strategies presented in Table ES2 offer a roadmap for the Utility's direction over the next six years. Further information and discussion regarding the goals, objectives and strategies and how the Utility intends to implement them through its existing programs during the 2021-2026 planning period can be found in Appendix ES1 Plan Implementation, Staffing and Monitoring.

Table ES2 2021-2026 Goals, Objectives and Strategies

Goal 1. Adequate supplies of water are available for the Olympia community while protecting in-stream flows and sustaining long-term capacity of aquifers. (Chapter 4)

Objective 1A. Identify water rights that ensure adequate supply for at least 50 years, so sources can be protected from contamination or commitment to lower priority uses.

Strategies

1. Evaluate existing water rights and forecasted demand every six years.
2. Continue implementing required mitigation actions associated with McAllister Wellfield water rights.

Objective 1B. Encourage multi-jurisdictional approaches to water rights and source development.

Strategies

1. Through agreements and in consultation with neighboring tribes, counties and cities, take a cooperative, regional approach to mitigating aquifer pumping impacts on water bodies in the Deschutes and Nisqually WRIAs (11 and 13, respectively).
2. Continue to evaluate future operational strategies for development of the former Olympia Brewery water rights.

Objective 1C. Monitor water levels in all pumped aquifers and maintain numerical groundwater models to better define aquifer characteristics and accurately evaluate the impacts of the City's withdrawals.

Strategies

1. Continue to record consistent and timely measurements of groundwater levels in all pumping supply wells and all drinking water protection area (DWPA) monitoring wells.
2. Evaluate groundwater level data to ensure optimal pump operation and to update DWPA numerical models as needed.
3. Continue to expand the long-term water level monitoring effort in all water supply areas to better understand impacts of the City's withdrawal on the aquifers used for water supply.
4. Evaluate whether aquifer pumping tests are needed in certain water supply aquifers and conduct tests as needed.
5. Maintain numerical models for all water sources. Use these models to predict future water supply impacts from climate change, development, and additional withdrawals.

Goal 2. Water is delivered at pressures required by the Washington State Department of Health and meets Safe Drinking Water Act standards. (Chapter 11)

Objective 2A. Maintain 100 percent compliance with all state and federal monitoring requirements.

Strategies

1. Continue compliance monitoring for source, distribution and tap locations according to required timelines, with analysis performed by accredited laboratories.
2. Continue groundwater protection monitoring to detect contamination that may be migrating toward drinking water sources.
3. Continue to track revisions to state and federal monitoring requirements.
4. Continue monitoring nitrate levels in Shana Park Well 11 (S10). If levels begin to increase, evaluate treatment or development of a new

source.

Objective 2B. Maintain 100 percent compliance with all state and federal treatment requirements.

Strategies

1. Maintain a minimum free chlorine residual of 1.07 mg/L at Shana Park Well 11 (S10) in order to maintain compliance with CT6.
2. Maintain a minimum pH of 7.2 at Shana Park Well 11 (S10), Allison Springs Well 13 (S09) and Allison Springs Well 19 (S11); a minimum 7.3 for McAllister Wellfield (S16) at Meridian Tanks; and a minimum pH of 6.8 in the Distribution System. Appropriate pH levels for Indian Summer Well 20, Kaiser RD Well and Hoffman Well are to-be-determined.
3. Verify minimum chlorine residual of 0.2 mg/L in the distribution system through measurement of residual chlorine levels, as part of monthly system coliform sampling.

Objective 2C. Respond to customer water quality concerns promptly and maintain accurate records.

Strategies

1. Investigate, validate and respond to water quality complaints by way of phone calls, emails and/or site visits.
2. Meet all reporting and record retention requirements.

Objective 2D. Support the groundwater protection network for the collection and evaluation of monitoring groundwater quality.

Strategies

3. Continue sampling groundwater protection monitoring wells in all drinking water protection areas (DWPA) to evaluate groundwater quality.
4. Compare groundwater protection water quality sample results to source water quality results to ensure necessary response time in case of contamination detected in DWPAs.

Goal 3. Olympia's water supplies are used efficiently to meet the present and future needs of the community and natural environment. (Chapters 5 & 6)

Objective 3A. Reduce water use by 5 percent per connection. (Chapter 5)

Strategies

1. Continue to implement flow reduction programs through partnership with the LOTT Clean Water Alliance and Cities of Lacey and Tumwater for single-family, multi-family and industrial/commercial/institutional (ICI) customers who receive LOTT sewer service.
2. Continue to implement water-saving programs for residential City water customers who are on septic systems and therefore cannot participate in the LOTT programs.
3. Continue outreach to raise awareness of the importance of water use efficiency.
4. Continue to implement outdoor water use reduction programs for residential customers.
5. Continue to implement the Efficient Irrigation Hardware Rebate Program for ICI customers.
6. Continue outreach to raise awareness of the importance of water use efficiency.

Objective 3B. Maintain water loss below 10 percent of production. (Chapter 5)

Strategies

1. Continue to monitor water loss in the system annually, as required by the DOH, by evaluating production, authorized consumption (both metered and unmetered) and resulting Distribution System Leakage (DSL).
2. Continue to work closely with the Olympia Fire Department and surrounding fire districts to get accurate estimates of water used for fire suppression, fire flow testing, sprinkler flushing, and training conducted off-site.
3. Continue to work closely with the Utility's Operations & Maintenance section to monitor water loss due to field use, main breaks and leaks, as well as expanding leak detection efforts.
4. If the water system exceeds the DSL standard, develop and implement a Water Loss Control Action Plan as required by DOH.

Objective 3C. Meet the needs of current and future City reclaimed water customers. (Chapter 6)

Strategies

1. Continue to respond to inquiries about reclaimed water use, regulations, availability, capacity, opportunities, and requests for assistance with existing infrastructure.
2. Continue to implement and enforce the City's reclaimed water ordinance, engineering design and development standards and End User Agreements to ensure compliance.

Objective 3D. Prioritize use of reclaimed water to meet the regional wastewater management goal of reducing the amount of treated wastewater discharged into Puget Sound. (Chapter 6)

Strategies

1. Pursue opportunities to increase infiltration of reclaimed water to recharge groundwater and enhance in-stream flows.
2. Participate as a LOTT partner in state and local reclaimed water regulation development and implementation activities, including presence on technical and advisory groups.
3. Support efforts to expand infrastructure for partnered or regional uses.
4. Pursue grants and other funding sources that support the reclaimed water program's regional objectives and strategies.

Goal 4. Customers have access to the information they need, have a role in accomplishing Utility goals, and participate in Utility decision making. (Chapter 1)

Objective 4A. Engage with drinking water customers regularly.

Strategies

1. Work with Olympia's Utility Advisory Committee to develop and review drinking water policies, projects, programs and rates.
2. Provide useful information to customers through the Utility bill insert that accompanies each water bill.
3. Maintain the Utility's web pages with current information that is easy to find and understand.
4. Continue to produce the annual consumer confidence report, include information about its availability on the City website in an annual utility bill insert article and make copies available to the public as requested.
5. Consider postcard mailings to our customers as a way to communicate information about our drinking water system.
6. Work with the Storm and Surface Water Utility, the Wastewater Utility and other City departments to develop the tools necessary to evaluate the Utility's public outreach work in order to create more equitable outcomes for our customers.

Objective 4B. Coordinate customer service and education with the City's other water resource utilities and LOTT.

Strategies

1. Cooperate with the Wastewater Management Utility, Storm and Surface Water Utility and LOTT on educational/promotional activities.

Goal 5. Groundwater quality is protected to ensure clean drinking water for present and future generations and to avoid the need for replacement or treatment facilities. (Chapter 7)

Objective 5A. Prevent contamination of groundwater through surveillance and response to evidence of existing, imminent or suspected contamination.

Strategies

1. Continue to monitor groundwater quality to understand risks to groundwater, detect contamination and evaluate pollution reduction efforts.
2. Continue to improve spill prevention actions and implement spill response procedures.

Objective 5B. Strengthen and exercise partnerships with tribal governments, state/local agencies, and citizen groups to protect groundwater.

Strategies

1. Raise awareness about the need to protect groundwater and positively influence human behaviors that place groundwater at risk.
2. Collaborate on groundwater protection efforts with tribal, state, county and neighboring city agencies.

Objective 5C. Improve program policies, procedures and tools to enhance the effectiveness of groundwater protection efforts.

Strategies

1. Continue to clarify the City's groundwater protection policies and streamline program procedures, including field methods and interactions with other City departments.
2. Ensure that groundwater protection-related capital projects and major equipment are included in the Utility's Asset Management Program.

Goal 6. Infrastructure is prudently financed and sustainably constructed, maintained and operated to ensure reliable delivery of high quality water to a growing community. (Chapters 8-13)

Objective 6A. Design and construct infrastructure to ensure reliable delivery of water. (Chapters 8, 9, 10)

Strategies

1. Develop and maintain multiple, geographically dispersed sources of water supply to enhance the reliability of the system. (Chapter 8)
2. Develop and maintain storage and transmission/distribution infrastructure to ensure delivery of water at state-required pressures throughout the system and maintain required fire flow (Chapters 9 & 10)
3. Work with the Storm and Surface Water Utility, the Wastewater Utility and other City departments to develop the tools necessary to evaluate utility services and decision processes in order to create more equitable outcomes for our customers.

Objective 6B. Continue to improve maintenance management, including preventive maintenance, repairs and replacements. (Chapter 12)

Strategies

1. Document and report on equipment efficiency and capacity.
2. Maintain, clean and exercise equipment per manufacturer recommendations.
3. Maintain buildings and grounds for function, safety and neighbor aesthetics.

Objective 6C. Continue to improve the Utility's emergency response program and maintain facility security. (Chapter 12)

Strategies

1. Plan for the anticipated impacts of sea level rise.
2. Continue to maintain and be prepared to implement the water system emergency response plan.
3. Store emergency supplies at several strategic locations and replenish before expiration dates.
4. Conduct tabletop and/or field exercises periodically.
5. Maintain existing security equipment at critical facilities.
6. Update or replace pump station telemetry system hardware and software as needed.
7. Following emergencies, conduct a briefing and prepare an after-hour report.

Objective 6D. Continue to improve O&M program management, including safety and asset management**.** (Chapter 12)

Strategies

1. Continue and expand scheduling and documenting all water system maintenance in the Utility's work order and asset management software.
2. Continue employee safety program, including safety committee review of accidents, review of new regulations and available training, and monthly staff training sessions.
3. Ensure that all Utility infrastructure is accurately depicted on maps and related databases.
4. Continue to refine the Utility's asset management program, in coordination with Public Works and City-wide efforts, to prioritize future capital improvement projects.
5. Continue to maintain and upgrade standard operating procedures.
6. Work with the Storm and Surface Water Utility, the Wastewater Utility and other City departments to develop the tools necessary to evaluate utility services and decision processes in order to create more equitable outcomes for our customers.

Goal 7. Drinking Water Utility finances are managed responsibly and costs are recovered equitably based on customer use. (Chapter 14)

Objective 7A. Set rates that reflect financial policies and recover the cost of providing services to each customer class.

Strategies

1. Increase annual depreciation funding to 75 percent of depreciation by 2026 in order to equitably charge current customers for the use and decline in value of the system.
2. Analyze how the tiered and seasonal rate structure is affecting consumption patterns/revenue and propose changes to the rate structure as appropriate.
3. Conduct a cost-of-service study for wholesale and retail customers on a six-year cycle or more often as needed.
4. Coordinate regular rate studies with the City's other water resources utilities, so that the full impact of utility rate increases on customers is considered.

Objective 7B. Manage Utility rates and connection fees consistent with the City's guiding principle of growth paying for growth.

Strategies

1. Increase the General Facility Charges to reflect the current pro rata share of system costs.
2. Review General Facilities Charges regularly to ensure that they accurately and equitably distribute system costs to new development and are adjusted for inflation.

Objective 7C. Use debt financing responsibly to support needed capital facility investments and "smooth" rate impacts.

Strategies

1. Continue the capital funding strategy that utilizes existing resources from reserves and general facility charges first before relying upon debt financing.
2. Maintain the required debt coverage ratio and a solid bond rating.
3. Pursue grants and state low-interest loans when available.

GOAL 8: The Utility implements all applicable City and region-wide climate change mitigation and adaptation measures.

Objective 8A: Reduce the Drinking Water Utility's greenhouse gas emissions.

Strategies

1. Meet City-wide greenhouse gas emissions reduction goals including those related to fleet and building operations.
2. Continue participation in Puget Sound Energy's Green Power Program.
3. Participate in the City's Climate Action Team, formed to coordinate the City's response to climate change including implementation of the Thurston Climate Mitigation Plan.

Objective 8B: Adapt drinking water infrastructure to accommodate predicted sea level rise projections.

Strategies

1. Elevate, flood proof or relocate low-lying infrastructure as may be required to addressing sea level rise.

Summary of Capital Projects

Table ES3 lists Capital Projects planned for construction in the 2022-2027 time period. Developer-contributed projects are not included in this table, as they will not require City funding. For a complete list of projects for the 20-year planning period, see Chapter 13, Table 13.2.

Table ES3 2022-2027 Recommended Capital Improvement Projects

Project Schedule and Costs (in thousands of dollars) [1]							
Code	**Project Name**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Water Source (WS)							
WS-1	Briggs Well Construction			100	1.600		
WS-2	McAllister Wellfield Mitigation -Deschutes River Basin	75	40	40	40	40	40
WS-3	Wellhead Protection Program Capture Zone Refinement						
WS-4	Groundwater Monitoring Wells	200	10				
WS-5	Olympia Brewery Water Engineering Analysis		400				
WS-6	Indian Summer Well Chlorination		50				
WS-7	Hoffman Well Treatment						
WS-8	McAllister Domestic Replacement Well		115				
WS-9	Deschutes Watershed Restoration		166				
WS-10	Sole Source Aquifer Designation			50			
WS-11	Shana Park Well VFD Replacement		130				
WS-12	Allison Well VFD Replacement			190			
WS-13	Rancho Serino Mitigation		50				
WS-14	McAllister Wellfield Phase 2						
Water Storage (ST)							
ST-1	Hoffman Court Reservoir Reconstruction						
ST-2	Boulevard Road Reservoir Rehabilitation Construction	4,000	50				
ST-3	Eastside Reservoir Reconstruction					435	4,500
ST-4	Elliot Reservoir (380 Zone) Evaluation			18			
ST-5	*Telecommunications Feasibility Analysis		24				
N/A	Elliot Avenue Reservoir Seismic Retrofits	10					
N/A	Fir Street Reservoir Seismic Retrofits	10					
Transmission and Distribution (TD)							
TD-1	Distribution System Oversizing	30	30	30	30	30	30
TD-2	Pressure Reducing Valves Installation – East Bay						
TD-3	Fones Road Water Main Construction	100	2,650	50	7		
TD-4	Indian Summer Water Main Extension to Rich Road						
TD-5	Decatur 298 Zone Connection						
TD-6	Eastside Street and Henderson Boulevard Water Main Extension			163	1,464		
TD-7	Elliot Avenue Water Main Replacement				308	208	
TD-8	Additional Isolation Valve Installation on the 36-inch Main	50	19	300	18		
TD-9	Cardinal Drive Water Main Extension	25					
TD-10	Zone 417 to 347 PRV Station Installation			50	260		
TD-11	36-inch Main Condition Assessment and Enhancement	25					
TD-12	New PRV Installations		40		40		

Restoration and Renewal Projects (RR)							
RR-1	Small Diameter Water Mains	570	300	300	350	522	522
RR-2	Asphalt Overlay Adjustments	15	15	15	15	15	15
RR-3	Storage Tank Coatings						
RR-4	Booster Station Upgrades/Rehabilitation			250	525	50	
RR-5	AC and Aging Pipe Replacements	500	200			1,000	1,000
RR-6	PRV Telemetry Installation	23					
RR-7	Distribution Main Condition Assessment	25	25	25	25	25	25
RR-8	On-site Generator Replacement Plan				100		
RR-9	Asset Management Program	60	60	60	60	60	60
RR-10	Corrosion Control Towner Condition Assessment & Upgrades						
RR-11	*Water Meter Replacement	180	180	180	180	180	180
RR-12	*McAllister Mitigation – Woodland Creek	20	20	20	20	20	20
RR-13	Fire Suppression Systems Installations at Allison Wellsite and Shana Park		100				
RR-14	Security and Remote Systems Program Enhancements	258	58	58	58	58	58
RR-15	*Leak Detection Program Analysis	20	155				
RR-16	*Tank Inspection and Cleaning	24	36	24	24	24	36
RR-17	Franklin Street Water Main Replacement	150					
RR-18	Percival Creek Bridge Repairs	25					
Planning (PL)							
PL-1	*Water System Plan Update					250	250
PL-2	Infrastructure Pre-Design and Planning	100	150	150	150	150	150

Notes:

[1] In July 2021 dollars. 2021 costs reflect actuals.

* Represents projects funded from the Utility's operating budget

N/A marked projects have not been included in Chapter 13 project descriptions since the projects are substantially completed.

Planning Process

This Water System Plan has been prepared by a team of Utility staff representing all areas of the Utility, with technical assistance from HDR Engineering, Inc. and financial analysis by Financial Consulting Services Group.

The Water System Plan has been reviewed by the City's Utility Advisory Committee. The Utility Advisory Committee serves as the principal public advisor on utility policy matters for the City's four public utilities: Drinking Water, Wastewater, Storm and Surface Water, and Waste ReSources. Committee members played a key role in reviewing this Water System Plan and providing recommendations to clarify and improve it.

The fourth Utility Advisory Committee Water System Plan briefing (November 4, 2021) served as the water use efficiency goal setting public forum and was advertised as such on DOH's Water Use Efficiency website, announced through an E-newsletter article and noticed through the standard Utility Advisory Committee meeting notice process. Following an April 4, 2022 Utility Advisory Committee meeting, a month long public comment period on the Water System Plan was held.

The Water System Plan has also been reviewed by Thurston County, the City of Tumwater and the City of Olympia Community Planning and Development Department for consistency with local plans and regulations, as required by WAC 246-290-108 (Appendix ES2).

SEPA Review

The State Environmental Policy Act (SEPA) requires the City of Olympia to consider the potential environmental impacts of a proposal before making any final decisions.

After reviewing the Water System Plan SEPA Checklist, the City's environmental review officer issued a Determination of Non-significance (DNS) (Appendix ES3). This means that no significant adverse environmental impacts were identified. No comments were received from the public nor were any appeals filed.

Potential impacts of construction projects planned for 2022-2027 were not specifically evaluated; they will be evaluated in a separate SEPA process when each project is designed.

Public Hearing

As part of the water system planning process, DOH requires utilities to hold public hearings to give the community an opportunity to comment on the water system plan. A staff briefing and public hearing/consumer meeting on the Water System Plan was held during the October 30, 2023 City Council special meeting. Additionally, on November 14, 2023 the City Council passed a resolution approving the 2021-2026 Water System Plan. The City Council October 30 and November 14, 2023 meeting material is included as Appendix ES4.

Plan Implementation

The Utility is currently comprised of four sections (Water Quality and Cross Connection Control; Drinking Water Operations; Pump Stations Operations; Water Resources Engineering and Planning). This organizational structure requires cross sectional coordination to effectively implement the Utility's nine programs:

- Source of Supply
- Conservation
- Reclaimed Water
- Groundwater Management
- Water Quality
- Operations and Maintenance
- Asset Management
- Capital Facilities
- Financial

Formal cross-sectional coordination occurs at Drinking Water Coordination Team meetings, held every other week under the leadership of the Utility's Water Purveyor.

Although not a regulatory requirement, the Utility has elected to demonstrate its commitment to implementation by including a plan implementation strategy as a component of this Water System Plan. (See Appendix ES1 Plan Implementation, Staffing and Monitoring.)

The Drinking Water Coordination Team will be responsible for reporting on implementation strategy progress on an annual basis and making adjustments as needed.

Continuing to take an “asset management” approach to infrastructure maintenance, renewal and replacement decisions is key to the Utility’s implementation strategy. While much work has been done to date by the Utility to gather the data necessary to make informed “at the right time” infrastructure decisions, the Utility is committed to continuously improving its asset management program. To gain support for the significant investment that will be required to address the Utility’s aging infrastructure, presenting refined estimates of 50-year infrastructure renewal and replacement costs to decision-makers and the community will be necessary over the planning period.



System Overview

Chapter 1

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1-1 Amendment to Extend Service Area (2006 Water System Plan update)

1-2 Intertie Agreement. *Emergency Water Intertie Agreement Temporary Water Service During an Emergency* (Candlewood Water System)

1-3 Intergovernmental agreement with City of Lacey. *Water Supply Agreement between the Cities of Lacey and Olympia for the Use of Emergency Water System Intertie*

1-4 Intergovernmental agreement with City of Tumwater. *Mutual Aid Agreement Between the Cities of Tumwater and Olympia for the Use of Emergency Water System Interties (2001)*

1-5 Intergovernmental agreement with Thurston PUD No. 1. *Mutual Aid Agreement Between the Public Utility District No. 1 of Thurston County and the City of Olympia for the Use of Emergency Water System Interties (2015)*

1-6 Intergovernmental agreement with U.S. Army (Fort Lewis). Department of the Army Mutual Aid Agreement (2005)

1-7 Water Facilities Inventory Form (DOH WF1 Form)

CHAPTER 1 - SYSTEM OVERVIEW

This chapter gives an overview of Olympia's water system, including ownership and management, customers, history, service area environment and land use, boundaries, neighboring purveyors, and related policies. It also generally describes the system infrastructure: supply, storage and transmission/distribution.

Olympia is located in Thurston County, at the southern tip of Puget Sound. It is approximately 65 miles south of Seattle, 105 miles north of Portland, and 45 miles east of Aberdeen. As the state capitol as well as the county seat, its economic activity is fueled to a great extent by government activity. The adjacent cities of Lacey and Tumwater contribute to the metropolitan nature of the area.

1.1 Ownership and Management

The City of Olympia owns and operates a public water supply system that serves customers within its Water Service Area. Key facts about the Utility are shown in Table 1.1. The City does not own or manage more than one public water system and therefore is not a satellite management agency.

Table 1.1 System Profile

Water system name	City of Olympia
Water system identification number	634506
Water system classification	Group A – Community Type
Type of ownership	Local government
System contact person	Mike Vessey, Drinking Water Purveyor
Service area population (2020)	66,790
Number of metered service connections (December 2020)	20,861
Capacity of distribution storage tanks	36.18 million gallons
Supply sources	McAllister Wellfield and six supply wells

Management and Staffing

Olympia's public utilities are managed within the Public Works Department, which is organized into five lines of business (Water Resources, Waste Resources, Transportation, Engineering, and General Services). The three water-related utilities (Drinking Water, Wastewater, and Storm and Surface Water) are managed under the leadership of the Water Resources Director.

The Drinking Water Utility encompasses Engineering and Planning, Drinking Water Operations, Pump Stations Operations, and Drinking Water Quality. The Utility is supported by Public Works Engineering, Facilities, and Fleet services. The Utility develops its own annual operating budget and capital facilities program.

The Utility has a total of approximately 32.15 FTE staff, as shown in Table 1.2.

Table 1.2 Drinking Water Utility Staffing Overview

Drinking Water Utility Section	Number of Full-time Employees (FTE)	Associated Chapter
Drinking Water Operations		
Drinking Water	16.75 FTE	Chapter 12
Pump Stations	4.25 FTE	Chapter 12
Drinking Water Quality		
Water Quality	3.0 FTE	Chapter 11
Water Conservation	2.0 FTE	Chapter 5
Reclaimed Water	0.5 FTE	Chapter 6
Groundwater Protection	0.75 FTE	Chapter 7
Engineering and Planning		
Engineering	2.0 FTE	Chapters 8, 9, 10, 13
Planning	1.34 FTE	Chapters 1, 2, 4, 14
Administrative Support	1.56 FTE	N/A
Total	32.25 FTE	

Customers

Olympia provides retail water service within the incorporated City limits and its Urban Growth Area (UGA), with a few exceptions noted below in Section 1.3.

As of year-end 2020, the Utility had 20,861 metered customers within its service area, which includes the incorporated City limits and its Urban Growth Area (Map 1.1). The Utility provides potable water to residential, commercial, and industrial customers, and reclaimed water to a few customers in downtown Olympia. See Chapter 3 for details.

Providing high quality service to customers is a priority for the Drinking Water Utility. Drinking Water Goal 4 states:

> **Customers have access to the information they need, have a role in accomplishing Utility goals, and participate in Utility decision making.**

Customer service is a recurring theme in this Water System Plan. In particular, the Utility uses the objectives and strategies below to implement Goal 4.

Objective 4A Engage with drinking water customers regularly.

Strategy 4A1 -- Work with Olympia's Utility Advisory Committee to develop and review drinking water policies, projects, programs, and rates.

Strategy 4A2 -- Provide useful information to customers through the Utility bill insert that accompanies each water bill.

Strategy 4A3 -- Maintain the drinking water utility's web pages with current information that is easy to find and understand.

Strategy 4A4 -- Continue to produce the annual consumer confidence (water quality) report, include information about its availability on the City website in an annual utility bill insert article, and make copies available to the public as requested.

Strategy 4A5 -- Consider postcard mailings to our customers to communicate information about our drinking water system.

Objective 4B Coordinate customer service and education with the City's other water resource utilities and LOTT.

Strategy 4B1 -- Cooperate with the Wastewater Management Utility, Storm and Surface Water Utility and LOTT in educational/promotional activities.

Levels of Service

Municipal utilities in the United States and elsewhere commonly use Level of Service (LOS) standards to evaluate whether the physical system and operations are functioning to an adequate level. LOS can be defined in terms of the customer's experience of utility service and/or technical standards based on professional expertise of utility staff.

The Utility complies with all regulatory standards for water quality and system design and operation. In addition to these minimum standards, the LOS standards address issues of concern for customers that influence decisions on infrastructure investments.

LOS standards can help guide investments in maintenance, repair, and replacement. For new assets, LOS can be used to establish design criteria and prioritize needs. Using a structured decision process that incorporates LOS can help a utility achieve desired service outcomes while minimizing life-cycle costs.

The Utility has refined its LOS standards using the following criteria:

- Specific goal or expectation identified.
- Focused on customer and community.
- Quantifiable and measurable.
- Relatively simple to understand and apply.
- Constrained by available budgets for maintenance, repair, and replacement.

The Utility's LOS standards are in these areas:

- System performance (including service interruption due to breakage, pressure, and system reliability).
- Sustainability (energy efficiency).

Additional information on the Utility's LOS standards can be found in Appendix ES-I – Plan Implementation, Staffing and Monitoring.

1.2 History

Historical accounts of water service to Smithville, as Olympia was originally known, are vague. The earliest accounts describe a combined creek and groundwater source emanating from the Moxlie Creek watershed. In 1941, when peak system demands began to exceed the supply capacity in this watershed, the City purchased the McAllister Springs property at the headwaters of McAllister Creek.

McAllister Springs and Creek have great cultural and historical significance to the Nisqually Indian Tribe. The Springs are within the aboriginal territory of the Nisqually, a Salish-speaking group that lived in villages along the banks of the Nisqually River and its tributaries, including McAllister Creek. McAllister Creek was also known as Medicine Creek, in reference to its spiritual importance for the Nisqually, and was the place where the 1854 Treaty of Medicine Creek was signed.

The City developed the Springs in 1945 and constructed the pump house and pipeline in 1946 and 1947. In 1949, Olympia began pumping water from McAllister Springs, which provided the majority of Olympia's water supply for the next 65 years. In 1995, due to concerns over the vulnerability of McAllister Springs and costly water quality treatment requirements, the City formally requested a transfer of its water rights from McAllister Springs (and nearby Abbott Springs) to the McAllister Wellfield.

In 1998, the City purchased a 20-acre site (hereafter McAllister Wellfield), along with the development rights for an additional 100 acres adjacent to the Wellfield. The agreement relating to development rights carries certain restrictions on the use of the land. To provide access, the City also purchased a 66-acre parcel of property south of the Wellfield property.

In 2008, the City entered into a Memorandum of Agreement with the Nisqually Indian Tribe to replace McAllister Springs with an up-gradient wellfield to avoid the need for ultra-violet treatment at the Springs, reduce the risk of contamination from transportation spills, and eliminate the potential effects of saltwater intrusion due to sea level rise.

In support of the water right application, the City subsequently conducted an extensive study on groundwater pumping, worked with regional partners on mitigation strategies across two watersheds, and reached two groundbreaking agreements with neighboring Tribes. Nearly 17 years later, in early January 2012, the Department of Ecology (Ecology) issued water rights for the McAllister Wellfield, marking a historic moment for the City and the Nisqually Tribe.

The Wellfield began operations in November 2014 and is now the City's primary source of water supply, supplemented seasonally by six additional wells. (See also Chapter 4 and Chapter 8 for development of McAllister Wellfield and details on other sources.)

1.3 Service Area

This section gives an overview of the natural environment, particularly climate and impacts of climate change; land use; and system information including boundaries, neighboring purveyors, interties and service area agreements.

Environment and Land Use

The following sections describe the climate and land use of the service area. Chapter 7 describes the topography, geology and groundwater conditions, as well as land use and zoning, of the designated Drinking Water Protection Areas (DWPAs) around supply sources.

Climate

Due to its elevation and location on Puget Sound, Olympia's climate is characterized by warm, dry summers and cool, wet winters.

Winter weather in Olympia is temperate, wet and generally overcast. Summer weather is moderate and comparatively dry. The average annual range in temperature is relatively narrow, from an average low of 39 degrees Fahrenheit (F) to an average high of 60 degrees F.

During the wet season, generally from October to May, storms usually arrive from the southwest and continue toward the Olympic Peninsula. An occasional Arctic storm from the northwest brings freezing temperatures, hail or sleet, freezing rain or snow.

The coast range and Olympic Mountains protect the area from strong Pacific storms during the fall and winter. An average annual rainfall of about 51 inches in the Olympia area can be attributed to the onshore effects of maritime disturbances originating in the Pacific Ocean.

Climate Change Trends

The warming climate is projected to cause changes in weather patterns. In general, Ecology expects western Washington to experience milder, wetter winters and hotter, drier summers. The water system will potentially be affected by changing levels of precipitation and rising sea level in Puget Sound. For details, see Ecology's climate change website.

The University of Washington Climate Impacts Group (CIG) has measured observed effects of global climate change in the Pacific Northwest and Puget Sound, and projected potential future trends. The CIG's findings as of 2013 are summarized below, as cited in *Climate Change Impacts and Adaptation in Washington State: Technical Summaries for Decision Makers (2013)* and previous CIG publications.

The Utility will continue to monitor the observed climate change and projected future trends work being done by the CIG and make adjustments to its long-range water resource planning.

Rising Temperature. Since 1895, the average annual temperature in the Pacific Northwest has increased 1.3 degrees F. Significant warming has occurred in all seasons except for spring, with the largest changes having occurred during the winter months. The rate of warming is expected to accelerate; the best estimate is a rate of over three times the increase of 0.15 percent per decade observed during the 20th century. Estimates range from increases of 0.7 to 3.2 degrees by the 2020s, 1.4 to 4.6 degrees by the 2040s, and 2.9 to 8.8 degrees by the 2080s. Olympia's water demand forecast more conservatively assumes temperature changes of 1.8 to 5.4 degrees F above historic levels by 2020 and 2.4 to 7.2 degrees higher by 2040, based on the CIG's 2002 forecasts for the Portland (OR) Water Bureau.

Precipitation uncertainty. No significant trends toward wetter or drier conditions in Pacific Northwest precipitation have been observed since 1985. This recent finding may contradict previously reported information documenting an increase in precipitation. Natural variability in precipitation is high. Similarly, the evidence of heavier downpours is ambiguous.

Spring snowpack fluctuates widely from year to year but has declined in the Washington Cascades since the mid-20th century. Glaciers are in decline. Snow melt and associated streamflow timing is occurring earlier in the year for many rivers and streams. These trends can be expected to continue.

Sea level rise. Downtown Olympia is currently vulnerable to flooding during high tides and storm events. With 12-inches of sea level rise, a 100-year flood event could occur every other year. To protect the 450-acre downtown area from increasing sea levels, Olympia partnered with the Port of Olympia and LOTT to develop the Olympia Sea Level Rise Response Plan (SLR Plan).

Development of the SLR Plan included a climate science review and a vulnerability and risk assessment. This assessment determined that one drinking water pump station, the Percival Pump Station, becomes vulnerable to flooding at 24-inches of sea level.

The SLR Plan provides comprehensive strategies for minimizing and preventing flooding to downtown Olympia, including a recommendation to incorporate sea level rise into other city planning documents and develop and adopt guidelines for incorporating consideration of sea level rise in the capital planning process.

This Plan's climate change goals, objectives and strategies are consistent with recommendations contained in the SLR Plan.

Potential Climate Change Impacts

Direct impacts on the Utility could result from projected increases in summer temperatures and saltwater intrusion from rising sea level.

Increased demand due to rising summer temperatures. Under current climate conditions, water use increases as summer temperatures rise. If summers in Olympia become hotter and drier, demand for water may increase correspondingly. The Utility believed it prudent to anticipate this potential trend in developing its 50-year demand forecast for the 2021-2026 Water System Plan.

Climate change effects are anticipated to occur gradually, allowing time for the community and water system to adapt over periods of years and decades. The Utility's focus on water conservation should help counteract increases in demand for potable water.

Saltwater intrusion from rising sea level. Prior to development of the McAllister Wellfield, the City's primary drinking water source at McAllister Springs was at risk of saltwater intrusion from rising sea levels. The City developed the McAllister Wellfield to provide an upgradient water supply and largely mitigate this risk. Currently the Allison Springs supply wells are the City's only drinking water sources considered at risk of saltwater intrusion. However, despite their proximity to the Puget Sound and screening near sea level, these wells are considered to be at low risk for saltwater intrusion. Utility staff regularly monitors Allison Springs groundwater, looking for changes in conductivity and chloride concentration that may indicate an influence of salt water.

Land Use and Zoning

This section characterizes the current land use and future zoning of the Utility's service area. See Chapter 7 for land use and zoning in designated DWPAs.

Development of residential and commercial properties in the area slowed during the 2008 recession but has since recovered. In general, most residential development in Olympia has shifted to large apartment complexes of 100 units or more with densities up to about 20 units per acre. Most single family and commercial development is occurring as "infill" in already developed areas. As a result, most development is occurring on the Westside where large multi-family tracts remain available. Map 1.2 shows current zoning.

The best projection of future land use is in the designations given by Olympia's Comprehensive Plan, as updated in 2018 (Map 1.3). The Plan is designed to accommodate 20-year projected growth as required by the Growth Management Act. Generally, the City is moving toward infilling areas already characterized by urban development, phasing urban development facilities outward from core areas, and requiring new development to be configured to allow for future infill. The Plan focuses higher residential densities downtown, along urban corridors, and near neighborhood centers. It encourages commercial development along urban corridors, and directs industrial development along Budd Inlet, Fones Road, and at Mottman Industrial Park.

A required periodic review and update of the City of Olympia Comprehensive Plan has started and will be completed by June 30, 2025.

Service Area System Information

Within Olympia's service area, water is available to all new retail customers through main extensions or by connecting to existing mains. As of 2020, the service area population was approximately 66,790, and the Utility had 20,861 metered service connections.

Water service consists of the sale of potable water to residential, commercial, industrial, and institutional customers, as well as the use of water for fire protection. The service area is divided into seven pressure zones. Water demand calculations for each pressure zone, as shown in Chapter 3, take into account population growth and development as well as uncertainties. The infrastructure improvements described in this Plan (Chapters 8-10) will ensure that the City has sufficient capacity to provide safe and reliable water service.

The City also distributes reclaimed water to a few customers in downtown Olympia, within a small reclaimed water service area that is entirely within the water service area (Chapter 6).

This section describes other system information including boundaries, neighboring purveyors, interties and service agreements. Service area policies are in Chapter 2, Section 2.2.

Service Area Boundaries

The public utility service areas for Olympia, Lacey and Tumwater are generally contiguous with the Urban Growth Area boundary**.**

Olympia's service area boundary establishes the area in which the City has the exclusive opportunity to provide water service, known as the "right of first refusal", as outlined in the North Thurston County Coordinated Water System Plan and encompasses both a retail water service area and a future water service area. Olympia's water service area generally includes the incorporated City limits and its Urban Growth Area (UGA), as shown in Map 1.1.

Over the years, the service area has been amended to include these parcels outside the UGA that are served by Olympia:

- The Evergreen State College (1969)
- Small areas around 11th Avenue Northwest and Overhulse Road Northwest in West Olympia
- A few parcels north of 26th Avenue Northeast
- Some locations in Lacey and Tumwater where Olympia is serving accounts that were connected prior to adoption of the Coordinated Water System Plan
- McLane Fire District 9 facility and McLane Elementary School near the intersection of Delphi and Mud Bay Roads (2006)

The most recent extension was the 2006 amendment to the 2004 Water System Plan to support water service to the new McLane Fire District 9. Thurston County signed the required local government consistency statement, and the Washington State Department of Health (DOH) approved this amendment in August 2006. The service area was also updated and approved as part of the 2006 Plan update (Appendix 1-1).

In addition, there are 21 direct service connections off the 36-inch main that lies outside Olympia's service area. These are historic connections, which pre-date the Coordinated Water System Act of 1977.

Olympia has discussed with Lacey and Thurston PUD No.1 about moving these connections off the 36-inch main and into their systems as appropriate.

Retail Water Service

Map 1.1 shows the existing retail water service area, a component of Olympia's larger water service area. The retail service area generally includes areas where the Utility currently provides service, or where service is immediately available and is the area within which the Utility has a duty to provide service as outlined in RCW 43.20.260

Future Water Service

The future zone includes areas within Olympia's water service area where the City does not yet provide services.

Wholesale Customers

Olympia no longer maintains wholesale agreements with its former wholesale customers: Thurston PUD No. 1 and the City of Lacey. Olympia does not anticipate providing wholesale water service during the time period covered by the 2021-2026 WSP.

Neighboring Purveyors

Olympia's service area is bordered to the east and south by the water service areas of Lacey and Tumwater. Map 1.1 depicts the service areas. Within the boundaries of Olympia's service area are approximately 14 Group A Water Systems and 38 Group B Water Systems. Of these neighboring systems, Olympia provides water to two Group A Water Systems and one Group B Water System through master meters.

Interties

Olympia has four emergency interties with the City of Lacey system: one located west of Marvin Road, at Pacific Avenue and Mountainaire Road; one on Sleater-Kinney Road Southeast near McDonald's Restaurant; one on Sleater-Kinney Road Southeast and Pacific Avenue Southeast; and another off Sleater-Kinney Road Northeast and Sixth Avenue Northeast near North Thurston High School.

Olympia has two emergency interties with the City of Tumwater: one at the intersection of Capitol Boulevard and Carlyon Avenue Southeast; the other at the intersection of Mottman Road and Crosby Boulevard Southwest.

Olympia has one emergency intertie with Thurston PUD No. 1 at Pacific Avenue Southeast and Seahawk Street Southeast.

Olympia has one emergency intertie with the Candlewood Water System at 4500 Martin Way. Use of the intertie is addressed in an emergency intertie agreement dated December 14, 2017, which can be found in Appendix 1-2. Under its agreement with the Candlewood Water System, Olympia will provide temporary water service to the Candlewood Water System during an emergency. In the event water is required for longer than one year, the service will become a permanent water service and the existing Candlewood Water System source shall be decommissioned.

For details on the emergency interties with Lacey, Tumwater, Thurston PUD No. 1 and Candlewood Water System see Chapter 10, Table 10.4 and the Emergency Response Plan (Chapter 12, Section 12.2 and Appendix 12-2). Map 1.4 shows the general location of these interties, which are included in the Water Facilities Inventory Form in Appendix 1-7.

Service Area Agreements

Water service areas in North Thurston County are designated in the 1986 Coordinated Water System Plan (CWSP) and 1996 Area Wide Supplement. The CWSP has not been updated to reflect the 2005 agreement under which the City no longer provides retail service to the Tanglewilde and Thompson Place areas within Thurston PUD No. 1: or the 2006 agreement extending City water service to the McLane Fire District 9 facility.

Intergovernmental Agreements

Olympia also has intergovernmental agreements with the Cities of Lacey and Tumwater, Thurston PUD No. 1, and Fort Lewis (now Joint Base Lewis McChord):

- **City of Lacey.** Under the *2018 Water Supply Agreement between the Cities of Lacey and Olympia for the use of Emergency Water System Intertie* (Appendix 1-3) Olympia agrees to provide potable water service to Lacey for use in firefighting, and for drinking water and personal hygiene in the event of an emergency as specifically defined by the agreement and only if Olympia has the capacity to do so.
- **City of Tumwater**. *Under the 2001 Mutual Aid Agreement Between the Cities of Tumwater and Olympia for the Use of Emergency Water System Interties* (Appendix 1-4), each City agrees to provide potable water service to the other for use in firefighting, and for drinking water and personal hygiene. It will be activated only in the event of an emergency proclamation by the city requesting assistance.
- **Thurston PUD No. 1.** The PUD and City entered into a mutual aid agreement in 2015 (Appendix 1-5). Under the *Mutual Aid Agreement Between the Public Utility District No. 1 of Thurston County* and the City of Olympia for the use of Emergency Water System Intertie each party agrees to provide potable water service to the other for use in firefighting, and for drinking water and personal hygiene. It will be activated only in the event of an emergency proclamation by the party requesting assistance.
- **Joint Base Lewis McChord (JBLM, formerly Fort Lewis).** Under this 2005 mutual aid agreement, the US Army at JBLM and the City of Olympia agree to assist each other in fire prevention and the protection of life and property from fire and firefighting and other emergencies, including response to hazardous materials spills (Appendix 1-6). The JBLM Fire Department staff is fully trained and equipped to respond to any size of spill. (See Chapter 12, Section 12.2.)

Emergency supply agreements are authorized under Chapter 38.52 RCW, Emergency Management. Sale of water to another municipality is authorized by Chapter 29.34 RCW, RCW 35.92.170 and RCW 35.92.200.

Service Area Policies

Under RCW 43.20.260, City of Olympia, as a municipal water supplier, has a duty to provide service to all new connections within its retail service area when the circumstances meet four threshold factors:

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

Map 1.1 depicts the retail service area in which the City of Olympia has a duty to provide service as described above. Additionally, Olympia anticipates having adequate capacity to supply customers in its larger service area with drinking water throughout the planning period for this water system plan.

Local and regional ordinances and policies regulating Utility operations are in Chapter 2, Section 2.2.

1.4 Facilities Inventory

This section is an overview of Olympia's water system facilities -- wells, pumps, storage tanks, and transmission and distribution lines described more fully in Chapters 8-10. The Water Facilities Inventory form submitted to DOH is in Appendix 1-7.

Map 1.4 shows the location of the major water system components; elevations are shown on Figure 1.1, a profile schematic of the system.

Source of Supply

Olympia depends solely on groundwater to meet its drinking water needs. The McAllister Wellfield is the primary source of water for all City customers. From May through October, daily water use doubles and sometimes nearly triples, mostly due to outdoor water use. During these months, the City uses up to five additional wells to supplement the McAllister Wellfield.

Drinking Water Protection Areas are designated for each source. See Chapter 7 for information regarding hydrogeology, boundary delineations, and land use and zoning for each area.

The McAllister Wellfield provides approximately 69% percent of the total source capacity for the City. It is located about 10 miles east of the City off Washington Highway 510. Water from the Wellfield is pumped to the Meridian Storage Tanks, which are just over a mile to the northwest of the Wellfield. A 36-inch transmission main takes the water on a nine-mile journey, mostly beneath Pacific Avenue, into the storage tanks on Fir Street at Seventh Avenue. From there, water is pumped and piped throughout the City.

The balance of the City water is provided seasonally by up to five wells. East Olympia is served by Shana Park Well 11 (S10), Hoffman Well 3 (S08) and Indian Summer Well 20 (S12). West Olympia is served by Allison Springs Well 13 (S09) and Well 19 (S11). (Kaiser Road Well 1 (S03) was designated an emergency source in YEAR.). Table 1.2 summarizes basic information about each source. For details, see Chapter 4 and Chapter 8.

Table 1.3 City of Olympia Water Supply Sources

Source	Location & Approximate Area of Drinking Water Protection Area	Percent of Current Capacity
McAllister Wellfield (S16)	North Thurston County south of Nisqually Delta	68.8%
Hoffman Well 3 (S08) Shana Park Well 11 (S10) Indian Summer Well 20 (S12)	Southeast Olympia, Lacey urban growth area and Thurston County. Hoffman and Indian Summer have not bed used in years. Is the 18% just Shana? - MV	18.7%
Allison Springs Well 13 (S09) and Well 19 (S11) Kaiser Well 1 (S03)	West Olympia and Thurston County Kaiser Well is an emergency Source - MV	12.5%

Storage

Twelve storage tanks serve seven pressure zones throughout the City, with a total capacity of 36.18 million gallons. Six tanks are steel and six are concrete. The Meridian storage tanks, located northwest of the McAllister Wellfield, provide eight million gallons of storage. (See Chapter 9 for details.)

Transmission and Distribution

The transmission and distribution system is a network of over 430 miles of pipe, ranging from ¾-inch to 36 inches in diameter and ranging in age from new to nearly 100 years old. The pipes are made of various materials, including galvanized steel, polyvinyl chloride (PVC), asbestos cement (AC), concrete, ductile iron, steel, high-density polyethylene and plastic.

Because of the topography and extent of the service area, as well as the arrangement of storage tanks and other facilities, Olympia's water distribution system has been divided into seven pressure zones, listed in Table 1.3. Five booster pump stations pump water throughout the system. For details, see Chapter 10.

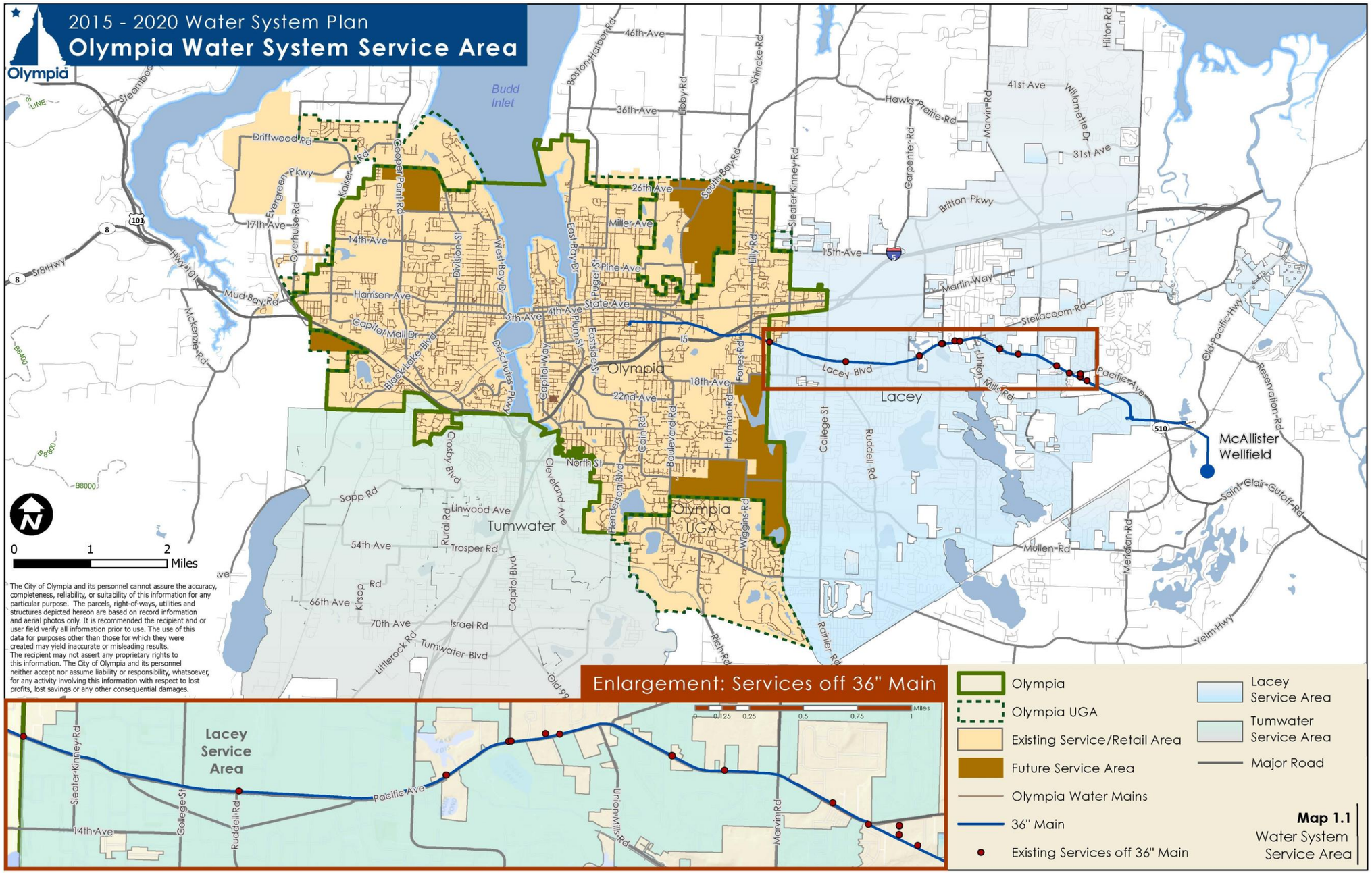
Map 1.4 shows the pressure zone boundaries. The pressure zones are designated with numbers corresponding to the overflow elevation of the reservoirs that feed a particular zone; that is, the highest water level in the reservoir as measured from mean sea level. For example, Zone 417 is served by the Hoffman Storage Tank and Log Cabin Storage Tank, which have a maximum water level of 417 feet above mean sea level. For details on pressure zones, see Chapter 9 and Chapter 10.

Table 1.4 Olympia Water Distribution System Pressure Zones

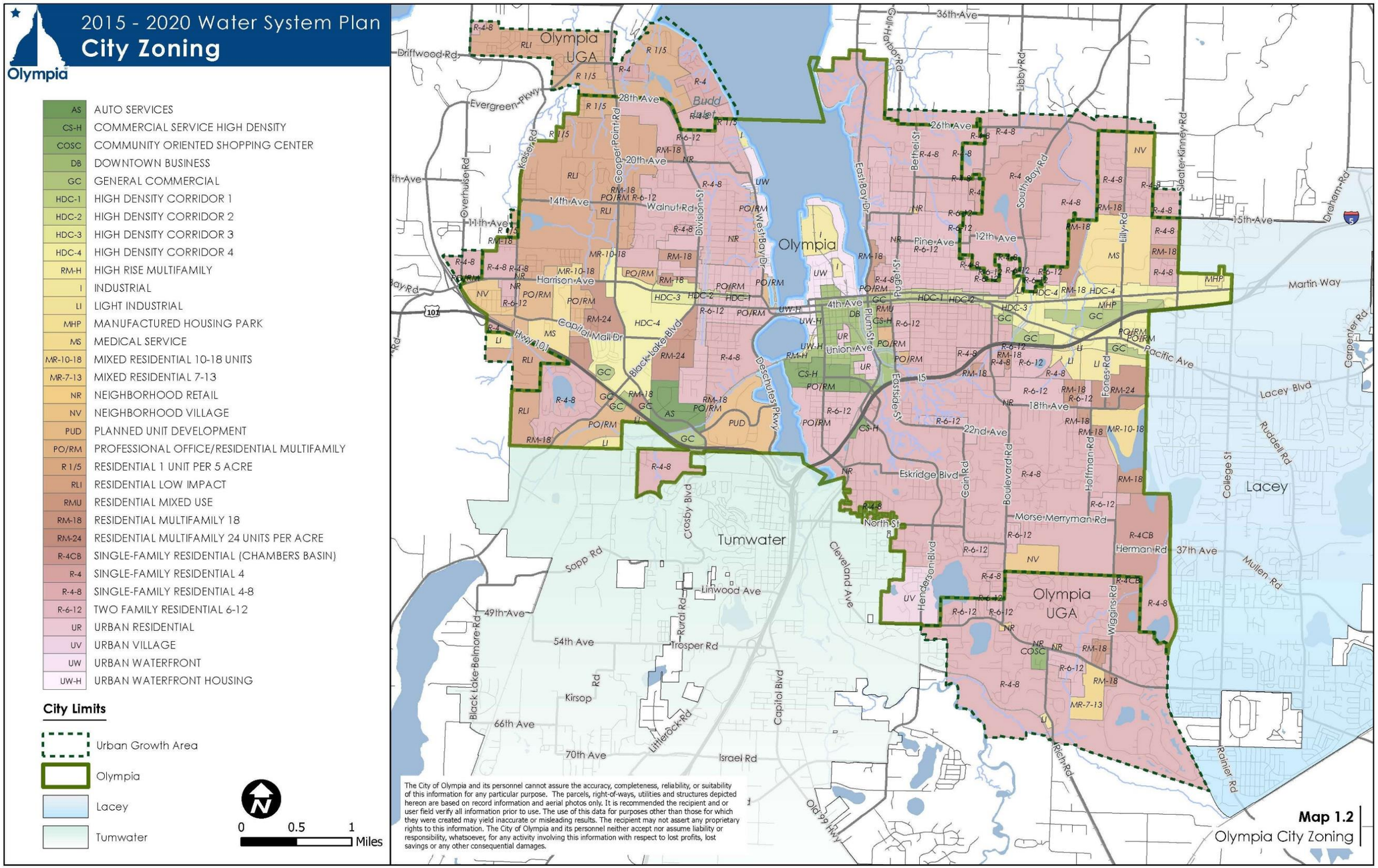
Zone	Pressure Control Facility	Maximum HGL[1]
417	Fones Road & South Sound Booster Pump Stations/Shana Park, Hoffman and Indian Summer wells, LBA Tank and Hoffman Tank	417
338	Boulevard Storage Tank /pressure-reducing valves from Zone 417	338
347	Eastside Booster Pump Station and Eastside Tank	347
264	36-inch gravity line from Meridian Storage Tanks, Stevens Tank and PRVs	264
226	Fir Street Storage Tanks and PRVs	226
298	Allison Springs Wells / Percival Booster Pump Station, Bush Tank, Elliot Reservoir and PRVs	298
380	West Bay Booster Pump Station and Elliot Tank	380

1. Maximum hydraulic grade line (HGL) is the overflow elevation of the tank(s) serving the zone.

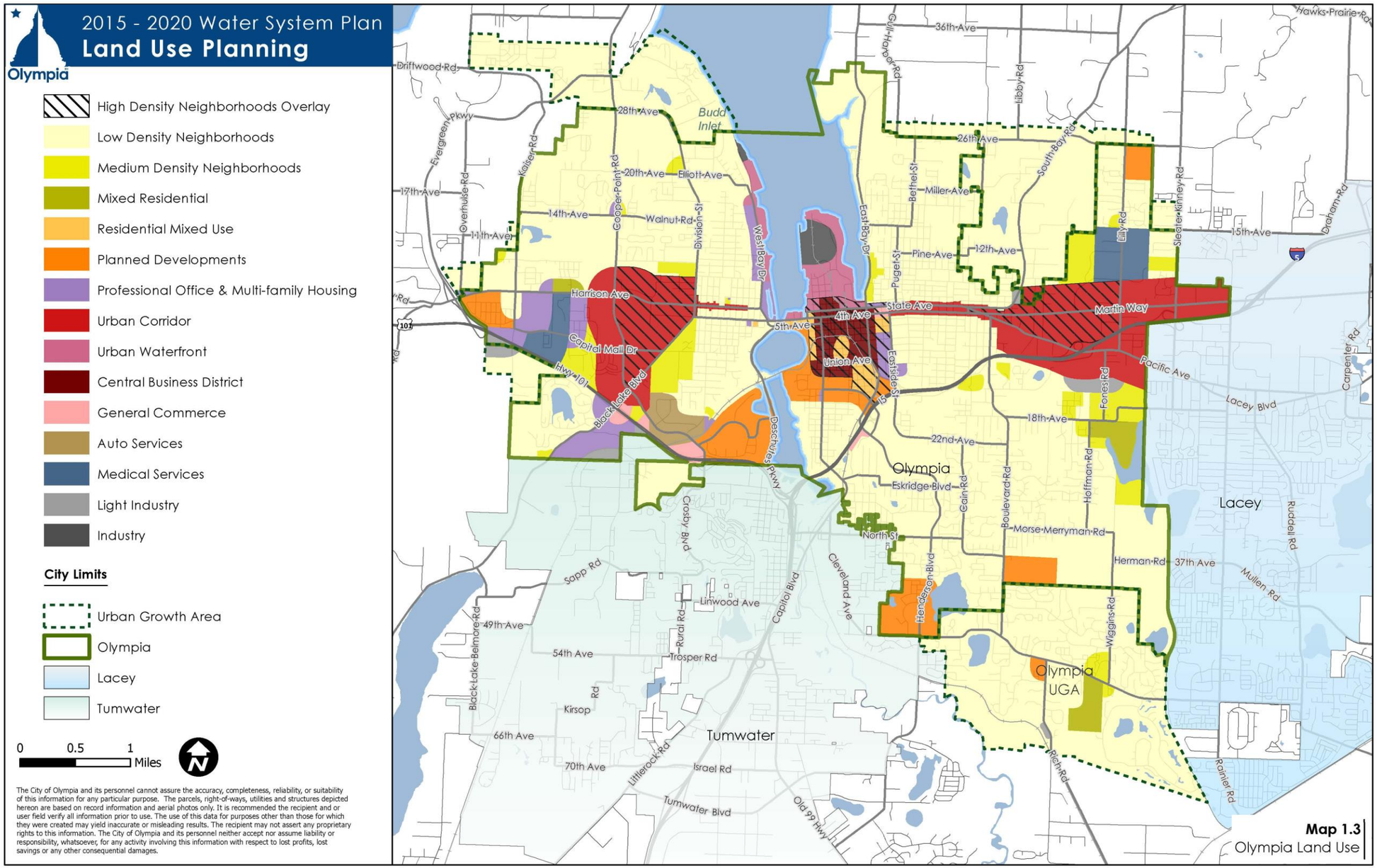
Map 1.1 Water System Service Area



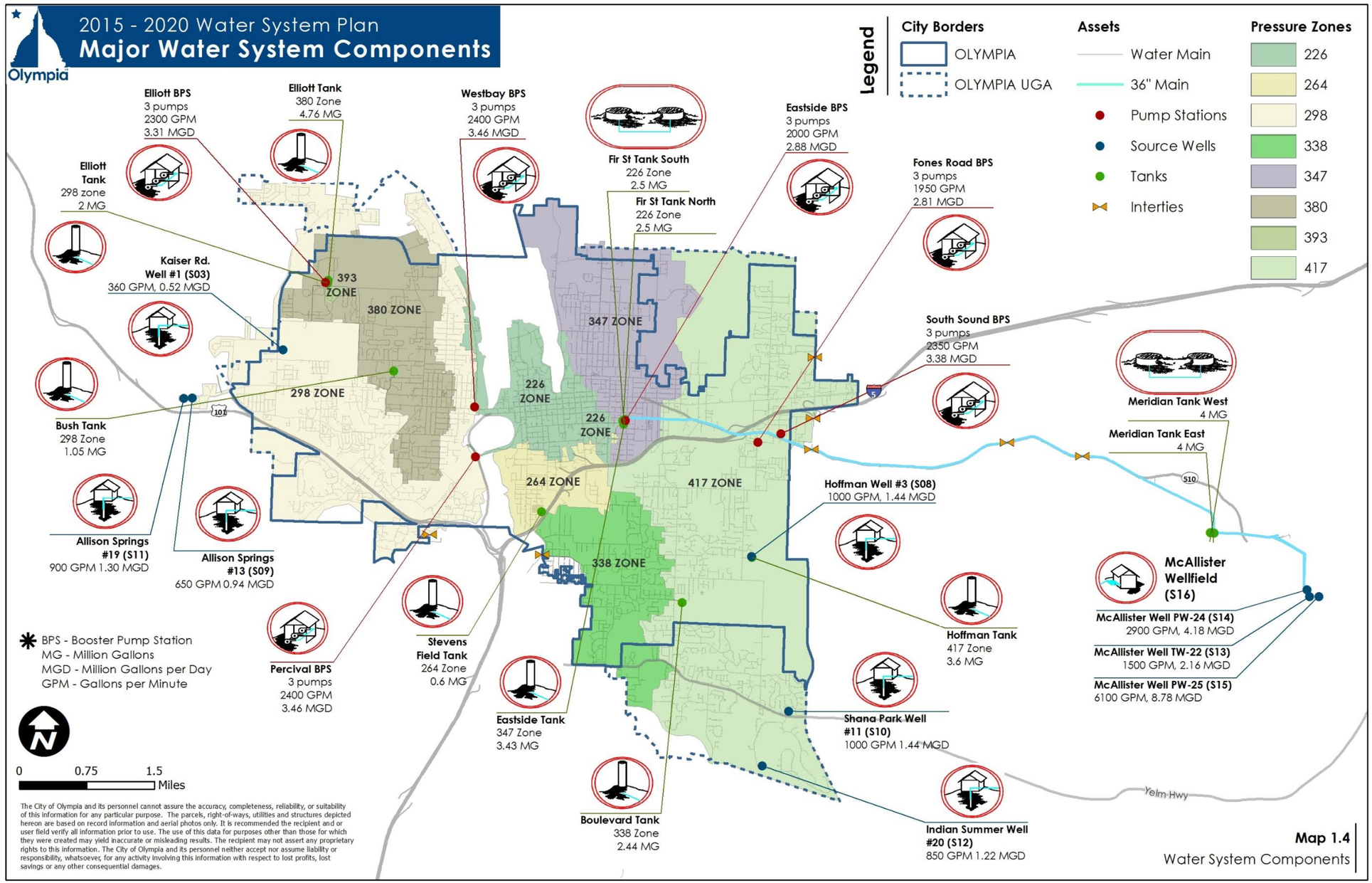
Map 1.2 Olympia City Zoning

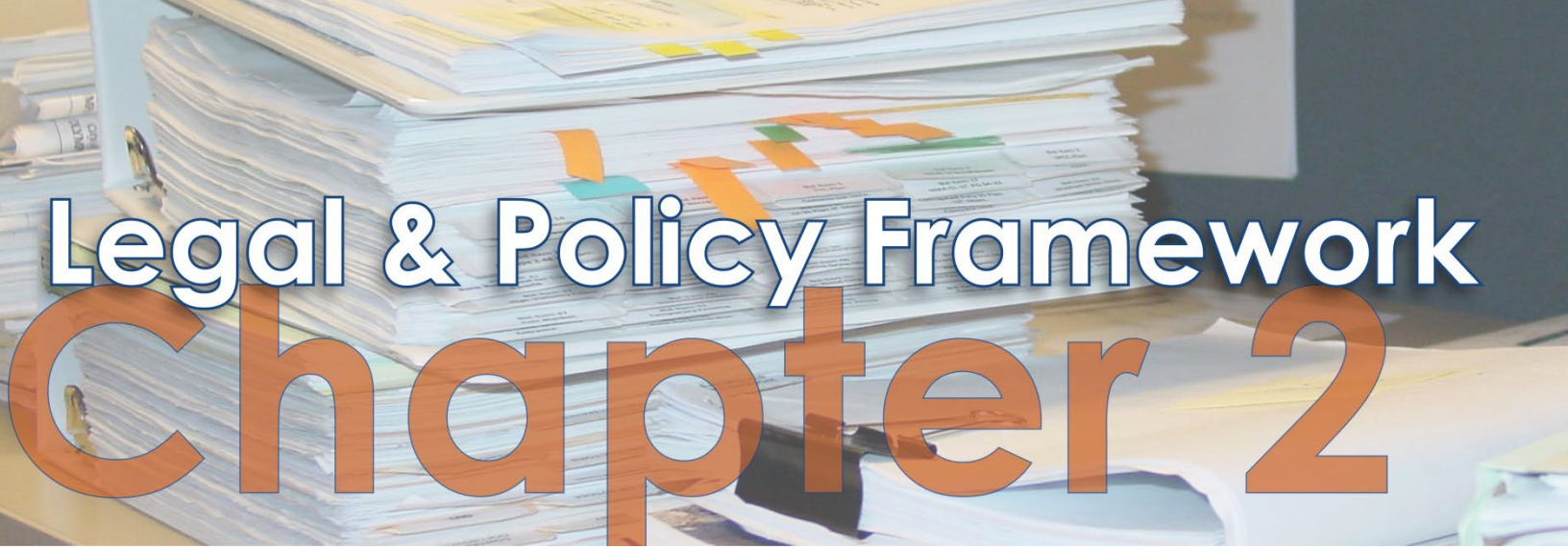


Map 1.3 Olympia Land Use



Map 1.4 Water System Components





Legal & Policy Framework

Chapter 2

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CHAPTER 2 - LEGAL & POLICY FRAMEWORK

This chapter gives an overview of the many federal, state and local laws, regulations, policies and plans that form the legal context within which the City of Olympia Drinking Water Utility (Utility) operates. Details are found in subsequent chapters of the Water System Plan.

2.1 Federal and State

In Washington, public water supply laws and regulations can be organized around these categories:

- Water rights
- Water quality
- Groundwater protection
- Water use efficiency
- Reclaimed water
- Source development and system operation
- Planning and financing

The major federal and state laws and accompanying regulations are described in this section and summarized in **Table 2.1**.

Table 2.1 Federal and State Laws Affecting Olympia's Drinking Water Utility

Category	Law	Implementing Regulations	Implementing Agency
Water Rights	Water Code (Chapter 90.03 RCW) and Regulation of Ground Water (Chapter 90.44 RCW).	Chapter 173-152 WAC	WA Dept of Ecology
Water Quality	Safe Drinking Water Act (Federal)	Chapter 246-290 WAC	WA Dept of Health
Groundwater Protection	Clean Water Act (Federal) Water Pollution Control Act (State) – (Chapter 90.48 RCW)	Chapter 173-200 WAC (groundwater quality standards); Chapter 173-201A WAC (surface water quality standards) WAC 246-290-135 (source water protection)	WA Dept of Ecology WA Dept of Health
Water Use Efficiency	Municipal Water Law – Efficiency Requirements Act (RCW 90.03.386(3) RCW and RCW 70.119A.180)	WAC 246-290-800.	WA Dept of Health
Reclaimed Water	Reclaimed Water Use Act (Chapter 90.46 RCW)	Water Reclamation and Reuse Standards (1997). Chapter 173-219 WAC (proposed)	WA Dept of Ecology WA Dept of Health
Source Development, System Operations		Chapter 173-160 WAC Chapter 246-290 WAC (Pt 3,5) Chapter 246-292 WAC Chapter 246-294 WAC	WA Dept of Health

Category	Law	Implementing Regulations	Implementing Agency
Planning	Growth Management Act (Chapter 36.70A RCW) Watershed Planning Act (Chapter 90.82 RCW) Public Water System Coordination Act (Chapter 70.116 RCW) Water System Planning Utility Financing (Chapter 35.92 RCW)	Chapter 246-293 WAC WAC 246-290-100.	WA Dept of Community, Trade and Economic Development WA Dept of Health WA Dept of Ecology

Water Rights

The basic laws governing water rights and withdrawals from groundwater and surface water in Washington are the Water Code (Chapter 90.03 RCW) and Regulation of Public Ground Water (Chapter 90.44 RCW). These laws are implemented by the Washington State Department of Ecology (Ecology). Water rights rules are in Chapter 173-152 WAC. (See Chapter 4.)

Water Quality

The federal Safe Drinking Water Act of 1974, as amended, and state laws and regulations implementing this act establish rules for public water suppliers. The US Environmental Protection Agency (EPA) is authorized to develop national drinking water regulations and oversee their implementation. The Washington State Department of Health (DOH) implements this law on the EPA's behalf.

DOH regulates the Utility as a large "Group A" water system, primarily through *State Board of Health Rules Regarding Public Water Supplies* (Chapter 246-290 WAC) and deriving its legislative authority from Chapter 43.20 RCW. The rules are codified in Chapter 70.119A RCW.

Water quality rules under the Safe Drinking Water Act are contained in WAC 246-290 Parts 4-7, and cover the following categories:

- Monitoring – for compliance at the source, in the distribution system, and at the tap (WAC 246-290-300); and surveillance monitoring of background water quality (WAC 246-290-135).
- Treatment – includes requirements for surface water and groundwater treatment. The requirement for public water systems to provide adequate treatment to protect public health is in RCW 70.119A.060 (1)(b). The Ground Water Rule, covering potential disinfection requirements for groundwater sources, was codified in 2011 as Chapter 246-290 WAC.
- Program management – includes public notification, record keeping and reporting (Chapter 246-290 WAC, Part 7).

In addition, the State has requirements for:

- Cross-connection control (WAC 246-290-490).
- Customer complaint response (RCW 43.20.240).

Chapter 11 of the Plan describes the Utility's compliance with these rules. Table 11.1 summarizes the applicable rules and the regulated contaminants affected.

Groundwater Protection

Pursuant to the federal Safe Drinking Water Act, water systems are required to develop and implement a source protection program. In Washington, DOH requires a wellhead protection program for utilities that rely on groundwater. Implementing state regulations are in WAC 246-290-135. See Chapter 7 for details on the Utility's Groundwater Protection Program.

The State's Groundwater Management Area program was established under RCW 90.44.030 to protect groundwater quality and quantity and manage the resource over a large area and for all beneficial uses (including drinking water). The City of Olympia's designation and regulation of drinking water (wellhead) protection areas is an important component of its Groundwater Protection Program and serves as the starting point for groundwater protection implementation efforts. Implementation requirements are in Chapter 173-100 WAC. Groundwater quality standards are in Chapter 173-200 WAC.

Water Use Efficiency

The Municipal Water Supply – Efficiency Requirements Act of 2003 requires water system plans to include conservation programs (RCW 90.03.386(3)). Implementing regulations are in WAC 246-290-800. The requirements address distribution system leakage, metering, water conservation planning, goals, performance evaluation and reporting. For details on applicability to the Utility, see Chapter 5, Table 5.1.

Reclaimed Water

State law (Chapter 90.46 RCW) encourages the use of reclaimed water to replace potable water in non-potable applications such as industry and agriculture. Such use supplements existing surface and groundwater supplies and can assist in meeting future water requirements. In 2018, Ecology adopted the State's first reclaimed water rule (Chapter 173-219 WAC). The new rule establishes an efficient, effective, and consistent statewide implementation framework for reclaimed water, including standards and permit requirements.

Source Development and System Operation

DOH rules on source development are in Chapter 173-160 WAC and Chapter 246-290 WAC, Part 3 (design of public water systems). Detailed specifications are in the DOH Water System Design Manual.

DOH regulations related to system operation, described in Chapter 12, cover the following:

- Operation and maintenance, system reliability, emergency response and metering (Chapter WAC 246-290 Part 5).
- Water Works Operator Certification (Chapter 70.119 RCW and Chapter 246-292 WAC).
- Drinking Water Operating Permits (Chapter 246-294 WAC).

Planning and Financing Requirements

The Utility is subject to several state laws that apply to land use and watershed planning, water system planning and financing.

Growth management. Under the Growth Management Act (Chapter36.70A RCW), the City of Olympia is required to plan for future growth for the next 20 years. State-mandated growth management planning is designed to create denser urban areas while protecting the rural character of unincorporated areas. Thus,

the Utility must manage its infrastructure capacity to accommodate projected development within the City of Olympia's Urban Growth Area (UGA).

Watershed planning. The 1998 Watershed Planning Act (Chapter 90.82 RCW) set a framework for developing local solutions to watershed issues on a watershed basis. It created water resource inventory areas (WRIAs) to inventory and manage water resources within these areas and to give local citizens an opportunity for input in planning. Olympia's service area and drinking water protection areas include parts of WRIA 11 (Nisqually) and WRIA 13 (Deschutes). A watershed plan under Chapter 90.82 RCW was approved for WRIA 11.

The 2016 Washington State Supreme Court "Hirst Decision" changed how counties decide to approve or deny new building permits that propose to use domestic (permit-exempt) wells for a water source. In response to this decision, the Legislature passed the 2018 Streamflow Restoration law (law; RCW 90.94). The law supports water availability for both salmon recovery and homes in rural Washington. It required local watershed planning to improve streamflows and clarified the process for counties to issue building permits for homes using a permit-exempt well.

As required by the law, Ecology convened watershed committees for both WRIA 11 and 13. The WRIA 11 watershed committee approved an addendum to its approved watershed plan while the WRIA 13 watershed committee was unable to reach consensus approval of its WRIA 13 watershed plan.

Water system coordination. The Public Water System Coordination Act of 1977 (Chapter 70.116 RCW) requires coordinated planning among public water supply systems within critical water supply service areas. Rules are in Chapter 246-293 WAC. Olympia's service area is part of the North Thurston County Coordinated Water System Area and subject to the *North Thurston County Coordinated Water System Plan, 1996 Area-wide Supplement*.

Water system plans. WAC 246-290-100 requires public water systems with more than 1,000 connections to submit a water system plan for review and approval by DOH every six years. Plans are intended to demonstrate the system's operational, technical, managerial and financial capability to achieve and maintain compliance with relevant local, state and federal plans and regulations. They also are to demonstrate how the system will address present and future needs in a manner consistent with other relevant plans and local, state and federal laws.

Utility financing. State law governing financing of municipal utilities is in Chapter 35.92 RCW. Regulatory authority is in WAC 246-290-100, WAC 246-293, WAC 246-294 and elsewhere.

Department of Health Guidance

The Office of Drinking Water provides numerous guidance documents to help water systems comply with the laws and regulations described above.

2.2 Regional and Local

In addition to the federal and state laws and regulations described above, the Utility has its own service area policies and conditions of service, established in the Olympia Comprehensive Plan and Olympia Municipal Code (OMC). The Thurston County Coordinated Water System Plan (CWSP) and other regional and local plans also affect Utility planning and operation.

Service Area Policies

This section summarizes the regional and local policies applicable to the Utility's water service area. The water service area is generally congruent with the Urban Growth Area boundary (Map 1.1), with exceptions noted in Chapter 1, Section 1.3 and is comprised of a retail service area and a future service area. Table 2.2 summarizes key policies related to the Utility's water service area.

Olympia Comprehensive Plan

The City of Olympia Comprehensive Plan (2014 as amended) provides maps of future land use and policy guidance for the City of Olympia and its Urban Growth Area (UGA), including specific direction for the City of Olympia utilities.

City of Olympia Comprehensive Plan policies support coordinated regional planning, public involvement and education, special review of proposed land uses near water supply sources, protection of aquifers and other critical areas, and groundwater monitoring. Public utilities policies direct the Utility to secure water supply rights 50 years in advance of projected need, protect water quality, conserve water and encourage reclaimed water use. These policies support integrated and regional approaches to water resources planning and management, and efficient operation and maintenance for adequate fire flow, pressure and preventive maintenance.

City of Olympia Comprehensive Plan goals and policies in the Environment and Utilities chapters were updated in December 2014 for consistency with the 2015 Water System Plan. A required periodic review and update of the Comprehensive Plan is expected to begin in late 2021 for completion by June 30, 2025. Utility will participate in the update process to ensure continued consistency between this Water System Plan and the Comprehensive Plan.

Olympia Municipal Code

Olympia Municipal Code (OMC) Title 13 regulates city public service operations to provide reliable utility services to City of Olympia residents and non-residents the City agrees to serve. Water Utility provisions are located in OMC Chapter 13.04, including those concerning service availability, service beyond city limits (annexation), extension of mains, service connections, connection size, meters, cross-connection and backflow protection, interruption of service for emergencies, waste of water, rates, charges and billing. Citations are below and provisions are summarized in Table 2.2.

- Charges and fees for services, Chapter 4.24 OMC.
- Drinking Water Utility policies, Chapter 13.04 OMC (includes the adopted Water System Plan, administrative rules, service applications and uses of water, prohibitions on wasting water and cross-connections).
- Fire hydrant policies, Chapter 16.36 OMC.
- Reclaimed water policies, Chapter 13.24 OMC (sets forth uniform policies and procedures for the distribution of reclaimed water and the use of reclaimed water by the City and its customers, as required by the State Reclaimed Water Permit issued to the LOTT Clean Water Alliance).

Conditions of service are found in these documents:

- Engineering Design and Development Standards (Chapter 12.02 OMC), Public Works Standard Specifications (Chapter 12.08 OMC), and Public Services – Water (Chapter 13.04 OMC).
- Engineering Design and Development Standards.

- Critical Areas Wellhead Protection (Chapter 18.32 OMC).
- Drainage Design and Erosion Control Manual for Olympia (updated in 2009, contains development standards for protecting surface water quality).

Related Plans

The Utility is also influenced by related plans adopted by Thurston County, the LOTT Clean Water Alliance, City of Olympia and neighboring cities. These plans have been reviewed to ensure that this Plan is compatible and consistent with them.

Thurston County Region

The following plans affect the Utility as well as other planning entities in Thurston County:

- *City of Lacey Water System Comprehensive Plan* (2013) and *City of Tumwater Water System Plan* (2020). Olympia has interties with each of these jurisdictions; an interlocal agreement to provide emergency water to Lacey; and a mutual aid agreement with Tumwater to provide water in emergencies. (See Appendix 1-3, Appendix 1-4 and Appendix 1-5.)
- *Coordinated Water System Plan*, Thurston County, 1986 and *Area-wide Supplement,* 1996. This plan establishes policies and standards for water utility expansion, priority of water service, service areas, satellite service, shared facilities and interties within the Critical Water Supply Service Area.
- *Water Conservation Coordination Plan*, LOTT Clean Water Alliance (LOTT), 2019. The current plan is a cooperative effort by the LOTT Clean Water Alliance (LOTT) and its three partner cities – Lacey, Olympia, and Tumwater, will guide the regional program from 2019 through 2024 planning period, with a goal of reducing wastewater flow by at least 120,000 gallons per day (gpd), and ideally by 180,000 gpd. Based on this plan, the Water Conservation Coordination Program is a cooperative effort to plan and offer indoor water conservation programs that reduce wastewater flows to LOTT treatment facilities.
- *Thurston County Comprehensive Plan*. Adopted pursuant to the Growth Management Act, this plan establishes land use designations and policies for the unincorporated areas of Thurston County. It was developed in coordination with comprehensive planning efforts by cities within the County and may be amended annually with concurrence by the cities on policies in their growth management areas. Thurston County last approved revisions to the Thurston County Comprehensive Plan in 2020.
- *Northern Thurston County Ground Water Management Plan*, 1992. This plan includes groundwater protection goals and an implementation strategy. It was developed cooperatively by Ecology; Thurston County; the cities of Olympia, Lacey, and Tumwater; the Squaxin Island and Nisqually tribes; and members of the public.
- *Final Implementation Plan for the Nisqually Watershed,* February 2007. The Phase IV implementation plan was approved by the WRIA 11 Nisqually Planning Unit in February 2007. It recommends short and long-term actions at both the watershed and sub-basin scale. Critical actions include identifying potential supply aquifers; processing water right applications in batches by sub-watershed; monitoring the quantity and quality of stream flows and groundwater supplies; understanding the interconnection between groundwater and surface water, including the impact

of exempt wells on groundwater; and strengthening Coordinated Water System Plan policies to more directly link land use planning and water supply availability.

- *Addendum to the Nisqually Watershed Management Plan, January 2019*. The Nisqually Planning Unit approved a Watershed Plan Addendum for WRIA 11 addressing the Streamflow Restoration Act on January 16, 2019. The Addendum estimates consumptive water use by new domestic permit-exempt well connections within the watershed through 2040 and identifies mitigation actions to offset instream flow impacts of this use and provide Net Ecological Benefit.

In addition to this Water System Plan, the following plans help frame the Utility's policy environment:

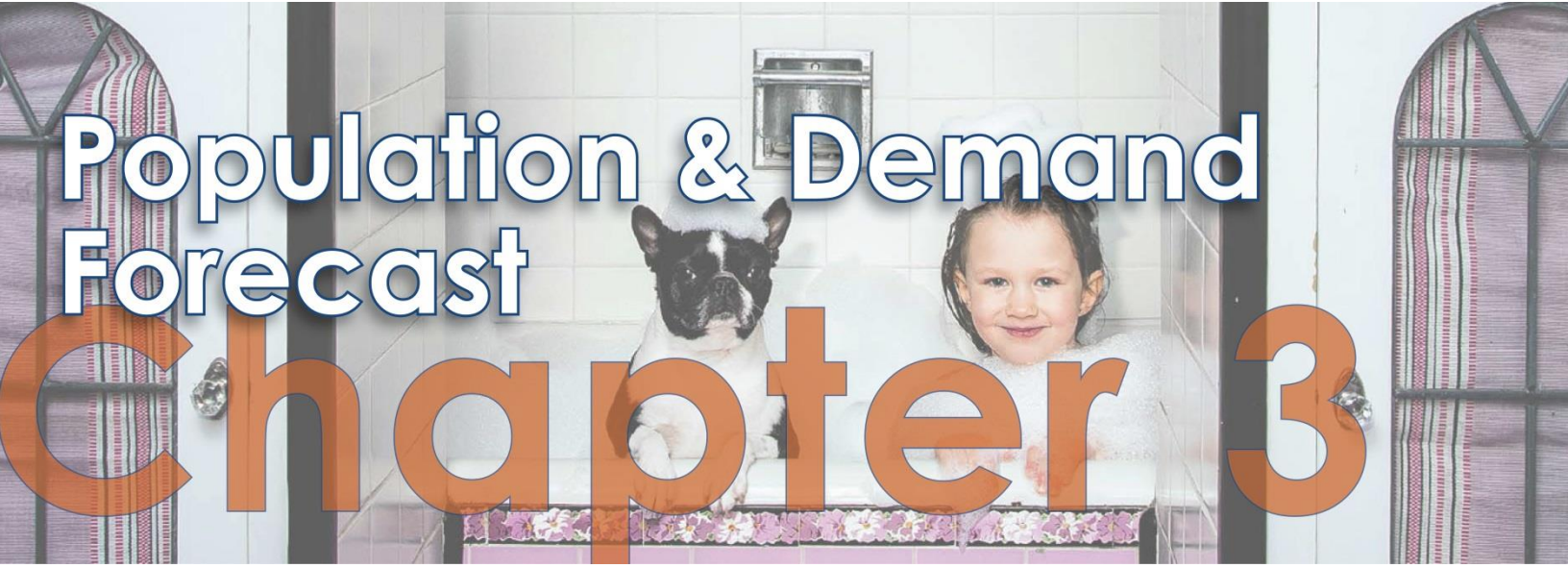
- *Wastewater Management Plan*, October 2020. This plan takes a proactive approach to planning and managing development of the wastewater system by maintaining and replacing existing utility infrastructure and planning for expansion into areas within the City and its Urban Growth Area that are currently undeveloped or served by onsite septic systems.
- *Storm and Surface Water Management Plan*, April 2018. This plan includes goals and strategies the Storm and Surface Water Utility is using to reduce the frequency and severity of flooding, improve or maintain water quality in streams and wetlands, and maintain or slow the decline of aquatic habitat.
- *City of Olympia and Thurston County, Percival Creek, Indian/Moxlie Creeks, Woodard Creek, McAllister/Eaton Creek, and Chambers/Ward/Hewitt Comprehensive Drainage Basin Plans*. These plans were developed during the 1990s, in cooperation with neighboring jurisdictions, to provide a basis for storm and surface water management planning.

Table 2.2 Regional and Local Service Area Policies

Policy Name	Policy Statement	References
Water Service Area and Retail Water Service Area	This plan defines and identifies the City's Water Service Area (WSA) as comprised of a Retail Water Service Area and a Future Water Service Area. The City will plan for water service to all land uses identified in the City's Comprehensive Plan and within the WSA. Additionally, the City will provide water service to all land uses (i.e. connections) identified in the City's Comprehensive Plan and within the Retail Water Service Area when the circumstances meet the four threshold factors outlined in RCW 43.20.260. Provisions for water service should be consistent with the goals, objectives, and policies of the City's Water System Plan and Comprehensive Plan.	2021 Water System Plan Map 1.1 2021 Water System Plan
Government Consistency	The City's Water System Plan will be consistent with local, county, and state land use authorities and plans.	North Thurston County Coordinated Water System Plan 1982, Area Wide Supplement 1996
Condition of Service	The City will plan to provide water service to all customers within the City's WSA. If the City is unable to provide water service to a property within the WSA, the owner or developer may facilitate an agreement between the City and another water purveyor to temporarily provide water service within the City's WSA. The City will review its WSA as part of the Water System Plan update. Revisions to the City's WSA shall be made only by written agreement in accordance with local, county and state regulations. Appropriate compensation to the City may be required as a result of cost associated the connection to the City's water system.	North Thurston County Coordinated Water System Plan 1982, Area Wide Supplement 1996 OMC 13.04.040 WAC 246-290-106
Properties with an Existing Water Source	All properties requesting water service that have a water source and/or water right associated with them will be required to meet additional conditions of service, such as cross connection control, EDDS, DOH and DOE requirements. All "exempt" wells on the property must be decommissioned except where use of such wells is for the purpose of resource protection, environmental monitoring, remediation of contamination, or, on a case-by-case basis, irrigation. All water right wells that are no longer in service must either be decommissioned or deeded to the City, at the discretion of the City. Appropriate compensation will be made for water rights and/or infrastructure deeded to the City, provided it is of value to the City.	2021 WSP OMC 13.04.335
New or Replacement Exempt Wells	For any existing customer or those requesting/required to connect to the City's water supply, new or replacement "exempt" wells will not be permitted, except for wells that will be used solely for resource protection, environmental monitoring, or contamination remediation.	2021 WSP OMC 13.04.335

Policy Name	Policy Statement	References
Service Extension	Whenever an applicant requests water service to premises with no main in the adjacent street, a standard main must be installed as a prerequisite to connection to the City water supply system. The standard main must conform to the EDDS and must be installed along the complete street frontage of the premises to be served in accordance with the EDDS. A standard main may be installed by any of the following methods: 1. The main may be installed at the expense of the owner or developer by a competent, licensed and bonded contractor under the supervision and approval of the City Engineer or his designated representative. 2. If the premises lie within the corporate limits of the City, the owner may elect to have the main installed by the formation of a local improvement district as prescribed by state law and the ordinances of the City. All new development within the corporate City limits or the City's Urban Growth area shall connect to a public water supply, provided that the property lies within 200 feet of a public water main, or when made a condition of project approval.	OMC 13.04.280OMC 13.04.290 OMC 13.04.335 OMC 3.20 EDDS Chapter 6
Ownership of Mains and Service Connections	Private ownership of domestic service lines will start at the downstream side of the meter. Private ownership of fire service lines will start at the downstream side of the fire service valve. The Drinking Water Utility will operate and maintain all approved and accepted water mains in public streets or utility rights-of-way. In no case shall an owner, agent, officer or employee of any premises have the right to remove or change any part thereof without the approval of the Public Works Director. No person shall install a water main which is connected to the Olympia water system without procuring a permit for such installation or connection.	OMC 13.04.180 OMC 13.04.270
Design and Performance	The City has published development standards for extension of water utilities within the service area. Design and performance of all new water infrastructure shall conform to the City of Olympia's adopted Engineering Design and Development Standards (EDDS). Approval of the plans for the extension of water utilities by the Public Works Department shall be required. The latest EDDS can be obtained from the City of Olympia website.	OMC 13.04 EDDS Chapter 6
Oversizing Main Extensions	Whenever the City requires a main size larger than would be required to serve the adjacent property or, in the case of a subdivision or development, a main size larger than required to serve that development, the City shall participate in the cost of the main to the extent of the additional size required, provided the amount of such participation shall be established by the City Engineer prior to the commencement of construction.	OMC 13.04.295
Service Connections	Refer to the OMC and EDDS for the City's latest service connection requirements.	OMC 13.04.200, EDDS 6.040 EDDS 6.200

Policy Name	Policy Statement	References
Water Meters	All service connections shall be metered. The City shall own, maintain, and repair all service meters. The City shall have and be given the right to replace or place a meter on a service and to remove the service at any time, and when so doing, the meter shall remain the property of the City. Water meters for new services will be issued after building permit approval. Meter specifications are provided in the EDDS. Fees for the installation of meters are established in the OMC.	OMC 13.04 OMC 4.24 EDDS 6.075
Water General Facility Charges	The City assesses and collects Water General Facility Charges (GFCs) in accordance with the OMC.	OMC 4.24.010 OMC 13.04.375
Latecomer Agreement	Any person who constructs a water main extension at the direction of the City, in excess of that which is required to meet minimum standards, or which meets minimum standards and will benefit properties abutting the new main, may, with the approval of the Public Works Director, enter into a contract with the City that will allow the developer to be reimbursed for that portion of the construction cost that benefits the adjoining properties and/or is in excess of the minimum standard.	OMC 13.04 EDDS 2.080
Water Service Outside City Limits	As a condition of water service outside city limits, properties shall be annexed or agreements to annex shall be executed in accordance with the OMC	OMC 13.04.240 OMC 13.04.242 OMC 13.04.244
Surcharges for Service Outside City Limits	The City collects a surcharge for water and fire protection services outside of the corporate city limits in accordance with the OMC	OMC 13.04.390OMC 13.04.400
Wholesaling Water	The City may enter into an agreement with any other municipal corporation or governmental unit for the purpose of obtaining or providing wholesale water.	OMC 13.04.230
Wheeling Water	The City may enter into an agreement with any other municipal corporation or governmental unit for the purpose of obtaining or providing water wheeling services. The City shall consider wheeling water on a case-by-case basis.	OMC 13.04.230
Cross-connection control devices and requirements for inspecting and testing	The installation or maintenance of any uncontrolled cross-connection is prohibited. Any such cross-connection now existing or hereafter installed is a nuisance and shall be abated immediately. The control or elimination of cross-connections shall be in accordance with WAC 246-290-490 or subsequent revisions, together with the City's Cross Connection Control Procedures Manual approved by the DOH. The water supply will be discontinued to any premises for failure to comply with the provisions of this section.	OMC 13.04.110



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CHAPTER 3 - POPULATION AND DEMAND FORECAST

Accurate data about projected water demand is essential for long-term water system planning. This chapter presents the City of Olympia Water Utility's (Utility) forecasts of population, households, employment and water demand. Following a review of historical and projected demographic data is a summary of use characteristics including production, consumption, and related factors. The chapter concludes with a demand forecast for the next 50 years based on the demographics, water supply characteristics and related uncertainties.

3.1 Demographic Data

Demographic data presented here includes total population, number of single-family and multi-family households and total employment. Table 3.1 shows the projected demographics at specific planning horizons from 2020 to 2070.

Forecasts are based on the Thurston Regional Planning Council (TRPC) 2018 data set for Olympia city limits and the UGA. TRPC provides forecasts for population and aggregate housing numbers in 5-year intervals between 2020 and 2045. TRPC provided a breakdown by housing type for year 2020. The data were interpolated to determine the population and housing values in 2026 and 2070. The proportion of single-family and multi-family houses described in 2020 was kept constant through the forecast period. Mobile homes were lumped into the single-family category.

TRPC provided employment data for 2017 and a forecast for 2045. The data were interpolated to determine the forecasted employment values.

Table 3.1 Projected Demographics

Year	Population	Single-Family Households	Multi-family Households	Employment
2020 (Base Year)	66,790	17,750	13,130	62,813
2026 (Plan Year 6)	72,940	20,314	15,026	67,178
2040 (Plan Year 20)	84,400	24,642	18,228	77,363
2070 (Plan Year 50)	106,021	32,091	23,739	99,188

Source: Thurston Regional Planning Council Small Area Population Estimates and Population and Employment Forecast, 2018 Update

3.2 Water Use Characteristics

This section describes the Utility's water use characteristics during 2013-2019, which were used in developing the demand forecast:

- Production and peaking factor
- Customer categories and consumption
- Non-revenue water and leakage
- Water use factors and ERUs

Production and Peaking Factor

Olympia produces water from the McAllister Wellfield and five production wells, as described in Chapter 4. Before the McAllister Wellfield came online in October 2014, Olympia obtained the majority of its drinking water from McAllister Springs. Table 3.2 shows total production by month from 2013 through 2019. Table 3.3 shows average production by source and by month from 2017 to 2019. The total

average annual production for the most recent three years has been 2,353 million gallons (Mg). Of that, approximately 73 percent was derived from the McAllister Wellfield. As is typical with most water utilities, production peaks in the summer months of May through October.

Figure 3.1 and Figure 3.2 show this same information graphically, and Figure 3.3 shows the annual production for each year from 2013 to 2019.

Table 3.2 Water Production Summary (2013 – 2019, in million gallons)

Month	2013	2014	2015	2016	2017	2018	2019
Jan	163.0	157.7	153.5	155.4	163.0	154.0	159.7
Feb	136.2	142.7	137.6	149.0	142.8	139.0	147.1
Mar	143.5	151.2	153.5	158.1	152.1	155.3	144.5
Apr	149.8	151.3	151.6	165.9	152.6	156.2	162.9
May	256.5	207.5	200.0	236.3	183.1	224.0	227.5
Jun	317.1	262.7	291.8	247.0	223.8	262.0	278.0
Jul	377.0	315.4	338.2	271.3	303.5	318.0	277.4
Aug	372.2	315.9	307.0	296.8	313.9	303.8	274.5
Sep	273.3	244.8	190.3	205.6	235.6	211.2	202.2
Oct	196.8	199.6	164.3	161.3	165.5	151.9	163.4
Nov	165.8	213.5	155.7	159.9	150.5	155.1	152.4
Dec	169.1	288.5	152.3	165.9	145.6	153.6	153.6
Total Annual Production	2,720.3	2,650.8	2,395.7	2,372.4	2,331.8	2,384.1	2,343.2

Table 3.3 Source Production Summary (2017 – 2019 average in million gallons)

Month	Kaiser Well 1 (S03)	Hoffman Well 3 (S08)	Allison Well 13 (S09)	Shana Park Well 11 (S10)	Allison Well 19 (S11)	Indian Summer 20 (S12)	McAllister Wellfield TW22 (S13)	McAllister Wellfield PW24 (S14)	McAllister Wellfield PW25 (S15)	Total	Percent
Jan	-	-	11.99	0.06	17.76	0.05	32.05	83.63	13.37	158.91	7%
Feb	-	-	11.49	0.01	15.35	0.04	22.66	62.29	31.14	142.98	6%
Mar	-	-	12.37	-	16.41	0.05	21.36	46.42	54.03	150.65	6%
Apr	-	-	11.66	6.00	16.17	0.05	15.52	29.92	77.94	157.25	7%
May	-	-	15.88	29.22	22.40	0.05	14.31	28.34	101.33	211.53	9%
Jun	-	0.23	17.95	33.62	25.33	0.03	10.15	27.47	139.79	254.59	11%
Jul	-	0.04	20.24	32.92	29.55	0.13	9.45	32.18	175.10	299.61	13%
Aug	-	0.00	20.77	30.67	29.32	0.09	0.15	76.98	139.42	297.40	13%
Sep	-	-	17.79	31.35	24.57	0.04	11.13	90.81	40.65	216.34	9%
Oct	-	-	12.13	22.48	18.33	0.05	35.84	71.04	0.38	160.24	7%
Nov	-	-	12.52	12.47	16.68	0.05	38.41	72.54	0.00	152.67	6%
Dec	-	-	12.94	0.01	18.36	0.05	38.38	80.55	0.61	150.90	6%
Total	-	0.27	177.75	198.80	250.21	0.68	249.42	702.16	773.77	2,353.05	**100%**
Percent	0%	0%	8%	8%	11%	0%	11%	30%	33%	**100%**	

Note: Seven years of production data were analyzed. However, this table uses the most recent three years in order to focus on current trends.

Figure 3.1 Water Production by Source (2017 – 2019 Average)

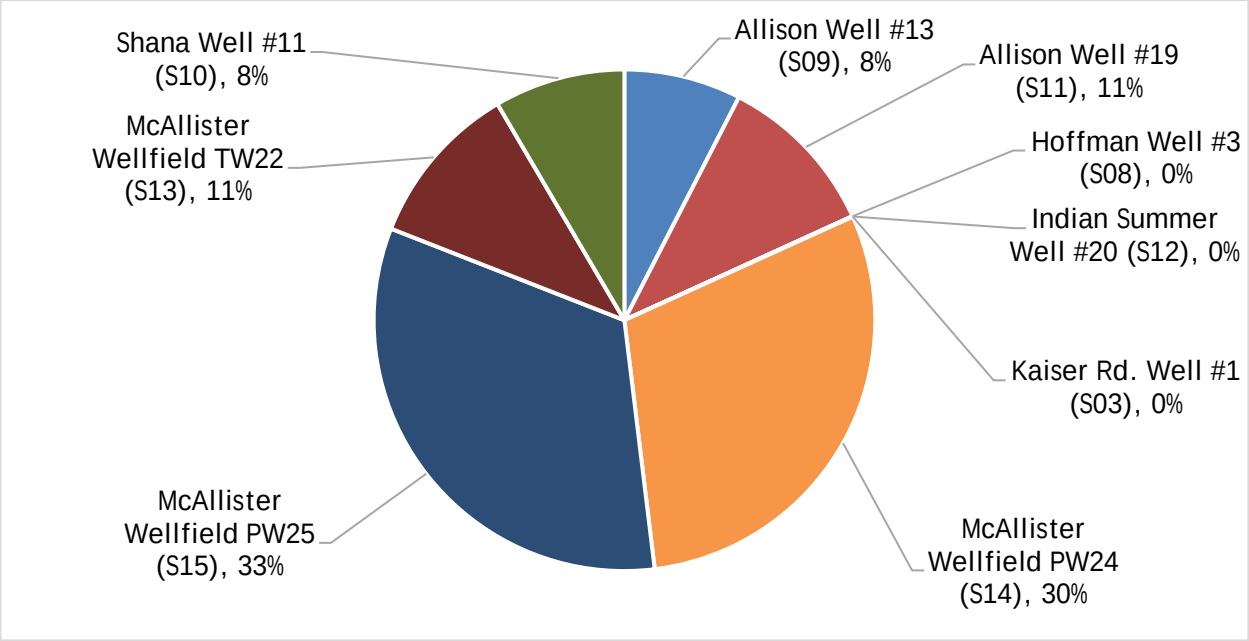


Figure 3.2 Water Production Monthly Distribution by Source (2017-2019 Average, in gallons)

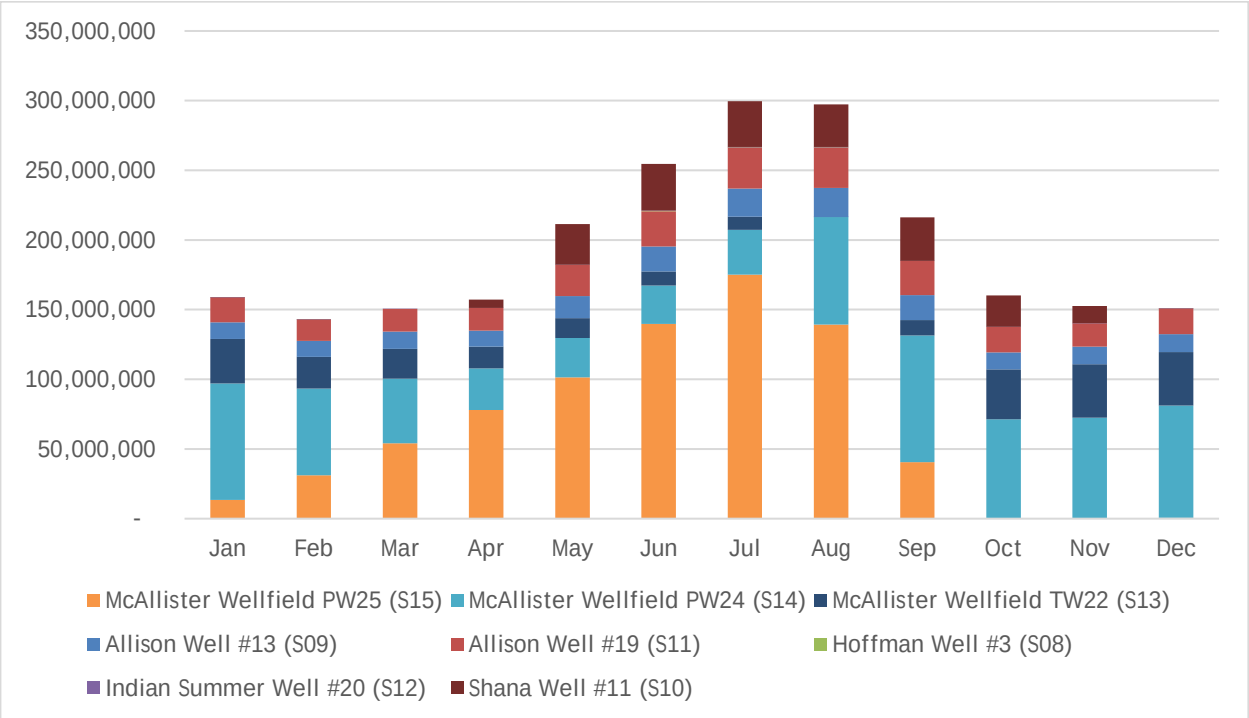


Figure 3.3 Annual Production (2013-2019, million gallons)

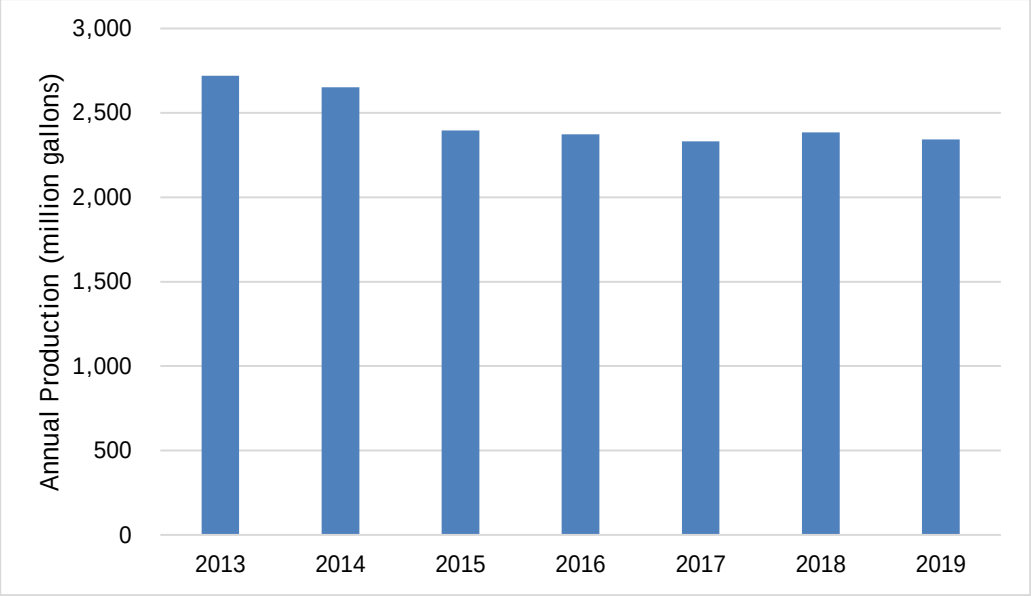


Table 3.4 gives the peaking factors from 2013 to 2019. The peaking factor has ranged from 1.7 to 2.0 and has averaged 1.88 (rounded to 1.9) for the most recent three years. Note that the demand forecast presented later in this chapter uses a slightly lower peaking factor of 1.85 because the peaking factor of the most recent three years is higher than that of the entire period of historical data reviewed, and it was determined that using the lower value was more appropriate for long-range forecasting as it is more reflective of long-term historical trends. This is slightly lower than 2.0, which was the peaking factor used in the 2015 Water System Plan.

Table 3.4 Peaking Factors

Year	Average Day (Mgd)	Peak Day		Peaking Factor
		(Mgd)	Date	
2013	7.5	12.4	7/26/13	1.7
2014	7.3	12.4	8/11/14	1.7
2015	6.6	13.1	8/1/15	2.0
2016	6.5	11.3	6/6/16	1.7
2017	6.4	11.8	8/3/17	1.9
2018	6.5	12.8	7/30/18	2.0
2019	6.4	11.8	6/12/19	1.8
2017-2019 Avg	**6.4**	**12.1**	**n/a**	**1.9**

Customer Categories and Consumption

Olympia has six retail customer categories. Each category has standard connections and irrigation-only connections.

- **Single-family**. Detached residential buildings serving a single family, duplex, triplex or four-plex.
- **Multi-family.** Residential buildings such as apartment buildings or condominiums that serve multiple households.
- **Commercial.** Business and governmental customers.
- **Municipal.** City of Olympia facilities.
- **Political subdivision.** Includes quasi-governmental customers such as Intercity Transit, Port of Olympia and schools.
- **State.** State of Washington facilities.

The Utility used to sell water wholesale to the City of Lacey and Thurston Public Utility District No. 1 (PUD). The PUD stopped purchasing water from the Utility in early 2015. Lacey stopped purchasing water from the City upon the expiration of the wholesale agreement on December 31, 2016. The Utility does not anticipate resumption of wholesale sales in the forthcoming planning period. Emergency water sales to the City of Lacey, the PUD and the Candlewood Water System may occur during the forthcoming planning period as outlined in water supply agreements with each neighboring system, however. (See Chapter 2 for additional information.)

Table 3.5 gives the number of connections for each customer category from 2013 to 2019. Most connections are either single-family (85%) or commercial (9%).

Average consumption, by customer category and by month, over the last three years, is shown in Table 3.6. The largest share of water consumption is accounted for by the single-family customer category (47%), followed by commercial (24%) and multi-family (21%). These collectively represent 92 percent of consumption.

Figure 3.4 demonstrates the typical pattern of seasonal demand changes. Figure 3.4 and Figure 3.5 show the same information as Table 3.6, graphically.

Actual monthly consumption of water may differ slightly from the data presented in Table 3.6 and Figures 3.4 and Figure 3.5. Most water meters are read bi-monthly and consumption is assigned to the month in which the meter is read.

Table 3.5 Connections by Customer Category

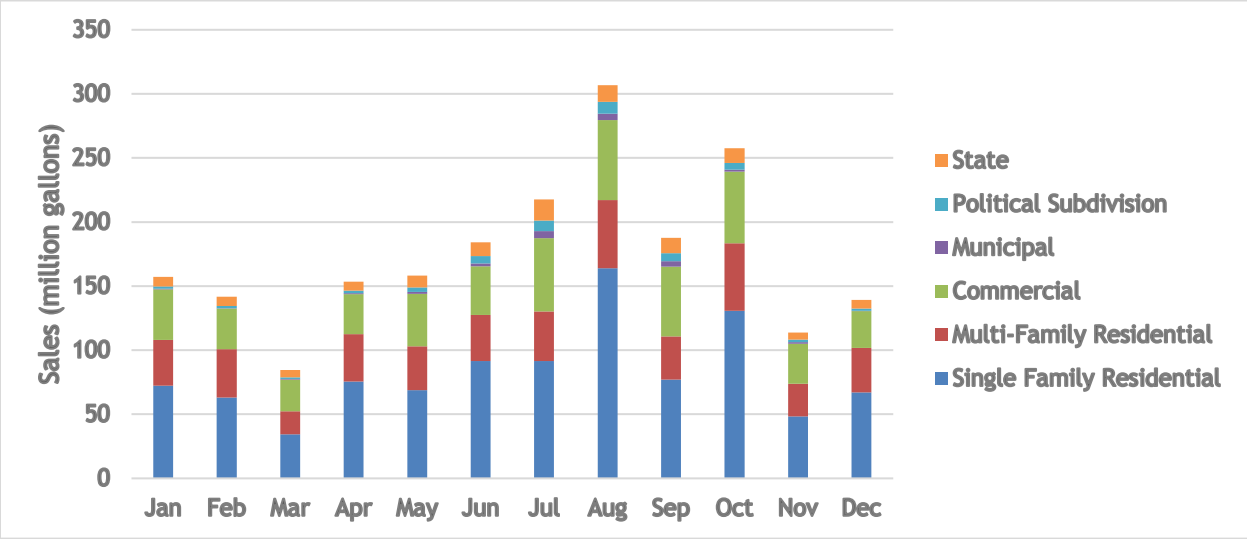
Customer Category		2013	2014	2015	2016	2017	2018	2019	% Of total Connections ('17 – '19 average)
1. Single-family	Standard	16,755	16,949	17,167	17,364	17,576	17,631	17,729	84.0%
	Irrigation	120	107	105	101	97	104	102	0.5%
	Total	16,875	17,056	17,272	17,465	17,673	17,735	17,831	**84.5%**
2. Multi-family	Standard	762	782	818	835	871	919	762	4.4%
	Irrigation	36	39	41	41	43	46	36	0.2%
	Total	798	821	859	876	914	965	1,000	**4.6%**
3. Commercial	Standard	1,539	1,567	1,599	1,585	1,578	1,588	1,539	7.5%
	Irrigation	304	307	315	315	319	320	304	1.5%
	Total	1,843	1,874	1,914	1,900	1,897	1,908	1,889	**9.0%**
4. Municipal	Standard	70	70	74	69	64	66	69	0.3%
	Irrigation	75	65	60	54	61	56	58	0.3%
	Total	145	135	134	123	125	122	127	**0.6%**
5. Political Subdivision	Standard	108	107	109	102	103	107	107	0.5%
	Irrigation	44	48	48	46	44	46	46	0.2%
	Total	152	155	157	148	147	153	153	**0.7%**
6. State	Standard	92	89	87	86	88	101	85	0.4%
	Irrigation	47	47	47	53	45	45	45	0.2%
	Total	139	136	134	139	133	146	130	**0.6%**
Total	Standard	19,326	19,564	19,854	20,041	20,280	20,412	20,528	97.2%
	Irrigation	626	613	616	610	609	617	602	2.8%
	Total	19,952	20,177	20,470	20,651	20,889	21,029	21,130	**100%**

Table 3.6 Average Metered Water Consumption 2017-2019 (Mg) [1]

Customer Category		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Percent
1. Single-family	Standard	72.4	63.0	34.4	75.3	68.4	88.0	89.7	154.6	75.5	125.0	48.2	67.1	961.4	45.7%
	Irrigation	0.1	0.0	0.0	0.2	0.3	3.4	1.9	9.4	1.6	5.9	0.2	0.1	23.1	1.1%
	Total	72.4	63.0	34.4	75.5	68.7	91.5	91.6	163.9	77.1	130.8	48.3	67.2	984.5	46.8%
2. Multi-family	Standard	35.6	37.8	18.0	37.1	34.1	33.6	35.5	46.9	30.7	48.6	25.2	34.5	417.7	19.9%
	Irrigation	0.1	0.0	0.0	0.0	0.3	2.5	3.2	6.2	3.0	3.9	0.3	0.1	19.6	0.9%
	Total	35.7	37.8	18.0	37.1	34.4	36.1	38.7	53.2	33.8	52.5	25.6	34.5	437.3	20.8%
3. Commercial	Standard	38.8	31.3	24.5	30.5	38.5	28.8	43.9	37.3	40.7	38.6	28.7	27.5	409.0	19.5%
	Irrigation	0.5	0.4	0.3	0.5	2.3	9.1	13.4	25.2	13.6	17.3	2.4	1.3	86.4	4.1%
	Total	39.3	31.7	24.7	31.0	40.8	37.9	57.3	62.5	54.3	55.9	31.1	28.8	495.4	23.6%
4. Municipal	Standard	0.4	0.2	0.2	0.2	0.6	0.2	0.9	0.5	0.9	0.4	0.4	0.2	5.0	0.2%
	Irrigation	0.2	0.1	0.2	0.5	1.0	2.0	4.6	4.4	3.3	1.3	1.0	0.1	18.7	0.9%
	Total	0.6	0.3	0.4	0.7	1.6	2.2	5.5	4.8	4.2	1.7	1.4	0.3	23.7	1.1%
5. Political Subdivision	Standard	1.8	1.5	1.3	1.9	2.5	2.1	2.5	2.0	2.2	2.3	1.6	1.6	23.2	1.1%
	Irrigation	0.1	0.1	0.0	0.2	1.0	3.6	5.7	7.3	4.3	2.9	0.3	0.1	25.6	1.2%
	Total	1.9	1.6	1.4	2.1	3.5	5.7	8.2	9.3	6.4	5.2	1.8	1.7	48.8	2.3%
6. State	Standard	7.3	7.4	5.6	6.7	7.6	8.2	8.9	10.1	7.3	8.1	5.2	6.4	88.8	4.2%
	Irrigation	0.0	0.0	0.0	0.2	1.4	2.6	7.4	3.1	4.7	3.3	0.3	0.3	23.4	1.1%
	Total	7.3	7.4	5.6	6.9	9.1	10.9	16.3	13.1	11.9	11.4	5.5	6.7	112.3	5.3%
Total	Standard	156.2	141.2	84.0	151.7	151.8	161.0	181.4	251.3	157.2	223.0	109.2	137.3	1,905.3	90.6%
	Irrigation	1.0	0.6	0.5	1.6	6.3	23.3	36.1	55.6	30.6	34.6	4.6	2.0	196.8	9.4%
	Total	157.2	141.8	84.5	153.4	158.1	184.2	217.5	306.9	187.7	257.6	113.7	139.3	2,102.0	**100%**
Percent		7%	7%	4%	7%	8%	9%	10%	15%	9%	12%	5%	7%	100%	

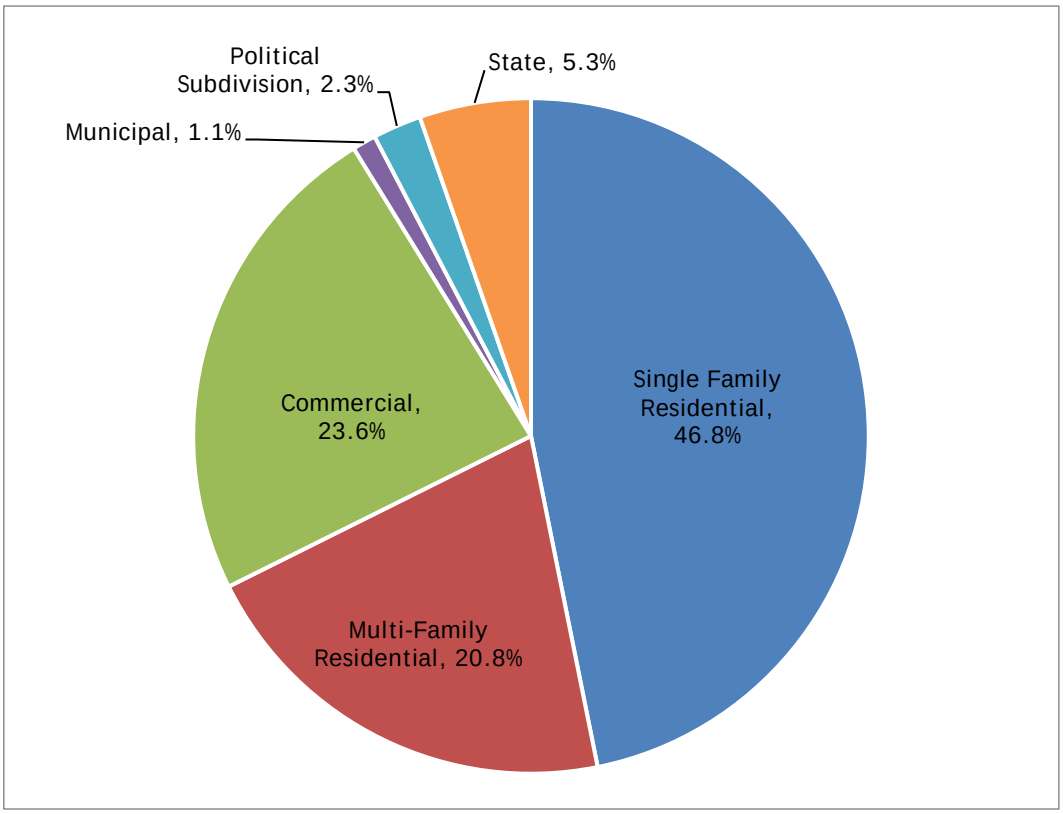
1. Actual monthly distribution water use may differ somewhat since the month of consumption is based on meter read dates and many meters are read bi-monthly.

Figure 3.4 Monthly Distribution of Water Consumption (2017-2019 Average)



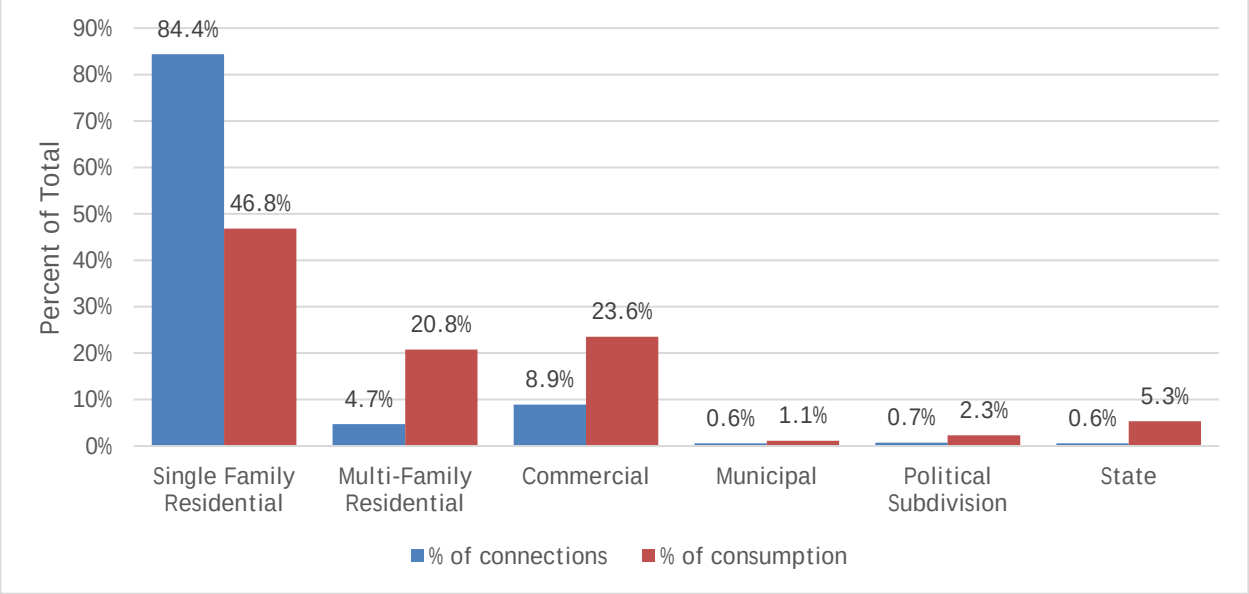
Note: Actual monthly distribution water use may differ since the month of consumption is based on meter read dates and many meters are read bi-monthly.

Figure 3.5 Water Consumption by Customer Category (2017-2019 Average)



Comparing the percent of connections to the percent of consumption can be useful, since water consumption does not always follow the same proportion as customer connections. This comparison is shown in Figure 3.6. Three customer categories stand out in this comparison. Single-family has a much larger percent of connections (84%) compared to the percent of consumption (47%). Multi-family has a much smaller percent of connections (5%) compared to the percent of consumption (21%). This is because one multi-family connection serves many multi-family households. Commercial has a much smaller percent of connections (9%) compared to consumption (24%).

Figure 3.6 Connections and Consumption Comparison (2017-2019 Average)



Customers with large water demand are of interest since their demand could have significant impact on overall demand. This is particularly true when the largest customers are commercial customers. Table 3.7 summarizes water use for the 20 customers with the highest water use for 2017 through 2019. Collectively, these customers represent approximately 18% of total consumption.

Large customer demands are removed from their respective customer category and held constant in the demand forecast, since a specific customer's demands are unlikely to grow alongside demographic projections in the same way an entire customer class will.

Table 3.7 Customers with Highest Water Use (2017-2019 Average Consumption)

Rank	Customer Name	Service Address	Customer Class	Total Consumption (Mg)
1	Evergreen State College	2700 Evergreen Pkwy NW	State	57.10
2	St Peters Hospital	413 Lilly Rd NE	Commercial	37.83
3	Olympia School Dist #111	City-wide	Pol Sub	32.88
4	Crown Beverage & Packaging Co	1202 Fones Rd. SE	Commercial	30.62
5	Lott Clean Water Alliance	500 Adams St NE	Commercial	21.95
6	Capitol Bldgs & Grounds	Capitol Campus	State	21.00
7	Colonial Estates	3700 14th Ave SE	Multi Family	19.67
8	Cambridge Court Apts	2323 9TH Ave SW	Multi Family	18.01
9	Black Lake Llc	3300 21st Ave SW	Multi Family	15.68
10	Capital Medical Center	3900 Capital Mall Dr SW	Commercial	14.68
11	Capital Mall	625 Black Lake Blvd SW	Commercial	14.67
12	City Of Olympia Parks	City-wide	Municipal	14.03
13	Apple Park Asset Managment Llc	3200 Capital Mall Dr SW	Multi Family	13.31
14	Courtside Asset Management	515 Courtside St SW	Multi Family	11.57
15	Evergreen Vista	1209 Fern St SW	Multi Family	10.14
16	Crowne Pointe Apts	2800 Limited Lane NW	Multi Family	9.79
17	Friendly Village Llc	1111 Archwood Dr SW	Multi Family	8.75
18	Woodland Apartment Associate	800 Yauger Way SW	Multi Family	8.55
19	Copper Trail Apartments Llc	701 Alta St SW	Multi Family	8.53
20	East Plaza Garage Irrigation	1400 Capitol Way S	State	3.32
			Total	**372.10**

Non-Revenue Water and Leakage

The forecast of future demand includes a calculation of "non-revenue water," which includes leakage and all other unmetered and metered uses that are not sold for revenue. Authorized uses of unmetered (and therefore, unbilled) water include firefighting and hydrant flushing, sampling, water and sewer line flushing and testing, street cleaning and other maintenance. For this purpose, a simple calculation of production minus sales was used to determine non-revenue water, as shown in Table 3.8. Distribution System Losses (DSL) are determined by subtracting unbilled authorized use from non-revenue water.

Table 3.8 Distribution System Losses and Non-Revenue Water (million gallons)

Year	Production	Sales	Non-Revenue Water			Unbilled Authorized Use		Distribution System Losses	
			Qty[1]	Percent of Production	Percent of Sales	Qty[2]	Percent of Production	Qty	Percent of Production
2013	2,720	2,301	419	15.4%	18.2%	24	0.9%	395	14.5%
2014	2,651	2,380	271	10.2%	11.4%	19	0.7%	252	9.5%
2015	2,396	2,240	156	6.5%	6.9%	17	0.7%	138	5.8%
2016	2,372	2,082	290	12.2%	13.9%	12	0.5%	279	11.8%
2017	2,332	2,084	248	10.6%	11.9%	20	0.9%	227	9.7%
2018	2,384	2,147	237	9.9%	11.0%	19	0.8%	217	9.1%
2019	2,343	2,075	269	11.5%	13.0%	36	1.5%	233	10.0%
17 - '19 average	**2,353**	**2,102**	**251**	**11%**	**11.9%**	**25**	**1.1%**	**226**	**9.6%**

1. Production minus sales.
2. Estimated use from firefighting, hydrant flushing, operations and maintenance, etc.

Water Use Factors and ERUs

Equivalent Residential Units (ERUs) are a method of representing water use by non-residential customers as an equivalent number of residential customers. An ERU is the amount of water used by a single-family household. This value is determined by dividing the average annual single-family customer class consumption between 2017 and 2019 (984.5 million gallons) by the average number of single-family connections over the same time period (17,746 connections). **The City's ERU value is 152 gallons per day per household.**

The number of ERUs for each customer category is obtained by dividing the consumption (in gpd) for a customer category by 152. Therefore, using 2019 as an example year, the single-family customer category equates to 17,225 ERUs (approximately the number of single-family connections); the multi-family category to 7,971 ERUs; and the commercial category to 8,889 ERUs. Table 3.9 shows the data used for the calculation.

The ERU water use factor has generally trended downward over the prior several planning periods. The ERU value in the City's 2015 Water System Plan was 166 gpd per household.

Table 3.9 Water Use Factors and ERUs

	2013	2014	2015	2016	2017	2018	2019	3 year average
SFR Annual Consumption (MG)[1]	939	968	1,043	970	989.0	1,009.0	955.6	984.5
SFR Total Connections[1]	16,875	17,056	17,272	17,465	17,673	17,735	17,831	17,746
Gal/ERU	55,655	56,772	60,395	55,525	55,961	56,891	53,593	55,482
GPD/ERU	152	156	165	152	153	156	147	152

1. Includes single family irrigation sales.

3.3 Demand Forecast

The City of Olympia Comprehensive Plan requires the Utility to reserve water supply rights for at least 50 years in advance of need, so that supplies can be protected from contamination or commitment to lower priority uses (Policy PU 5.1). This section describes the methodology used in developing the demand forecast and provides the results with and without additional conservation.

Demand Forecast Methodology

The basic process is to apply population growth rate forecasts to historical and projected demands to calculate customer demands for specific years in the planning horizon. Demand components for non-revenue water are added to create the total average day demand (ADD). To generate the total maximum day demand (MDD), a peaking factor is applied to all demands. Details of the methodology for each forecast component are explained below.

- **Step 1 Single-Family Demands.** The projection for single-family demands began with the average consumption from 2017 – 2019 for the single-family billing category (including single-family irrigation) in Table 3.6, multiplied by the annual population growth rate for 2020 (2.2%), to arrive at the Base Year demand for 2020. Growth rates were then applied to this forecasted demand consistent with the population forecasts in Table 3.1, so as to generate future demand projections.
- **Step 2 Multi-Family Demands.** The projection for multi-family demands began with the average consumption from 2017 – 2019 for the multi-family billing category in Table 3.6 minus the large multi-family users identified in Table 3.7, multiplied by the same growth rates used to develop single-family demands.
- **Step 3 Non-Residential Demands.** The customer categories associated with non-residential demands are commercial, municipal, political subdivision, and state. The projection for the non-residential demands began with the average consumption from 2017 – 2019 for each non-residential billing category in Table 3.6 minus the non-residential large users identified in Table 3.7, multiplied by the same growth rates used to develop single-family demands.
- **Step 4 Largest User Demands.** The demand projection for the "Large Users" category used the 2017-2019 average actual consumption for the 20 largest users in Table 3.7, which was held constant through the planning horizon as no substantial growth is anticipated by most of these customers.
- **Step 5 Subtotal Average Day Demands (ADD).** The subtotal for the Average Day Demand is a summation of all the categories above.
- **Step 6 Authorized Non-Revenue Water.** The demand projection for authorized non-revenue water used the 2017-2019 average of unbilled authorized use (Table 3.8), which was held constant through the planning horizon as no substantial changes to this category are anticipated.
- **Step 7 Allowance for Potential Large Users.** This category reserves an allowance for unforeseen potential new large users throughout the forecast period. This category forecasts an additional 100,000 gpd every five years. This is generally consistent with historical demands of large customers.

- **Step 8 Distribution System Leakage (DSL).** The demand projection for DSL multiplies the subtotal ADD by the non-revenue factor. The non-revenue factor used the 2017-2019 average of approximately 11 percent of billed consumption (Table 3.8). This factor is assumed to remain constant throughout the planning horizon.
- **Step 9 Total Average Day Demand (ADD).** The subtotal ADD, authorized non-revenue, allowance for potential large users, and DSL are added together. This is considered the baseline ADD forecast.
- **Step 10 Maximum Day Demand (MDD).** A peaking factor of 1.85 (Table 3.4 and Section 3.4) is applied to the total ADD. This is considered the baseline MDD forecast.
- **Step 11 Conservation Savings.** Additional conservation as shown reflects what demand would look like if conservation goals are met (Chapter 5). The Utility's demand-side conservation goal is to reduce water use by five percent per service connection over the conservation planning period (six years). Savings are calculated by multiplying the total forecasted consumption in a year by five percent, then scaling down based on the time in the conservation planning period (e.g., in planning year two, savings are multiplied by 2/6). Full conservation potential is realized in planning year six. No conservation goals are set beyond that time, so the savings forecasted at six years are carried into the future.

Demand Forecast with and without Conservation

Projected demand for average day and maximum day are shown in Table 3.10 and Figure 3.9, with and without additional conservation. Additional conservation as shown reflects what demand would look like if conservation goals are met (Chapter 5). Figure 3.10 shows the individual components of the average day demand to illustrate the relative impact of each component over the 50-year planning period.

Table 3.10 Projected Demand with and without Additional Conservation

	Average Day Demand (mgd)						
Customer	2020	2025	2026	2030	2035	2040	2070
Single Family Residential	2.76	2.98	3.01	3.15	3.33	3.48	4.38
Multi-Family Residential	0.88	0.95	0.95	1.00	1.06	1.11	1.39
Commercial	1.05	1.14	1.14	1.20	1.27	1.33	1.67
Municipal	0.03	0.03	0.03	0.03	0.03	0.03	0.04
Political Subdivision	0.04	0.04	0.04	0.04	0.05	0.05	0.06
State	0.09	0.09	0.09	0.10	0.10	0.11	0.14
Largest Users	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Subtotal	5.86	6.24	6.28	6.55	6.87	7.13	8.70
Authorized Non-Rev	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Allowance for Potential Large Users (100,000 gpd every 5 years)	0.00	0.10	0.10	0.20	0.30	0.40	1.00
DSL	0.63	0.67	0.67	0.70	0.74	0.77	0.94
Total System Demand (ADD, without conservation)	6.55	7.08	7.12	7.53	7.97	8.37	10.70
Max Day Demand (without conservation)	12.14	13.12	13.19	13.94	14.77	15.50	19.83
Conservation Savings	(0.05)	(0.25)	(0.30)	(0.30)	(0.30)	(0.30)	(0.30)
Total System Demand (ADD, with conservation)	6.51	6.83	6.82	7.23	7.67	8.07	10.40
Max Day Demand (with conservation)	12.05	12.66	12.64	13.39	14.22	14.95	19.28

Figure 3.9 Average Day and Maximum Day Demand Forecast

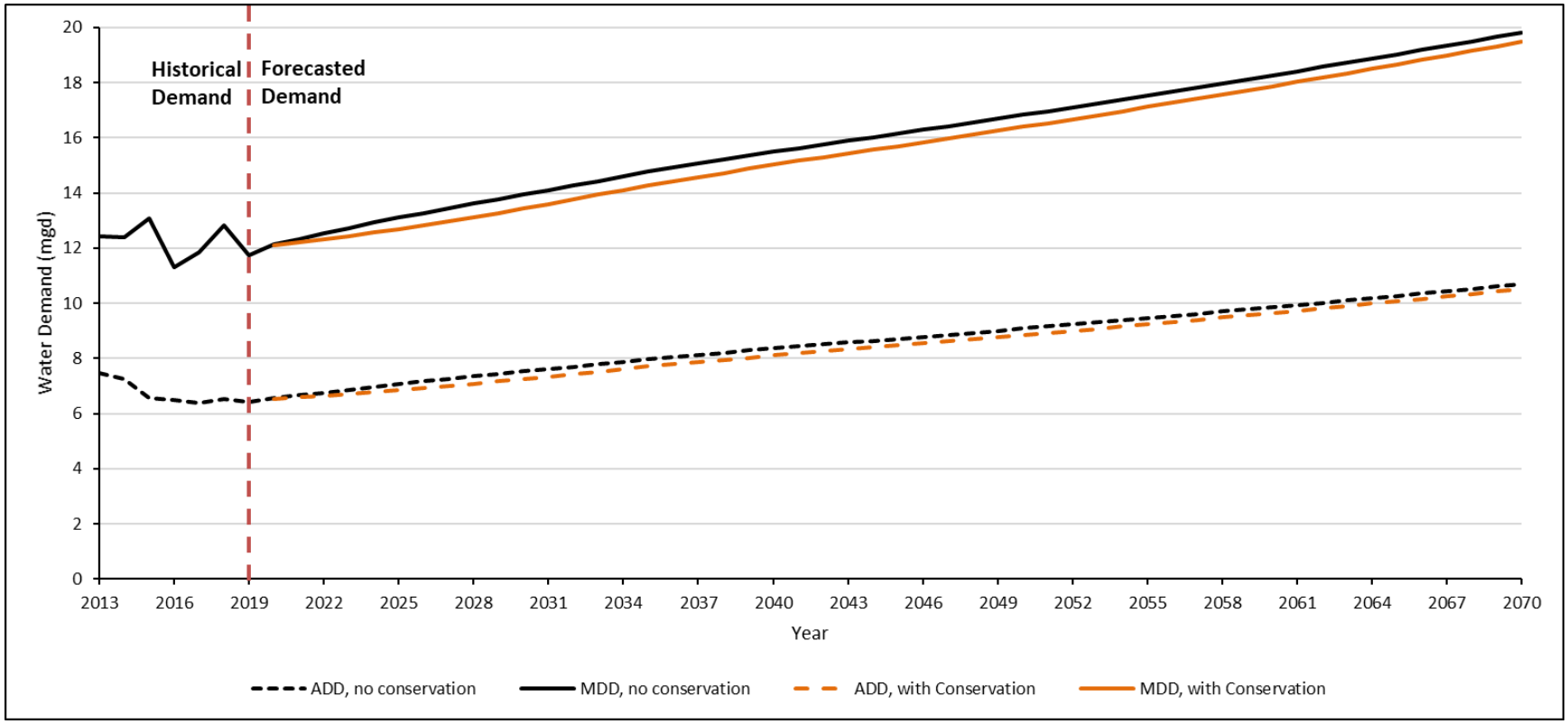


Figure 3.10 Average Day Demand Forecast Details (No Conservation)

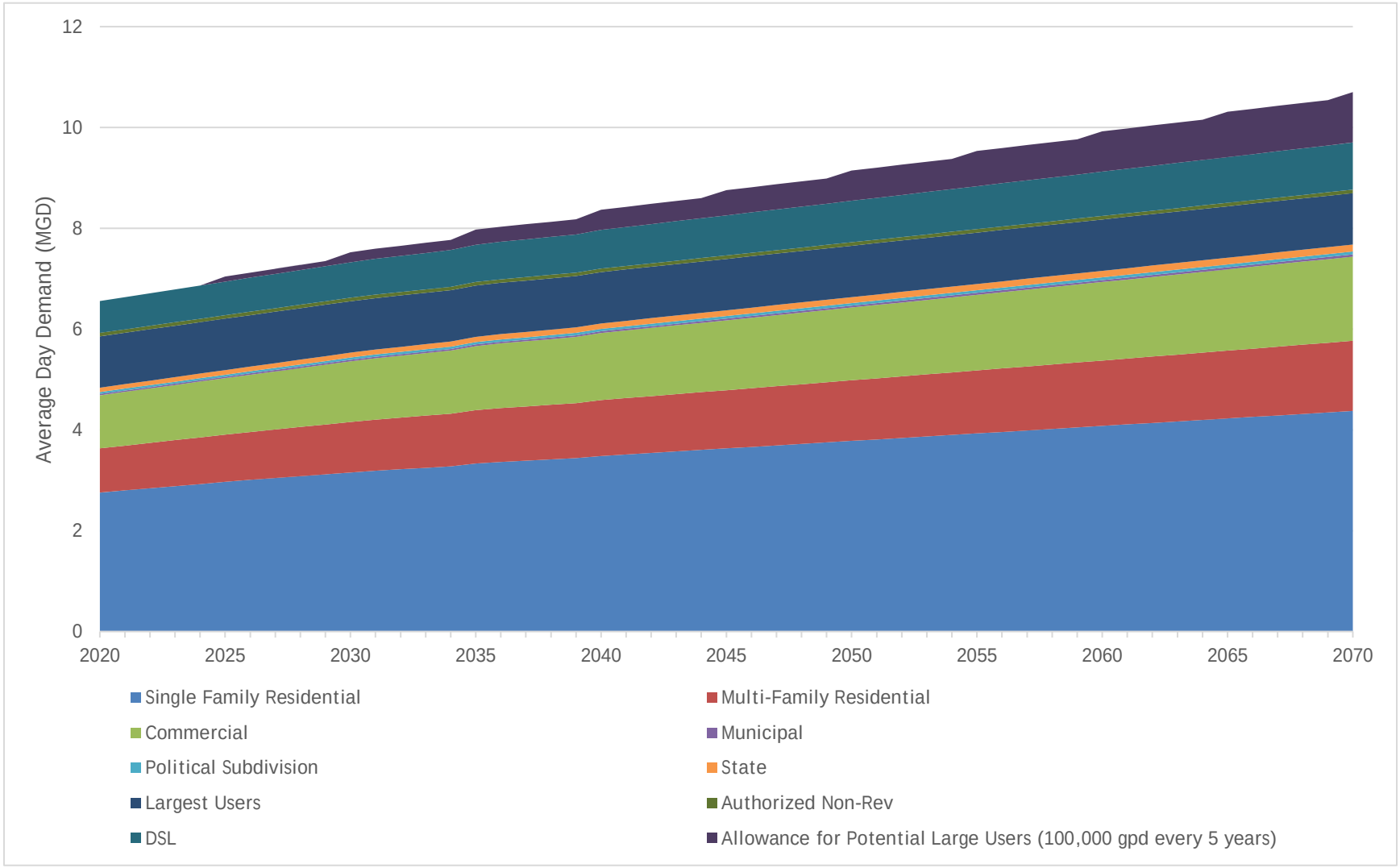
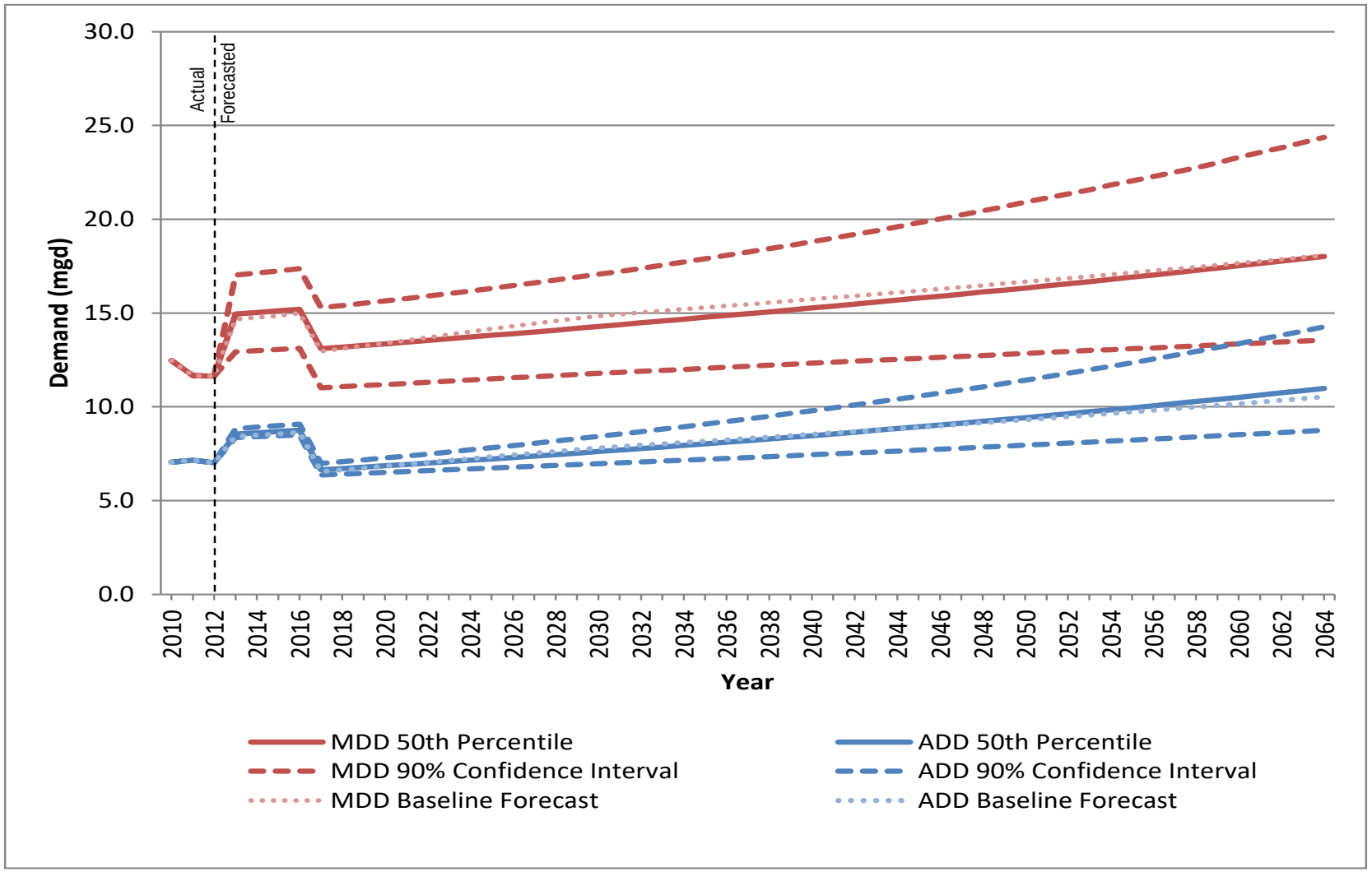


Figure 3.11 Results of Demand Forecast Uncertainty Analysis



3.4 Uncertainty Analysis of Demand Forecast

The baseline demand forecast is an *estimate* of what future demand might be. To understand the uncertainty in the future values, an uncertainty analysis was conducted to define a *range* of possible future demands relative to the baseline demand forecast.

A detailed uncertainty analysis was conducted in the 2015 Water System Plan (see Appendix 3-2 of that document), considering ranges in the following forecast variables:

- Growth rates for the major customer types,
- per capita water use (i.e., water use factor),
- and peaking factor for maximum day demand.

This resulted in the depiction of a range in the demand forecast bounded by a 90 percent confidence interval that was calculated using a Monte Carlo computational approach. This detailed analysis was not replicated in this Water System Plan; rather, similar characteristics of the 90 percent confidence intervals (i.e., relative values compared to the baseline demand forecast) were applied to the updated baseline demand forecast presented above in Table 3.10 and Figure 3.10. For example, in the 2015 WSP analysis, at the six-year horizon the upper bound of the 90 percent confidence interval for average day demands was equal to 105% of the baseline demand projected for that year, while the lower bound of the 90 percent confidence interval was equal to 97% of baseline. These same relative percentages were applied to the baseline demand forecast in this WSP to provide the updated uncertainty analysis. Table 3.11 summarizes the relative percentages associated with multiple time horizons used to develop the uncertainty band that is presented in Figure 3.11.

Table 3.11 90% Confidence Intervals for Forecasted Demands

	Average Day Demand				Maximum Day Demand			
Year	**2026**	**2030**	**2040**	**2070**	**2026**	**2030**	**2040**	**2070**
Lower Bound[1]	97%	94%	90%	87%	87%	85%	82%	80%
Upper Bound[1]	105%	105%	107%	128%	114%	112%	112%	126%

1. Expressed as percentages of baseline demands.

One factor that has recently emerged and which will likely continue to drive uncertainty in future water demand is the impact of the COVID-19 pandemic and its associated changes in where and how people work. The commercial, state, and political subdivision customer categories contain accounts that were notably affected by these changes. Commercial demand represents a significant component of the City's overall demand profile. Annual usage in this category decreased from 2019 to 2020 by approximately 8.8 million gallons, representing a decline of approximately 16 percent. Similarly, decreases were seen in the state and political subdivision categories of 27 percent and 21 percent, respectively. This likely is largely attributable to the shift by many workers, including state and local governmental employees, to work from home as opposed to in the office, as well as the overall decrease in commercial business activity (e.g., through temporary closures of restaurants and retail establishments). This began in the spring of 2020 and continues to be the case (though to a lesser extent) as of the writing of this WSP. It is unknown how this may continue into the future, but indications are that in-office work will continue to be less than it was before COVID-19, with a potential impact (i.e., sustained decrease) in commercial water demand. While there are not sufficient data to quantify this effect in detail for the long term, it is acknowledged that this is a key factor that is contained within the projected uncertainty of the demand forecast.



Source of Supply Program

Chapter 4

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CHAPTER 4 - SOURCE OF SUPPLY PROGRAM

As described in Chapter 1, the City of Olympia Drinking Water Utility (Utility) depends on groundwater to meet its drinking water needs, drawing on sources within the Nisqually and Deschutes Watersheds. McAllister Wellfield is the Utility's primary supply, serving all Utility customers from September through May. In the spring and summer, when outdoor water use increases, the City supplements this source with five production wells in East Olympia and the Allison Springs area of West Olympia. The City is extending the supply resource through aggressive water conservation and the use of reclaimed water strategies (Chapter 5 and Chapter 6).

The Utility's Goal 1 is:

> **Adequate supplies of water are available for the Olympia community while protecting in-stream flows and sustaining the long-term capacity of aquifers.**

This goal is consistent with the City of Olympia Comprehensive Plan Goal GU5, and associated policies, PU5.1-PU5.5.

The previous planning period focused on fulfilling mitigation requirements associated with the McAllister Wellfield water rights, as well as beginning to further evaluate the timing and sequencing of the Utility's undeveloped water rights. This planning period will focus on making and implementing long-term strategic decisions on the sequencing of the Utility's undeveloped water rights and existing southeast Olympia water sources.

The Program will continue to focus on three objectives during this planning period:

- Maintain water rights that ensure sufficient supply for at least 50 years, so sources can be protected from contamination or commitment to lower priority uses.
- Encourage multi-jurisdictional approaches to water rights and source development.
- Monitor water levels in all pumped aquifers and maintain numerical groundwater models to better understand aquifer characteristics and evaluate the impacts of the Utility's withdrawals used for water supply.

4.1 Source of Supply Regulations

Several legal mechanisms limit the use of water. The basic laws governing water rights and withdrawals from groundwater and surface water in Washington are the Water Code (Chapter 90.03 RCW) and Regulation of Public Ground Water (Chapter 90.44 RCW). These laws are implemented by the Washington State Department of Ecology (Ecology). Water rights rules are in Chapter 173-152 WAC. Each water right includes specific withdrawal limits and often includes other conditions that may limit water use.

In addition, legal constraints can result from Endangered Species Act recovery plans, interlocal agreements, watershed plans, water resource management plans, and court decisions.

The Utility draws water from the Nisqually and Deschutes watersheds where salmon species are listed under the Endangered Species Act. Watershed planning activities are underway, but no specific legal constraints limit the Utility's use of its water rights.

4.2 Source Description

This section focuses on the interactions between surface water and groundwater in the two regional watersheds from which the Utility withdraws water, and the basic hydrology of the aquifers that supply each of the Utility's drinking water wells.

This information has been used to assess the ability of these sources to continue to reliably supply customer water needs. The additional information needed to complete the reliability assessment is in several other chapters. Chapter 7 gives details on hydrogeology of the Drinking Water (Wellhead) Protection Areas; Chapter 8 provides an analysis of source infrastructure and describes planned improvements; and Chapter 11 describes treatment methods.

Regional Water Resources

The Utility views its water system from the perspective of the full hydrologic cycle. This perspective recognizes the connection between groundwater and surface water, and the effect that a groundwater-dependent water system may have on surrounding surface water bodies.

The Utility withdraws water from aquifers in two watersheds. McAllister Wellfield is in the Nisqually Watershed. The other five production wells, one emergency well and future Briggs and Brewery Wells are in the Deschutes Watershed. The State of Washington designates these watersheds as Water Resource Inventory Area (WRIA) 11 and 13, respectively.

Analysis indicates relatively active interaction between the Utility's aquifers and surface water bodies in these watersheds. This work includes the groundwater modeling that was done to assess the impact of transferring the McAllister Springs/Abbott Springs water rights to the McAllister Wellfield, delineate Drinking Water Protection Areas (DWPAs), and to support watershed planning efforts in the Nisqually and Deschutes watersheds.

Drinking Water Supply Sources

This section briefly summarizes the basic hydrology of areas around McAllister Wellfield, Olympia's other five supply wells, one emergency well and the future Briggs and Brewery wells. The most recent comprehensive hydrogeological information is in two reports prepared by Golder and Associates to support the 2009 revisions to delineations of the Utility's Drinking Water Protection Areas (DWPA) (Golder, 2008a and 2008b), referred to in this Water System Plan as the Golder reports. In Chapter 7, findings of these reports are described in detail for each DWPA. More recent hydrogeological information has been obtained from several new groundwater monitoring wells installed in the Allison Springs, Shana Park, and Indian Summer DWPAs, and from research conducted to site the location of a test well (the LBA Pilot Well) west of the Hoffman DWPA. Information post-2008 will be incorporated with other hydrogeological data to be obtained in support of the Utility's plan to recalibrate the existing numerical groundwater models and evaluate the boundaries of the DWPAs (see Chapter 7).

Although hydrogeological information is somewhat limited, the interaction between surface water and groundwater in the McAllister numerical model area, which includes the East Olympia wells, is generally well understood. The surface water-groundwater interaction is less understood in the Allison Springs area of West Olympia because less supporting hydrogeological data is available to calibrate the model.

The McAllister groundwater modeling work simulated the impacts of McAllister Wellfield operation and conservatively predicted the long-term impacts on surface water. These impacts are being addressed in mitigation plans prepared by the Cities of Olympia, Lacey, and Yelm and the Nisqually Indian Tribe (see Section 4.4).

No studies have been completed to determine the long-term impacts of the Utility's existing five supply wells. However, with numerical groundwater models in place for all of Olympia's water sources, the Utility now has the basic analytical tools to predict the impacts of withdrawals from these wells on surface water and groundwater.

State regulations require aquifer pumping tests to establish the capacity of wells used for public water supply. For information about the wells and their pumping capacities see Chapter 8, Section 8.1.

McAllister Wellfield

The Utility's major source, McAllister Wellfield (S16), is located approximately eight miles east of Olympia at the southern edge of the Nisqually Valley in WRIA 11 (see Map 1.4). The City of Olympia and Nisqually Indian Tribe partnered to develop the McAllister Wellfield in 2014 as a more protected source of supply than the previously used McAllister Springs surface water withdrawal site.

The McAllister Wellfield taps into the McAllister Gravel Aquifer three-quarters of a mile up-gradient of McAllister Springs. According to the Golder report (2008a), recharge is primarily from infiltration of precipitation and subsurface inflow from the up-gradient area to the south. Groundwater discharge occurs through natural springs and seeps, groundwater pumping, seepage from shallow aquifers to rivers, lakes and streams, and subsurface outflow to the north.

Manual and electronic groundwater level monitoring data for the McAllister Springs area has been collected for over a decade. The quantity of groundwater level information is enormous because of the (minimum) daily pressure transducer readings taken at most locations. The Utility has formatted these data to allow meaningful analysis. Some of the McAllister Springs groundwater level data is pertinent to the McAllister Wellfield and has enabled the Utility to revise the monitoring strategy for the entire McAllister Wellfield Drinking Water Protection Area.

East Olympia Wells

The Utility uses three wells in the East Olympia area: Hoffman Well 3 (S08) located off Hoffman Road, Shana Park Well 11 (S10) along Yelm Highway, and the Indian Summer Well 20 (S12) located in the Indian Summer gated community development, all shown in Map 1.4. No large-scale aquifer pumping tests have been completed to determine the long-term impacts of these specific wells on surrounding groundwater and surface water bodies. The Utility does have several years of monitoring well water level data surrounding Shana Park Well 11 (S10), which was used to delineate the Drinking Water Protection Area for the 2009 Water System Plan (see Chapter 7, Section 7.4).

The Golder (2008a) report provides some information on historical groundwater levels. The report found typical annual reductions and recovery in shallow groundwater levels, but overall water levels were relatively unchanged throughout the periods of study. Hoffman Well (S08), completed in a deep, confined aquifer, is not connected to local shallow groundwater or surface water, but is recharged several miles to the south. Indian Summer Well 20 (S12) is recharged more locally and is completed in a confined aquifer.

The report identified a potential connection between the Shana Park Well 11 (S10) and nearby surface water when an "extended" capture zone is manually added to the results of the modeled wellhead protection area. The report reflects a conservative evaluation of possible connection between surface water and the shallow aquifer system suggesting Shana Park Well 11 (S10) may be considered groundwater under the influence of surface water (GWI). The Utility is not conducting a GWI evaluation of Well 11 because the well depth and distance from surface water do not meet the state's regulatory definition of GWI. (Shana Park Well 11 is about 2,000 feet from Smith Lake.) However, the Utility has

begun to assess the long-term viability of the Shana Park source well given its susceptibility to elevated nitrate levels in the area.

In 2018, the Utility completed Project WS-10 Shana Park Source Contingency Plan which evaluated future options for the source well in support of our long-term supply development and diversification efforts (Chapter 11). The Capital Improvement Program (Chapter 13) includes funding for the recommendation in the plan to drill a test well in the Utility-owned LBA parcel about 1.3 miles north of the Shana Park well location. This "LBA Pilot Well" (under CFP Project WS-5) is planned to be drilled to a depth of 400 feet in pursuit of a sufficient quantity of high-quality water to relocate Shana Park's water right. The outcome of the LBA Pilot Well exploration, which includes an aquifer pumping test and groundwater quality grab samples, is anticipated to be completed in 2021 and will help guide evaluation of the Utility's East Olympia water rights portfolio.

West Olympia Wells

The Utility has three wells in the West Olympia area: Allison Springs Well 13 (S09) and Allison Springs Well 19 (S11), located near Mud Bay Road, and the Kaiser Well 1 (S03) emergency source near Kaiser Road and Louise Lake (see Map 1.4).

No large-scale aquifer pumping tests have been completed to determine the long-term impacts of these wells on surrounding groundwater and surface water bodies. However, the Golder report (2008a) found that the primary source of water for this aquifer is vertical seepage from the overlying aquifer. The main discharge occurs at Eld Inlet and Budd Inlet. Analysis of water levels by Golder and City staff for monitoring wells in the Allison Springs area shows that groundwater levels typically vary by less than 15 feet (as measured since 2007).

Future Briggs Well

A new Briggs Well (S13) is planned in the Briggs Village development west of the East Olympia wells and immediately west of the former Briggs Nursery.

This well would draw from the Deschutes Valley Aquifer (DVA) system. Golder (2008a and 2008b) reported that the main sources of groundwater in the well area are infiltration of precipitation and underflow from the southeast. The primary discharge features are underflow to the northwest, withdrawals at groundwater wells, and seepage to surface water, including the Deschutes River, and Ward and Hewitt Lakes.

Future Brewery Wellfield

The Cities of Olympia, Lacey and Tumwater are investigating joint development of the former Olympia Brewery wellfield to meet future demand. The wellfield is located next to the Deschutes River, north of Custer Boulevard.

In 2012, the cities evaluated existing infrastructure and assessed aquifer conditions through pumping tests and water quality sampling at selected wells. The testing revealed the presence of separate shallow and deep aquifer systems, in both upland and lowland areas. The three cities are continuing evaluations to better understand potential alternatives for wellfield operation

4.3 Water Rights

Water rights granted by the State can establish limits on withdrawal of water from the environment in two ways: by establishing specific limits on annual and instantaneous withdrawals and by establishing other conditions. Appendix 4-1 includes the final and most recent water rights documents for all Utility water sources.

This section compares the Utility's existing water rights with current and projected demand.

Total Water Rights

The Utility currently has water rights totaling:

- 26,502 gallons per minute (gpm) instantaneous withdrawal
- 29,649 acre-feet annual (AFY) withdrawal

Individual Source Analysis

The individual source analysis shows that the existing maximum instantaneous and maximum annual quantities used are within the limits of the water rights for the City's sources.

The Utility's forecasted 20-year demand totals are also within the City's existing water rights, so with proper management of each source, the Utility's projected 20-year demands should not exceed the water rights for individual source.

Table 4.1 shows the Utility's existing water rights compared with existing consumption (based on 2020 data). The difference between these amounts is shown as the Utility's current excess in water rights. Table 4.1 also shows information for the Utility's forecasted six-year and 20-year demands, as well as the forecasted excess. This assessment demonstrates that the Utility has sufficient water rights to meet demand throughout the 20-year planning period with current sources.

Existing water rights also allow for further development of the McAllister Wellfield, and development of the planned Briggs and Brewery wells. These new sources support the Utility's intent to secure a 50-year supply of water, as stated in the City of Olympia Comprehensive Plan. Bringing them online will assure sufficient supply through 2070-. (See Chapter 3, Section 3.3 for 50-year demand forecast.) Also, because they are geographically dispersed the new sources will provide additional system reliability.

Maintaining Compliance with Water Rights

This section reviews how the Utility is complying with conditions included in recently acquired water rights.

McAllister Wellfield

Water Rights. Ecology approved a transfer of the Utility's water rights from McAllister and Abbott Springs to the McAllister Wellfield on January 3, 2012.

Mitigation Plan. Pumping of the McAllister Wellfield wells is expected to impact surface waters in the Nisqually and Deschutes watersheds. As part of their applications for transfer of water rights, the Cities of Olympia, Lacey, and Yelm jointly developed a mitigation plan outlining how the cities will compensate for these impacts. Each city submitted a mitigation plan covering the aspects of the overall plan pertinent to their jurisdiction. The City of Olympia's Mitigation Plan was submitted jointly with the Nisqually Indian Tribe (see Appendix 4-3). The plan includes a collaborative approach to mitigation, including joint acquisition of water rights, land purchase and habitat restoration, and a reclaimed water infiltration facility.

The overall plan includes several documents that formalize the agreements between various jurisdictions. These agreements are included in Appendix 4-3:

- McAllister Wellfield Mitigation. Memorandum of Agreement between Olympia and the Nisqually Indian Tribe (Mitigation Plan Appendix A). The Tribe agrees to mitigate impacts on the Nisqually River, and the City agrees to mitigate impacts on Woodland Creek, Lake St. Clair, Tri-Lakes and Deschutes River. (Olympia to share these responsibilities with the Cities of Lacey and Yelm.) (Mitigation Plan Appendix A)
- Woodland Creek/Tri-Lakes Mitigation. Interlocal Agreement between Olympia and Lacey to use reclaimed water from the LOTT's Martin Way Wastewater Treatment facility for groundwater recharge and instream flow enhancement in the Woodland Creek Basin (Mitigation Plan Appendix D). (See Chapter 6, Section 6.3.)
- Deschutes River Mitigation Actions. Interlocal Agreements between Olympia, Lacey and Yelm for water rights acquisitions, property acquisition and habitat restoration actions in the Deschutes basin. (Mitigation Plan Appendix E).
- Deschutes River Mitigation. Memorandum of Understanding between the Squaxin Island Tribe and the cities of Olympia, Lacey and Yelm to participate in a Budd Inlet/Deschutes Watershed Environmental Coalition. The Coalition will pursue short- and long-term solutions towards restoration of a healthy watershed.

As of year-end 2020, the Utility and the Nisqually Indian Tribe have completed the bulk of the requirements outlined in the McAllister Wellfield Mitigation Plan. Only final retirement of the Smith water right and ongoing operations and maintenance remain (including, for Olympia, the ongoing operational and maintenance of the Woodland Creek Groundwater Recharge Facility in partnership with Lacey). Additionally, Olympia continues to be obligated to participate in a Budd Inlet/Deschutes Watershed Environmental Coalition.

Briggs Well

In April 2005, Ecology approved the Utility's purchase of water rights associated with the former Briggs Nursery. A well on this site that provided irrigation water for the nursery has been abandoned.

A new Utility well was scheduled to be completed by December 2009, but in response to the Utility's April 2009 request, Ecology extended the Construction Notice date to May 2014. In July 2013, Ecology granted the Utility a second extension of the construction schedule (until May 2019) and granted the Utility a third extension to July 1, 2024 following the Utility's April 2019 extension request. The delay in constructing a new well is pending evaluation of how this new source would be used in conjunction with the Brewery Wellfield. The current schedule anticipates construction of this new well to begin in 2024.

Development of the Briggs Well would add 1.58 Mgd of daily supply.

Brewery Wellfield

In 2008, the Cities of Olympia, Tumwater and Lacey jointly acquired the infrastructure and most of the water rights for the historic Olympia Brewery's wellfield, located north of Custer Way next to the Deschutes River.

Infrastructure and Water Rights. For nearly 100 years, the wellfield had been used for potable, commercial and industrial supply by a succession of beer manufacturers. Olympia Brewery closed in 2003. The wellfield consists of 30 wells, some of which are equipped with pumps, a one-million-gallon tank, and a distribution system of pipelines that connects most of the wells to the storage tank and all of the wells to the former brewery facility.

The water rights, shared equally among the three cities, authorize a maximum instantaneous combined rate of 6,515 gallons per minute and an annual combined withdrawal of 2,283.53 acre-feet per year.

The Utility's share of the rights is approximately 2,171 gpm and 761 acre-feet per year. In March 2021, Ecology granted Olympia, Tumwater and Lacey a water right extension request. The new Construction Notice deadline for the water rights is April 1, 2041, revised from March 15, 2021.

Wellfield Evaluation and Development. In November 2010, the City of Olympia signed an Interlocal Agreement with the cities of Tumwater and Lacey to conduct a preliminary engineering evaluation of the former Olympia Brewery property.

The first evaluation phase of this project was completed in November 2012, and included well evaluations and aquifer pumping tests, water quality testing and assessment of the need for water quality treatment, and evaluation of the existing storage tank and other acquired water facilities.

In 2016, a strategic plan for redeveloping the Brewery Wellfield was completed. This document lays the groundwork for the development of an interlocal agreement (ILA) and redevelopment of the wellfield for municipal supply. Since January 2018, the three cities have been working to develop an ILA to formalize how the Brewery Wellfield will be redeveloped.

In 2018 Tumwater undertook an effort to rehabilitate Well No. 39, which confirmed the well can be operated at 1,086 gpm for municipal supply. Following ILA execution, Tumwater intends to drill and test a new deep well in the Brewery Wellfield to further wellfield development.

Pending Water Right Applications

The City has no pending water right applications at this time.

4.4 Alternate Sources

The Washington State Department of Health (DOH) and Ecology both require public water systems to include an alternate source of supply analysis in water system plans if they are seeking new water rights within 20 years.

The DOH Water System Planning Guide identifies five categories of alternate supply strategies that should be explored before pursuing new water rights and developing new sources:

- Water conservation
- Reclaimed water
- Water right changes/transfers
- Interties
- Aquifer storage and recovery (artificial aquifer recharge)

As described in Section 4.3, the Utility has sufficient water rights to meet demand throughout the 20-year planning period and beyond. Nevertheless, the Utility is engaged in two of the alternate supply strategies: water conservation and use of reclaimed water. These are discussed briefly below. The Utility does not obtain water through interties with other purveyors and does not anticipate doing so in the future. Using interties as a source is not necessary or technically feasible since adjacent water systems operate at lower pressures. Also, the neighboring cities of Lacey and Tumwater do not have excess supply for wholesale purchase by the Utility. The Utility has not conducted any analysis to determine whether aquifer storage and recovery is a feasible supply alternative.

Water Conservation

Since 1996, the Utility has been seen as a regional leader in water conservation. The Utility will continue to implement a Water Conservation Program, described in detail in Chapter 5. By 2026, implementation is expected to reduce water consumption by an additional 5 percent per connection. This means that Olympia will use less water than predicted by the demand forecast presented in Chapter 3.

Reclaimed Water

The City of Olympia began distributing Class A reclaimed water in 2005. Reclaimed water used in the downtown Olympia area is generated at the LOTT Clean Water Alliance Budd Inlet Reclaimed Water Plant. LOTT also generates reclaimed water at its Martin Way Reclaimed Water Plant. Olympia has negotiated with LOTT for distribution rights to a total of 760,000 gallons per day from the Budd Inlet and Martin Way facilities.

In 2015, the City of Olympia entered into a Memorandum of Understanding with the City of Tumwater to temporarily redistribute Olympia's unused portions of reclaimed water (up to 400,000 gpd) for irrigation at Tumwater Valley Municipal Golf Course.

The City of Olympia also has a joint project with the City of Lacey to infiltrate reclaimed water from the Martin Way Reclaimed Water Plant for groundwater recharge in the Woodland Creek basin, as part of the McAllister Wellfield water rights mitigation plan. See Chapter 6 for details about the City of Olympia's Reclaimed Water Program.

The City of Olympia has agreements with four customers who use reclaimed water for direct beneficial use (mostly irrigation). Between 2015 and 2020, these four customers used an average of 10.3 million gallons per year, or about 15 percent of Olympia's allotment of reclaimed water from the Budd Inlet Reclaimed Water Plant. Although this use of reclaimed water has reduced outdoor use of potable water, developing reclaimed water further has not proven to be a cost-effective strategy.

Table 4.1 Water Rights Self-Assessment

Water Right Certificate # and Well Name	WFI Source #	Existing Water Rights				Current (2020) Source Production				6-Year (2026) Forecasted Source Production				20-Year (2040) Forecasted Source Production				50-Year (2070) Forecasted Source Production			
		Primary Qi (gpm)	Non-Additive Qi (gpm)	Primary Qa (afy)	Non-Additive Qa (afy)	Total Maximum Qi (gpm)	Current Qi Excess or (deficiency) (gpm)	Total Qa (afy)	Current Qa Excess or (deficiency) (afy)	Total Maximum Qi (gpm)	Current Qi Excess or (deficiency) (gpm)	Total Qa (afy)	Current Qa Excess or (deficiency) (afy)	Total Maximum Qi (gpm)	Current Qi Excess or (deficiency) (gpm)	Total Qa (afy)	Current Qa Excess or (deficiency) (afy)	Total Maximum Qi (gpm)	Current Qi Excess or (deficiency) (gpm)	Total Qa (afy)	Current Qa Excess or (deficiency) (afy)
8030 - McAllister Wellfield	S16	11,220		18,099		*(see totals below)*															
CS2-01105 - McAllister Wellfield		2,392		782	3,088																
CS2-SWP10191 - McAllister Wellfield		4,488		7,240																	
G2-00979, G2-01116, G2-00213, G2-23683 - Indian Summer Well 20	S12	850		329																	
G2-24052 - Kaiser Road Well 1	S03	380		450																	
G2-27217 - Shana Well 11	S10	900			1,143																
G2-27225 - Hoffman Well 3	S08	900			720																
G2-27426 - Allison Springs Well 13 [a]	S09	900		800																	
G2-27941 - Allison Springs Well 19 [a]	S11	1,200		900																	
60, 2643, S2-21810, S2-21811, G2-26836 - Briggs Nursery Well	S13	1,100		288																	
785-D - Brewery Wellfield	[b]	203		328																	
784-D - Brewery Wellfield		200		323																	
34-A - Brewery Wellfield		500		800																	
453-A - Brewery Wellfield		700		228																	
4587-A - Brewery Wellfield		2,250			1,723																
G2-01073C - Brewery Wellfield		900			1,440																
G2-01072C - Brewery Wellfield		900			1,440																
G2-20844C - Brewery Wellfield		862			1,379																
G2-26058C - Brewery Wellfield (Well 39)			1500 [c]	604	604																
Brewery Wellfield - Olympia's Total Share [d]		2,172		761																	
TOTALS [d,e]		26,502		29,649		8,434	18,068	7,342	22,307	9,161	17,341	7,975	21,674	10,766	15,736	9,373	20,276	13,770	12,732	11,987	17,662

Footnotes:

[a] When Allison Spring Well 13 (S09) and Weill 19 (S11) are pumped simultaneously, the combined instantaneous flow rate (Qi) is limited to 2,000 gpm.

[b] The full Qi and Qa of each individual Brewery Wellfield water right is shown in the table, not just Olympia's one-third share. See footnote d.

[c] The Brewery Wellfield Well 39 Qi (Supplemental quantity) is not included in the Total Qi because of limitations on concurrent pumping with other Brewey Wellfield wells per Report of Examination G2-

[d] Total Qi include Olympia's one-third share of the Brewery Wellfield water rights, not the full Qi and Qa shown in the table. See footnote b.

[e] The total Qa for existing water rights does not include supplemental rights.

Other Notes:

1. Olympia has no interruptible water rights.
2. Olympia has no pending water rights.
3. Olympia does not obtain water through interties with other purveyors, but is capable of doing so during emergencies via established agreements.



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CHAPTER 5 - WATER USE EFFICIENCY PROGRAM

As shown in Chapter 4, the City has secured sufficient supply to meet the water demands projected through 2070. Chapter 5 and Chapter 6 describe how the City is using water conservation and reclaimed water strategies to make efficient use of the water supply.

Both the Water Conservation Program and Reclaimed Water Program (Chapter 6) help meet the Drinking Water Utility's Goal 3:

> **Olympia's water supplies are used efficiently to meet the present and future needs of the community and natural environment.**

This goal is consistent with the City's Comprehensive Plan Goal GU4 and subsequent policies.

Water conservation helps meet the City's water needs by reducing the amount of water taken from the environment to support community demand. Using reclaimed (treated) water for non-potable purposes reduces the demand for potable water.

Olympia's first Water Conservation Plan was adopted by City Council in December 1996, and the City began implementing conservation measures in mid-1997. Subsequent plans have been approved and implemented ever since.

The Water Conservation Program for 2021-2026 is designed to continue to meet State water use efficiency regulations. The Program will focus on two objectives during this planning period:

- Reduce water use by five percent per service connection
- Maintain water loss below 10 percent of production

The above objectives are the City's water use efficiency goals as required by the Municipal Water Law (WAC 246-290) and were established through a public forum.

5.1 Water Use Efficiency Regulations

In January 2007, the State of Washington adopted water use efficiency regulations (WAC 246-290). Some of the requirements are directly related to planning, while others address metering and performance reporting. Table 5.1 lists the water use efficiency requirements and demonstrates Olympia's compliance in each area. The required annual water use reports submitted to the State for 2014-2019 are in Appendix 5-1.

Table 5.1 Water Use Efficiency Requirements

Category	Requirement	Olympia's Compliance
Meters	Meter all sources.	All sources are metered.
	Meter all service connections.	All service connections are metered.
Data Collection	Provide monthly and annual production for each source.	See Chapter 3, Table 3.2, Figure 3.2, Figure 3.3.
	Provide annual consumption by customer class.	See Chapter 3, Table 3.5 and Figure 3.4, Figure 3.5.
	Provide "seasonal variations" consumption by customer class.	See Chapter 3, Table 3.6, Figure 3.4.
	Provide annual quantity supplied to other public water systems.	See Chapter 3, Table 3.5.
	Evaluate reclaimed water opportunities.	See Chapter 6.
	Consider water use efficiency rate structure.	Olympia charges inclining block rates and seasonal rates. See Section 5.2 and Chapter 14.
Distribution System Leakage	Calculate annual volume and percent using formula defined in the Rule.	See Section 5.2, Table 5.6.
Goals	Establish measurable (in terms of water production or usage) conservation goals. Provide schedule for achieving goals.	See Section 5.3.
	Use a public process to establish the goals.	
Efficiency Program	Describe existing conservation program.	See Section 5.4.
	Estimate water saved over last six years due to conservation program.	See Section 5.2.
	Describe conservation goals.	See Section 5.3.
	Implement or evaluate 1-12 measures, depending on size (nine measures required for Olympia).	Olympia is required to implement or evaluate nine measures. See Section 5.4 for planned activities.
	Describe conservation programs for next six years including schedule, budget and funding mechanism.	See Section 5.4 and Section 5.5.
	Describe how customers will be educated on efficiency practices.	
	Estimate projected water savings from selected measures.	
	Describe how efficiency program will be evaluated for effectiveness.	
Demand Forecast	Provide demand forecast reflecting no additional conservation.	See Chapter 3, Figure 3.9 and Table 3.9.
	Provide demand forecast reflecting savings from efficiency program.	
	Provide demand forecast reflecting all "cost-effective" evaluated measures.	N/A, Olympia only implements cost-effective measures.
Performance Reports	Develop annual report including goals and progress towards meeting them, total annual production, annual leakage volume and percent, and, for systems not fully metered, status of meter installation and actions taken to minimize leakage.	Olympia distributed its first performance report in June 2008; and has done so annually thereafter.
	Submit annually by July 1 to DOH and customers and make available to the public.	

5.2 Water Conservation Performance

The Water Conservation Program goal for the 2015-2020 planning period was to reduce indoor water use by 100,000 gallons per day (gpd); reduce outdoor use by 5 percent; and to maintain water loss below 10 percent of production. By the end of 2019, indoor use was reduced by 79,302 gpd; outdoor use was reduced by 4.35%; and water loss was at 9.6%, keeping us in compliance with State requirements.

Olympia's successes in conservation can be attributed to a combination of rate incentives, rebates for water efficient fixtures and appliances, customer education and controlling leakage from the system.

The City's partnership with the LOTT Clean Water Alliance (LOTT) was largely responsible for the indoor water savings achieved through our efforts. LOTT helped make a variety of conservation programs available to residential and commercial sewer customers in Olympia, Lacey and Tumwater to meet LOTT's 250,000 gallon per day flow reduction goal as well as local conservation goals.

Water conservation performance can be measured in many ways. Each year, water utilities are required to report to the Washington Department of Health (DOH) and their customers their total water production and distribution system leakage, along with a narrative description of progress toward meeting water conservation goals.

This section summarizes these and other measures the City uses to track performance:

- Total production
- Consumption
- Distribution system leakage
- Water shortage planning

Total Production

In 2019, the City produced 2,343,245,819 gallons of water. Between 2014 and 2019, average annual water production was 2,393,793,990 gallons. Since 2014, despite population growth, production has decreased by over 7 percent.

Consumption

Some of the increase in consumption during 2014-2019 is due to the unusually warm summer of 2015 when we reached drought conditions. Table 5.2 reflects the changes in water consumption and number of service connections since 1996, when the Water Conservation Program was adopted.

Connections vs Consumption

As shown in Figure 5.1, consumption has remained fairly flat despite the increasing number of service connections. Between 2014 and 2019, the total number of connections to the water distribution system increased by 4.3 percent, while consumption increased by only 1 percent.

Extreme changes in consumption are most often weather-related; as shown by higher consumption values in Figure 5.1 for the warmer summer of 2015. Substantial increases in water use occur in years with abnormally warmer summers.

Figure 5.1 Annual Water Use and Number of Connections, 2014 – 2019

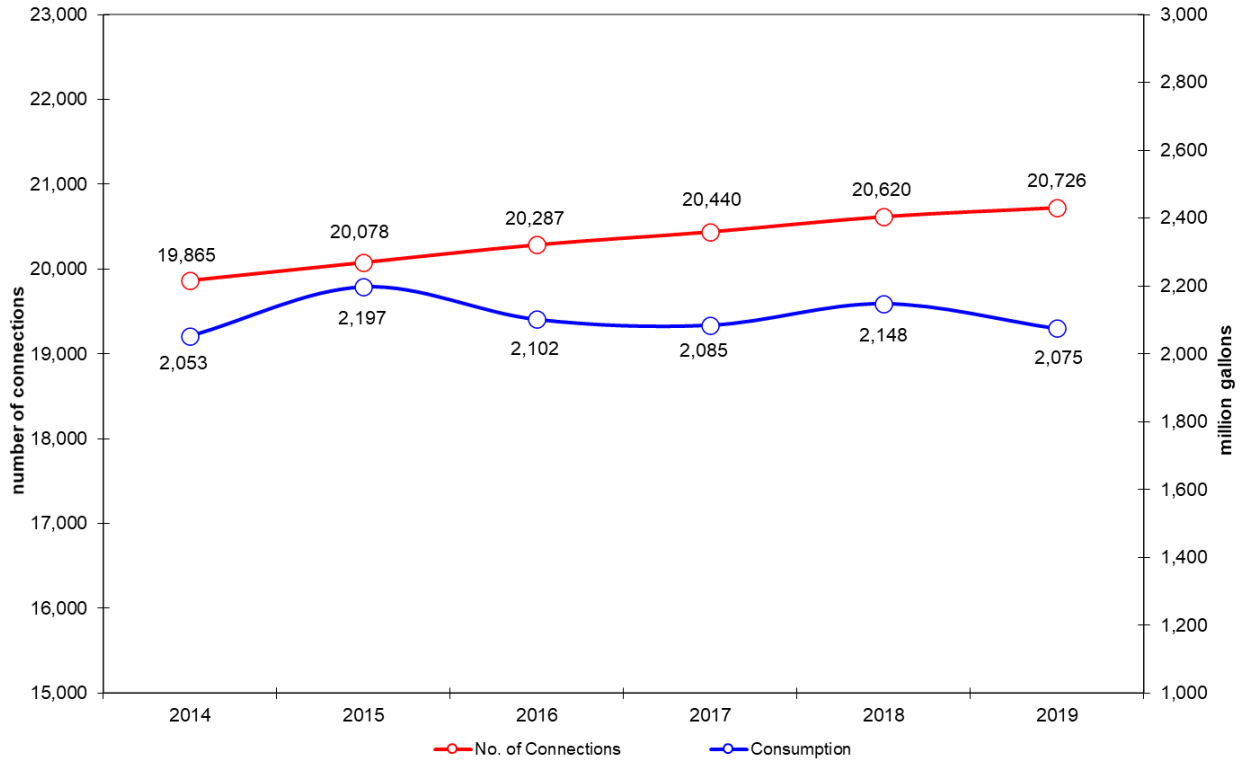


Table 5.2 Changes in Water Consumption, 1996-2019

Year	Connections	Consumption (million gallons)	Total annual usage change from 1996	Gallons used per connection per day	Per connection reduction from 1996	Per connection reduction from previous year
1996	15,279	2,557	n/a	457	n/a	n/a
1997	15,697	2,592	1.37%	452	-1.06%	-1.06%
1998	16,022	2,850	11.46%	487	6.58%	7.72%
1999	16,544	2,454	-4.03%	406	-11.12%	-16.61%
2000	16,653	2,453	-4.07%	402	-11.98%	-0.97%
2001	16,904	2,308	-9.74%	374	-18.19%	-7.05%
2002	17,139	2,348	-8.17%	375	-17.91%	0.34%
2003	17,652	2,547	-0.39%	395	-13.55%	5.32%
2004	18,051	2,375	-7.59%	358	-21.78%	-9.52%
2005	18,190	2,286	-10.64%	344	-24.73%	-3.78%
2006	18,523	2,331	-9.11%	344	-24.82%	-0.12%
2007	18,827	2,184	-14.82%	317	-30.68%	-7.80%
2008	19,000	2,127	-16.82%	306	-33.11%	-3.50%
2009	19,236	2,127	-16.82%	303	-33.75%	-0.96%
2010	19,090	1,939	-24.17%	278	-39.14%	-8.14%
2011	19,421	1,977	-22.68%	279	-39.01%	0.22%
2012	19,490	2,010	-21.39%	282	-38.38%	1.03%
2013	19,646	1,970	-22.96%	275	-39.92%	-2.50%
2014	19,865	2,053	-19.71%	283	-38.08%	2.97%
2015	20,078	2,197	-14.08%	300	-34.44%	5.55%
2016	20,287	2,102	-17.79%	283	-38.09%	-5.90%
2017	20,440	2,085	-18.46%	279	-38.88%	-1.30%
2018	20,620	2,148	-16.00%	285	-37.58%	2.08%
2019	20,726	2,075	-18.85%	274	-40.01%	-4.05%
Total Change	35.7%	**Average Change**	-12.37%	**Average Change**	-26.74%	-2.42%

Rate Incentives and Consumption

The City uses an "inclining block" rate structure for single-family residential customers, meaning that the cost of water increases as a customer uses more. Prior to 2005, the City had a three-tier rate structure with the third tier specifically designed to discourage discretionary use of water during summer months. In 2005, the City added a fourth tier to provide a stronger price signal to those who use the most water during the summer. Table 5.3 shows the tiered rate structure from 2014 through 2019.

In addition to the inclining block rate structure, the City uses seasonal water rates for non-residential, multi-family and irrigation customers to help curb summer water waste. These customer classes pay more for each unit of water used during the summer months than in winter. Customers also pay consumption-based sewer charges (based on water use). For more information on the utility rate structure, see Chapter 14.

Table 5.3 Drinking Water Utility Tiered Rate Structure: Single-Family Residential (SFR)

SFR Rates	Tier 1 0 to 800 cubic feet (cf)	Tier 2 801 to 1,800 cf	Tier 3 1,801 to 2,800 cf	Tier 4 2,801 + cf
2014	$1.53 per ccf*	$2.52 per ccf	$4.01 per ccf	$5.27 per ccf
2015	$1.62 per ccf	$2.67 per ccf	$4.25 per ccf	$5.59 per ccf
2016	$1.74 per ccf	$2.86 per ccf	$4.56 per ccf	$6.00 per ccf
2017	$1.80 per ccf	$3.02 per ccf	$4.82 per ccf	$6.34per ccf
2018	$1.88 per ccf	$3.15 per ccf	$5.03 per ccf	$6.62 per ccf
2019	$1.88 per ccf	$3.15 per ccf	$5.03 per ccf	$6.62 per ccf

*ccf – hundred cubic feet

Table 5.4 and Table 5.5 provide consumption information per rate tier and the changes between tiers annually since 2014 for single-family residential customers. The drastic increase in Tier 4 for 2015 can be attributed to the 2015 drought conditions we experienced.

Table 5.4 Annual Water Consumption by Rate Tier (Million Cubic Feet)

	Tier 1	Tier 2	Tier 3	Tier 4	Total
2014	69.64	35.12	10.93	13.75	129.43
2015	70.53	37.67	12.42	18.22	138.86
2016	68.12	36.11	11.63	13.79	129.65
2017	70.18	36.12	11.40	14.51	132.22
2018	70.89	36.61	11.71	15.68	134.89
2019	70.49	34.69	10.38	12.10	127.66

Table 5.5 Change in Water Consumption by Rate Tier (Percentage)

	Tier 1	Tier 2	Tier 3	Tier 4
2015	1.28%	7.26%	13.63%	32.51%
2016	-3.42%	-4.14%	-6.36%	-24.31%
2017	3.03%	.03%	-1.98%	5.22%
2018	1.01%	1.36%	2.72%	8.06%
2019	-.56%	-5.24%	-11.36%	-22.83%

Distribution System Leakage

Water utilities are required to report their distribution system leakage (DSL) to DOH annually. Utilities are required to meet a DSL standard of 10 percent or less of total production. To track DSL, the Utility works closely with various City staff to track and estimate authorized but unmetered uses, such as fire suppression, hydrant flushing, operation and maintenance, and water quality sampling. DSL is calculated by subtracting metered consumption and authorized non-metered consumption from total production. The result indicates how much water was lost to leaks, main breaks, meter inaccuracies and theft of water. Chapter 3, Section 3.2 explains how the Utility accounts for leakage in forecasting future demand.

The Utility reported to DOH a total water loss of 9.9 percent for 2019; with a current rolling three-year average of 9.6 percent. Table 5.6 offers an overview of the Utility's DSL for 2014-2019.

In anticipation of exceeding 10 percent DSL, the Utility is preemptively taking measures to address water loss such as assessing data accuracy and calibrating source meters.

Table 5.6 Distribution System Leakage (Gallons)

Year	Total Production	Total Authorized Consumption	Total DSL	Percent DSL
2019	2,343,245,819	2,110,264,473	232,981,346	9.9%
2018	2,384,064,395	2,166,982,799	217,081,596	9.1%
2017	2,331,836,755	2,104,982,118	226,854,637	9.7%
2016	2,372,427,035	2,122,376,931	250,050,104	10.5%
2015	2,406,544,152	2,252,653,943	153,890,209	6.4%
2014	2,524,645,783	2,329,548,274	195,097,509	7.7%

Water Shortage Plan

Olympia's Water Conservation Program encourages customers to voluntarily decrease their water use to use the water supply more efficiently. During times of drought or other supply emergencies, established curtailment measures would be put in place quickly to reduce water usage.

In the Puget Sound area, drought usually occurs when there is less than average fall/winter precipitation, or a summer of sustained higher than normal temperatures and lower than normal precipitation. Either condition can contribute to above-average demand and an accelerated drawdown of the City's water supplies.

The Water Shortage Plan (Appendix 5-2) details four levels of curtailment:

- Advisory
- Voluntary
- Mandatory
- Emergency

As a water shortage situation becomes more serious, higher stages of response are implemented. Each stage has progressively more stringent requirements to coincide with conditions of increasing severity.

5.3 Planned Water Conservation Activities

This section describes the conservation activities that will continue in this planning period and estimated water savings for each. The activities are summarized in Table 5.7.

Table 5.7 Planned Water Conservation Activities (2021 – 2026)

Indoor	Outdoor	Additional Ongoing
Ultra-High-Efficiency Toilet Rebate	Smart Irrigation Controller Rebate	Pressure Reducing Valve Rebate
Clothes Washer Rebate	Sprinkler Nozzle Rebate	Water Resources E-News & Utility Bill Insert Articles/Promotion
WaterSmart Technology Rebate	Rain Barrel Rebate	Annual Smart Irrigation Month Campaign
Water Saving Kits	Hose Watering Timers	Annual Water Resources Stewardship through Art Calendar Contest
	Soil Moisture Meters	Annual Fix-a-Leak Week Campaign
	Water Saving Kits	Regional Partnerships
	Efficient Irrigation Equipment Rebate (MF/ICI)	Targeted Program Outreach
	Title 16.60 OMC and Title 18.36 OMC contain native vegetation landscaping provisions	Water Loss Accounting

Indoor Water Conservation

For indoor conservation, the Program focuses on installation of water-efficient technologies. The bulk of the indoor program is implemented through a cooperative effort with LOTT and the Cities of Lacey and Tumwater. Because its primary motivation is reducing wastewater flow to the LOTT Wastewater Treatment Plant, LOTT funds 100 percent of all non-staff program costs for customers with sewer service. The City offers rebates for customers with septic systems that do not qualify for LOTT's programs.

The following activities, with water savings assumptions and calculations for each, are described in greater detail in the LOTT Water Conservation Coordination Plan (Appendix 5-3), updated by the LOTT partners in 2019. Ongoing activities are:

- Ultra-High-Efficiency Toilet Rebates
- Clothes Washer Rebates
- WaterSmart Technology Rebate Program
- Free Water Saving Kits

Ultra-High-Efficiency Toilets

Ultra-High-efficiency toilets (UHETs) offer water savings in many applications, across all customer categories. Toilets installed prior to 1994, using between 3.5 and 5 gallons per flush (gpf). In 1994, toilets were regulated so that only those flushing at 1.6 gpf or less could be sold. A new law effective January 1, 2021, ensures toilets sold in Washington State meet a new efficiency standard of 1.28 gpf or less. High-Efficiency toilets meeting current standards use 1.28 gpf, about 14 percent more than ultra-high-efficiency toilets using 1.1 gpf or less. Replacing toilets with an ultra-high-efficiency model results in substantial water savings, as shown in Table 5.8.

Table 5.8 Water Savings Assumptions for Ultra-High-Efficiency Toilets

	Flow Reduction
Single-Family Residential	17.3 gpd
Multi-Family Residential	12.0 gpd
Industrial, Commercial & Institutional	31.8 gpd

For the 2021-2026 planning period, two UHET offerings will be available across all customer categories through the LOTT program:

- UHET Rebates
- WaterSmart Technology Rebates

The program chosen will depend on customer category, water usage of existing fixtures, and in some cases the number of toilets to be replaced.

Residential water customers with septic systems who do not qualify for LOTT's programs are eligible for a rebate from the City of $100 per toilet, the same rate as LOTT's rebate program.

Clothes Washer Rebates

For this planning period, residential customers on either sewer or septic systems will be eligible for a $50 rebate per household on the purchase of resource-efficient clothes washers. To qualify for rebate, clothes washers must be ENERGY STAR certified.

Water Savings Assumptions: 14 gpd

Watersmart Technology Rebates

Available to Olympia's ICI customers, this program offers rebates of up to 75 percent of the installed costs of water-efficient devices and fixture upgrades, such as plumbing, water-cooled ice machines, dish washers, laundry equipment, boiler and steam systems, and rinsing and cleaning processes.

Interested customers work with City staff to identify prospective projects and complete the rebate application, describing the proposed project, estimating total cost and providing water savings assumptions. Following staff review of the proposal and approval by LOTT's Water Conservation Coordination Committee (WC3), the customer completes the project and then submits invoices and work orders to the City. City staff inspects the new equipment, confirms installation and recommends that LOTT award the rebate.

Water Savings Assumptions: Vary, calculated on a case-by-case basis.

Water Saving Kits

Indoor Water Saving Kits, which include a low-flow showerhead, kitchen and bathroom faucet aerators, toilet leak detection tablets and installation instructions, are distributed to single-family and multi-family customers free of charge. The fixtures included use less water than current plumbing code standards without compromising function. Kits are available to water customers on either sewer or septic systems. LOTT funds the kits for sewer customers; the City funds the kits for septic customers.

Water Savings Assumptions: 12 gpd

Outdoor Water Conservation

Since water use doubles (and sometimes triples) in the summer months, this strategy focuses on reducing outdoor water waste for all customer categories. Because water used outdoors for lawns, gardens, car washing, etc. does not end up in the wastewater system, these programs are funded entirely by the City.

For the 2021-2026 planning period, ongoing offerings include:

Residential Customers

- Smart Irrigation Controller Rebates
- Sprinkler Nozzle Rebates
- Rain Barrel Rebates
- Free Hose Watering Timers
- Free Soil Moisture Meters
- Free Water Saving Kits

ICI Customers

- Efficient Irrigation Equipment RebatesSmart Irrigation Controller Rebate

Residential customers with in-ground irrigation systems are eligible for a rebate of up to 50 percent of the installed cost of a "smart" irrigation controller, not to exceed $200. Smart irrigation controllers automatically adjust watering times based on weather conditions to provide optimal moisture for healthy plants and conserve water. Water savings of 15 to 30 percent is common when traditional irrigation timers are changed to smart controllers.

Sprinkler Nozzle Rebates

Residential customers with in-ground irrigation systems are eligible for a $5 rebate for each sprinkler converted to a high-efficiency nozzle (not to exceed $200). Entire zones must be converted. Changing to high-efficiency nozzles is the simplest reliable way to improve irrigation efficiency.

Rain Barrel Rebates

Residential customers are eligible for a rebate of up to $20 per rain barrel, with a maximum of four rebates per residence. A rain barrel collects rainwater from the roof and stores it for later uses like watering potted plants and gardens. Rain barrels help to conserve drinking water and reduce stormwater flows. Each barrel holds about 55 gallons of rainwater.

Hose Watering Timers

Residential customers who water their lawns and gardens with a hose-end sprinkler can reduce overwatering by using a timer provided free by the City. Timers can be set to water only as long as needed.

Soil Moisture Meters

Soil moisture meters help to determine when to water your lawn and garden. The easy-to-read meter indicates whether your soil is dry, moist or wet to ensure proper watering. These are free to residential customers.

Water Saving Kits

Outdoor Water Saving Kits include an adjustable spray nozzle for car washing, a hose repair kit to fix leaks and a rain/sprinkler gauge to monitor how much water lawns and gardens are receiving. Free kits are available to residential customers.

Efficient Irrigation Equipment Rebates

ICI customers with in-ground irrigation systems are eligible for rebates of up to $3,500 for installing selected efficient irrigation equipment to improve existing systems. Equipment eligible for these rebates includes spray nozzle retrofits, smart controller sensor retrofits, smart controller installation, drip irrigation conversions, flow sensor installation, pressure regulators and networked control systems. Water savings varies depending on the existing system and the upgrades made.

Additional Ongoing Program Activities

Other ongoing activities described below are:

- Pressure Reducing Valve Rebates
- Utility Bill Inserts
- Water Resources E-News
- Smart Irrigation Month Campaign
- Fix-a-Leak Week Campaign
- Stormwater Utility Collaboration
- Regional & National Partnerships
- Targeted Program Outreach
- Water Loss Accounting

Pressure Reducing Valve Rebate

Residential customers with water pressure above 80 pounds per square inch (psi) are eligible for a rebate of up to 50 percent of the installed cost of a pressure reducing valve (PRV), not to exceed $125. Installing a PRV can reduce the strain on plumbing fixtures and reduce water waste. Water savings varies depending on the pressure before and after the PRV is installed.

Utility Bill Insert

Customers receive information on water conservation practices, tips, incentives and rebates through the bi-monthly utility bill insert, Five Things.

Smart Irrigation Month Campaign

July has been designated as Smart Irrigation Month by the Irrigation Association. The City celebrates this campaign by promoting efficient water use outdoors through a radio advertisement, reader boards, street banners, direct mailings, conservation giveaways and utility bill inserts.

Fix-a-Leak Week Campaign

Each March, the EPA sponsors Fix-a-Leak Week, a campaign to raise awareness on the water wasted through household leaks. Household leaks can waste more than 1 trillion gallons of water annually nationwide. The City participates by promoting the event through the website, street banner, news releases and free toilet leak detection tablets to encourage customers to check for and repair leaks in their homes.

Stormwater Utility Collaboration

The Utility will continue to collaborate with the Stormwater Utility on education and outreach activities for water conservation and stormwater pollution prevention best practices. The Utilities have had success with projects such as our *Are You Waterwise?* on-line quiz and annual calendar art contest involving local middle schoolers.

Regional/National Partnerships

Partnerships are critical to ensuring regional coordination of resource conservation and environmental protection messages. They also increase program efficiency and the consistency of messages to the public. The City will continue to foster relationships and partnerships with the LOTT Clean Water Alliance's Water Conservation Coordination Committee (WC3), the Pacific Northwest Section of the American Water Works Association (PNWS-AWWA), the Alliance for Water Use Efficiency and EPA WaterSense Partnership.

Targeted Program Outreach

The Utility will continue to use a variety of outreach methods to promote programs that directly engage customers. These methods include utility bill inserts, web site postings, social media postings, e-newsletters, brochures, street banners, water conservation performance reports, direct customer invitations, vendor contact and purchased advertising.

Water Loss Accounting

Water loss accounting is a regulatory priority for the City. Water loss includes leaks and main breaks, system flushing, firefighting, theft and meter inaccuracies. The Water Conservation Program devotes significant staff time to identifying and minimizing all components of water loss (Table 5.6). The work involves data collection and analysis and coordination with multiple City staff and surrounding fire districts to obtain accurate information about authorized but unmetered water use.



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CHAPTER 6 – RECLAIMED WATER PROGRAM

Reclaimed water is highly treated wastewater that can be used for a variety of beneficial purposes. Use of reclaimed water supports conservation and can extend available water resources by offsetting the demand on potable water. By using reclaimed water for non-potable purposes, higher quality water can be saved for drinking water supplies. For these reasons, reclaimed water is an important element of the City of Olympia Drinking Water Utility's (Utility) overall water portfolio.

Both the Water Conservation Program and the Reclaimed Water Program aim to achieve the Utility's Goal 3:

> **Olympia's water supplies are used efficiently to meet the present and future needs of the community and natural environment.**

For the Reclaimed Water Program, this goal is consistent with and is a refinement of the City of Olympia Comprehensive Plan Goal GU4 and Policy PU4.6 which is to "advance the use of reclaimed water as defined in Council-adopted policies."

While the Water Conservation Program achieves greater efficiency by *reducing* use of potable water, the Reclaimed Water Program supports efficiency by *reusing* and *recycling* potable water. Potable water has been used once in homes and businesses and then treated at the LOTT Clean Water Alliance (LOTT) wastewater treatment plants. Rather than being discharged to Puget Sound, the treated wastewater is *reused* for irrigation, toilet flushing, heating/cooling, industrial and commercial processes, and educational and interactive water features. It is also *recycled* by using it to recharge groundwater rather than discharging it into Puget Sound.

Since 2014, the Utilityy has shifted from emphasizing reclaimed water as a conservation strategy, which has not proven to be cost-effective, to prioritizing reclaimed water for groundwater recharge and enhanced stream flow.

Two objectives have been identified for 2021-2026:

- Meet the needs of current and future reclaimed water customers.
- Direct reclaimed water towards meeting the regional wastewater management goal of reducing the amount of treated wastewater discharged into Puget Sound.

6.1 Reclaimed Water Regulations

Legislation

State law, initially developed in 1995 (Chapter 90.46 RCW), encourages the use of reclaimed water to help meet growing water requirements and directs the Washington State Department of Ecology (Ecology) and Department of Health (DOH) to encourage the development of water reclamation facilities.

A 2006 legislative amendment, Engrossed Substitute House Bill (ESHB) 2884, directed Ecology to develop and adopt rules on all aspects of reclaimed water use by December 31, 2010. It also directed Ecology to coordinate with DOH and form a rule-making advisory committee with a broad range of interested individuals. Reclaimed Water Program staff has participated in this advisory committee since its inception in 2007.

A 2007 legislative amendment, Engrossed Second Substitute Senate Bill (E2SSB) 6117, reaffirmed the State's commitment to reclaimed water and recognized the importance of the benefits of reclaimed water use, including:

- Consistent, reliable water supply as Washington faces climate change challenges.
- Reduced discharge of treated wastewater into Puget Sound.
- More water in rivers and streams for salmon recovery.

The Municipal Water Law (70.119A.180 RCW), a 2003 amendment to Washington water law, clarifies the nature of water rights issued for municipal supply purposes and provides flexibility for municipal water suppliers in exercising their water rights. Ecology and DOH share responsibilities under the law, bringing to it elements of water resources and watershed management, as well as public health and safety. Collaboration between these agencies resulted in a requirement for utilities to evaluate potential uses of reclaimed water in their water system plans (see Chapter 5, Table 5.1).

State Regulations

In 1997, DOH and Ecology developed the *Water Reclamation and Reuse Standards* to specify general requirements for the use of reclaimed water, which is categorized into four Classes: A, B, C and D. Class A is the highest quality and is considered safe for public contact and virtually all uses except human consumption. The *Standards* include requirements for treatment and plant design, engineering and operations.

In 2008, Ecology's Water Quality Program developed the *Criteria for Sewage Works Design* (also known as the *Orange Book*) which contains a Water Reclamation and Reuse chapter covering the use of sewage treatment plant effluent (reclaimed water) for beneficial purposes. The *Orange Book* is intended to supplement the *Standards*.

In 2018, Ecology adopted the State's first reclaimed water rule, Chapter 173-219 Washington Administrative Code (WAC), replacing the 1997 *Standards*. The new rule establishes an efficient, effective, and consistent statewide implementation framework for reclaimed water, including standards and permit requirements.

Thurston County Critical Areas Ordinance

In 2012, Thurston County Commissioners revised Thurston County Code Title 24 Critical Areas Ordinance (CAO). The revision changed Chapter 24.10 Critical Aquifer Recharge Areas (CARA), which includes Section 24.10.190 Reclaimed Water. This regulation allows irrigation with Class A reclaimed water at agronomic rates but prohibits infiltration of reclaimed water by application to the land's surface above agronomic rates. Table 24.10-1 of the CARA (in Section 24.10.020 Standards and Restricted and Prohibited Uses) indicates infiltration of reclaimed water is prohibited in all Thurston County aquifer recharge area categories. This prohibition will stand until more information is available to Thurston County from LOTT's Regional Reclaimed Water Infiltration Study and other studies and information about reclaimed water. LOTT's study is scheduled to be completed in 2021, after which Thurston County is expected to revisit the Critical Areas Ordinance to reevaluate the prohibition on infiltrating reclaimed water.

Olympia Reclaimed Water Ordinance

As a requirement of LOTT's Reclaimed Water Permit, the City of Olympia was required to adopt a reclaimed water ordinance. The ordinance was adopted in 2005 as Chapter 13.24 Reclaimed Water of the Olympia

Municipal Code. It includes policies and procedures for the distribution and use of reclaimed water. The initial ordinance established a rate for reclaimed water at 70 percent of the equivalent potable rate to encourage its use and placed the Reclaimed Water Program within the Drinking Water Utility. (Reclaimed water could not be a stand-alone utility since rates would not be sufficient to cover the costs of the needed infrastructure.)

In 2007, the Olympia City Council directed staff to revise the ordinance *requiring* use of reclaimed water in some locations to increase conservation of potable water. Olympia City Council's directive was to require customers fronting reclaimed water mains (and meeting other criteria) to connect to the City of Olympia's reclaimed water system; customers were to bear the connection costs with some rebate assistance from the City. Olympia City Council direction was also to require developers of projects (meeting certain criteria on use and proximity to existing pipeline) to install reclaimed water mains.

In 2011, Utility staff initiated the process of adopting into ordinance the direction of the 2007 Council. However, upon considering the cost of the rebate program and an excessive-cost exemption from the connection requirement, the cost of infrastructure and anticipated revenue, Utility management decided to pursue a less assertive strategy for advancing reclaimed water use.

Instead of revising the ordinance to require the use of reclaimed water, Utility staff focused on updating the ordinance to address regulatory gaps and achieve consistency with other updated utility ordinances. Also added were fees, rates, and charges not included in the original reclaimed water ordinance; these changes in revenue base aligned the reclaimed water financial structure with that of the drinking water, storm and surface water, and wastewater utilities. The amended ordinance was adopted by the Olympia City Council in late 2013 and became effective January 1, 2014.

The City of Olympia's Engineering Design and Development Standards (EDDS), an ordinance typically updated and adopted annually, contains Chapter 10 for reclaimed water systems. The EDDS specifies standards for infrastructure and accessories (for example, valves and meters), service interruptions, testing and inspections, submittals, and other technical specifications. It parallels the Drinking Water Utility's EDDS Chapter 6, given the similarities in the two water systems.

Reclaimed Water End User Agreements

Reclaimed Water End User Agreements are required between the City of Olympia and each reclaimed water customer prior to use of reclaimed water. A model End User Agreement was developed by the LOTT partner jurisdictions when establishing the various initial General Interlocal, Distribution, and Supply Agreements (described in Section 6.2). The model was approved by DOH and Ecology as part of the Agreement review process. The End User Agreement is tailored to each customer regarding the type, location and period of intended reclaimed water use, and quantity and price. The End User Agreement also specifies restrictions and other conditions for compliance.

As of 2021, the Utilty has End User Agreements with three customers: the Washington State Department of Enterprise Services (DES), the Port of Olympia, and the Hands On Children's Museum. The Olympia Parks, Arts & Recreation Department also uses reclaimed water, but an End User Agreement is not required because distribution by the City-to-City departments is regulated directly under General Interlocal and Supply Agreements with LOTT.

6.2 Regional Implementation and Infrastructure

The Utility's Reclaimed Water Program has been developed as part of a regional system through its partnership with LOTT. As a reclaimed water purveyor, Olympia is an active participant in LOTT-related

activities. LOTT regional and Utility local reclaimed water distribution lines as of 2019 are shown in Map 6.1.

LOTT Treatment Facilities

LOTT Clean Water Alliance is a nonprofit corporation formed by the cities of Lacey, Olympia and Tumwater, and Thurston County to provide wastewater treatment and reclaimed water production services for the urban area. LOTT operates a large central treatment facility, the Budd Inlet Treatment Plant, in downtown Olympia. Wastewater is piped to the plant from Lacey, Olympia and Tumwater residential and commercial sewer customers. Each day, about 12 million gallons of wastewater receives advanced secondary treatment, the highest level of treatment on Puget Sound. Most of the final treated effluent is discharged into Budd Inlet; however, some is diverted to the Budd Inlet Reclaimed Water Plant for further treatment to Class A reclaimed water standards.

As part of its 1998 Wastewater Resource Management Plan, LOTT identified construction of satellite reclaimed water facilities throughout its service area as a cost-efficient way to manage the need for future treatment capacity as the area continues to grow. Generation of Class A reclaimed water is one of LOTT's key strategies to meet regulatory restrictions on the volume and quality of treated wastewater that can be discharged into Budd Inlet.

In addition to the Budd Inlet Reclaimed Water Plant, LOTT has constructed the Martin Way Reclaimed Water Plant in the City of Lacey. In the long term, LOTT plans to construct other reclaimed water plants and infiltration basins in the Lacey-Olympia-Tumwater area.

Permits

Ecology and DOH issued permits to LOTT for each of its reclaimed water facilities. Because it discharges to surface water, the Budd Inlet facility was issued a combined National Pollutant Discharge Elimination System Waste Discharge and Reclaimed Water Permit, specifying regulation of monitoring, reporting and recordkeeping, as well as distribution and use of reclaimed water. The Martin Way facility, which discharges to groundwater only, was issued a Reclaimed Water Permit, covering treatment, monitoring, reporting, recordkeeping, reclaimed water distribution and use, and plant operation and maintenance.

As a distributor of LOTT's reclaimed water, the Utility is required to uphold the permit requirements and ensure that the Utility and its customers abide by these requirements.

Olympia's Reclaimed Water Allocation

LOTT does not sell reclaimed water as a commodity but provides it to the partner utilities for distribution and beneficial use. Through a Distribution Agreement (Section 6.2), LOTT allocates the Utility a portion of the reclaimed water from the Budd Inlet Reclaimed Water Plant to distribute within city limits for direct beneficial use. The Utility is also allotted a portion of reclaimed water generated at the Martin Way Reclaimed Water Plant.

The Utility uses reclaimed water from the Budd Inlet plant for irrigation, toilet flushing, and educational and interactive water features. The Utility's reclaimed water from the Martin Way plant is being infiltrated at the Woodland Creek Groundwater Recharge Facility in Lacey's Woodland Creek Community Park to enhance groundwater recharge and stream flow as part of both cities' water rights mitigation portfolios and as a key element in the broader approach to managing the sustainability of regional water resources.

Reclaimed Water Task Force and Partner Agreements

The Reclaimed Water Policies Task Force is composed of staff from LOTT, the three cities and the County. The Task Force resolves policy issues related to the distribution and use of reclaimed water, through a series of general interlocal, distribution, supply, and end user agreements. These agreements offer regional resource management structure while preserving each jurisdiction's operating autonomy. These agreements were updated in 2020.

General Interlocal Agreement. Specifies policies, distribution methodology, negotiation protocols, roles, and responsibilities. It is required by the State reclaimed water permit and was approved by Ecology and DOH.

Supply Agreement. Serves as an operational agreement. A separate Supply Agreement is prepared for each LOTT partner jurisdiction distributing water from a LOTT reclaimed water facility. The City of Olympia has Supply Agreements for both the Budd inlet Reclaimed Water Plant and the Martin Way Reclaimed Water Plant. Each agreement specifies how much water will be made available from that facility and incorporates general operating and technical details. A model End User Agreement is appended to each Supply Agreement.

Distribution Agreement. Exhibit A of the General Interlocal Agreement, the Distribution Methodology details the volume of reclaimed water available to the City of Olympia from the Budd Inlet and Martin Way plants. The City of Olympia was allotted 460,000 gallons per day from the Budd Inlet plant beginning in 2005, when it came on-line. The City of Olympia was also allotted 300,000 gallons per day from the Martin Way plant, for a total of 760,000 gallons per day.

End User Agreement. Developed by LOTT and the partners; this agreement was approved by Ecology and DOH as Exhibit B of the Supply Agreement.

In 2005, as required by LOTT's permit, Olympia and Lacey adopted uniform reclaimed water ordinances to ensure permit requirements were met (Section 6.1). In 2014, Olympia adopted amendments to the City's municipal code, OMC 13.24 Reclaimed Water, to fill regulatory gaps, achieve consistency with other updated City utility ordinances, and to add fees, rates, and charges in alignment with other City utilities.

Recent and Future Regional Expansion

LOTT's 2009-2025 *Capital Improvements Plan* resulted in the construction of a pipeline to carry reclaimed water to groundwater recharge sites, beginning with one planned for the Tumwater area. As shown in Map 6.1, the first leg of this pipeline (installation completed in 2010) extends from Marathon Park, south on Deschutes Parkway to the Tumwater Valley Municipal Golf Course and includes an extension of reclaimed water pipe up Lakeridge Drive leading to Olympia's west side.

LOTT's *2021-2022 Budget and Capital Improvements Plan* includes projects for future management of wastewater directly associated with use of reclaimed water:

- **System upgrade at Martin Way Reclaimed Water Plant**. Since the Martin Way Reclaimed Water Plant first came on-line in 2006, several operational challenges have been identified. Also, reclaimed water demand in the system has increased significantly, making continuous and reliable operation increasingly important. This project will address some of the operational limitations of this facility.

- **Reclaimed water capacity development**. LOTT has purchased a number of properties as potential sites for future recharge of reclaimed water produced at the Budd Inlet Treatment Plant and is exploring the possibility of streamflow/wetland enhancement with reclaimed water.

6.3 Reclaimed Water Activities

The Utility uses reclaimed water in two ways: for direct beneficial use by agencies and businesses and for groundwater recharge.

Direct Beneficial Use

As shown in Map 6.1, LOTT has constructed a reclaimed water distribution main that runs south from the Budd Inlet plant to Heritage Park, under the pedestrian bridge across Capitol Lake and through Marathon Park to LOTT's Capitol Lake Pump Station. The south line provides reclaimed water to DES for irrigation of state park grounds. (This line continues south along Deschutes Parkway to the Tumwater Valley Golf Course area.)

In a cost-share arrangement, the Port of Olympia installed a reclaimed water distribution line that runs north from the Budd Inlet plant to the end of the Port peninsula. The north line provides reclaimed water to the Port, Hands On Children's Museum and Anthony's Hearthfire Grill Restaurant, and is available for use by Weyerhaeuser and other Port tenants.

The Utility has approximately 4.85 miles of reclaimed water pipeline within city limits.

Current Customers and Uses

LOTT's Budd Inlet Reclaimed Water Plant began generating Class A reclaimed water in 2005. The following year, the Utility began distributing reclaimed water in the downtown area. As of 2021, the Utility has Reclaimed Water End User Agreements with three reclaimed water customers in downtown Olympia (shown in Map 6.1):

- Washington State Department of Enterprise Services (DES) – For irrigation at Heritage and Marathon Parks.
- Port of Olympia – For irrigation along Marine Drive and at the Anthony's Hearthfire Grill Restaurant at the north end of the Port peninsula.
- Hands On Children's Museum – For irrigation and toilet flushing in the City-owned building to the east of the LOTT Administration Building.

In addition, the City of Olympia Parks, Arts & Recreation Department uses reclaimed water at Percival Landing Park for irrigation. (No End User Agreement is needed for City departments.)

Quantity of Reclaimed Water Used in Olympia

As specified in the Distribution Agreement (Section 6.2), Olympia has been allotted 460,000 gallons per day (equivalent to about 167.9 million gallons per year) from the Budd Inlet plant.

Table 6.1 shows the annual reclaimed water use for the Utility's reclaimed water customers. On average, the Utility used about 15 percent of its allotted reclaimed water from the Budd Inlet plant each year during this period. The average annual use of reclaimed water between 2014 and 2019 was about 10.5 million gallons per year. The year of highest usage, 2018, (12.76 million gallons) represents just over one-half percent (0.006%) of the Utility's potable water usage for that year (2,148 million gallons; Table 5.2).

Table 6.1 Annual Reclaimed Water Use, 2014-2019 (million gallons)

Customer	2014	2015	2016	2017	2018	2019
Washington State Dept. of Enterprise Services	4.61	5.33	3.55	4.94	7.24	5.19
Port of Olympia	3.33	3.73	3.18	2.50	3.15	2.68
Anthony's Hearthfire Grill	0.33	0.38	0.35	0.35	0.38	0.15
Olympia Parks, Arts & Recreation Dept.	0.89	1.09	0.97	0.89	0.84	1.24
Hands On Children's Museum	1.24	1.24	0.84	0.81	1.15	.69
Total	**10.07**	**11.77**	**8.89**	**9.49**	**12.76**	**9.95**

Groundwater Recharge - McAllister Wellfield Mitigation

The Utility began using reclaimed water from LOTT's Martin Way Reclaimed Water Plant in 2014 as part of its mitigation plan for the McAllister Wellfield (Chapter 4, Section 4.3).

Mitigation Plans

The McAllister Wellfield mitigation planning process concluded that predicted impacts in the Deschutes River basin from wellfield pumping could be effectively mitigated by infiltrating reclaimed water to enhance in-stream flows in the Woodland Creek sub-basin as part of the City's portfolio of in-kind mitigation actions. In 2008, the Cities of Lacey and Olympia submitted to Ecology separate but coordinated mitigation plans proposing to jointly mitigate predicted impacts to Hicks Lake, Pattison Lake and Long Lake (the "Tri-Lakes") in the Woodland Creek sub-basin resulting from the new and additional water sources (Olympia's McAllister Wellfield and Lacey's groundwater wells).

The City of Olympia and the Nisqually Indian Tribe jointly developed the McAllister Wellfield Mitigation Plan (Appendix 4-3) and submitted a final version to Ecology in December 2010. The mitigation plan acknowledges the potential for reclaimed water to benefit the lower reach of the Deschutes River as was determined during the mitigation planning process.

Infiltration Facility

In October 2008, Lacey and Olympia signed an Interlocal Agreement to mitigate the predicted impacts to the Tri-Lakes by infiltrating Class A reclaimed water downstream from the outlet of Long Lake and upstream of where Woodland Creek passes beneath Martin Way. The cities have applied their respective shares of reclaimed water from the Martin Way Reclaimed Water Plant to share the cost and ownership of a mitigation facility at Lacey's Woodland Creek Community Park.

As specified in the Interlocal Agreement, based on the predicted impact by McAllister Wellfield pumping, Utility's share is 21.7 percent of the cost to construct, operate and maintain the

Woodland Creek Community Park Groundwater Recharge Facility. This effort is an important component of the Utility's McAllister Wellfield water rights mitigation portfolio.

During the water rights mitigation planning period (2000-2013), a hydrogeological (infiltration) feasibility study was conducted (2009-2010), followed by facility design (2011-2012) and construction (2013). A pilot test, infiltrating potable water at the new facility, was conducted in early 2014. Lacey began operating the facility in mid-2014. The cities have collaborative reporting requirements to Ecology, due annually in January. The feasibility study indicates between 0.3 and 0.8 million gallons per day of reclaimed water will need to be infiltrated to mitigate for the predicted impacts from the cities' new and transferred water rights. The facility may be able to infiltrate up to 1.3 million gallons per day depending on seasonal groundwater levels at the site. Olympia has been allotted up to 0.3 million gallons per day from the Martin Way plant, while Lacey's allotment is up to 1.45 million gpd.

Potential Future Customers and Uses

The Utility's 2005 *Business Plan* and 2011 *Reclaimed Water System Expansion Plan* (**Section 6.4**) identify potential future users of reclaimed water at approximate volumes and peak demands. The *Business Plan* focused on potential users located close to existing reclaimed water mains, while the *Expansion Plan* proposed extending reclaimed water infrastructure to new areas east and south and within the downtown Olympia core; it also included existing irrigation meters.

The largest potential future user identified in both plans is the State Capitol Campus, which used an average of about 8.4 million gallons of potable water annually (in 2012, 2013 and 2014) for irrigation and other outdoor uses. Directed through Section 11 of E2SSB 6117, DES (then the Department of General Administration) worked with the Utility to provide a report to the Legislature in December 2007 regarding the potential use of reclaimed water on the Capitol Campus. The report identified needed infrastructure, implementation costs and potential funding sources for irrigation and related outdoor applications using reclaimed water. The recommended approach would cost approximately $2.32 million in 2007 dollars, with the Utility contributing approximately $750,000 in 2009 dollars. The Utility and DES periodically revisit their mutual interest in extending reclaimed water to the Capitol Campus; however, given the cost of infrastructure, the project has not yet been pursued.

6.4 Reclaimed Water Program Development (2005-2014)

In launching the Reclaimed Water Program in 2005, the Utility envisioned reclaimed water would significantly reduce potable water use. By 2008, much had been accomplished to establish reclaimed water as a new water resource: generation by LOTT, installation of infrastructure by LOTT and the Utility, development of local regulations and partnership agreements, first customers, billing processes, new signs and educational materials, and initial program staffing and implementation.

The 2009 Water System Plan described the status of the Reclaimed Water Program through 2008 and projected the strategy of advancing the direct beneficial use of reclaimed water in a fairly assertive manner through that planning period. The initial *Business Plan for Reclaimed Water Distribution* in 2005 captured the Program's early developmental efforts, and the 2011 *Reclaimed Water System Expansion Plan* laid out an ambitious plan to extend reclaimed water infrastructure throughout the Olympia's core east side.

Also in 2011, the *Reclaimed Water Procedures Manual* was approved, spelling out specific program implementation procedures and summarizing the history and legal basis of the Program.

In 2014, the Utility revisited the financial structure of the Reclaimed Water Program, with an analysis that showed that direct beneficial use of reclaimed water was not cost effective enough to fully implement as initially envisioned.

These major developmental documents are summarized in this section.

Business Plan for Reclaimed Water Distribution (2005)

The Utility contracted with HDR, Inc. to develop the initial *Business Plan for Reclaimed Water Distribution*. Completed in June 2005, the plan presents a long-range vision for the Utility's Reclaimed Water Program and discusses policy issues that would affect development and financing in the program's early years. The plan estimated $40 million (in 2005 dollars) would be needed to construct the infrastructure necessary to deliver 2.8 million gallons a day of reclaimed water from LOTT reclaimed water plants to the potential customers that had been identified. (This 2.8 million gallons a day is about six times the current allotment from the Budd Inlet plant.)

Procedures Manual (2011, Updated 2020)

In April 2011, a *Reclaimed Water Procedures Manual*, written by Utility staff for internal use, was approved by the then-Acting Director of the Public Works Department. The manual documents programmatic roles and responsibilities, and implementation and operating procedures. Included are sections on program history and partnerships; regulations, guidance, and plans; record keeping and reporting; and funding, rates and billing, and enforcement. The manual highlights incident response procedures for cases of reclaimed water spillage or cross-connection control violations.

System Expansion Plan (2011)

In November 2011, the Utility contracted with the engineering firm Skillings Connolly, Inc. to develop a *Reclaimed Water System Expansion Plan*. The *Expansion Plan*, completed as a Technical Memorandum, is intended to provide guidance to the Utility ahead of any development-driven expansion of the reclaimed water system.

The *Expansion Plan* builds on previous evaluations and predictions of reclaimed water use in the City of Olympia by identifying geographic service areas and pipeline alternatives to serve current and future potential users. Potential new users previously identified in the 2005 *Business Plan*, and new customers added since then, were included in the analysis, as well as over 100 existing potable-water irrigation meters (that could be retrofitted to deliver reclaimed water). Potential user demand was quantified, and peak instantaneous demand was calculated to determine any storage needs. Locations of users were considered to create a basic pressure zone map that has been helpful in evaluating delivery of reclaimed water to the higher-elevation Capitol Campus and areas further south from the Budd Inlet plant. Therefore, planning-level cost estimates provided in the plan include both a storage tank and pump station.

Build-out of the new service areas was proposed in eight phases. The total cost of build-out was more than $11.1 million, not including any railroad crossings/permitting, property acquisition for storage tank(s) and booster pump station(s), and possible re-chlorination facilities. LOTT's planned storage tank in the Tumwater valley area could alleviate the need for storage and pumping.

Financial Considerations (2014)

In recent years, the community – notably represented by the LOTT Reclaimed Water Infiltration Study Community Advisory Group and the City of Olympia's Utility Advisory Committee – has posed questions regarding the cost effectiveness of using reclaimed water for various purposes.

In 2014, Utility staff worked with HDR Engineering, Inc. to explore basic financial considerations relating to the costs of using reclaimed water for direct beneficial use (instead of potable water for non-potable uses) and for groundwater recharge and enhancing in-stream flows.

The City and HDR distilled the community's broader cost-related questions into two specific questions:

1. Is reclaimed water use for non-potable purposes an economical means of reducing potable water use?
2. How does the cost of using reclaimed water for non-potable purposes compare to the cost of using it for groundwater recharge?

To answer these questions, HDR conducted a general cost-benefit analysis. To estimate costs, the firm reviewed existing information, plans and analyses. These included the *Reclaimed Water System Expansion Plan*, the Woodland Creek Groundwater Recharge Facility Engineering Report, a Utility demand forecast analysis, the capital improvement program and irrigation water rates. HDR's Technical Memorandum, *Reclaimed Water Cost Benefit Analysis* (September 2, 2014), is summarized here.

Present Value Analysis (2014)

HDR conducted a 20-year present value analysis to capture "life cycle" capital and operational/maintenance costs, and benefits. Present value cost totals were divided by the volumes of water considered to arrive at present value unit costs ($/gallon) to enable a relative cost-effectiveness comparison of the various options considered. An important assumption made for this analysis acknowledges that LOTT has developed reclaimed water as a new water resource and plans to continue expansion of its reclaimed water program, regardless of the extent to which the Utility uses reclaimed water for its particular purposes. Therefore, reclaimed water production costs by LOTT are not included.

Reducing Potable Water Use

"Is reclaimed water use for non-potable purposes an economical means of reducing potable water use?"

HDR addressed this first question by calculating the cost of delivering reclaimed water through a separate "purple pipe" distribution network dedicated for direct beneficial use purposes. This cost was compared with the cost of delivering potable water from the Utility's potable water system, which is supplied by groundwater wells, for the same volume of non-potable use.

An estimate of the total volume of reclaimed water usage for irrigation in downtown Olympia and the Capitol Campus/Stevens Field area (obtained from the Reclaimed Water System Expansion Plan) correlated to a total annual volume of reclaimed water usage of approximately 49,820,000 gallons. Delivery costs indicated in the plan amounted to about $12,000,000 (in 2014 dollars). Operation and maintenance costs, primarily for energy and labor, were estimated at $50,000 per year. Because the Utility's reclaimed water rate is 70 percent of the potable water rate, revenue is lost when potable irrigation demand is replaced with reclaimed water. This lost revenue was estimated to be about $125,000 per year.

A benefit of using reclaimed water can be realized by deferring capital investments in future water supply projects, such as the planned Briggs well (Chapter 4, Section 4.2) used in this analysis. A potential deferment, calculated to be four years, resulted in an estimated cost savings of $270,000, which offsets a portion of the costs of using reclaimed water.

To fully answer this first question, the analysis also estimated the cost of delivering potable water, for the same use as estimated for reclaimed water, using the Utility's 2014 summer irrigation water rate ($6.19 per hundred cubic feet) and the same volume of reclaimed water delivered. Thus, the total potable water costs could be compared with the total reclaimed water delivery costs.

The result of this analysis gives a unit cost of approximately $0.0141 per gallon of reclaimed water used for non-potable purposes. By comparison, the unit cost of delivering potable water supplied by Utility wells for

such uses is approximately one-third of the reclaimed water cost, or $0.0055 per gallon of potable water used. The Utility recognizes that specific, targeted uses of reclaimed water for non-potable purposes may make economic sense in some applications. However, it does not appear cost effective at this time for the Utility to focus on expanding this element of its reclaimed water program extensively. Other factors may be considered that could make direct beneficial uses of reclaimed water more economically feasible, but such factors were not explored in this general level analysis.

Comparing Uses: Non-Potable Water vs Groundwater Recharge

"How does the cost of using reclaimed water for non-potable purposes compare to the cost of using it for groundwater recharge?"

HDR addressed this second question by comparing the cost of delivering reclaimed water for non-potable purposes (as estimated above) with the cost of constructing and operating groundwater recharge facilities. Information on the Cities of Lacey and Olympia Woodland Creek Groundwater Recharge Facility (Section 6.3) was used for this analysis. This facility, constructed in 2013 and placed online in July 2014, has a total project cost of $4.3 million and annual operation and maintenance costs of about $36,000. The hydrogeological analysis for infiltration feasibility estimates this site can accept about 179,200,000 gallons of reclaimed water per year.

With cost and rate escalation factors, and a discount factor assumed over a 20-year "life-cycle" time frame, the unit cost is approximately $0.0014 per gallon for reclaimed water used for groundwater recharge. Therefore, it appears more cost-effective, in terms of a general strategy, to use reclaimed water for groundwater recharge as opposed to using it for non-potable purposes. This result was not unexpected, as groundwater recharge facilities require infrastructure that is typically less extensive than a "purple pipe" distribution system network and can make beneficial use of reclaimed water on a larger scale and over the course of the entire year, as compared to the limited seasonality of use in most non-potable applications, like irrigation.

Summary of Results

The results of this general cost-benefit analysis indicate the unit cost per gallon of using reclaimed water for direct beneficial use ($0.0141) is about 2.5 times the cost of using potable water ($0.0055) and 10 times the cost of reclaimed water use in groundwater recharge facilities ($0.0014).

Based on this analysis, the Utility's reclaimed water use focus has shifted to using reclaimed water for groundwater recharge. However, the Utility remains fully committed to extending reclaimed water for direct beneficial use where it best suits a specific application or area or meets a particular customer's preference.

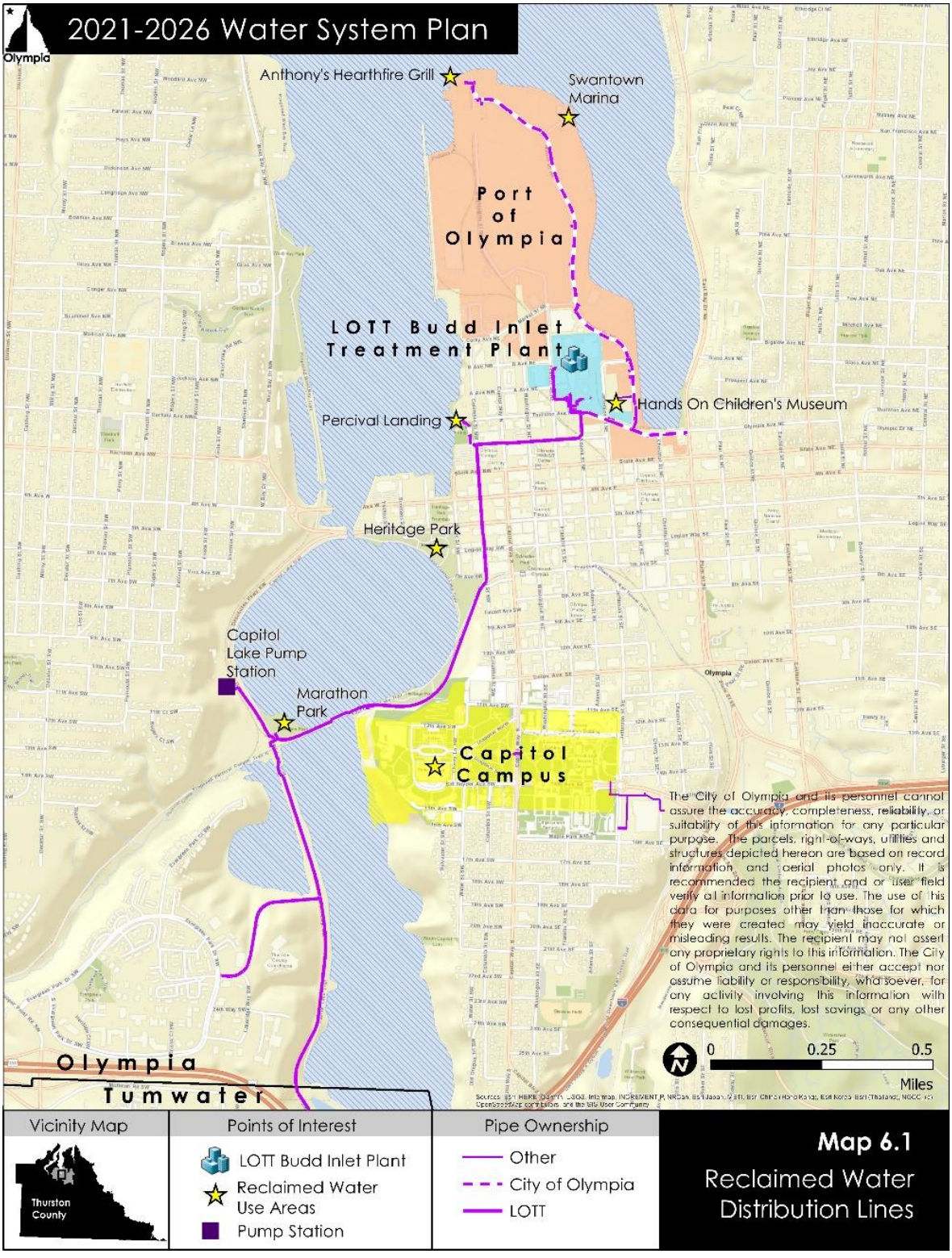
6.5 2021-2026 Priorities and Direction

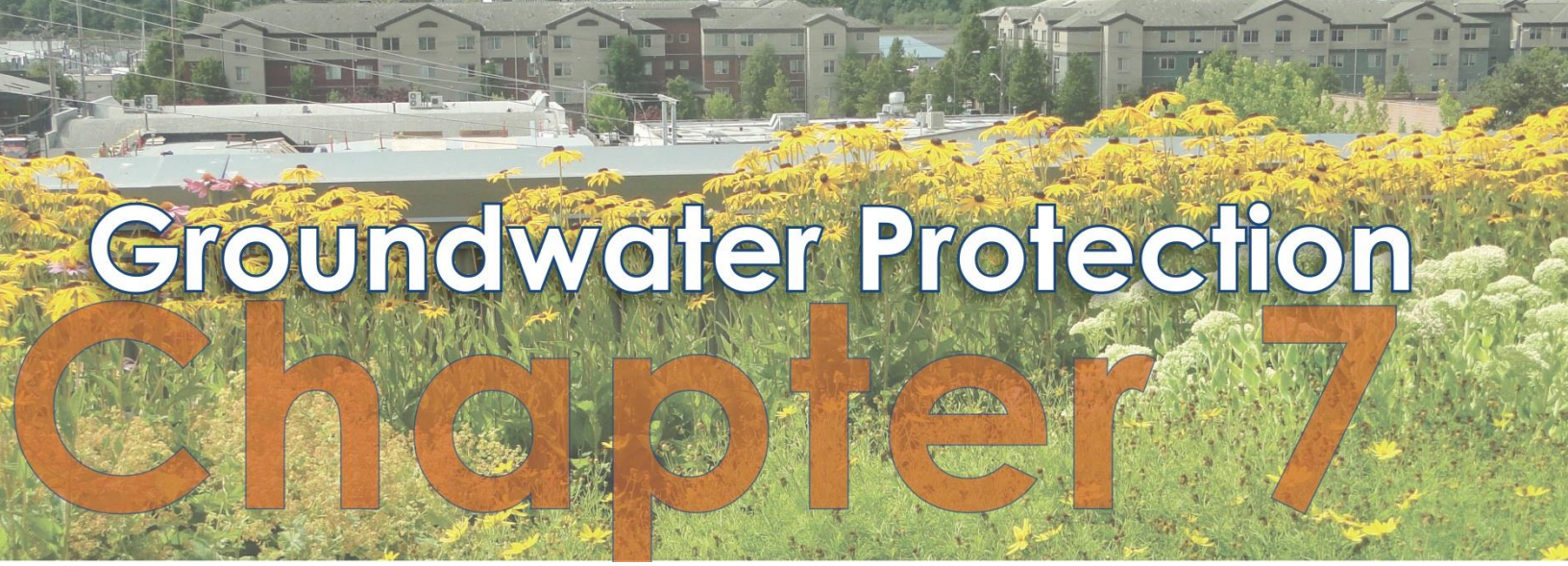
As described in Section 6.4, the Utility first projected a strategy of advancing direct beneficial use of reclaimed water. Infiltrating reclaimed water for groundwater recharge or stream-flow enhancement was not considered in this initial strategy. By the 2015 Water System Plan, the Utility shifted away from emphasizing direct beneficial use to focusing on infiltration of reclaimed water to enhance groundwater recharge and stream flow. This shift exercised regional partnerships and goals and achieved financial economies of scale.

This Water System Plan continues to emphasize using reclaimed water in support of regional wastewater management priorities:

- **Reduce the use of drinking water for non-potable uses**. This priority aligns with the Utility's water conservation goals (Chapter 5). For example, reclaimed water used for outdoor irrigation reduces the use of potable water for this purpose. The Utility has been manifesting this priority through its existing customers who use reclaimed water for irrigation and a variety of other applications.
- **Reduce wastewater going to LOTT**. This priority supports regional wastewater management efforts by helping to avoid increasing capacity at existing treatment facilities or building new treatment facilities. Any use of reclaimed water that reduces wastewater to LOTT supports this priority, including using reclaimed water to replace potable water.
- **Reduce treated wastewater discharge into Budd Inlet**. This priority provides environmental benefits to Puget Sound by complying with LOTT's wastewater discharge limits and contributing to a reduction in wastewater discharge to Puget Sound. The Utility has been supporting this priority by using reclaimed water for groundwater recharge to mitigate the impacts of the McAllister Wellfield (Section 6.3). With other LOTT partners, the Utility is exploring the further use of reclaimed water for groundwater recharge in LOTT's Reclaimed Water Infiltration Study (Section 6.2).

Map 6.1 Reclaimed Water Distribution Lines in Olympia





Groundwater Protection

Chapter 7

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CHAPTER 7 – GROUNDWATER PROTECTION PROGRAM

As described in Chapter 4, the City of Olympia Drinking Water Utility (Utility) is securing sufficient supplies to meet water demands for at least 50 years. The Groundwater Protection Program, by working to prevent contamination of those water supplies, helps meet the Uility's Goal 5:

> **Groundwater quality is protected to ensure clean drinking water for present and future generations and to avoid the need for replacement or treatment facilities.**

This goal is consistent with the City of Olympia Comprehensive Plan Goal GU6 for the Utility. The Groundwater Protection Program implements Comprehensive Plan Policies PU6.1 through PU6.5.

The Program has three objectives for 2021-2026:

- Prevent contamination of groundwater through surveillance and response.
- Strengthen and exercise partnerships with citizens and state/local agencies.
- Improve program policies, procedures, and tools to enhance the effectiveness of groundwater protection efforts.

Implementation strategies have been developed to achieve these objectives, with performance measures designed to meet the Utility's groundwater protection goal (see Appendix ES1 Plan Implementation, Staffing and Monitoring).

The Groundwater Protection Program applies to the Utility's five main Drinking Water (Wellhead) Protection Areas (DWPAs), comprised of the McAllister Wellfield PW24, PW25, TW22, Shana Park Well #11, Indian Summer Well #12, Hoffman Well #3, Allison Springs, Well #13, Well #19, one DWPA for an emergency source (Kaiser Well 1) and one DWPA for a planned well (Briggs)

The 2021-2026 Groundwater Protection Program continues to implement a proactive and precautionary approach to preventing contamination of the City's water sources. The foundations of the Program continue to be the DWPA delineations and the con : source inventories, which together enable staff to focus on the areas of greatest risk to the City's drinking water aquifers.

7.1 Groundwater Protection Regulations

The Utility protects its groundwater sources by complying with the 1986 federal Safe Drinking Water Act and its amendments. This federal regulation is implemented through the Washington State Department of Health's (DOH) Source Water Protection requirements, which are captured in Chapter 246-290 of Washington's Administrative Code (WAC). The City implements the sanitary control area and wellhead protection requirements of WAC 246-290-135.

Portions of the Utility's DWPAs extend into the City of Tumwater, the City of Lacey and Thurston County jurisdictions (Section 7.2). Because the Utility can exercise groundwater protection requirements only within its own city limits, the Utility coordinates with neighboring jurisdictions.

The City of Olympia's groundwater protection ordinance was codified in 2005 in Olympia Municipal Code, Title 18 Unified Development Code, Chapter 18.32 Critical Areas, with Sections 18.32.200–240 applying to Drinking Water (Wellhead) Protection Areas. The ordinance was revised in 2009, adopting

new DWPA delineations, and again in 2016 to clarify the City of Olympia's groundwater monitoring well construction standards.

The City of Olympia regulates the construction of groundwater monitoring wells through the City of Olympia Engineering Design and Development Standards (EDDS). Chapter 6-Drinking Water includes Section 6.300 Groundwater Monitoring Wells and Drawing No. 6-27 Resource Protection–Monitoring Well Design to ensure consistent construction of wells that also meet Washington State Department of Ecology (Ecology) well construction standards (Chapter 173-160 WAC). Program staff has developed a process to deviate from the EDDS monitoring well standard as needed, with the approval of the City of Olympia City Engineer. Ecology has supported such deviations.

To protect groundwater within the City of Olympia's urban growth area, the Utility collaborates with Thurston County Health Department to implement Thurston County's Code of Ordinances. Specifically, Title 23 Olympia Urban Growth Area Zoning and Title 24 Critical Areas (Chapter 24.10 Critical Aquifer Recharge Areas) are used to protect the Utility's groundwater resources within Thurston County's jurisdiction.

7.2 Regional Environment

This section reviews the physical environment of the Utility's water service area as reflected in the regional topography and hydrogeology of north Thurston County.

Topography

The City of Olympia lies within the Puget Sound lowlands basin, which was formed by glacial action and erosion and sedimentary deposition since the last ice age. The topography of the Utility's water service area is generally low-lying, ranging from sea level to about 380 feet mean sea level (msl).

Because land elevation within and between neighborhoods varies appreciably, the water service area is divided into pressure zones. Storage tanks and booster pumps ensure adequate water pressure regardless of location (see Chapter 1).

Most of Olympia is at the mouth of a watershed drained by the Deschutes River, which discharges into Puget Sound's Budd Inlet (Map 7.1). Near its confluence with Budd Inlet, the river flows through Capitol Lake, an artificial lake created in 1951 by a dam on the Deschutes River. The lake separates the downtown business district from Olympia's west side.

A portion of west Olympia drains into Green Cove Creek in the Eld Inlet watershed, and a portion of east Olympia drains into Woodard Creek in the Henderson Inlet watershed. The McAllister Wellfield (S16), the Utility's primary water source, is within the Nisqually River watershed (WRIA 11). The other five production wells are in the Deschutes River watershed (WRIA 13).

Hydrogeology

The most recent information on the hydrogeology of the Utility's DWPAs is in two companion reports prepared by Golder and Associates to support the 2009 revisions to delineations of the Utility's DWPAs. One report is focused on the hydrogeological conditions of the Utility's wellfield areas; the other report addressed the groundwater modeling which resulted in the new delineations. These reports are collectively referred to in this chapter as the Golder reports (2008a and 2008b).

This section highlights key points from these reports that are relevant to understanding the Utility's drinking water supply aquifers and delineation of DWPAs. Since the development of the Golder reports, the Utility has installed new groundwater monitoring wells. The new hydrogeological information gained from these new wells is generally consistent with that presented in the Golder reports. However, this new information will be applied during this planning period to recalibrate the groundwater models and evaluate the accuracy of the 2009 DWPA delineations.

Geology in the City of Olympia and the rest of Thurston County is the result of substantial glacial activity in Puget Sound. Receding glaciers left the land dotted with lakes and ponds. Materials deposited during successive glacial periods vary from fine-grained sand and clay to gravel and boulders. These materials are dispersed throughout the area in a complex series of geologic formations created by thousands of years of land, water and ice movement. Many of the formations are highly permeable, with the capacity to easily transmit 50-plus inches of annual precipitation.

The Utility's most productive aquifers are in these glaciated areas and are extremely vulnerable to contamination. Several relatively minor incidents of groundwater contamination have occurred in northern Thurston County over the years, and studies have documented steadily increasing levels of nitrate in the groundwater, particularly in the area around the Shana Park Well 11 (S10), due to soluble landscape and turf fertilizers and on-site septic systems.

Following is a general description of the various hydrostratigraphic units (layers) under the current interpretation as offered in the Golder reports. The units are ordered from shallower to greater depths below ground surface.

- **Post-Vashon (Holocene) Alluvial and Deltaic Sediments.** Along shallow valley bottoms of the main streams. Minimally significant in storing or transmitting groundwater.
- **Vashon Recessional Outwash (Qgo, Qgos).** Permeable sand and gravel deposits that make up the unconfined water table aquifer in large parts of the region but may not always contain groundwater. Supports wells for mostly small-scale domestic use. Shana Park Well 11 (S10) withdraws water from this aquifer, as well as from the Vashon Advance Outwash (Qga).
- **Vashon Glacial Till (Qgt).** Sand, gravel, and boulders encased in a silt-clay matrix. Commonly referred to as "hardpan" where laid down beneath heavy glacial mass, but less compact where formed by melting ice. Exposed in many parts of the region, notably above incised stream valleys and in upland areas. Till generally acts as an extensive confining bed with occasional permeable zones.
- **Vashon Advance Outwash (Qga).** Fine- to coarse-grained sand and gravel, laterally extensive in the region, but exposed only along steep riverbanks and Puget Sound bluff faces. The main aquifer for most small-scale private wells; supplies several larger-yielding municipal and industrial wells. Shana Park Well 11 (S10) and Kaiser Well 1 (S03) withdraw water from this aquifer.
- **Pre-Vashon Glaciolacustrine Deposits (Qpf).** Laminated clayey and silty sediments, with low permeability. Confining layer between the overlying Vashon and underlying pre-Vashon aquifers.
- **Pre-Vashon Gravel (Qpg).** Coarse, stratified sand and gravel, laterally extensive and exposed along the bottom of the Nisqually River between the confluence with the McAllister Valley and

Muck Creek. Rarely more than 50 feet thick (between 15 and 70 feet), it forms the principal (mostly confined) aquifer in the area and is tapped extensively by wells. Primary supply source for the Allison Springs Well 13 (S09) and Well 19 (S11), Hoffman Well 3 (S08) and Indian Summer Well 20 (S12).

- **Undifferentiated Quaternary and Tertiary Deposits (TQu).** Fine to coarse-grained unconsolidated sediments extending to bedrock. Consists of a sequence of aquifers and confining beds, tapped locally by a few water wells.
- **Bedrock.** Relatively impermeable sedimentary sandstone, siltstone and claystone, and some igneous bodies of andesite and basalt. Does not contribute to the regional groundwater flow system, although some private wells produce groundwater from these layers.

Two locally defined aquifer units, the Unconfined McAllister Gravel (Qmg) and Deschutes Valley Aquifer (DVA) systems supply most of the Utility's water. The McAllister Wellfield (S16) is supplied by the deep and productive Unconfined McAllister Gravel. The planned Briggs Well will be supplied by the Deschutes Valley Aquifer system.

Groundwater Flow

This section summarizes information on groundwater flow, and regional recharge and discharge from the Golder reports (Golder 2008a and 2008b).

Regional groundwater flow occurs in the three primary regional aquifers: the Vashon Advance Outwash (Qga), the Pre-Vashon Gravel (Qpg) and the Undifferentiated Quaternary and Tertiary Deposits (TQu). Local flow occurs in the mostly perched Vashon Recessional Outwash **(**Qgo) unit and in the highly transmissive, unconfined McAllister Gravel aquifer (Qmg) located in the McAllister-Nisqually area. Where present, the intervening till and fine-grained lacustrine units act to hydraulically separate the aquifers, resulting in hydraulic head differences of more than 100 feet between the water table and the Undifferentiated Quaternary and Tertiary Deposits (TQu) aquifers in some areas.

Regionally, groundwater flows from the upland recharge areas in the southern part of Thurston County toward the north, where groundwater discharges to Puget Sound, the main rivers (the Nisqually and Deschutes), natural springs and seeps, numerous shallow lakes, and streams. Groundwater elevations up to 400 feet above msl occur in the area south of the towns of Rainier and Yelm. Conversely, groundwater levels are as low as a few feet above msl along the Puget Sound and less than 20 feet above msl in the upper part of the McAllister Valley.

The primary regional source of groundwater is infiltration of precipitation (or precipitation-derived) recharge. Locally, seepage from rivers, streams and lakes also provides a source of groundwater where surficial soils are sufficiently permeable to allow for the vertical movement of water to the water table. Also, some relatively minor return flow of groundwater pumped by individual private wells occurs via on-site septic systems in areas that are not connected to sanitary sewer systems. Some inflow of groundwater into the area also occurs from the south of Fort Lewis.

The main discharge of groundwater occurs as subsurface outflow to Puget Sound, seepage to support the main rivers, lakes and streams, discharge at natural springs and groundwater pumping. Most of these are non-point flows and therefore are difficult to measure directly. However, records of discharge

at some of the main features (such as McAllister Spring and the municipal wells) do allow local water budgets to be estimated.

Groundwater Quality

The regional groundwater quality is considered good, although a few water chemistry issues can be found in localized areas, including:

- **Iron and Manganese** at levels above the secondary drinking water standards.
- **Nitrates**, likely associated with on-site septic systems and soluble fertilizer applications.
- **Chloride**, particularly in deeper groundwater in aquifers in continuity with saline Puget Sound that are at risk from seawater intrusion under excessive pumping pressure. Although none of the Olympia's wells have exhibited elevated chlorides, this risk is monitored as groundwater development increases in the region.

See Section 7.4 for potential sources of contamination in DWPAs. See Chapter 11 for information on how the Utility maintains quality of water at the tap.

7.3 Drinking Water Protection Areas

Drinking Water Protection Areas (DWPAs) are drawn around the Utility's water supply sources (groundwater wells) to represent the primary recharge areas for specific water supply aquifers (Map 7.1). These groundwater flow areas also contain designations of 0.5-year, 1-year, 5-year and 10-year time-of-travel capture zones within their boundaries.

Wells are referred to by their Utility name (for example, Well 13) and DOH source number (for example, S09). In this chapter, information on the Utility's DWPAs (and associated wells) is presented from east to west.

McAllister Wellfield DWPA (S16) around three individual wells:

- Test Well TW-22 (S13)
- Production Well PW-24 (S14)
- Production Well PW-25 (S15)

East Olympia DWPAs:

- Shana Park DWPA around Well 11 (S10)
- Indian Summer DWPA around Well 20 (S12)
- Hoffman DWPA around Well 3 (S08)
- Briggs DWPA around the planned Briggs Well

West Olympia DWPAs:

- Allison Springs DWPA around Well 13 (S09) and Well 19 (S11)
- Kaiser DWPA around the emergency Well 1 (S03)

The 2009 Water System Plan presented then-new delineations of the Utility's DWPAs and capture zones, which were determined by computer models to mathematically simulate the inflows (recharge) and outputs (discharge) of aquifers. The 2009 Water System Plan contains extensive detail about the

DWPAs, including hydrogeological characteristics, groundwater flow conditions, water quality, land use and zoning. That information was taken from the source susceptibility assessments (completed by City staff as required by DOH) and the Golder reports.

This section summarizes the basic characteristics of each DWPA as determined from the susceptibility assessments, the 2008 Golder reports, and 2021 land use and zoning information. It focuses on activities and accomplishments made during the previous planning period, including expansion of the Utility's network of monitoring wells primarily associated with the construction of a new private development stormwater infiltration facility. Since 2008, new hydrogeological information has been obtained; thus, the Utility has committed capital funds to re-evaluate selected DWPA delineations during this 2021-2026 planning period.

The major hydrogeological features of Olympia's DWPAs are summarized in Table 7.1.

McAllister Wellfield DWPA

Description

The McAllister Wellfield (S16) is in north Thurston County (Map 7.2). The Wellfield can supply the entire water service area and provides most of the Utility's drinking water year-round. Much of the McAllister Wellfield DWPA overlaps the Utility's former McAllister Springs DWPA and some monitoring wells in the McAllister Springs DWPA are used for Wellfield monitoring. Currently, groundwater levels are measured in two monitoring wells (MW-17 and MW-2D) and water quality samples are collected from four monitoring wells (MW-2S, MW-Pete, MW-StCl, and MW-Troc) in the McAllister Wellfield DWPA. The Utility plans to supplement the Wellfield DWPA with additional monitoring wells during 2021-2026. Lake St. Clair surface water levels are no longer measured by Utility staff (as of June 2021) since these measurements can be obtained directly from Thurston County as needed.

Hydrogeology

The primary aquifer supplying the McAllister Wellfield (S16) is the highly transmissive, semi-confined McAllister Gravel unit with a thickness of at least 400 feet (Table 7.1). Hydrogeological cross-sections are available in the Golder reports on hydrogeological conditions that led to the DWPA delineation.

Groundwater flow from surrounding upland areas converges towards the McAllister Valley, flowing northward toward the Nisqually River and eventually into Puget Sound. Up to an estimated 70 million gallons of groundwater per day flows through the McAllister Gravel unit. Although the large volume of water moving through the aquifer provides a high dilution capacity, the aquifer supplying the Wellfield (S16) is semi-confined and is therefore at risk from potentially contaminating activities on the land surface.

As shown on Map 7.2, the Wellfield (S16) capture zones are relatively narrow in the area between the supply wells (in the northern portion of the DWPA) and Lake St. Clair (in the middle portion) due to the presence of the highly transmissive McAllister Gravel aquifer. The hydraulic gradient in this area is predicted to remain relatively flat in response to planned pumping. The capture zones widen south of Lake St. Clair as the groundwater is drawn in from the surrounding Pre-Vashon glacial and non-glacial sediments.

In general, groundwater quality in the McAllister area is excellent. The Utility performs regular groundwater quality sampling at the water supply wells, and at one City-owned (MW-2S) and three private monitoring wells (MW-Pete, MW-StCl, and MW-Troc) in the McAllister Wellfield DWPA. Since 1987, sampling frequency has ranged from quarterly to annually in as many as 16 monitoring wells located throughout the old McAllister Springs DWPA and the new McAllister Wellfield DWPA. The Utility has sampled for pathogenic indicators, synthetic organic compounds, volatile organic compounds and inorganic compounds including nitrates. (See Section 7.4.)

Land use and Zoning

The McAllister Wellfield DWPA encompasses about 2,960 acres in rural northeastern Thurston County (Map 7.1). Assessed land use is primarily residential, agriculture and parks, and government or institutional. Most of this area has a zoning designation of McAllister Geologically Sensitive Area, which allows only single-family residential development with one unit per five acres (Map 7.2).

East Olympia DWPAs

Description

Three DWPAs in southeast Olympia protect three wells: Shana Park Well 11 (S10), Indian Summer Well 20 (S12) and Hoffman Well 3 (S08). Shana Park Well 11 (S10) (Map 7.3) supplements the Utility's annual supply seasonally, primarily between May and October. The Indian Summer Well 20 (S12) (Map 7.4) came online in late 2009 to provide additional water supply mostly during the summer. It has not been used since October 2011. The Hoffman Well 3 (S08) (Map 7.5) is rarely used.

The Utility currently measures groundwater levels and collects water quality samples from two monitoring wells (MW-25 and MW-26) in the Shana Park DWPA and in one monitoring well (MW-27) in the Indian Summer DWPA. Monitoring wells have not been installed in the Hoffman DWPA given the well's limited use and naturally protective aquifer system.

A DWPA also has been delineated for the planned Briggs Well (Map 7.6). Well construction has been deferred to July 2024 under a construction extension granted by Ecology. The well is planned to be on the site of the Briggs Village development (former Briggs Nursery) near Ward Lake.

Hydrogeology

Two of the three wells in the East Olympia DWPA, Indian Summer Well 20 (S12) and Hoffman Well 3 (S08), draw water from the confined Pre-Vashon sediments. The third well, Shana Park Well 11 (S10), draws water from the shallower unconfined aquifer (Table 7.1). Flow directions in the shallow aquifer are to the north-northwest and are affected by groundwater mounding beneath Chambers Lake that provides recharge to the shallow unconfined aquifer in the vicinity of the Hoffman Well 3 (S08) (Map 7.5). Flow directions in the deeper Pre-Vashon aquifer are different, with flow to the north-northeast and a north-south trending groundwater divide. There is a downward hydraulic gradient from the shallow unconfined (Qga) aquifer to the confined Pre-Vashon aquifer (Qpg).

Hydrogeological cross-sections are shown in the Golder reports, while additional hydrogeologic description is provided in the 2009 Water System Plan. Groundwater level and water quality data in the East Olympia local area aquifers are very limited, affecting the accuracy of hydrogeology characterization that may be important for DWPA planning.

Shana Park DWPA. Shana Park Well 11 (S10) (Map 7.3) is highly susceptible to contamination from the surface because it draws water from the shallow unconfined aquifer (Table 7.1). The 2009 DWPA groundwater modeling results indicate the shallow aquifer is vulnerable to surface contamination within a radial distance of less than one mile from Well 11 (S10). Many of the modeled particles migrated to the water table in less than ten years. Because some particles migrated to nearby Smith Lake within this period as well, an Extended Capture Zone was drawn around Smith Lake to account for possible surface water drainage toward the Shana Park DWPA. Well 11 (S10) is more than 2000 feet from Smith Lake however, so DOH does not require testing for possible designation as "groundwater under the influence of surface water".

In order to address the susceptibility of the Shana Park source well to shallow contamination, the 2015 WSP contained a recommendation to prepare a contingency plan for the Shana Park source (2015 WSP Project WS-10). As of the writing of this Water System Plan, the Utility is currently acting on the recommendation contained in the Shana Park Contingency Plan, completed in 2018, to explore the feasibility of relocating the Shana Park water right to a more protected and productive aquifer with high quality water. In line with the recommendation, the Utility is currently initiating installation of a pilot well in the Utility-owned LBA parcel located about 1.3 miles to the northwest of Well 11 (S10). The outcome of this effort is expected by the end of 2021. The outcome will help the Utility to determine whether to abandon or move the Shana Park well and its DWPA, and develop a new source and DWPA in the LBA parcel area, or pursue other options for addressing the susceptibility of the Shana Park well to shallow contamination. Additionally, the outcome of the LBA Pilot well is also anticipated to assist with operational and location decisions associated with the Utility's other SE Olympia wells including the planned Briggs source.

Since 1988, the Utility has collected groundwater quality samples at the Shana Park Well 11 (S10) and, since 1998, at up to eight monitoring wells at frequencies ranging from quarterly to annually. Samples have been tested for pathogenic indicators, synthetic organic compounds, volatile organic compounds and inorganic compounds including nitrates. Nitrate levels have leveled off since 2015 (See Ch 11 Water Quality for results) in the Shana Park Well 11 (S10) and monitoring wells. Nitrogen isotope monitoring has indicated that fertilizers and on-site septic systems are the primary sources of nitrates. (See Section 7.4.)

Indian Summer DWPA. Despite being installed in the deeper (Qpg) sediments (Table 7.1), Indian Summer Well 20 (S12) (Map 7.4) has a relatively shallow water level (20 feet below ground surface) and may also be susceptible to contamination from the surface. The 2009 DWPA modeling analysis indicates none of the recharge to the water table that occurs in the five-year travel zone is withdrawn at the well, and the actual recharge occurs to the south of the five-year zone. This suggests that the well is protected against surface contamination within an up-gradient distance of at least one mile.

The Utility has also collected groundwater quality samples from the Indian Summer Well (S12), a now-unused monitoring well (S5-3), and a monitoring well installed in 2014 (MW-27) at frequencies ranging from quarterly to annually. Samples have been tested for pathogenic indicators, synthetic organic compounds, volatile organic compounds and inorganic compounds including nitrates. Nitrate was not observed in the Indian Summer Well (S12) until 2012, 2013 and 2015. Eighteen nitrate samples have been collected since then and all have been non-detect. The result of one nitrogen isotope sample indicates that on-site septic systems may be the primary source of nitrates. (See Section 7.4.)

Hoffman DWPA. Hoffman Well 3 (S08) (Map 7.5) pumps water from a deep, confined aquifer. The top of the well's screened interval is at a depth of 324 feet below ground surface. A coarse outwash channel, containing no protective till unit (Table 7.1), has been identified to the south of the Hoffman Well in the Chambers Creek area. However, the water pumped at this well is derived from the deep aquifer within the 10-year time-of-travel capture zone. The primary recharge source for this well has been modeled to be four to five miles to the southeast of the DWPA, with recharge reaching the well over an estimated time frame of 50 years.

The Utility has collected groundwater quality samples from the Hoffman Well 3 (S08) on a mostly annual basis. Samples have been tested for pathogenic indicators, synthetic organic compounds, volatile organic compounds, and inorganic compounds including nitrates. Iron and manganese above the secondary maximum contaminant levels are the only water quality indicators of concern in the Hoffman Well. (See Section 7.4.)

Briggs DWPA (planned). The Briggs Well (Map 7.6) is planned for construction at the Briggs Village (former Briggs Nursery) site. The depiction of hydrostratigraphy in the Briggs (planned) DWPA was significantly revised by the 2009 groundwater modeling effort. The former Briggs Nursery well is understood to have drawn water from the lower part of the Deschutes Valley Aquifer (DVA) sequence rather than the Pre-Vashon units that occur regionally (Table 7.1). The Briggs (planned) DWPA zones are assumed to extend to the southeast more than 1.5 miles within the lower DVA and a further 0.5 miles in the upper part of the DVA unit. The planned DWPA delineation is still preliminary because of limited hydrogeological data. Hydrogeological cross-sections are available in the Golder reports.

The estimated groundwater flow direction is to the north-northwest in both the shallow and deeper DVA materials. The 2009 groundwater model analysis indicated the particles migrated to the water table near Chambers Lake in five to ten years. Therefore, water quality at the well is not expected to be at significant risk from land practices within the five-year zone. No influence from the adjacent Ward and Hewitt Lakes is expected on the deeper aquifer materials, but there is no data to confirm this.

Since the planned Briggs Well has not yet been installed, no water quality data is yet available. Information on the old Briggs Nursery well can be found on Ecology's Toxics Cleanup Program website. Ecology issued a No Further Action memo in 2019 and removed the site from the Hazardous Sites List.

Land use and Zoning

Shana Park DWPA has a land area of about 525 acres (Map 7.3). Assessed land use in the Shana Park DWPA is predominately high, moderate and low urban residential densities, followed by parks, preserves and open space, including the Indian Summer Golf Course and Capital City Golf Course. Near the intersection of College Street and Yelm Highway in Lacey is a rapidly growing commercial area.

Zoning is urban residential in the majority of the DWPA, in both Olympia's urban growth area and in Lacey and its urban growth area. Lacey also has large areas zoned commercial and moderate density urban residential.

Indian Summer DWPA has a land area of about 1,356 acres (Map 7.4). Assessed land use in the Indian Summer DWPA is predominately urban and rural residential low density followed by vacant land. The Indian Summer Golf Course is also located in this DWPA. Zoning is a combination of urban low densities

in Olympia's urban growth area, and rural densities of one unit per two and three acres in Thurston County.

Hoffman DWPA has a land area of about 811 acres (Map 7.5). Assessed land use is predominately residential low density followed by vacant land and natural resource land. The land area is zoned in a wide variety of residential urban densities in both Olympia and Lacey. There is also Neighborhood Village zoning, which allows for commercial and mixed residential uses, and a small area zoned Neighborhood Commercial.

Briggs (planned) DWPA has a land area of about 400 acres (Map 7.6). Low density residential development is the most common land use, followed by vacant or undeveloped land. The rest of the DWPA is natural resource land and parks, preserves and open space. Commercial development within the one-year time-of-travel zone includes the Briggs YMCA and other commercial activities at the intersection of Henderson Boulevard and Yelm Highway. The development of the Briggs Urban Village has changed land use significantly, with a general increase in high-density residential and commercial properties.

Zoning designations within the Briggs (planned) DWPA include an Urban Village within the six-month and one-year time-of-travel zones. This designation allows for a combination of residential and commercial development. The Briggs Urban Village has been permitted and continues to be developed under phased construction. The remainder of the DWPA is zoned single-family residential at 4-8 units per acre.

West Olympia DWPAs

Description

Two DWPAs protect three wells on the west side of Olympia: Allison Springs Well 13 (S09), Allison Springs Well 19 (S11) and Kaiser Well 1 (S03). The Allison Springs wells (Map 7.7) are used year-round. Until the status of the Kaiser Well 1 (S03) (Map 7.8) was changed to emergency usage in mid-2015, it primarily provided seasonal support during the summer months. Currently, groundwater levels are measured and water quality samples are collected from five monitoring wells (MW-18, MW-22, MW-23, MW-24 and MW-28) in the Allison Springs DWPA. No monitoring wells have been installed in the Kaiser DWPA given the historically limited use of the well, its location in a mostly rural area of West Olympia, and the Utility's designation of the Kaiser Well 1 (S03) as an emergency source in mid-2015.

Hydrogeology

The West Olympia DWPAs for the Allison Springs and Kaiser wells are shown in Map 7.7 and Map 7.8, respectively.

Two of the three West Olympia area wells (Allison Springs Well 13 (S09) and Well 19 (S11)) draw water from the confined Pre-Vashon sediments, while the third (Kaiser Well 1 (S03)) draws water from the shallower unconfined aquifer (Table 7.1). The zones are subject to some uncertainty however, because of data gaps in this area, the main gap being a more accurate characterization of the groundwater flow direction in the deeper Pre-Vashon Gravel aquifer. The geology of this area appears complex, both vertically and horizontally, with distinct areas of till separating aquifer layers in some areas, but complete separation between upper and lower layers not likely in other areas. Hydrogeological cross-sections are available in the Golder reports.

Allison Springs DWPA. Flow directions in the deeper confined Pre-Vashon aquifer are not well defined because of limited water level data. However, bedrock exposed along the Black Hills just south of Allison Well 13 (S09) and Well 19(S11) is probably an important factor that affects groundwater flow in the vicinity of these wells (Map 7.7). A northwesterly component of groundwater flow is likely influenced by the Black Hills bedrock outcrop to the south of these supply wells. A north-northwest regional flow direction would be expected on the northeast side of the Black Hills and would transition to a westerly flow direction on the north side of the Black Hills, where the Allison Springs wells are located.

As with the other supply and monitoring wells, the Utility has collected groundwater quality samples at each Allison Springs well and, since 2009, at up to five monitoring wells, at frequencies ranging from quarterly to annually. Samples have been tested for pathogenic indicators, synthetic organic compounds, volatile organic compounds and inorganic compounds including nitrates. Nitrate has been detected at low levels in both source wells and some monitoring wells, confirming that surface activities have impacted groundwater quality (See Section 7.4).

Kaiser DWPA (Emergency Source). Flow directions in the shallow aquifer that supplies the Kaiser Well 1 (S03), although fairly radial, generally trend to the northeast (Map 7.8). A north-south trending groundwater divide has also been identified along the eastern portion of the study area.

The Utility has collected groundwater quality samples at the Kaiser Well 1 (S03) at frequencies ranging from quarterly to annually. Samples have been tested for pathogenic indicators, synthetic organic compounds, volatile organic compounds and inorganic compounds including nitrates. Water quality monitoring does not indicate cause for concern at this well. There are no monitoring wells in the Kaiser DWPA. (See Section 7.4).

Land use and Zoning

Allison Springs DWPA land use has changed, particularly within the one-year and five-year time-of-travel zones, shifting from low-density rural residential uses to more high-density residential and commercial uses within Olympia's city limits and urban growth area. Despite the shift to increased densities, most of the residential land is still low density (less than 3.5 dwelling units per acre), with the remaining area primarily vacant land, roads and rights-of-way (Map 7.7).

Zoning designations in the Allison Springs DWPA primarily fall into urban use categories. Within the one-year time-of-travel zone, they include Urban Village and professional office/mixed residential, medical services, light industrial/commercial, and professional office/mixed residential. Within the five-year time-of-travel zone, they include general commercial, medical services, residential multi-family, and high-density corridor zones.

Kaiser DWPA (**Emergency Source)** is also undergoing a shift in assessed land use from rural residential densities to urban residential densities. All this land is zoned for residential development, and a large portion of the DWPA lies within the Green Cove Basin, which is zoned for low impact development (Map 7.8).

Table 7.1 Summary of DWPA Hydrogeological Characteristics

	Aquifer Conditions (the supply aquifer is shaded)				Major Surface Water Features			Groundwater Flow Directions			General Groundwater Quality		
	Well Depth	**Shallow**	**Intermediate**	**Deep**	**Lakes**	**Rivers**	**Seeps/Springs**	**Shallow**	**Intermediate**	**Deep**	**Shallow**	**Inter-mediate**	**Deep**
McAllister Wellfield (S16)													
Wells TW-22 (S13), PW-24 (S14), and PW-25 (S15)	Up to 400 ft	Semi-confined McAllister Gravel (Qmg) 1			Lake St. Clair	Nisqually River, Eaton Creek, McAllister Creek	McAllister Springs, Abbot Springs, McAllister Bluff	N/NE - toward Nisqually River			Excellent. Some elevated iron and manganese in area wells. Some increasing nitrates in shallower monitoring wells.		
Briggs (planned)													
Planned Well	350-450 ft	Deschutes Valley Aquifer (DVA)			Ward Lake, Hewitt Lake	Deschutes River	None	Limited water level data - assumed N/NW			No water quality monitoring data available.		
East Olympia Area													
Hoffman Well 3 (S08)	362 ft	Unconfined (Qga)	Confined Pre-Vashon (Qpg)		Chambers Lake	Chambers Creek	None	N/NW with mounding beneath lakes	N/NE with north trending groundwater divide	Limited water level data - assumed N/NW	N/A	N/A	Elevated iron/man-ganese
Shana Park Well 11 (S10)	90 ft	Unconfined (Qga)	Confined Pre-Vashon (Qpg)		Smith Lake						Elevated nitrate	N/A	N/A
Indian Summer Well 20 (S12)	211 ft	Unconfined (Qga)	Confined Pre-Vashon (Qpg)		Golf Course Lakes						Elevated nitrate	Elevated iron/man-ganese	N/A
West Olympia Area													
Kaiser Well 1 (S03)	111 ft	Confined (Qga)	Confined Pre-Vashon (Qpg)		Louise Lake	Cave Creek	None	East to West. North-south groundwater divide in east half of study area	Limited data – assumed W/NW	N/A	N/A	N/A	N/A
Allison Well 13 (S09)	200 ft	Confined (Qga)	Confined Pre-Vashon (Qpg)		Ken Lake	Mud Bay, McLane Creek, Percival Creek	Allison Springs				TCE plume at former landfill (up-gradi-ent)	Increasing nitrate trend	N/A
Allison Well 19 (S11)	183 ft	Confined (Qga)	Confined Pre-Vashon (Qpg)									Increasing nitrate trend	N/A

1 Hydrostratigraphic units (such as Qmg) are defined in Section 7.2

7.4 Contaminant Source Inventory

This section summarizes the results of the 2019-2020 contaminant source inventory with a table of risk levels in each Drinking Water Protection Area (DWPA). Contaminant source inventories have been completed since 1997. Updates conducted since the 2015 Water System Plan include the 2015-2016, 2017-2018 and 2019-2020 biennia. Contaminant source inventory notifications for 2015-2016 and 2017-2018 are summarized in letters to DOH (Appendix 7-1 and Appendix 7-2).

The 2019-2020 inventory identifies the types of contamination and the major sources of contamination in each DWPA, as well as lists resources available to Utility staff to monitor and address potential contaminating conditions and events. The findings and the notification documents required in WAC 246-290-135 for the 2019-2020 biennium update (completed in2021) is included in Appendix 7-3.

Sources of Contamination

Four basic types of contaminants can be found in groundwater:

- Microbial pathogens (bacteria, viruses and other microorganisms).
- Inorganic chemicals (nutrients, salts, heavy metals and others).
- Organic chemicals (pesticides, solvents, fuels and other chemicals).
- Sediments/turbidity.

The Groundwater Protection Program monitors these types of contaminants in the Utility's DWPAs, evaluates their potential impacts on groundwater, and implements strategies to minimize the chances of these contaminants from occurring or increasing to levels that would pose a risk.

For the contaminant source inventory, Program staff focuses on contaminants regulated by DOH under the federal Safe Drinking Water Act, which includes the following 12 major sources of potential contamination:

1. Use, storage and disposal of hazardous waste.
2. Pesticides and fertilizers.
3. Transportation and utility corridors.
4. Underground storage tanks.
5. Contaminated sites.
6. Existing and abandoned solid waste landfills.
7. Stormwater runoff and infiltration.
8. On-site septic systems.
9. Agricultural land and golf courses.
10. Abandoned and poorly constructed wells.
11. Animal wastes.
12. Seawater intrusion.

Ranking Risk

Staff developed ranking criteria based on the DOH's Wellhead Protection Program Guidance (publication 331-018) and the Utility's Land Acquisition Strategy (Appendix 7-4). High and low degrees of risk were assigned to each DWPA considering the presence of the risk, the extent or distribution of the risk, the potential severity of the threat to groundwater and hydrogeological factors. Risk levels are:

- High. The risk is distributed throughout the DWPA or the potential threat to groundwater is great.
- Low. Both the distribution of the risk and potential threat to groundwater are minimal.

Table 7.2 shows the risk rankings for each DWPA. These rankings were used to develop the 2021-2026 Groundwater Protection Program's goals, objectives, strategies, and performance measures described in Appendix ES1.

Table 7.2 Ranking of Risks in Olympia's Drinking Water Protection Areas

Risk	McAllister Wellfield (S16)	Allison Springs Well 13 (S09) and Well 19 (S11)	Kaiser Well 1 (S03)	Hoffman Well 3 (S08)	Shana Park Well 11 (S10)	Indian Summer Well 20 (S12)	Briggs Well, planned
Hazardous materials (use, storage, and disposal)	High	High	Low	Low	High	High	High
Pesticides and fertilizers	Low	High	Low	Low	High	High	High
Transportation and utility corridors	High	High	Low	Low	High	High	High
Underground storage tanks	Low	High	Low	Low	Low	Low	Low
Contaminated sites	Low	High	Low	Low	Low	High	High
Existing and abandoned solid waste landfills	Low	High	Low	Low	Low	Low	Low
Stormwater runoff and infiltration	High	High	Low	Low	High	High	High
On-site septic systems	High	Low	High	Low	High	High	High
Agriculture and golf courses	High	Low	Low	Low	High	High	Low
Abandoned and poorly constructed wells	High	High	High	High	High	High	High
Animal wastes	High	Low	Low	Low	Low	Low	Low
Seawater intrusion	Low	Low	Low	Low	Low	Low	Low

Notification of Inventory Findings

The DOH requires utilities to conduct a notification process regarding actual and potential sources of contamination within its DWPAs. For the 2019-2020 (completed in 2021) contaminant source inventory, the Utility sent notification letters to:

- Regulatory agencies, local governments, and emergency responders to inform about the locations of potential and actual groundwater contaminant sources in the DWPAs.
- Owners and operators of actual and potential contaminant sources including known and suspected contaminant sites and septic systems.

The list of sites, maps of site locations, the mailing list of owners/operators, the mailing list of agencies and responders, and sample letters are in Appendix 7-3.

Source Susceptibility Assessments

Completed susceptibility assessment forms and well logs for all Utility source wells are on file with DOH.

Groundwater Reports

In addition to implementing DOH's contaminant source inventory requirements, the Utility is vigilant in protecting our groundwater resources by evaluating water quality data and water level measurements at all active source wells and select monitoring wells. These evaluations are intended to help staff stay apprised of long-term variations in water quality or availability. Staff summarize the evaluations in the Groundwater Report, which is updated about every two years. This report is for in-house use by staff.

The 2011 Groundwater Report was written to bring together in one document an overview of the history of groundwater protection monitoring events and an analysis of long-term trends in water levels and water quality. It also references regulations that apply to the Utiilty's water system and DWPAs, characterizes the regional hydrogeological setting, and references past studies of water development and investigations into known and potential contamination sources and risks. It also summarizes information on water rights, water facilities, supply and monitoring wells, well logs and construction, source production and monitoring schedules.

Updates of the Groundwater Report primarily focus on analysis of groundwater level measurements and water quality sample results. Therefore, updates assist the Utility to determine ways to improve water level monitoring and interpretation, maximize collection of representative monitoring well water quality samples, and expand the network of monitoring wells in each DWPA.

Major activities, findings, and recommendations from Groundwater Report updates since the 2015 Water System Plan and overviews of water quality analyses through 2020 are summarized below. Some of the recommendations are also included as Performance Measures (See Appendix ES1).

Main Activities

Main activities accomplished since the 2015 Water System Plan and summarized in the Groundwater Report updates include:

- Updated the City of Olympia Critical Areas Ordinance and Engineering Design and Development Standards in July 2018 to clarify monitoring well and landscape requirements for developers.

- Timely review of monitoring well network nitrate sample results and development of annual monitoring schedules.
- Collection of groundwater quality samples in August 2018 from four monitoring wells for analysis of volatile organic compounds, inorganic compounds, synthetic organic compounds, herbicides, and carbamates. (All analytical results were reported as non-detect.)
- Renewal of easement agreements with the Nisqually Indian Tribe and Washington Department of Transportation to continue monitoring wells in the McAllister Wellfield and Allison Springs DWPAs.
- Approval by Ecology to extend construction of the planned Briggs Well through July 1, 2024.
- Installation of a monitoring well (MW-28) in September 2014 by a private developer for constructing a stormwater infiltration facility in the Allison Springs DWPA as required by Olympia's drinking water (wellhead) protection area municipal code.
- Approval by Ecology of a remedial investigation (2019) and feasibility study (2020) and development of a draft cleanup action plan (2021) for the City of Olympia's former West Olympia Landfill site under an Ecology Agreed Order. Located within the Allison Springs DWPA, the City of Olympia has renamed the site the West Olympia Commercial Property to reflect the City's intent to sell the parcel for commercial development.

Findings and Recommendations

Key findings highlighted in Groundwater Report updates include:

- Nitrate continues to persist in the Shana Park Well 11 (S10), averaging 2.7 milligrams per liter (mg/L). MCL is 10 mg/L
- Nitrate has been detected in three samples, in the Indian Summer Well 20 (S12) in2012, 2013 and 2015, values range between 1.40 mg/L and 2.37 mg/L. All 18 samples collected since then are non-detect.
- Monitoring wells in the Allison Springs DWPA provide evidence that nitrate may be present throughout the DWPA at levels up to about 1.2 mg/L.

Key recommendations include:

- Drill a test well in the Utility-owned LBA parcel to evaluate the presence of a sufficiently productive aquifer with good water quality for purposes of potentially relocating the Shana Park Well #11 (S10) and/or other SE Olympia water rights. Collect groundwater quality samples and conduct an aquifer pumping test during drilling of the "LBA Pilot Well" to expedite hydrogeological knowledge about the location.
- Retrofit selected existing monitoring wells and install additional monitoring wells in the McAllister Wellfield and Indian Summer DWPAs, and possibly the Shana Park DWPA depending on the outcome of the LBA Pilot Well.
- Apply hydrogeological information (obtained since the Golder reports and from retrofit and new monitoring wells) to recalibrate the numerical groundwater models used to delineate the Allison Springs, Indian Summer, and McAllister Springs DWPAs, as well as the Shana Park DWPA depending on the outcome of the LBA Pilot Well.
- Partner with Thurston County and other local jurisdictions to implement "GData" or similar data management application to share regional water resource information.

Land Acquisition Strategy

This section gives an overview of the Groundwater Protection Program Land Acquisition Strategy completed in 2016 (Appendix 7-4). The concept of protecting water resources through land acquisition assumes that Utility ownership or otherwise direct management of property is the most effective way to eliminate risks to water quality and supply. The purpose of the strategy is to inform Utility staff of the methods for participating in land acquisition and conservation activities. It is also intended to help Utility customers, rate payers, and City of Olympia residents understand the drivers behind and the benefits of the Utility's investment in land, especially land located outside City of Olympia city limits and urban growth area.

The document describes the Utility's strategy for protecting its drinking water sources through land acquisition and conservation. It also touches on development-related risks to groundwater and City of Olympia policies intended to mitigate those risks. Owning land, establishing conservation easements, purchasing development or timber rights, and implementing other property management tools may reduce risk to groundwater beyond what regulations can achieve. The strategy also includes how the Utility pursues land acquisition opportunities, values parcels for acquisition, and may fund acquisition efforts. The methods applied to prioritize the DWPAs and identify specific parcels for acquisition or conservation – perhaps providing protection into perpetuity – are also described.

As an outcome of this work, the Utility's seven DWPAs and thirty (30) parcels within them have been prioritized for groundwater protection through land acquisition strategies. The Allison Springs, Indian Summer, and McAllister Wellfield DWPAs are the highest priority, with a total of 23 parcels providing opportunity for protection through land acquisition strategies. Seven other parcels are located within the Briggs (planned) and Hoffman DWPAs. No parcels are identified for land acquisition/conservation opportunities within the Shana Park or Kaiser DWPAs.

Water Resources/Groundwater Protection Program staff will periodically revise the strategy by updating the numbers and acres of parcels, and parcel ownership, within each DWPAs' groundwater flow time-of-travel capture zones. The criteria and methods used to rank individual parcels and prioritize DWPAs may also be revised as new hydrogeological information is acquired or zoning or land use activities change.

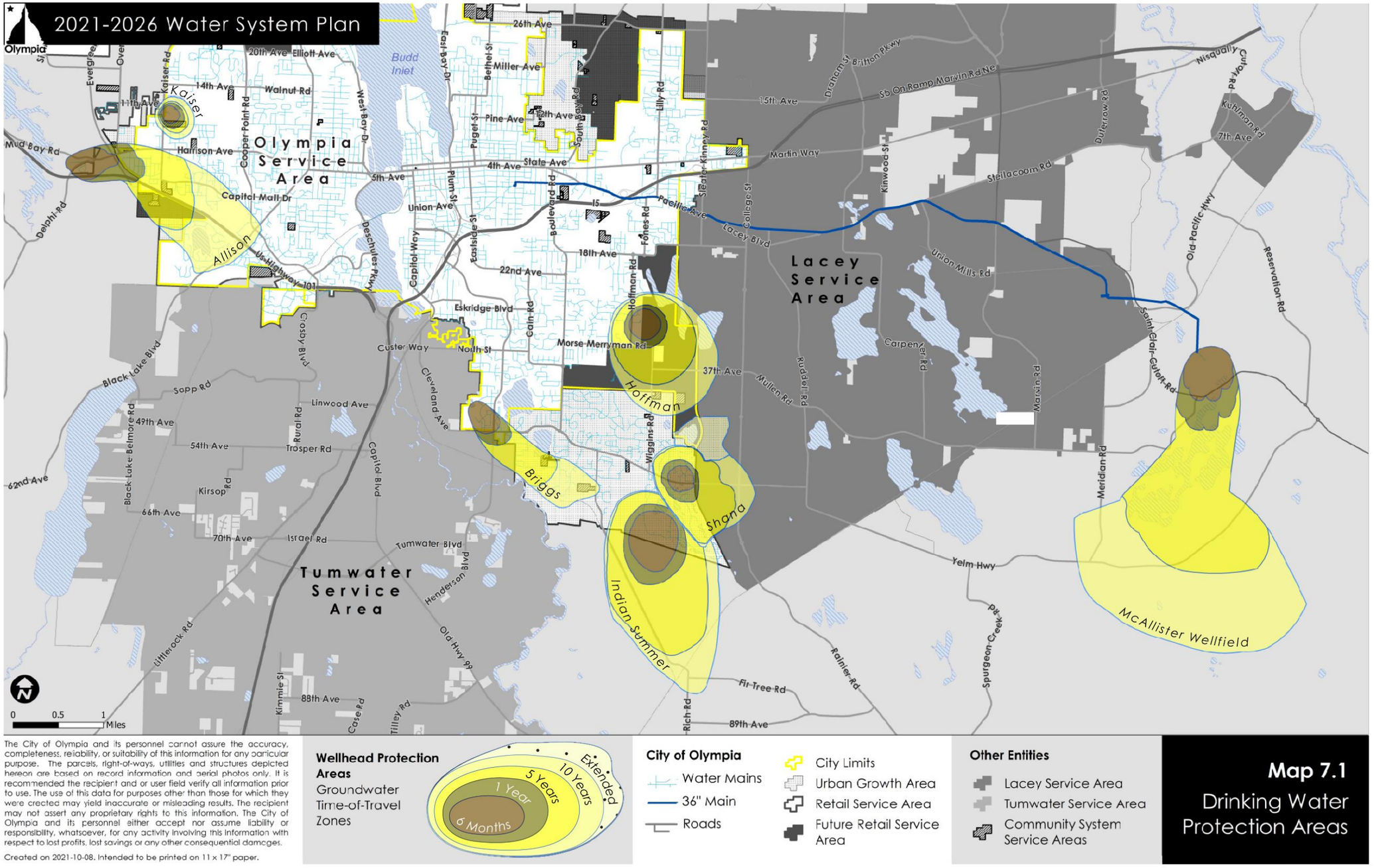
7.5 Contingency Planning

Contingency planning is integral to managing the Utility's Drinking Water Protection Areas to ensure customers have an adequate supply of potable water in case contamination results in the temporary or permanent loss of the McAllister Wellfield or other supply wells (WAC 246-290-135 (3)(c)(vi) and (vii)). Through the Utility's emergency response planning efforts (Chapter 12, Section 12.2), staff is prepared to address immediate or short-term threats to groundwater (such as a transportation spill) and longer-term threats (such as the loss of a well due to contamination or natural disaster). The Utility's Emergency Response Plan contains the Utility's Contingency Plan, Water Shortage Response Plan and Spill Response Plan required by DOH for groundwater protection and general emergency preparedness. The Emergency Response Plan was updated in June 2021 to be consistent with the Utility's Risk and Vulnerable Assessment, December 2020 (Appendix 12-2).

While contingency planning addresses longer-term impacts to water supply sources, it includes procedures for emergency incident and spill response, immediate or short-term threats. Thus, the Utility is by default prepared to manage spills and other immediate hazards quickly and effectively, which is especially important should any occur within our DWPAs. Chapter 12, Section 12.2 further describes actions and resources the Utility is prepared to exercise in cases of immediate emergencies that may occur within a DWPA.

A critical component of emergency response in the DWPAs is effective coordination with neighboring jurisdictions and regional response partners, given that portions of the Utility's DWPAs are outside City of Olympia city limits. The Utility has implemented DOH source water protection requirements by providing partner emergency responders (Chapter 12, Table 12.3) with maps of the DWPA boundaries, recent contaminant source inventory findings (Appendix 7-3), the results of source water susceptibility assessments and contingency planning information.

Map 7.1 Drinking Water Protection Areas



The City of Olympia and its personnel cannot assure the accuracy, completeness, reliability, or suitability of this information for any particular purpose. The parcels, right-of-ways, utilities and structures depicted hereon are based on record information and aerial photos only. It is recommended the recipient and or user field verify all information prior to use. The use of this data for purposes other than those for which they were created may yield inaccurate or misleading results. The recipient may not assert any proprietary rights to this information. The City of Olympia and its personnel either accept nor assume liability or responsibility, whatsoever, for any activity involving this information with respect to lost profits, lost savings or any other consequential damages.

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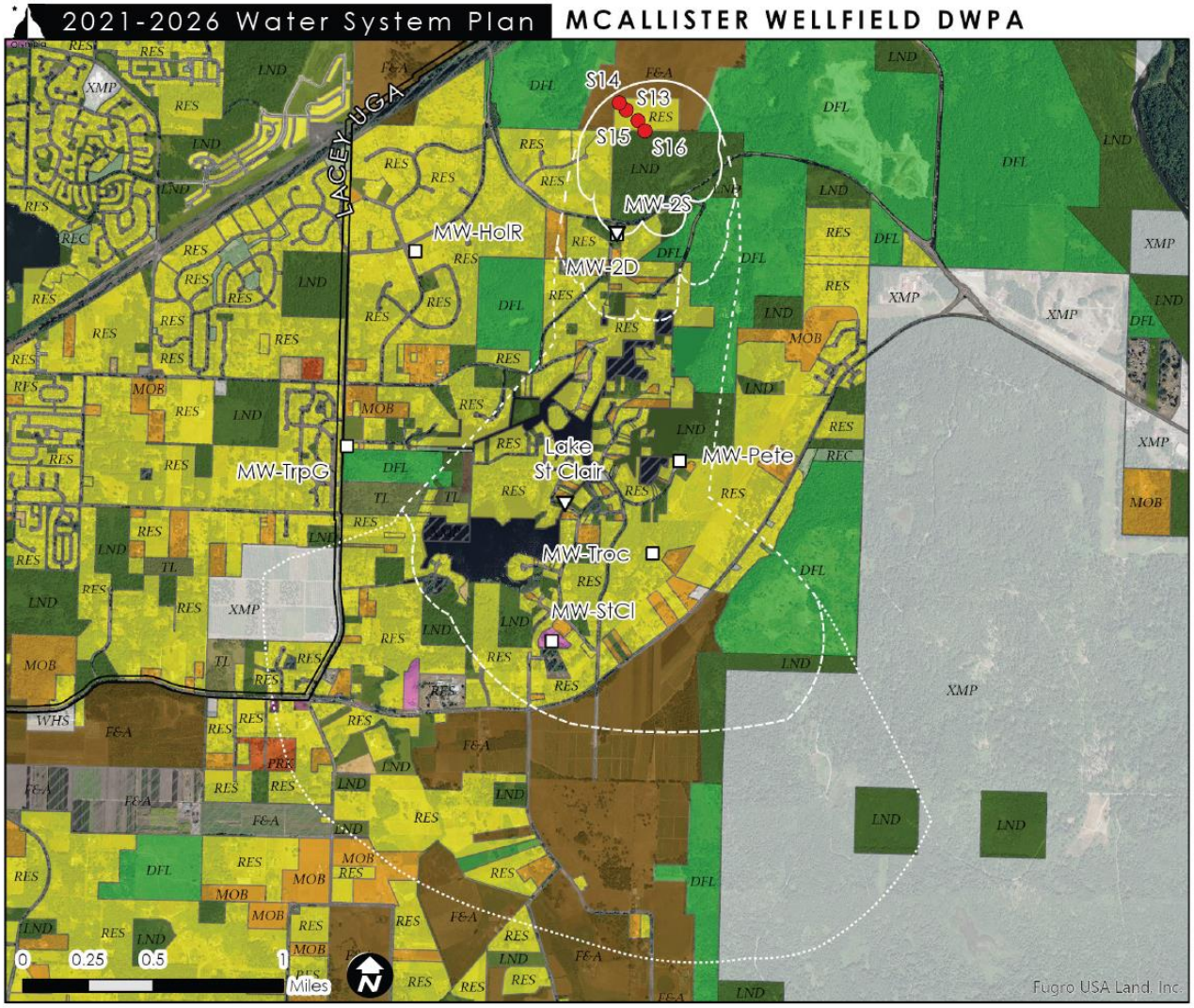
Wellhead Protection Areas
Groundwater Time-of-Travel Zones

City of Olympia
- Water Mains
- 36" Main
- Roads
- City Limits
- Urban Growth Area
- Retail Service Area
- Future Retail Service Area

Other Entities
- Lacey Service Area
- Tumwater Service Area
- Community System Service Areas

Map 7.1
Drinking Water Protection Areas

Map 7.2 McAllister Wellfield DWPA



Land Use

AGR	Agricultural	OPR	Operating-Prop
APT	Apartments	OS	Open Space
CNU	Condo-Unit	OYL	Oyster-Lands
DFL	Desig. Forest Land	PRK	Mobile/RV Park
F&A	Farm & Agriculture	REC	Recreational
GLF	Golf Course	RES	Residential
HOS	Hospital-Surg. Ctr	RST	Rests-Taverns
IND	Industrial	RTL	Retail
LDG	Lodging	SRV	Service
LND	Land-Only	TDL	Tide-Lands
MED	Medical & Vet	TL	Timber Land
MOB	Mobile-Home	TRN	Transportation
MUL	Multi-Family	WHS	Warehouse
NUR	Nursing-Asst Living	XMP	Exempt
OFF	Office		Other

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Source Well

Sampling Well

Monitoring Well - Water Quality

Monitoring Well - Water Levels

Groundwater Time-of-Travel Zones

6 Months

1 Year

5 Years

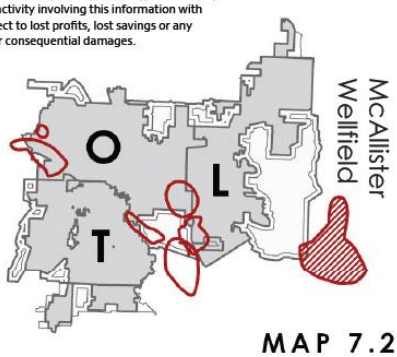
10 Years

Extended

City Limits

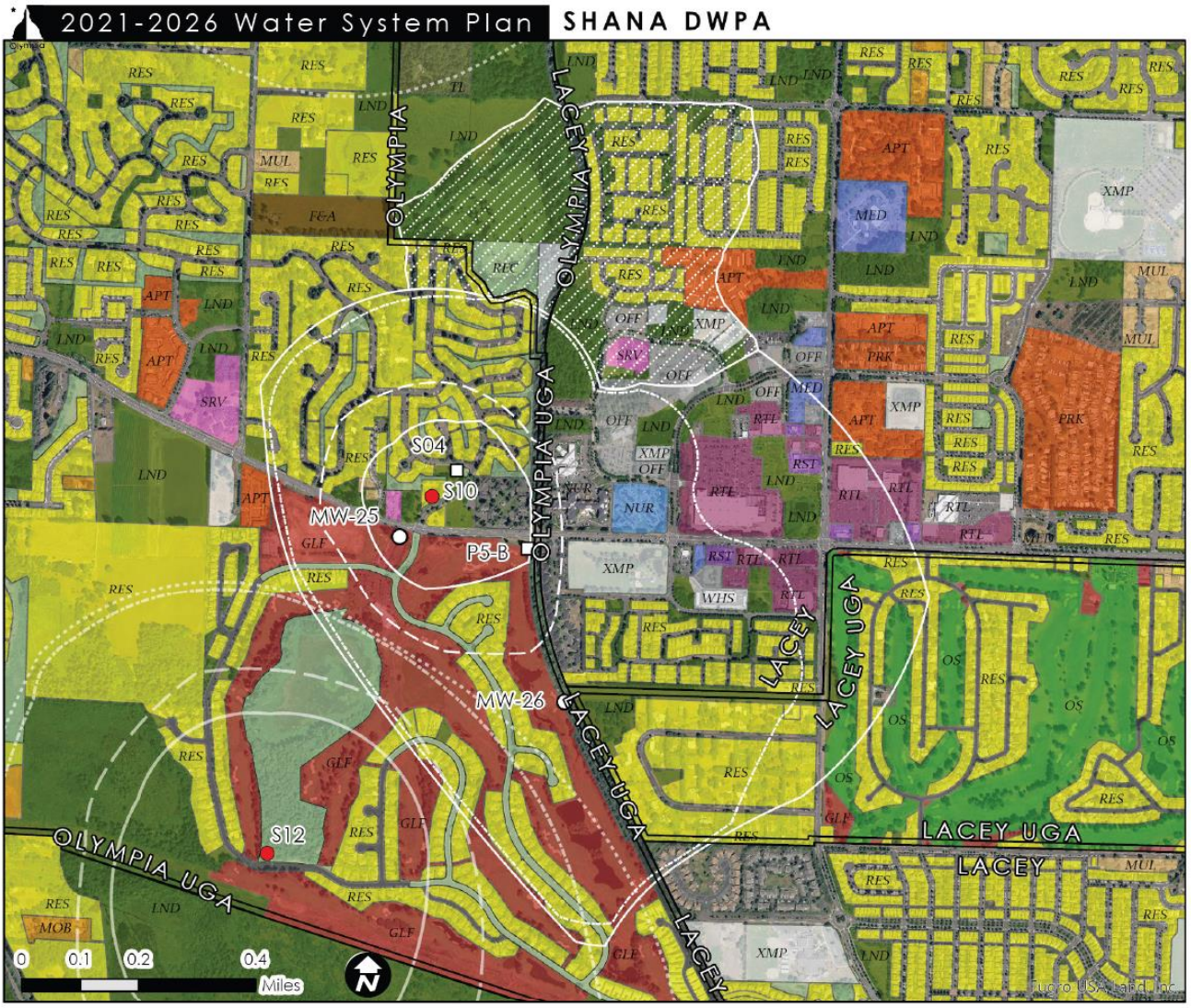
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MAP 7.2
DRINKING WATER
PROTECTION AREAS

Map 7.3 Shana DWPA



Land Use

AGR	Agricultural	OPR	Operating-Prop
APT	Apartments	OS	Open Space
CNU	Condo-Unit	OYL	Oyster-Lands
DFL	Desig. Forest Land	PRK	Mobile/RV Park
F&A	Farm & Agriculture	REC	Recreational
GLF	Golf Course	RES	Residential
HOS	Hospital-Surg. Ctr	RST	Rests-Taverns
IND	Industrial	RTL	Retail
LDG	Lodging	SRV	Service
LND	Land-Only	TDL	Tide-Lands
MED	Medical & Vet	TL	Timber Land
MOB	Mobile-Home	TRN	Transportation
MUL	Multi-Family	WHS	Warehouse
NUR	Nursing-Asst Living	XMP	Exempt
OFF	Office		Other

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Source Well

Sampling Well

Monitoring Well - Water Quality and Levels

Monitoring Well - Water Quality

Groundwater Time-of-Travel Zones

6 Months

1 Year

5 Years

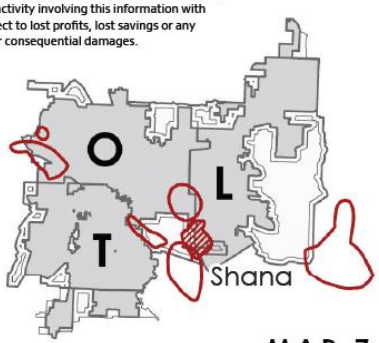
10 Years

Extended

City Limits

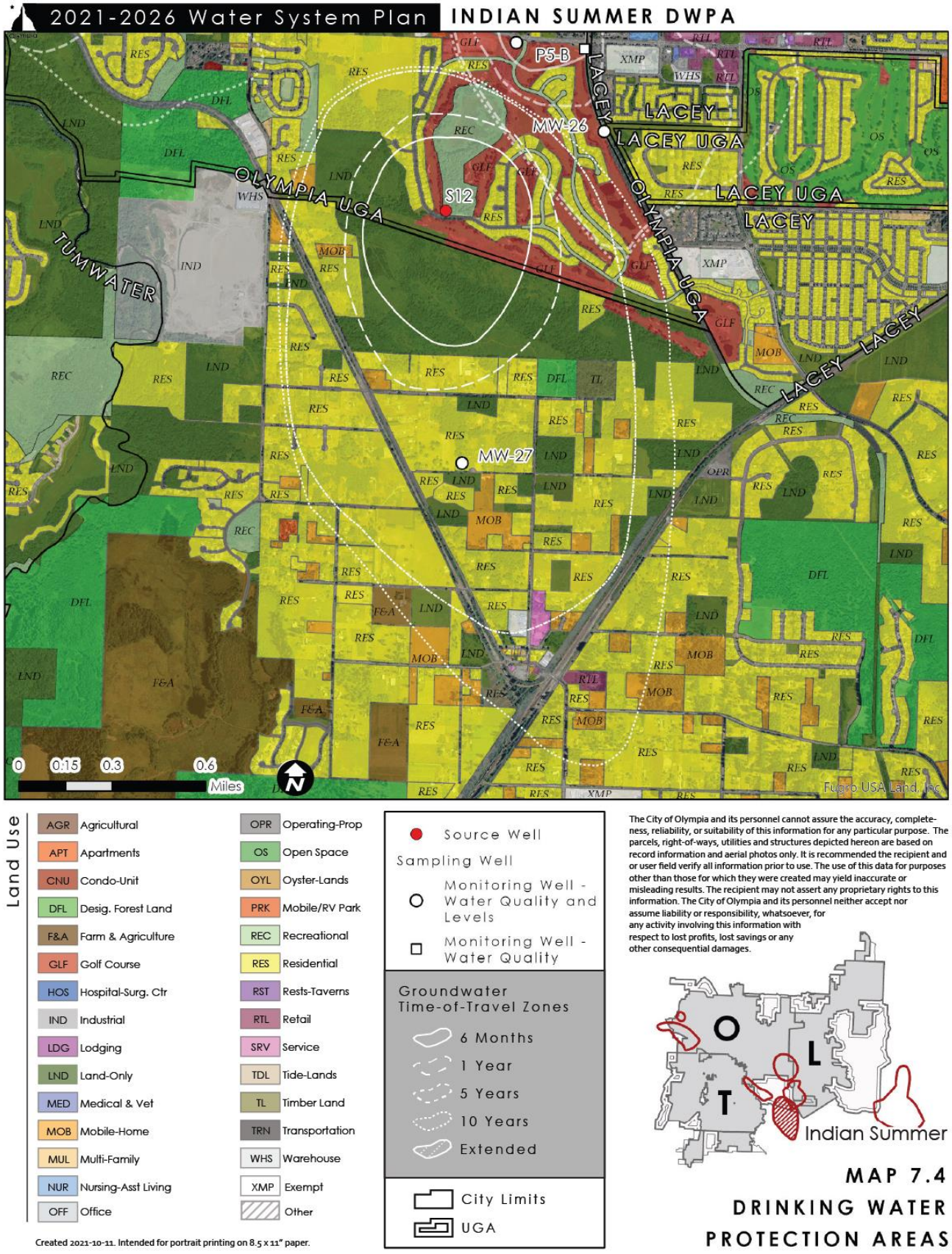
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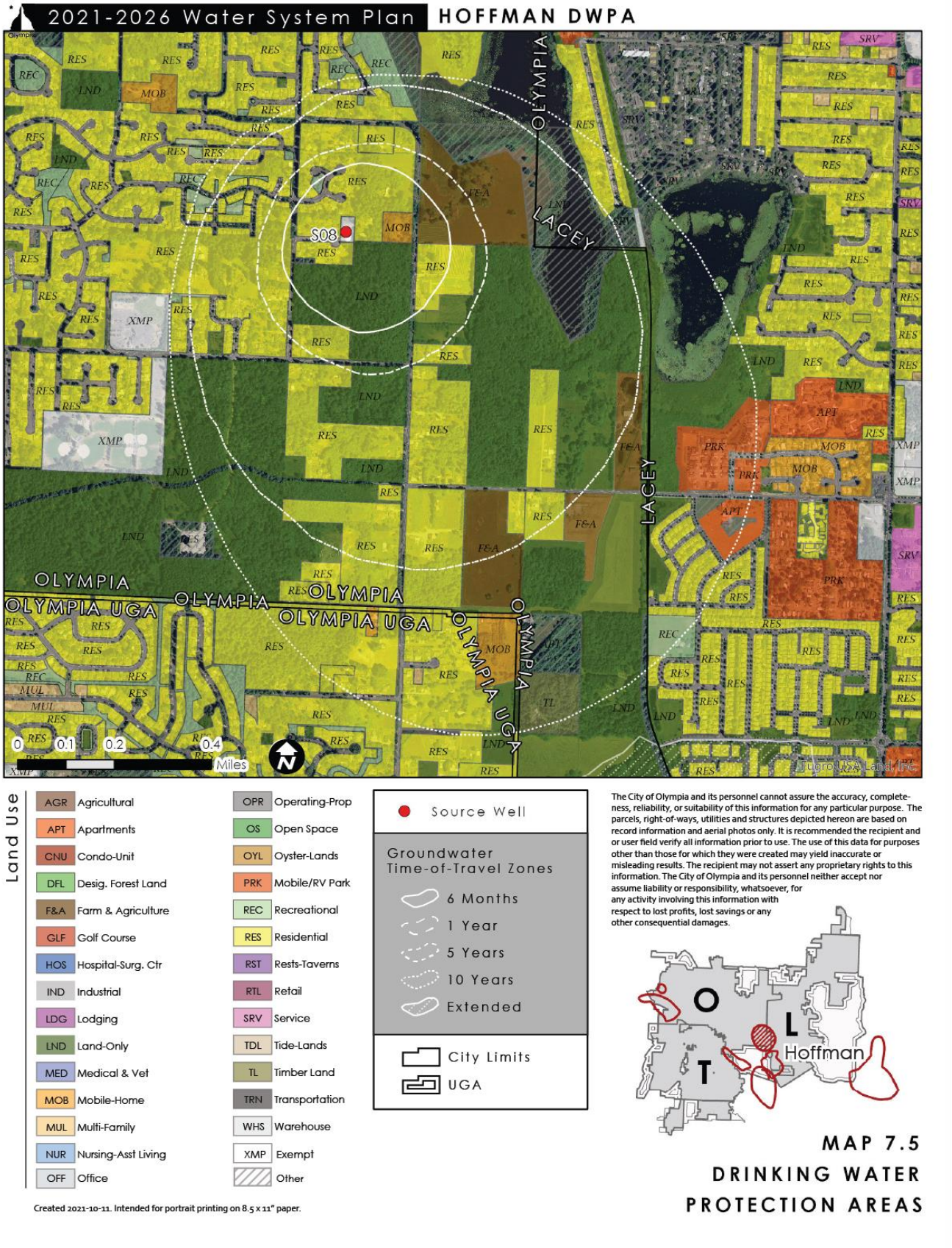


MAP 7.3
DRINKING WATER
PROTECTION AREAS

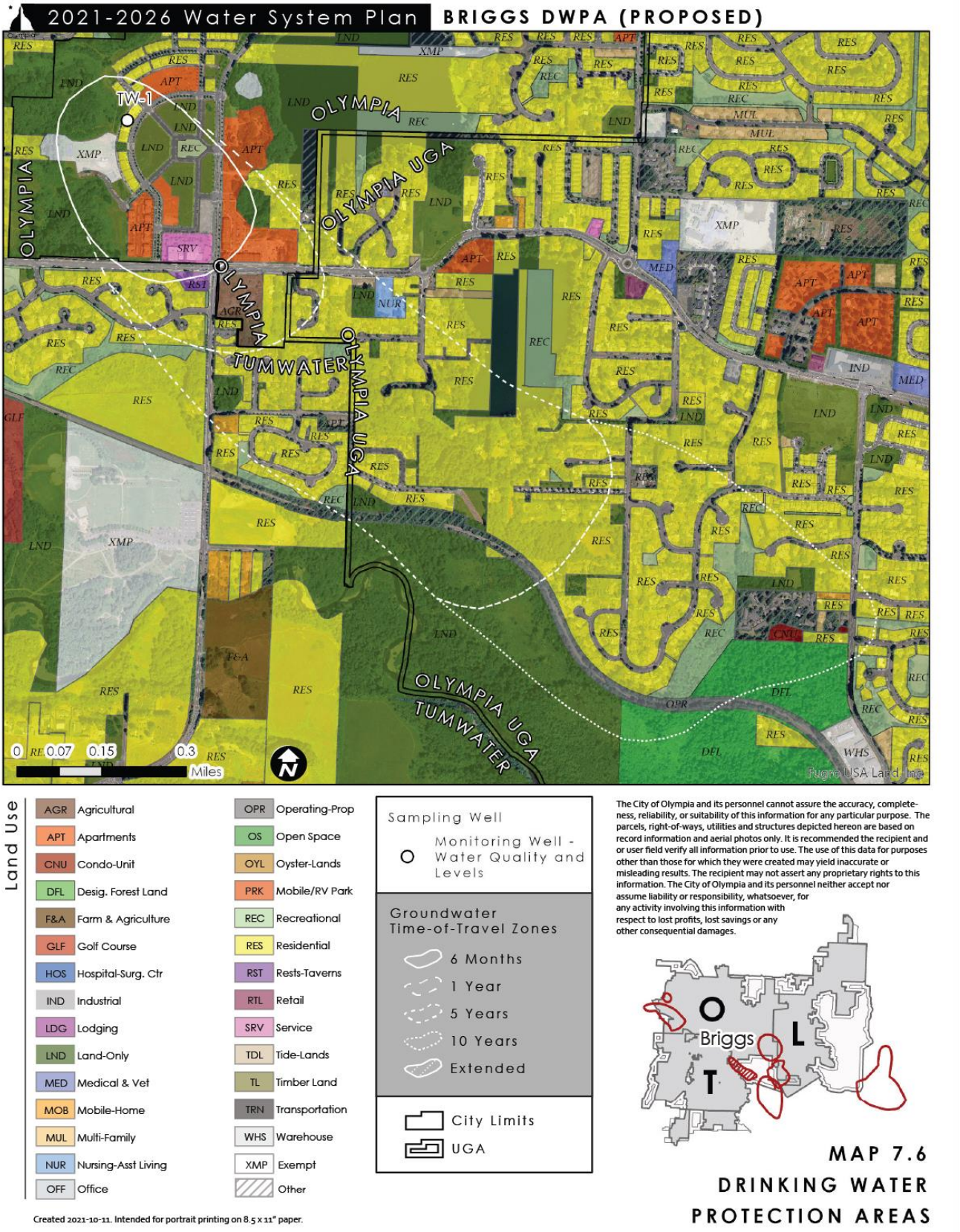
Map 7.4 Indian Summer DWPA



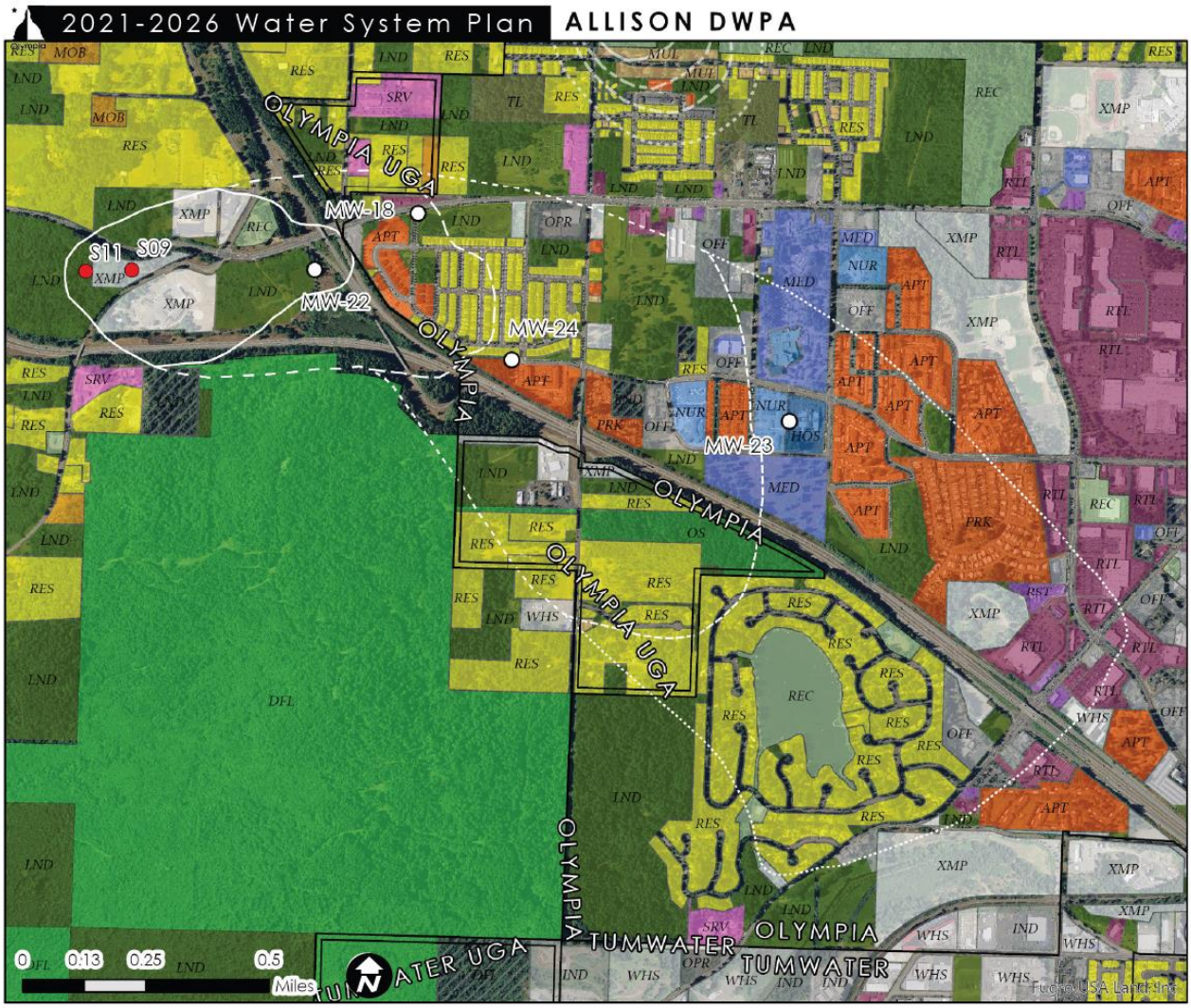
Map 7.5 Hoffman DWPA



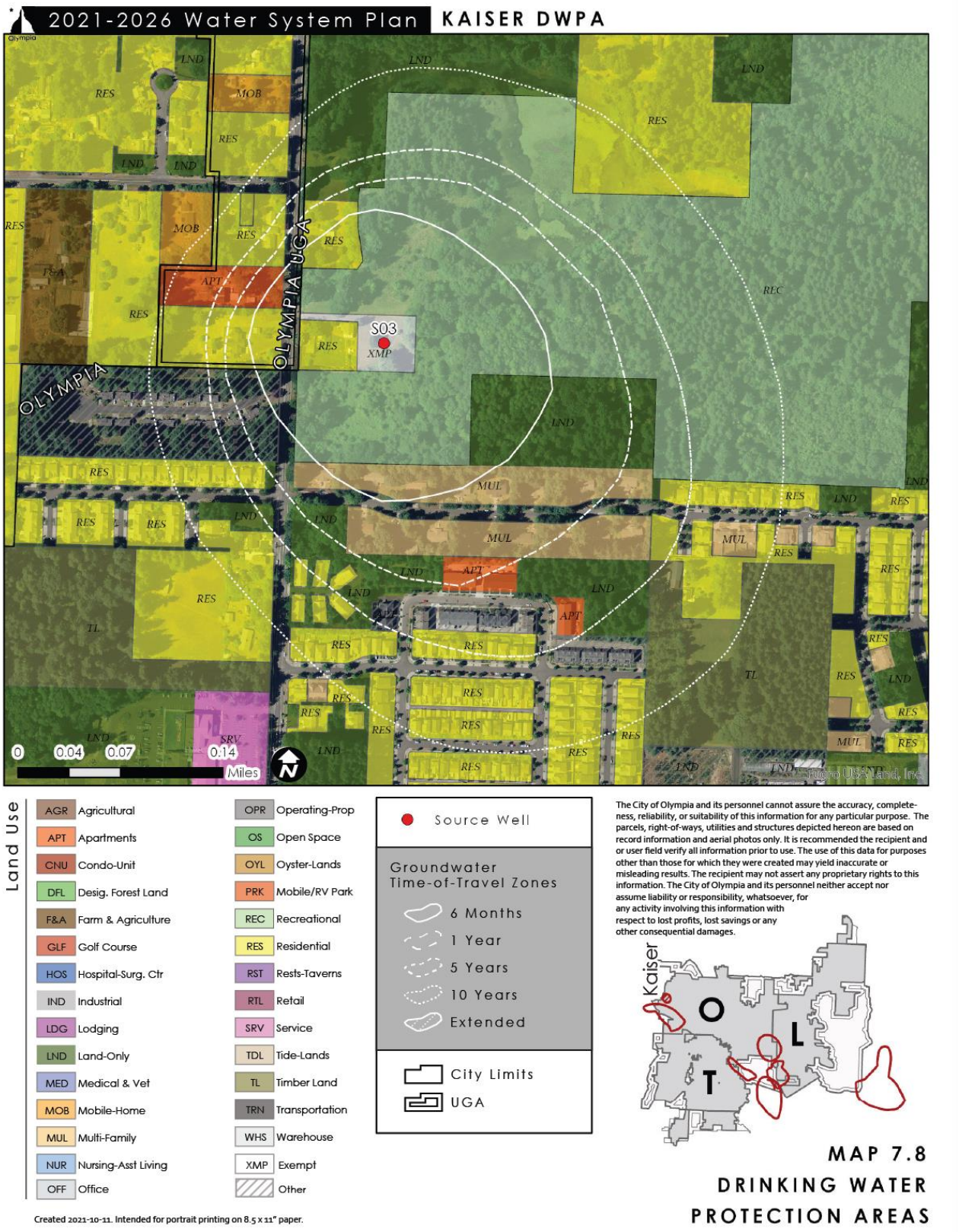
Map 7.6 Briggs DWPA (Proposed)



Map 7.7 Allison DWPA



Map 7.8 Kaiser DWPA





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CHAPTER 8 - SOURCE INFRASTRUCTURE

Source infrastructure projects help meet the City of Olympia Drinking Water Utility's (Utility) Goal 6:

> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high-quality water to a growing community.**

The 2021-2026 strategy for source projects is to develop and maintain multiple, geographically dispersed water supplies to enhance system reliability.

Other projects for improving the infrastructure are discussed in Chapter 9 (Storage Infrastructure) and Chapter 10 (Transmission/Distribution Infrastructure). Water quality strategies are in Chapter 11 and operations and maintenance strategies are in Chapter 12.

This chapter describes existing sources, evaluates their ability to meet current and projected needs, and identifies projects to be constructed in 2021-2026. Washington State Department of Health (DOH) rules on source development are in Chapter 173-160 WAC and Chapter 246-290 WAC, Part 3 (design of public water systems). Detailed specifications are in the DOH Water System Design Manual.

8.1 Description of Existing Source

Olympia's current drinking water sources are McAllister Wellfield and five additional groundwater production wells. The Utility's wells tap aquifers to obtain water that is of adequate quality and sufficient quantity to provide a long-term supply of water to Utility customers. Chapter 4 describes each source, with information about water rights; Chapter 7 provides hydrogeological details about each source aquifer; and Chapter 11 includes water quality and treatment protocols.

Each of these sources is described below. Map 1.4 in Chapter 1 shows where these sources are located. Table 8.1 is an inventory of equipment at each source.

McAllister Wellfield

The Utility's main source of drinking water is McAllister Wellfield (S16). The McAllister Wellfield is located approximately a mile southeast of McAllister Springs and ten miles east of Olympia.

The Washington State Department of Ecology (Ecology) approved developing the McAllister Wellfield water rights in three phases, with full development by 2050:

- Phase 1 included drilling one new well and rehabilitating two existing wells drilled in the late 1990s. Phase 1 has a target production rate of 15 million gallons per day (Mgd) and replaced the capacity of McAllister Springs. Construction of Phase 1 was completed in 2014. Phase 1 will provide sufficient water to meet summer water demands until Phase 2 supplies come online.
- Phase 2, planned to come online between 2030 and 2040, will enable production levels to increase up to 19.6 Mgd for the Utility and provide 0.5 Mgd for the Nisqually Tribe.
- Phase 3, scheduled for completion by 2050, will raise production to 23.06 Mgd for the Utility and 3 Mgd for the Nisqually Tribe, thereby maximizing full use of the water rights.

Table 8.1 Source Equipment Inventory

Source Name	Pump Type	Pump Model	Pump Size (HP)	Current Capacity (GPM)	Year Installed	Current Capacity (Mgd)	Well Diameter (Inches)	Well Depth (ft.)
McAllister TW-22 (S13)	Turbine	Ruhrpumpen	200	1,500	2014	2.16	12	370
McAllister PW-24 (S14)	Turbine	Ruhrpumpen	400	2,900	2014	4.18	20	400
McAllister PW-25 (S15)	Turbine	Ruhrpumpen	700	6,100	2014	8.78	24	425
Total McAllister Wellfield (S16)						15.12		
Hoffman Well 3 (S08)	Submersible	Byron Jackson	100	1,000	1985	1.44	10	378
Shana Park Well 11 (S10)	Submersible	American Marsh	25	760	2005	1.09	16	100
Indian Summer Well 20 (S12)	Submersible	Peerless	125	600	2008	0.86	12	213
Kaiser Well 1 (S03)[1]	Submersible	Peabody	25	360	1992	0.52	12	92
Allison Springs Well 13 (S09)	Submersible	American Marsh	40	530	2005	0.76	16	200
Allison Springs Well 19 (S11)	Submersible	American Turbine	60	900	2005	1.30	16	183
Total Other Wells						5.97		

1. Emergency source.

Pumping Facilities

McAllister Wellfield pumps were installed in 2014 in three wells. The wells are called PW (Production Well)-24, TW (Test Well)-22, and PW-25. PW-24 and TW-22 were drilled in 1998 as part of the investigation to determine the best location for the City's new water source. PW-25 was drilled and tested in 2013 after Ecology granted the Utility and Nisqually Tribe water rights for the new source. PW-24 is a 20-inch diameter well that produces 2,900 gallons per minute (gpm); TW-22 is a 12-inch diameter well that produces 1,500 gpm; and PW-25 is a 24-inch diameter well that produces 6,100 gpm. The pumps are located in concrete masonry block buildings. The wells pump into 36-inch, 30-inch and 24-inch ductile iron pipe and then to a 36-inch welded steel transmission main that heads north about 4,100 feet and connects to the original 36-inch main just west of McAllister Springs before heading to the Meridian Storage Tanks.

The susceptibility assessment forms and well logs for the McAllister Wellfield wells are on file with DOH.

Power Supply

Power for the facility, including pumps, pump controls, chlorination equipment and telemetry systems, is provided by an air-cooled, 1,500 KVA, three-phase transformer located adjacent to the PW-25 well house.

Underground power follows the 36-inch transmission main and connects to three-phase power at Old Pacific Highway.

An emergency diesel generator capable of powering PW-24, chlorination equipment, telemetry and other systems is located at PW-25. The generator is capable of powering the 2,900 gpm well pump at PW-24. The City's winter water demands can be met using only PW-24 plus the other five City wells (excluding Kaiser), rendering TW-22 and PW-25 unnecessary during a winter power outage. Power outages are more common in winter than in the summer. If necessary, the Utility has provisions to add generator capacity with Phase 2 of the wellfield development.

Water Quality Treatment

Water pumped from McAllister Wellfield is disinfected with chlorine before it reaches the Meridian Storage Tanks. At the chlorine source is an automatic switchover manifold feed system. The supply room is equipped with dual scales, ventilation, alarm systems and emergency response equipment. Aeration towers were constructed in 2018 at the Meridian Storage Tanks. The aeration towers raise the pH of the wellfield water from about 6.5 to the required 7.3 at Meridian Tank outlet. Because the City's population is over 50,000, Olympia is required by DOH to optimize for pH adjustment of its sources (Chapter 11).

East Olympia Area Wells

The three wells located in East Olympia are described below.

Hoffman Well 3 (S08)

In 1985, the City drilled the 16-inch-diameter Hoffman Well 3 (S08) in Zone 417. The well and pumping facilities are in a locked enclosure and have been used primarily to meet peak hour demands since May 1985.

The well casing extends 378 feet from the ground surface through various glacial deposits to bedrock. A 34-foot stainless steel screen was installed between the depths of 324 and 358 feet. Aquifer pump testing indicates a sustained yield of 1,000 gpm. This well is considered to be in good condition and

requires only routine maintenance. Water quality testing indicates that the well produces water with levels of iron and manganese in excess of secondary maximum contaminant levels, which is an aesthetic rather than a health-related concern. Consequently, its use is restricted to supplement supply only during peak hour demands. The well pumps directly into a storage tank where mixing dilutes the higher iron and manganese levels.

Shana Park Well 11 (S10)

In 1988, Shana Park Well 11 (S10) was drilled to a depth of 91 feet in Zone 417. Although the well was screened from 75 feet to 88 feet below ground, the casing was perforated from 38 feet to 45 feet to improve production. The capacity of this well is approximately 760 gpm. The well pump was replaced in 2005 with a more energy efficient 25-hp pump, using a 50 percent funding grant from Puget Sound Energy. Well 11 is considered to be in good condition and requires only routine maintenance.

In 1989, a treatment facility was installed to elevate pH by injecting soda ash into the water. The slightly acidic nature of the aquifer (pH 6.2) had created localized complaints of blue discoloration from corroded copper leaching in household plumbing. In 1996, the Utility constructed an aeration tower, which strips the dissolved carbon dioxide from the water and raises the pH to about 7.6. This pH level allows the Utility to meet the requirements of the federal Lead/Copper Rule (Chapter 11).

Water from Well 11 is chlorinated using gas chlorine from 150-pound cylinders. All the chlorination equipment is located in the well building.

The Utility continues to monitor the nitrate levels in Well 11 and its overall vulnerability to contamination (Chapter 7). The Shana Park Well Contingency Plan (2018) explored options to address any concerns by either improving groundwater quality at the well or providing a replacement water supply. Funds were provided in the 2021 budget to pursue the plan recommendation to drill a test well in the City-owned LBA parcel and the project began in summer 2021 during development of this Water System Plan. The outcome of the LBA Pilot Well project will help staff evaluate whether to replace the water supply by relocating the Shana Park water right 1.3 miles to the north.

Indian Summer Well 20 (S12)

Indian Summer is a gated Master Planned Community with a golf course, located in Southeast Olympia off Yelm Highway. The community is completely built out, with about 500 single-family homes, townhomes and condominiums. Indian Summer Well 20 (S12) is located in the center of the community, at the entrance to the community-owned 36-acre Nature Preserve.

The well was drilled in 1993 to a depth of 213 feet and is located in Zone 417. The initial aquifer pumping test in 1993 indicated a potential short-term pumping capacity of 900 gpm with long-term continuous capacity of 650 gpm. A minor amount of fine sand was produced at start-up. In 2006, the Utility redeveloped the well to eliminate the sand and confirm the well capacity. The maximum production rate that does not produce sand is approximately 600 gpm. The Indian Summer Well water right limits the instantaneous pumping rate to 850 gpm. An on-site chlorine generation system using a brine solution is used to disinfect the water.

New on-site chlorine injection and secondary containment systems to replace the existing sodium hypochlorite generation chlorination system to disinfect the water are currently under design and construction is expected to be completed in 2022.

West Olympia Area Wells

Three wells located in West Olympia, in the Allison Springs/Kaiser Road area of West Olympia, are described below.

Kaiser Well 1 (S03)

Kaiser Well 1 (S03), located in Zone 298, was first put into service in 1976. Aquifer pumping tests indicated a sustained capacity of 340 to 380 gpm, with a stabilized drawdown after four hours of pumping, although flow was originally restricted to 280 gpm to prevent over-pumping. The well is equipped with a water-lubed 25-hp submersible pump. The original pump was replaced in 1992 with a larger capacity pump that is producing 360 gpm.

DOH approved gas chlorination in August 2010. This well is considered to be in good condition. The Kaiser Well 1 (S03) is an emergency source and was physically disconnected from the water system on June 23, 2015.

Allison Springs Well 13 (S09)

Allison Springs Well 13 (S09) was installed near Allison Springs to augment the supply to Olympia's west side (Zone 298). It consists of a 16-inch steel casing drilled to a depth of 200 feet with the screens set between 171 and 185 feet. The original 125-hp pump was replaced in 2005 with a more energy-efficient 40-hp pump, using a 50 percent grant from Puget Sound Energy. Installed well capacity is 900 gpm. The current pumping rate is approximately 530 gpm. Well 13 is considered to be in good condition and requires only routine maintenance.

Allison Springs Well 19 (S11)

Allison Springs Well 19 (S11) is located near Well 13 in Zone 298. It consists of a 16-inch steel casing drilled to a depth of 183 feet and is screened in a sand and gravel aquifer that lies 120 to 160 feet below the surface. In 2005, the well pump was replaced with a more energy efficient 60-hp pump, using a 50 percent grant from Puget Sound Energy. The current pumping rate is approximately 900 gpm. The Utility is considering options to increase the yield, as needed.

In 1996, an aeration facility was installed to strip the dissolved carbon dioxide from water from Wells 13 and 19 to raise pH. Water from both wells is pumped to the aeration tower, where it then flows to a clear well. Water is pumped to the water system from the clear well. The clear well has two variable speed pumps that automatically adjust output to match variations in well production. Well 19 is considered to be in good condition and requires only routine maintenance.

Both Allison Springs Wells 13 and 19 are chlorinated using gas chlorine from 150-pound cylinders. All the chlorination equipment is located in the building housing Well 13.

8.2 Source Capacity Analysis

The ability of existing sources to meet current and projected water supply requirements was evaluated for this Water System Plan. This section presents the capacity analysis design criteria and a discussion of the evaluation results.

Design Criteria

The DOH requires that sources of supply, operating for a full 24 hours, be sufficient to meet maximum day demands (MDD) for each pressure zone within a system, as well as for the system as a whole. Therefore, this evaluation compares the Utility's total groundwater source capacity with full system

water demand, as well as the source and booster pump station capacities within each pressure zone (or logical groupings of pressure zones) with water demand specific to that zone (or grouping).

This source capacity analysis utilizes the "baseline" water demand forecast presented in Chapter 3 (Table 3.9) and does not include the effects of additional water conservation or the potential impacts of climate change on future water demands. This approach is taken for the following reasons:

- Future water conservation goals may not be fully realized, as they are dependent upon unpredictable customer behavior changes. Excluding potential future water demand reductions ensures that source capacities are sufficient to meet needs if conservation goals are not attained.
- Significant uncertainties also exist with regard to the potential effects of climate change on future demand, as discussed in Chapter 3. The Utility will monitor demand and weather variables closely in order to refine demand forecasts and source capacity analyses when needed.

These two factors will tend to alter water demands in an opposing fashion over time. While conservation savings serve to reduce future water demand, climate change may result in increased demands. Thus, the effects of one variable may be offset by the impacts of the other, resulting in minimal net change to the water demand forecast.

Evaluation of Source Capacity

Source capacity was evaluated for the entire system and then for each pressure zone or zone combination. In addition to the required MDD evaluation noted above, the City conducted several additional DOH-recommended source capacity evaluations to demonstrate heightened levels of system reliability. Each source capacity evaluation includes:

- Ability to meet MDD with all sources operating for 24 hours (DOH required)
- Ability to meet MDD with all sources operating for 20 hours (DOH recommended)
- Ability to meet average day demand (ADD) with the largest source offline, with all sources operating for 20 hours (DOH recommended)
    - For pump stations with multiple pumps, DOH suggests considering a single pump offline sufficient for this analysis. However, if a pump station is the largest source for a zone, Olympia considers the entire station offline as a conservative assumption.
- Ability to replenish fire suppression storage over 72 hours and meet MDD with all sources operating for 24 hours (DOH recommended)
    - Fire suppression storage requirements are zone specific and described in more detail in Chapter 9. For analyses with grouping of zones, the largest fire storage requirement is assumed. The total fire storage requirement, in gallons, is divided by three to determine the daily replenishment requirement.

The location of each zone is shown on Map 1.4, Chapter 1.

Table 8.2 Evaluation of Source Adequacy for Total Olympia System

	Year				
	2020	2026	2040	2070	Max[1]
Equivalent Residential Units (ERU's)	43,129	46,844	55,054	70,412	60,895
Projected Demand - Gallons per Day (gpd) [2]					
Average Day	6,554,793	7,119,532	8,367,254	10,701,466	9,256,023
Maximum Day	12,144,997	13,191,370	15,503,201	19,828,127	17,148,000
Fire Suppression Storage Replenishment (72 hr) [3]	320,000	320,000	320,000	320,000	320,000
Source Capacity					
Available Existing Source - 24-hour Pumping (gpd)					
McAllister Wellfield (10,500 gpm)					
TW-22 (1,500 gpm)	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000
PW-24 (2,900 gpm)	4,176,000	4,176,000	4,176,000	4,176,000	4,176,000
PW-25 (6,100 gpm)	8,784,000	8,784,000	8,784,000	8,784,000	8,784,000
Allison Well #19 (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well #13 (530 gpm)	763,200	763,200	763,200	763,200	763,200
Shana Well and Corrosion Facility (760 gpm)	1,094,400	1,094,400	1,094,400	1,094,400	1,094,400
Hoffman Well #3 (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
Indian Summer Well (600 gpm)	864,000	864,000	864,000	864,000	864,000
Kaiser Rd. Well #1 (360 gpm) [4]	0	0	0	0	0
Total Available Source (gpd)	20,577,600	20,577,600	20,577,600	20,577,600	20,577,600
Total Available Source (gpd) - Largest Offline	11,793,600	11,793,600	11,793,600	11,793,600	11,793,600
Available Existing Source - 20-hour Pumping (gpd)					
McAllister Wellfield (10,500 gpm)					
TW-22 (1,500 gpm)	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000
PW-24 (2,900 gpm)	3,480,000	3,480,000	3,480,000	3,480,000	3,480,000
PW-25 (6,100 gpm)	7,320,000	7,320,000	7,320,000	7,320,000	7,320,000
Allison Well #19 (900 gpm)	1,080,000	1,080,000	1,080,000	1,080,000	1,080,000
Allison Well #13 (530 gpm)	636,000	636,000	636,000	636,000	636,000
Shana Well and Corrosion Facility (760 gpm)	912,000	912,000	912,000	912,000	912,000
Hoffman Well #3 (1,000 gpm)	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Indian Summer Well (600 gpm)	720,000	720,000	720,000	720,000	720,000
Kaiser Rd. Well #1 (360 gpm) [4]	0	0	0	0	0
Total Available Source (gpd)	17,148,000	17,148,000	17,148,000	17,148,000	17,148,000
Total Available Source - Largest Offline (gpd)	9,828,000	9,828,000	9,828,000	9,828,000	9,828,000
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	**8,432,603**	**7,386,230**	**5,074,399**	**749,473**	**3,429,600**
MDD - 20 hr capacity	**5,003,003**	**3,956,630**	**1,644,799**	**(2,680,127)**	**0**
ADD with Largest Source Offline - 20 hr capacity	**3,273,207**	**2,708,468**	**1,460,746**	**(873,466)**	**571,977**
Fire Storage Replenishment During MDD - 24 hr capacity	**8,112,603**	**7,066,230**	**4,754,399**	**429,473**	**3,109,600**
Evaluation of Future Sources					
Future Source (gpd)					
Briggs Well (1,100 gpm)[5]	0	0	1,584,000	1,584,000	1,584,000
McAllister Wellfield 2nd Phase (3,111 gpm)[6]	0	0	4,480,000	4,480,000	4,480,000
McAllister Wellfield 3rd Phase (2,400 gpm)[7]	0	0	0	3,456,000	3,456,000
Brewery Wellfield (2,172 gpm)[8]	TBD	TBD	TBD	TBD	TBD
Total Available Source (Existing + Future) - 24 hr (gpd)	20,577,600	20,577,600	26,641,600	30,097,600	30,097,600
Total Available Source (Existing + Future) - 20 hr (gpd)	17,148,000	17,148,000	22,201,333	25,081,333	25,081,333
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	**8,432,603**	**7,386,230**	**11,138,399**	**10,269,473**	**12,949,600**
MDD - 20 hr capacity	**5,003,003**	**3,956,630**	**6,698,133**	**5,253,206**	**7,933,333**
ADD with Largest Source Offline - 20 hr capacity	**3,273,207**	**2,708,468**	**7,524,746**	**8,646,534**	**10,091,977**
Fire Storage Replenishment During MDD - 24 hr capacity	**8,112,603**	**7,066,230**	**10,818,399**	**9,949,473**	**12,629,600**

Notes:

1 Maximum ERUs to be served with Current Sources, based on limiting factor of capacity analysis.
2 Projected demands taken from Chapter 3. ERUs calculated as MDD / Max Day ERU water use factor (282 gpd/ERU).
3 This value is calculated by dividing the maximum fire flow storage requirement, in the area being analyzed, by 3 days.
4 Kaiser Road Well #1 is an emergency source and is therefore not considered as an available source in the analysis.
5 The Briggs well source is anticipated to be online between 2020 and 2034.
6 The second phase of the McAllister wellfield development will allow the City to make full use of the McAllister Springs water right (13,611
7 The 3rd phase of the McAllister wellfield development will provide an additional source capacity of 2,400 gpm or 3.46 Mgd. Water rights from Abbott Springs (6.46 Mgd) will be transferred to the wellfield in 2050. Per an agreement between the City and the Nisqually Tribe, the City will use 3.46 Mgd of the water right and the remaining water rights will be used by the Nisqually Tribe.
8 The Brewery well source is currently in development and the timing and estimated capacity has not been determined.

Full System

Table 8.2 summarizes the comparison of the Utiilty's total available source capacity with current and future system-wide demands. Current sources provide adequate supply capacity beyond 2070, the 50-year planning horizon, for the MDD 24-hour capacity and fire storage replenishment scenarios. Deficiencies are observed by 2070 for the MDD 20-hour scenario and ADD 20-hour scenario.

Additional planned sources will serve to bolster the system's reliability in the future (see also Chapter 4). The current capacity of the McAllister Wellfield is 10,500 gpm (15.12 Mgd). Phase 2 of the wellfield development, planned for 2030/2040, will increase the capacity by 3,111 gpm to 13,611 gpm (19.60 Mgd) for the City. Phase 3 production of the wellfield reflects the long-term development under the full Abbott Springs water right to meet Olympia's and the Nisqually Tribe's 50-year planning horizon and would be completed sometime around 2050. Maximum production at full build-out will be 23.06 Mgd for the Utility and 3.0 Mgd for the Nisqually Tribe.

The Utility's other planned sources are:

- **Briggs Well.** Construction of this new well in southeast Olympia has been extended by Ecology to July 1, 2024, with the source anticipated to be online no later than 2034.
- **Olympia Brewery.** In partnership with the cities of Lacey and Tumwater, Olympia has obtained water rights associated with the former Olympia Brewery property. The timing and capacity of this source are uncertain, as the wellfield and associated infrastructure is currently in planning and development by the three cities.

(See Chapter 4 for details on these new sources.)

These new sources support the Utility's intent to secure a 50-year supply of water, as mandated in the City of Olympia Comprehensive Plan. Also, as geographically dispersed sources, they will provide additional system reliability. Incorporating these sources into the full-system analysis, the Utility is projected to have source surplus in 2070 for each criteria, even without including the Olympia Brewery supply.

Zones 417, 338, 298, & 264

Source capacity for this pressure zone grouping is summarized in Table 8.3. This pressure zone grouping covers all zones in the eastern portion of the system served by the 36-inch water main between the Meridian storage tanks and Fir Street storage tanks. Sources serving these zones are the McAllister Wellfield, Shana Well, Hoffman Well, and Indian Summer well. The future Brewery well would also serve this zone.

The analysis indicates supply sources are sufficient for meet demands through the 2070 planning horizon without the addition of the Brewery Well.

Table 8.3 Evaluation of Source Adequacy for Zones 417, 338, 298 and 264

	Year				
	2020	2026	2040	2070	Max[1]
Equivalent Residential Units (ERU's)	29,576	32,124	37,754	48,286	53,368
Projected Demand - Gallons per Day (gpd) [2]					
Average Day	4,495,005	4,882,280	5,737,916	7,338,622	8,112,000
Maximum Day	8,328,536	9,046,095	10,631,453	13,597,308	15,028,547
Fire Suppression Storage Replenishment (72 hr)	320,000	320,000	320,000	320,000	320,000
Evaluation of Existing Sources					
Available Existing Source - 24-hour Pumping (gpd)					
McAllister Wellfield (10,500 gpm)					
TW-22 (1,500 gpm)	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000
PW-24 (2,900 gpm)	4,176,000	4,176,000	4,176,000	4,176,000	4,176,000
PW-25 (6,100 gpm)	8,784,000	8,784,000	8,784,000	8,784,000	8,784,000
Shana Well and Corrosion Facility (760 gpm)	1,094,400	1,094,400	1,094,400	1,094,400	1,094,400
Hoffman Well #3 (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
Indian Summer Well (600 gpm)	864,000	864,000	864,000	864,000	864,000
Total Available Source (gpd)	18,518,400	18,518,400	18,518,400	18,518,400	18,518,400
Total Available Source (gpd) - Largest Offline	9,734,400	9,734,400	9,734,400	9,734,400	9,734,400
Available Existing Source - 20-hour Pumping (gpd)					
McAllister Wellfield (10,500 gpm)					
TW-22 (1,500 gpm)	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000
PW-24 (2,900 gpm)	3,480,000	3,480,000	3,480,000	3,480,000	3,480,000
PW-25 (6,100 gpm)	7,320,000	7,320,000	7,320,000	7,320,000	7,320,000
Shana Well and Corrosion Facility (760 gpm)	912,000	912,000	912,000	912,000	912,000
Hoffman Well #3 (1,000 gpm)	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Indian Summer Well (600 gpm)	720,000	720,000	720,000	720,000	720,000
Total Available Source (gpd)	15,432,000	15,432,000	15,432,000	15,432,000	15,432,000
Total Available Source - Largest Offline (gpd)	8,112,000	8,112,000	8,112,000	8,112,000	8,112,000
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	**10,189,864**	**9,472,305**	**7,886,947**	**4,921,092**	**3,489,853**
MDD - 20 hr capacity	**7,103,464**	**6,385,905**	**4,800,547**	**1,834,692**	**403,453**
ADD with Largest Source Offline - 20 hr capacity	**3,616,995**	**3,229,720**	**2,374,084**	**773,378**	**0**
Fire Storage Replenishment During MDD - 24 hr capacity	**9,869,864**	**9,152,305**	**7,566,947**	**4,601,092**	**3,169,853**
Evaluation of Future Sources					
Future Source (gpd)					
Brewery Well (2,172 gpm) [3]	TBD	TBD	TBD	TBD	3,127,680
Total Available Source (Existing + Future) - 24 hr (gpd)	18,518,400	18,518,400	18,518,400	18,518,400	21,646,080
Total Available Source (Existing + Future) - 20 hr (gpd)	15,432,000	15,432,000	15,432,000	15,432,000	18,038,400
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	**10,189,864**	**9,472,305**	**7,886,947**	**4,921,092**	**6,617,533**
MDD - 20 hr capacity	**7,103,464**	**6,385,905**	**4,800,547**	**1,834,692**	**3,009,853**
ADD with Largest Source Offline - 20 hr capacity	**3,616,995**	**3,229,720**	**2,374,084**	**773,378**	**2,606,400**
Fire Storage Replenishment During MDD - 24 hr capacity	**9,869,864**	**9,152,305**	**7,566,947**	**4,601,092**	**6,297,533**

Notes:

1 Maximum ERUs to be served with Current Sources, based on limiting factor of capacity analysis.
2 Projected demands taken from Chapter 3. ERUs calculated as MDD / Max Day ERU water use factor (282 gpd/ERU).
3 The Brewery well source is currenlty in development and the timing and estimated capacity has not been determined.

Zones 338 and 417

Pressure Zones 338 and 417, in the southeast and east part of the water service area, are evaluated in combination. Both zones receive water from the same sources: the Shana Park Well (S10), Hoffman Well (S08), Indian Summer Well 20 (S12), South Sound Booster Station and Fones Road Booster Station. These sources feed directly into Zone 417 and indirectly into Zone 338 via a flow control valve that allows water to enter the Boulevard Storage Tank (which then establishes the hydraulic grade in Zone 338). A pressure reducing valve (PRV) on Yelm Highway/Boulevard Road and Cain Road/22nd are another way for water to move from Zone 417 to Zone 338. The zones cannot be analyzed independently (from a source perspective) and have been combined into one analysis zone.

The South Sound and Fones Road Booster Stations receive water through the 36-inch water main from the Meridian Storage Tanks and provide the primary supply to these zones. Shana Park Well 11 (S10) provides a significant portion of the total supply capacity, while Hoffman Well 3 (S08) is used only during emergencies and on high demand days. Indian Summer Well (S12) was added to supplement supply to these zones.

Table 8.4 summarizes the source adequacy evaluation for Zones 338 and 417. Existing supplies are sufficient to meet demands through the 2070 planning horizon.

The addition of the planned Briggs Well (S13), which will feed directly into these zones, will supplement supplies in these zones. With this additional source, the zones will have a supply surplus of 3.27 Mgd in 2070, based on MDD conditions with 24-hour well production.

Zone 347

The Eastside Booster Station supplies water to pressure Zone 347 with three pumps, each rated at 1,000 gpm. The combined supply capacity is 2,400 gpm. Since the Eastside Booster station is the single supply source to this zone, the "Largest Source Offline" analysis considers a single pump in the station offline, reducing the station's capacity to 2,000 gpm. The source adequacy evaluation, summarized in Table 8.5, indicates that the booster station provides sufficient supply capacity throughout the entire planning period.

Zone 226, 298, and 380

Due to the hydraulic characteristics of Zones 226, 298 and 380, these three zones are analyzed in combination, as well as independently of each other. McAllister Wellfield supplies these zones by transmitting water through the Fir Street tanks. The West Bay Booster Station feeds Zone 380 from Zone 226. The Percival Booster Pump Station feeds Zone 298 from Zone 226. Zone 298 is also supplied directly by the Allison Springs Wells 13 (S09) and 19 (S11), and the Kaiser Road Well 1 (S03), which is an emergency source. Additional supply is provided to Zone 298 via a pressure reducing valve that allows for water to enter this zone from Zone 380. Additional supply to Zone 226 is provided by another pressure reducing valve from Zone 298. If needed, water can also be transferred from Zone 298 to Zone 380 via the Elliot Booster Station.

When analyzed together, the three zones have sufficient supply capacity throughout the planning period, as shown in Table 8.6.

Table 8.7 shows the analysis of Zones 298 and 380 together. The main difference between the three-zone analysis and this one is that only the Westbay and Percival Booster Stations are considered, as they are the direct feeds to these zones. A supply deficiency is observed in 2070 during MDD conditions if sources are run for 20 hours.

Table 8.4 Evaluation of Source Adequacy for Zones 338 and 417

	Year				
	2020	2026	2040	2070	Max[1]
Equivalent Residential Units (ERU's)	16,964	18,426	21,655	27,696	28,082
Projected Demand - Gallons per Day (gpd) [2]					
Average Day	2,578,227	2,800,359	3,291,131	4,209,257	4,268,523
Maximum Day	4,777,048	5,188,623	6,097,946	7,799,089	7,908,000
Fire Suppression Storage Replenishment (72 hr)	320,000	320,000	320,000	320,000	320,000
Evaluation of Existing Sources					
Available Existing Source - 24 Hour Pumping (gpd)					
South Sound Booster (2,300 gpm)[3]	3,312,000	3,312,000	3,312,000	3,312,000	3,312,000
Fones Road Booster (1,930 gpm)[4]	2,779,200	2,779,200	2,779,200	2,779,200	2,779,200
Shana Well and Corrosion Facility (760 gpm)	1,094,400	1,094,400	1,094,400	1,094,400	1,094,400
Hoffman Well #3 (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
Indian Summer Well (600 gpm)	864,000	864,000	864,000	864,000	864,000
Total Available Source (gpd)	9,489,600	9,489,600	9,489,600	9,489,600	9,489,600
Total Available Source - Largest Offline (gpd)	6,177,600	6,177,600	6,177,600	6,177,600	6,177,600
Available Source - 20-hour Pumping (gpd)					
South Sound Booster (2,300 gpm)[3]	2,760,000	2,760,000	2,760,000	2,760,000	2,760,000
Fones Road Booster (1,930 gpm)[4]	2,316,000	2,316,000	2,316,000	2,316,000	2,316,000
Shana Well and Corrosion Facility (760 gpm)	912,000	912,000	912,000	912,000	912,000
Hoffman Well #3 (1,000 gpm)	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Indian Springs Well (600 gpm)	720,000	720,000	720,000	720,000	720,000
Total Available Source (gpd)	7,908,000	7,908,000	7,908,000	7,908,000	7,908,000
Total Available Source - Largest Offline (gpd)	5,148,000	5,148,000	5,148,000	5,148,000	5,148,000
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	**4,712,552**	**4,300,977**	**3,391,654**	**1,690,511**	**1,581,600**
MDD - 20 hr capacity	**3,130,952**	**2,719,377**	**1,810,054**	**108,911**	**0**
ADD with Largest Source Offline - 20 hr capacity	**2,569,773**	**2,347,641**	**1,856,869**	**938,743**	**879,477**
Fire Storage Replenishment During MDD - 24 hr capacity	**4,392,552**	**3,980,977**	**3,071,654**	**1,370,511**	**1,261,600**
Evaluation of Future Sources					
Future Source (gpd)					
Briggs Well (1,100 gpm)[5]	0	0	1,584,000	1,584,000	1,584,000
Total Available Source (Existing + Future) - 24 hr (gpd)	9,489,600	9,489,600	11,073,600	11,073,600	11,073,600
Total Available Source (Existing + Future) - 20 hr (gpd)	7,908,000	7,908,000	9,228,000	9,228,000	9,228,000
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	**4,712,552**	**4,300,977**	**4,975,654**	**3,274,511**	**3,165,600**
MDD - 20 hr capacity	**3,130,952**	**2,719,377**	**3,130,054**	**1,428,911**	**1,320,000**
ADD with Largest Source Offline - 20 hr capacity	**2,569,773**	**2,347,641**	**3,176,869**	**2,258,743**	**2,199,477**
Fire Storage Replenishment During MDD - 24 hr capacity	**4,392,552**	**3,980,977**	**4,655,654**	**2,954,511**	**2,845,600**

Notes:

1. Maximum ERUs to be served with Current Sources, based on limiting factor of capacity analysis.
2 Projected demands taken from Chapter 3. ERUs calculated as MDD / Max Day ERU water use factor (282 gpd/ERU).
3 Station contains three pumps at 1,000 gpm each. Capacity of the station is 2,300 gpm with three pumps and 1,995 gpm with two pumps, when the Fones Road Booster Station is also operating.
4 Station contains three pumps at 1,000 gpm each. Capacity of the station is 1,930 gpm with three pumps and 1,640 gpm with two pumps, when the South Sound Booster Station is also operating.
5 The Briggs well source is anticipated to be online between 2020 and 2034.

Table 8.8 shows the analysis of Zone 380 by itself. Only the Westbay and Elliot Booster Stations serve this zone. Sources are sufficient to meet demands through the 2070 planning horizon.

Table 8.9 shows the analysis of Zone 298 by itself. With the largest source offline (Percival Booster Station), deficiencies are observed in the ADD 20-hour capacity analysis beginning in 2026. However, this analysis is conservative and not a DOH requirement, and therefore is not considered a supply deficiency required to mitigate. In 2070, supply deficiencies are seen in in all categories except providing MDD at 24-hour pumping capacity. If demands in this zone increase per the water demand forecast over the next six years, the Utility will begin planning for source capacity increases which would be implemented later in the 20-year planning horizon, to maintain source reliability to this zone.

Table 8.5 Evaluation of Source Adequacy for Zone 347

	Year				
	2020	2026	2040	2070	Max[1]
Equivalent Residential Units (ERU's)	3,702	4,021	4,726	6,044	10,227
Projected Demand - Gallons per Day (gpd) [2]					
Average Day	562,627	611,101	718,198	918,554	1,554,545
Maximum Day	1,042,459	1,132,274	1,330,708	1,701,936	2,880,000
Fire Suppression Storage Replenishment (72 hr)	40,000	40,000	40,000	40,000	40,000
Evaluation of Existing Sources					
Available Existing Source - 24-hour Pumping (gpd)					
Eastside Booster (2,400 gpm)	3,456,000	3,456,000	3,456,000	3,456,000	3,456,000
Total Available Source (gpd)	3,456,000	3,456,000	3,456,000	3,456,000	3,456,000
Total Available Source - Largest Offline (gpd)	2,880,000	2,880,000	2,880,000	2,880,000	2,880,000
Available Source - 20-hour Pumping (gpd)					
Eastside Booster (2,400 gpm)	2,880,000	2,880,000	2,880,000	2,880,000	2,880,000
Total Available Source - 20-hour Pumping (gpd)	2,880,000	2,880,000	2,880,000	2,880,000	2,880,000
Total Available Source - Largest Offline (gpd)	2,400,000	2,400,000	2,400,000	2,400,000	2,400,000
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	**2,413,541**	**2,323,726**	**2,125,292**	**1,754,064**	**576,000**
MDD - 20 hr capacity	**1,837,541**	**1,747,726**	**1,549,292**	**1,178,064**	**0**
ADD with Largest Source Offline - 20 hr capacity	**1,837,373**	**1,788,899**	**1,681,802**	**1,481,446**	**845,455**
Fire Storage Replenishment During MDD - 24 hr capacity	**2,373,541**	**2,283,726**	**2,085,292**	**1,714,064**	**536,000**

Notes:

1 Maximum ERUs to be served with Current Sources, based on limiting factor of capacity analysis.

2 Projected demands taken from Chapter 3. ERUs calculated as MDD / Max Day ERU water use factor (282 gpd/ERU).

Table 8.6 Evaluation of Source Adequacy for Zone 226, 298 and 380

	Year				
	2020	2026	2040	2070	Max[1]
Equivalent Residential Units (ERU's)	20,730	22,516	26,462	33,844	50,838
Projected Demand - Gallons per Day (gpd) [2]					
Average Day	3,150,568	3,422,010	4,021,729	5,143,670	7,727,386
Maximum Day	5,837,505	6,340,445	7,451,629	9,530,409	14,316,000
Fire Suppression Storage Replenishment (72 hr)	320,000	320,000	320,000	320,000	320,000
Evaluation of Existing Sources					
Available Existing Source - 24 hour pumping (gpd)					
McAllister Wellfield (10,500 gpm)					
TW-22 (1,500 gpm)	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000
PW-24 (2,900 gpm)	4,176,000	4,176,000	4,176,000	4,176,000	4,176,000
PW-25 (6,100 gpm)	8,784,000	8,784,000	8,784,000	8,784,000	8,784,000
Allison Well #19 (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well #13 (530 gpm)	763,200	763,200	763,200	763,200	763,200
Kaiser Rd. Well #1 (360 gpm) (3)	0	0	0	0	0
Total Available Source (gpd)	17,179,200	17,179,200	17,179,200	17,179,200	17,179,200
Total Available Source - Largest Offline (gpd)	8,395,200	8,395,200	8,395,200	8,395,200	8,395,200
Available Source - 20-hour Pumping (gpd) [3]					
McAllister Wellfield (10,500 gpm)					
TW-22 (1,500 gpm)	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000
PW-24 (2,900 gpm)	3,480,000	3,480,000	3,480,000	3,480,000	3,480,000
PW-25 (6,100 gpm)	7,320,000	7,320,000	7,320,000	7,320,000	7,320,000
Allison Well #19 (900 gpm)	1,080,000	1,080,000	1,080,000	1,080,000	1,080,000
Allison Well #13 (530 gpm)	636,000	636,000	636,000	636,000	636,000
Kaiser Rd. Well #1 (360 gpm) [3]	0	0	0	0	0
Total Available Source - 20-hour Pumping (gpd)	14,316,000	14,316,000	14,316,000	14,316,000	14,316,000
Total Available Source - Largest Offline (gpd)	6,996,000	6,996,000	6,996,000	6,996,000	6,996,000
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	**11,341,695**	**10,838,755**	**9,727,571**	**7,648,791**	**2,863,200**
MDD - 20 hr capacity	**8,478,495**	**7,975,555**	**6,864,371**	**4,785,591**	**0**
ADD with Largest Source Offline - 20 hr capacity	**5,244,632**	**4,973,190**	**4,373,471**	**3,251,530**	**667,814**
Fire Storage Replenishment During MDD - 24 hr capacity	**11,021,695**	**10,518,755**	**9,407,571**	**7,328,791**	**2,543,200**

Notes:

1 Maximum ERUs to be served with Current Sources, based on limiting factor of capacity analysis.

2 Projected demands taken from Chapter 3. ERUs calculated as MDD / Max Day ERU water use factor (282 gpd/ERU).

3 Kaiser Road Well #1 is an emergency source and is therefore not considered as an available source in the analysis for future years.

Table 8.7 Evaluation of Source Adequacy for Zones 298 and 380

	Year				
	2020	2026	2040	2070	Max[1]
Equivalent Residential Units (ERU's)	16,636	18,069	21,236	27,160	24,567
Projected Demand - Gallons per Day (gpd) [2]					
Average Day	2,528,402	2,746,241	3,227,528	4,127,911	3,734,148
Maximum Day	4,684,730	5,088,350	5,980,101	7,648,368	6,918,000
Fire Suppression Storage Replenishment (72 hr)	320,000	320,000	320,000	320,000	320,000
Evaluation of Existing Sources					
Available Existing Source - 24-hour pumping (gpd)					
Westbay Booster (2,075 gpm)(3)	2,988,000	2,988,000	2,988,000	2,988,000	2,988,000
Percival Booster (2,260 gpm)(4)	3,254,400	3,254,400	3,254,400	3,254,400	3,254,400
Allison Well #19 (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well #13 (530 gpm)	763,200	763,200	763,200	763,200	763,200
Kaiser Rd. Well #1 (360 gpm)	0	0	0	0	0
Total Available Source (gpd)	8,301,600	8,301,600	8,301,600	8,301,600	8,301,600
Total Available Source - Largest Offline (gpd)	5,047,200	5,047,200	5,047,200	5,047,200	5,047,200
Available Source - 20-hour Pumping (gpd)					
Westbay Booster (2,075 gpm)[3]	2,490,000	2,490,000	2,490,000	2,490,000	2,490,000
Percival Booster (2,260 gpm)[4]	2,712,000	2,712,000	2,712,000	2,712,000	2,712,000
Allison Well #19 (900 gpm)	1,080,000	1,080,000	1,080,000	1,080,000	1,080,000
Allison Well #13 (530 gpm)	636,000	636,000	636,000	636,000	636,000
Kaiser Rd. Well #1 (360 gpm)	0	0	0	0	0
Total Available Source - 20-hour Pumping (gpd)	6,918,000	6,918,000	6,918,000	6,918,000	6,918,000
Total Available Source - Largest Offline (gpd)	4,206,000	4,206,000	4,206,000	4,206,000	4,206,000
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	**3,616,870**	**3,213,250**	**2,321,499**	**653,232**	**1,383,600**
MDD - 20 hr capacity	**2,233,270**	**1,829,650**	**937,899**	**(730,368)**	**0**
ADD with Largest Source Offline - 20 hr capacity	**1,677,598**	**1,459,759**	**978,472**	**78,089**	**471,852**
Fire Storage Replenishment During MDD - 24 hr capacity	**3,296,870**	**2,893,250**	**2,001,499**	**333,232**	**1,063,600**

Notes:

1 Maximum ERUs to be served with Current Sources, based on limiting factor of capacity analysis.

2 Projected demands taken from Chapter 3. ERUs calculated as MDD / Max Day ERU water use factor (282 gpd/ERU).

3 Actual installed capacity is 3,200 gpm. System hydraulics limit total pumping capacity to 2,075 gpm.

4 Actual installed capacity is 3,545 gpm. System hydraulics limit total pumping capacity to 2,260 gpm.

Table 8.8 Evaluation of Source Adequacy for Zone 380

	Year				
	2020	2026	2040	2070	Max[1]
Equivalent Residential Units (ERU's)	5,757	6,253	7,349	9,399	15,621
Projected Demand - Gallons per Day (gpd) [2]					
Average Day	874,995	950,382	1,116,939	1,428,531	2,490,000
Maximum Day	1,621,227	1,760,907	2,069,512	2,646,843	4,815,634
Fire Suppression Storage Replenishment (72 hr)	40,000	40,000	40,000	40,000	40,000
Evaluation of Existing Sources					
Available Existing Source - 24-hour pumping (gpd)					
Westbay Booster (2,075 gpm) [3]	2,988,000	2,988,000	2,988,000	2,988,000	2,988,000
Elliot Booster (2,300 gpm)	3,312,000	3,312,000	3,312,000	3,312,000	3,312,000
Total Available Source (gpd)	6,300,000	6,300,000	6,300,000	6,300,000	6,300,000
Total Available Source - Largest Offline (gpd)	2,988,000	2,988,000	2,988,000	2,988,000	2,988,000
Available Source - 20-hour Pumping (gpd)					
Westbay Booster (2,075 gpm) [3]	2,490,000	2,490,000	2,490,000	2,490,000	2,490,000
Elliot Booster (2,300 gpm)	2,760,000	2,760,000	2,760,000	2,760,000	2,760,000
Total Available Source - 20-hour Pumping (gpd)	5,250,000	5,250,000	5,250,000	5,250,000	5,250,000
Total Available Source - Largest Offline (gpd)	2,490,000	2,490,000	2,490,000	2,490,000	2,490,000
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	**4,678,773**	**4,539,093**	**4,230,488**	**3,653,157**	**1,484,366**
MDD - 20 hr capacity	**3,628,773**	**3,489,093**	**3,180,488**	**2,603,157**	**434,366**
ADD with Largest Source Offline - 20 hr capacity	**1,615,005**	**1,539,618**	**1,373,061**	**1,061,469**	**0**
Fire Storage Replenishment During MDD - 24 hr capacity	**4,638,773**	**4,499,093**	**4,190,488**	**3,613,157**	**1,444,366**

Notes:

1 Maximum ERUs to be served with Current Sources, based on limiting factor of capacity analysis.

2 Projected demands taken from Chapter 3. ERUs calculated as MDD / Max Day ERU water use factor (282 gpd/ERU).

3 Actual installed capacity is 3,200 gpm. System hydraulics limit total pumping capacity to 2,075 gpm.

Table 8.9 Evaluation of Source Adequacy for Zone 298

	Year				
	2020	2026	2040	2070	Max[1]
Equivalent Residential Units (ERU's)	10,879	11,816	13,887	17,761	11,289
Projected Demand - Gallons per Day (gpd) [2]					
Average Day	1,653,407	1,795,859	2,110,589	2,699,380	1,716,000
Maximum Day	3,063,502	3,327,443	3,910,589	5,001,525	3,179,116
Fire Suppression Storage Replenishment (72 hr)	320,000	320,000	320,000	320,000	320,000
Evaluation of Existing Sources					
Available Existing Source - 24-hour pumping (gpd)					
Percival Booster (2,260 gpm)[3]	3,254,400	3,254,400	3,254,400	3,254,400	3,254,400
Allison Well #19 (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well #13 (530 gpm)	763,200	763,200	763,200	763,200	763,200
Kaiser Rd. Well #1 (360 gpm)	0	0	0	0	0
Total Available Source (gpd)	5,313,600	5,313,600	5,313,600	5,313,600	5,313,600
Total Available Source - Largest Offline (gpd)	2,059,200	2,059,200	2,059,200	2,059,200	2,059,200
Available Source - 20-hour Pumping (gpd)					
Percival Booster (2,260 gpm)[3]	2,712,000	2,712,000	2,712,000	2,712,000	2,712,000
Allison Well #19 (900 gpm)	1,080,000	1,080,000	1,080,000	1,080,000	1,080,000
Allison Well #13 (530 gpm)	636,000	636,000	636,000	636,000	636,000
Kaiser Rd. Well #1 (360 gpm)	0	0	0	0	0
Total Available Source - 20-hour Pumping (gpd)	4,428,000	4,428,000	4,428,000	4,428,000	4,428,000
Total Available Source - Largest Offline (gpd)	1,716,000	1,716,000	1,716,000	1,716,000	1,716,000
Capacity Analysis Surplus/(Deficiency)					
MDD - 24 hr capacity	**2,250,098**	**1,986,157**	**1,403,011**	**312,075**	**2,134,484**
MDD - 20 hr capacity	**1,364,498**	**1,100,557**	**517,411**	**(573,525)**	**1,248,884**
ADD with Largest Source Offline - 20 hr capacity	**62,593**	**(79,859)**	**(394,589)**	**(983,380)**	**0**
Fire Storage Replenishment During MDD - 24 hr capacity	**1,930,098**	**1,666,157**	**1,083,011**	**(7,925)**	**1,814,484**

Notes:

1 Maximum ERUs to be served with Current Sources, based on limiting factor of capacity analysis.

2 Projected demands taken from Chapter 3. ERUs calculated as MDD / Max Day ERU water use factor (282 gpd/ERU).

3 Actual installed capacity is 3,545 gpm. System hydraulics limit total pumping capacity to 2,260 gpm.

8.3 2021-2026 Source Infrastructure Projects

The source infrastructure projects planned for 2022-2047 will help meet the Utility's Goal 6:

> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high-quality water to a growing community.**

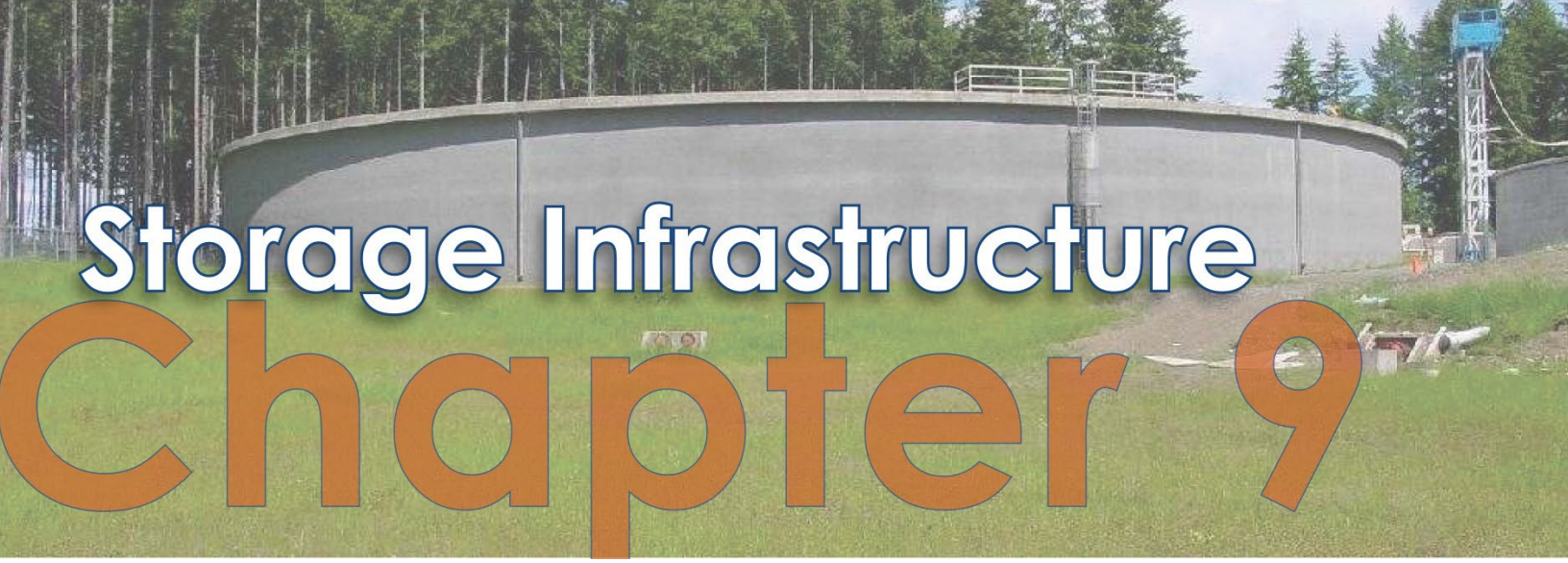
Objective 6A is to design and construct infrastructure to ensure reliable delivery of water.

These projects will implement Strategy 6A1: Develop and maintain multiple, geographically dispersed sources of water supply to enhance the reliability of the system. Chapters 9 and 10 describe storage and transmission/distribution infrastructure; Chapter 12 describes operations and maintenance of the infrastructure. Water quality strategies are in Chapter 11.

The City's 6-year Capital Improvement Program includes the following supply source projects.

- Briggs Well. Construction of this 1,100 gpm supply well will provide an additional 1.58 Mgd of daily supply capacity for Zones 338 and 417.
- Olympia Brewery engineering evaluation of possible operational and source development options for the Brewery water source (with cities of Tumwater and Lacey).

Project level cost estimates are shown in Chapter 13, Table 13.2.



Storage Infrastructure

Chapter 9

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CHAPTER 9 - STORAGE INFRASTRUCTURE

Storage projects help meet the City of Olympia Drinking Water Utility's (Utility) Goal 6:

> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high-quality water to a growing community.**

The 2021-2026 strategy is to develop and maintain storage and transmission/distribution infrastructure to ensure delivery of water at adequate pressure throughout the system and maintain required fire flow.

Other projects for improving the infrastructure are discussed in Chapter 8 (Source Infrastructure) and Chapter 10 (Transmission/Distribution Infrastructure); Chapter 12 describes operations and maintenance of the infrastructure. Water quality strategies are in Chapter 11.

This chapter describes existing water storage tanks, evaluates their ability to meet current and projected needs, and identifies projects to be constructed in 2021-2026. Washington State Department of Health (DOH) rules on storage facilities are in Chapter 173-160 WAC and Chapter 246-290 WAC, Part 3 (design of public water systems). Detailed specifications are in the DOH Water System Design Manual. The chapter ends with an evaluation of the water system's reliability under abnormal operating conditions.

9.1 Description of Existing Storage

The Utility's system has 12 water storage tanks, with a total capacity of 35.58 million gallons. Table 9.1 is an inventory of these facilities, including capacities, elevations and dimensions. Locations are shown in Chapter 1, Map 1.4. Further details regarding the storage tanks serving each pressure zone are provided below in the analysis section.

9.2 Storage Capacity Analysis

This section reports the analysis of how well existing and planned storage facilities support current and future storage requirements. The design criteria upon which the analysis is based are first presented, followed by a discussion of the evaluation results.

Storage Volume Components

According to DOH requirements, water system storage volume is comprised of five separate components:

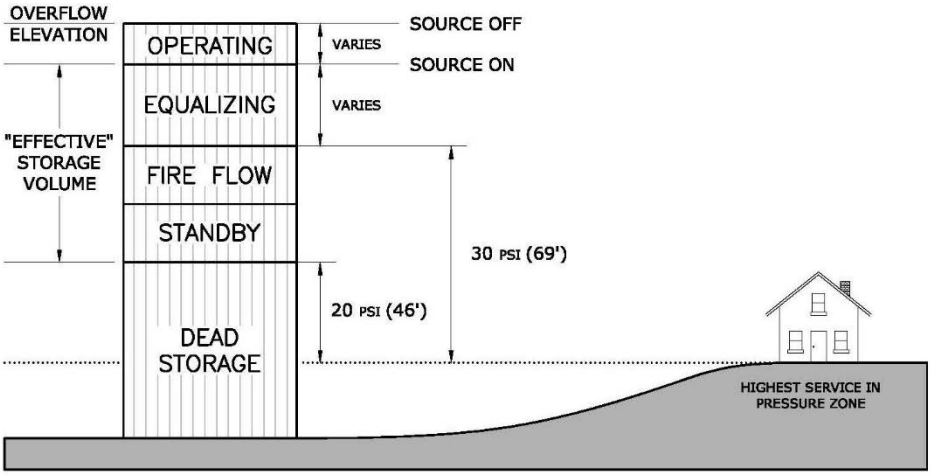
- Operating storage
- Equalizing storage
- Fire flow storage
- Standby storage
- Dead storage

These components are illustrated in Figure 9.1.

Table 9.1 Storage Facilities Inventory

	Meridian No. 1	Meridian No. 2	Fir 226 (north)	Fir 226 (south)	Hoffman 417	LBA 417	Boulevard 338	Eastside 347	Stevens Field 264	Bush 298	Elliott 298	Elliott 380
Zone Served												
Zone Name	All Zones	All Zones	Zone 226	Zone 226	Zone 417	Zone 417	Zone 338	Zone 347	Zone 264	Zone 298	Zone 298	Zone 380
Elevation Range	N/A	N/A	0 – 139 ft	0 – 139 ft	150 – 276 ft	150-276 ft	110 – 205 ft	110 – 204 ft	16 – 165ft	0 – 230 ft	0 – 230 ft	0 – 280 ft
Capacity (mg)												
Total	4.0	4.00	2.50	2.50	3.69	5.20	2.44	3.43	0.60	1.05	2.00	4.76
Elevations (ft)												
Tank Overflow	301	299	226	226	417	420.5	338	347	264	298	298	380
Tank Floor	281	281	206	206	277	283	238	214	160	258	278	280
Dimensions (ft)												
Engineering Plans	Variable	Variable	Variable	Variable	67-ft Diam.	80-ft Diam.	66-ft Diam.	67-ft Diam.	32	67-ft Diam.	130-ft Diam.	90-ft Diam.
Water Depth	20	20	20	20	140	137.5	95.5	130	104	40	20	100
Construction												
Year Constructed	2004	1998	~1935	~1935	1980	2018	2001	1987	2007	2007	1975	1994
Type	Ground level	Ground level	Buried	Buried	Standpipe	Standpipe	Standpipe	Standpipe	Standpipe	Standpipe	Buried	Standpipe
Material	Concrete	Concrete	Concrete	Concrete	Steel	Steel	Steel	Steel	Steel	Steel	Concrete	Steel
Security												
Enclosed/covered?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fenced & locked?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Figure 9.1 Storage Components



Operating and Dead Storage

Operating storage is the water that lies between low- and high-water storage elevations set by Utility Operations staff to control system pumps and flow control valves. Dead volume is the volume at the bottom of the tank that cannot be used because it is physically too low to provide sufficient pressures. Operational and dead storage volumes are subtracted from total storage to determine the effective storage available for equalizing, standby and fire flow.

Equalizing Storage

Equalizing storage is the total volume needed to moderate fluctuations in diurnal demands during periods when the demand exceeds the capacity of the supply system. Equalizing storage requirements are greatest during the peak hours of the maximum day demand. Operation of a properly balanced system results in replenishment of storage facilities during times of day when the demand curve is below the capacity of the supply system, and results in withdrawal from storage facilities when the demand exceeds the supply capacity. The equalizing storage of a storage tank must be located at an elevation that provides a minimum pressure of 30 pounds per square inch (psi) to all customers served by the tank.

Fire Flow Storage

Fire flow is defined as either 1,000 gpm for two hours or 4,000 gpm for four hours, depending on the demographics of the zone. The Olympia Fire Department establishes the fire flow needed for each zone. DOH allows for the “nesting” of standby and fire flow storage, with the larger used for the storage volume. However, the Olympia Fire Department requires that both standby and fire flow volumes be provided.

The required fire flow storage for a given pressure zone is calculated as the required fire flow multiplied by the required duration. The fire flow storage required for Zones 417, 338, 226, 264 and 298 is 960,000 gallons, based on a flow rate of 4,000 gpm for a duration of four hours. The fire flow storage required for Zones 347 and 380 is 120,000 gallons, based on a flow rate of 1,000 gpm for a duration of two hours.

The fire flow storage of a tank must be located at an elevation that provides a minimum pressure of 20 psi to all customers served by the tank.

Standby Storage

Standby storage is required to supply reasonable system demands during a foreseeable system emergency or outage. A key concept is that establishing standby storage involves planning for reasonable system outages – those that can be expected to occur under normal operating conditions, such as a pipeline failure, power outage or valve failure. Major system emergencies, such as those created by an earthquake, are intended to be covered by emergency system operations planning, since construction of sufficient reserve volume to accommodate sustained system demands under emergency conditions is not economically feasible.

DOH has established guidelines for determining minimum required standby storage. This component is calculated as the greater of: two times the average day demand, less multi-source credit; *or* 200 gallons times the number of ERUs served by the storage facility.

The multi-source credit allows the required standby storage to be reduced in pressure zones that have multiple sources of supply. The credit assumes the largest source of supply is out of service. It is calculated as the total source available to a particular pressure zone, or zone combination, less the capacity of the largest source. No credit is allowed for zones having only one source of supply.

DOH recommends that standby storage be located at an elevation that provides a minimum pressure of 20 psi to all customers served by a tank similar to the fire flow volume requirement.

Evaluation of Storage Capacity

To meet City of Olympia design standards, storage facilities must be designed so the sum of the required storage for each of the five components is met for the pressure zone(s) that will be served. Detailed results of the storage capacity analysis for each pressure zone are provided below. The minimum required storage for each pressure zone is calculated by adding the five storage components.

In addition to the storage tanks that directly serve the Utility's pressure zones, as described in the following subsections, the Meridian Storage Tanks provide supplemental standby storage. However, due to the long 36-inch diameter transmission main that links these storage tanks to the distribution system, the Utility has elected to focus its standby storage capacity analysis on those storage facilities that directly hydraulically feed a pressure zone and/or are in close proximity to the geographic area covered by the zone.

Map 1.1 in Chapter 1 shows the location of the pressure zones and major drinking water system facilities.

Zones 417 and 338

The storage capacities for Zones 417 and 338 are first analyzed together, since the Hoffman and LBA Storage Tanks provide storage capacity for both zones. The Boulevard Storage Tank provides additional storage for Zone 338. As a combined system, there is sufficient storage through 2070, as shown in Table 9.2.

Zone 417 is also analyzed independently, as only the Hoffman and LBA Storage Tanks provide capacity for this zone. In the prior plan, Zone 417 showed a storage deficiency because the LBA Tank had not been built yet. Table 9.3 summarizes the analysis for Zone 417. With the addition of the LBA Storage Tank, storage capacity is sufficient to serve the zone through the 2070 planning horizon.

Zone 338 is also evaluated independently, to analyze the ability of only the Boulevard Storage Tank to serve this zone. This storage facility provides sufficient capacity throughout the planning period, as shown in table 9.4.

Table 9.2 Evaluation of Storage Adequacy for Zone 417 and Zone 338

	Year				
	2020	2026	2040	2070	Max [11]
Projected Equivalent Residential Units (ERUs)	16,964	18,426	21,655	27,696	31,580
Projected Demand - Gallons per Day (gpd)[1]					
Average Day	2,578,227	2,800,359	3,291,131	4,209,257	4,800,130
Maximum Day	4,777,048	5,188,623	6,097,946	7,799,089	8,892,872
Peak Hour Demand (gpm)[2]	5,370	5,827	6,837	8,728	9,943
Available, Existing + Future Source (gpd)[3]					
South Sound Booster (2,300 gpm)	3,312,000	3,312,000	3,312,000	3,312,000	3,312,000
Fones Road Booster (1,930 gpm)	2,779,200	2,779,200	2,779,200	2,779,200	2,779,200
Shana Well and Corrosion Facility (760 gpm)	1,094,400	1,094,400	1,094,400	1,094,400	1,094,400
Hoffman Well #3 (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
Indian Summer Well (600 gpm)	864,000	864,000	864,000	864,000	864,000
Briggs Well (1,100 gpm)	0	0	1,584,000	1,584,000	1,584,000
Total Available Source (gpd)	9,489,600	9,489,600	11,073,600	11,073,600	11,073,600
Multi-Source Credit (gpd)[4]	6,177,600	6,177,600	7,761,600	7,761,600	7,761,600
Required Storage Calculations					
Operational Storage (gal)[5]	625,206	625,206	625,206	625,206	625,206
Equalizing Storage (gal)[6]	0	0	0	155,648	337,945
Standby Storage (gal)[7]	3,392,790	3,685,101	4,330,928	5,539,126	6,315,960
Fire Flow Storage (gal)[8]	960,000	960,000	960,000	960,000	960,000
Required Storage					
Greater than 30 psi at highest meter (gal)[9]	625,206	625,206	625,206	780,854	963,151
Greater than 20 psi at highest meter (gal)[10]	4,977,996	5,270,307	5,916,134	7,279,980	8,239,111
Existing Storage Greater Than 30 psi (gal)					
Hoffman Storage Tank	1,843,072	1,843,072	1,843,072	1,843,072	1,843,072
LBA Storage Tank	2,710,619	2,710,619	2,710,619	2,710,619	2,710,619
Boulevard Storage Tank	1,626,880	1,626,880	1,626,880	1,626,880	1,626,880
Total Existing Storage at 30 psi (gal)	6,180,570	6,180,570	6,180,570	6,180,570	6,180,570
Storage Surplus/(Deficiency) at 30 psi (gal)	**5,555,364**	**5,555,364**	**5,555,364**	**5,399,716**	**5,217,419**
Existing Storage Greater Than 20 psi (gal)					
Hoffman Storage Tank	2,437,286	2,437,286	2,437,286	2,437,286	2,437,286
LBA Storage Tank	3,584,534	3,584,534	3,584,534	3,584,534	3,584,534
Boulevard Storage Tank	2,217,292	2,217,292	2,217,292	2,217,292	2,217,292
Total Existing Storage at 20 psi (gal)	8,239,111	8,239,111	8,239,111	8,239,111	8,239,111
Storage Surplus/(Deficiency) at 20 psi (gal)	**3,261,115**	**2,968,804**	**2,322,978**	**959,131**	**0**
Existing Storage Greater Than 10 psi (gal)					
Hoffman Storage Tank	3,031,500	3,031,500	3,031,500	3,031,500	3,031,500
LBA Storage Tank	4,458,449	4,458,449	4,458,449	4,458,449	4,458,449
Boulevard Storage Tank	2,440,000	2,440,000	2,440,000	2,440,000	2,440,000
Total Existing Storage at 10 psi (gal)	9,929,949	9,929,949	9,929,949	9,929,949	9,929,949
Storage Surplus/(Deficiency) at 10 psi (gal)	**4,951,953**	**4,659,641**	**4,013,815**	**2,649,968**	**1,690,837**
Existing Storage Greater Than 0 psi (gal)					
Hoffman Storage Tank	3,600,000	3,600,000	3,600,000	3,600,000	3,600,000
LBA Storage Tank	5,200,000	5,200,000	5,200,000	5,200,000	5,200,000
Boulevard Storage Tank	2,440,000	2,440,000	2,440,000	2,440,000	2,440,000
Total Existing Storage at 0 psi (gal)	11,240,000	11,240,000	11,240,000	11,240,000	11,240,000
Storage Surplus/(Deficiency) at 0 psi (gal)	**6,262,004**	**5,969,693**	**5,323,866**	**3,960,020**	**3,000,889**

Notes:

1. gpd/ERU).
2. PHD = (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18. C & F values obtained from DOH Water System Design Manual.
3. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
4. Multi-source credit assumes largest source is out of service (in this case, the South Sound Booster Station).
5. Required Operational Storage is based on Storage Tank level when pump turns on.
6. Required equalization storage = (PHD - Total Available Source) x 150 minutes. If total available source is greater than PHD, required equalizing storage is 0 gallons.
7. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
8. Required fire flow storage = 4,000 gpm x 4 hours.
9. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
10. Total required storage greater than 20 psi is equal to the total of operational, equalizing, fire flow, and standby storage.
11. Maximum ERUs with Available Storage, assuming a 20 psi minimum for standby storage.

Table 9.3 Evaluation of Storage Adequacy for Zone 417

	Year				
	2020	2026	2040	2070	Max [11]
Projected Equivalent Residential Units (ERUs)	14,100	15,315	17,999	23,020	23,403
Projected Demand[1]					
Average Day	2,142,957	2,327,587	2,735,505	3,498,628	3,632,615
Maximum Day	3,970,562	4,312,652	5,068,458	6,482,406	6,862,680
Peak Hour Demand (gpm)[2]	4,474	4,854	5,694	7,265	7,385
Available, Existing + Future Source (gpd)[3]					
South Sound Booster (2,300 gpm)	3,312,000	3,312,000	3,312,000	3,312,000	3,312,000
Fones Road Booster (1,930 gpm)	2,779,200	2,779,200	2,779,200	2,779,200	2,779,200
Shana Well and Corrosion Facility (760 gpm)	1,094,400	1,094,400	1,094,400	1,094,400	1,094,400
Hoffman Well #3 (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
Indian Summer Well (600 gpm)	864,000	864,000	864,000	864,000	864,000
Briggs Well (1,100 gpm)	0	0	1,584,000	1,584,000	1,584,000
Total Available Source (gpd)	9,489,600	9,489,600	11,073,600	11,073,600	11,073,600
Multi-Source Credit (gpd)[4]	6,177,600	6,177,600	7,761,600	7,761,600	7,761,600
Required Storage Calculations					
Operational Storage (gal)[5]	381,206	381,206	381,206	381,206	381,206
Equalizing Storage (gal)[6]	0	0	0	0	0
Standby Storage (gal)[7]	2,820,001	3,062,963	3,599,757	4,603,981	4,680,614
Fire Flow Storage (gal)[8]	960,000	960,000	960,000	960,000	960,000
Required Storage					
Greater than 30 psi at highest meter (gal)[9]	381,206	381,206	381,206	381,206	381,206
Greater than 20 psi at highest meter (gal)[10]	4,161,207	4,404,169	4,940,963	5,945,187	6,021,820
Existing Storage Greater Than 30 psi (gal)					
Hoffman Storage Tank	1,843,072	1,843,072	1,843,072	1,843,072	1,843,072
LBA Tank	2,710,619	2,710,619	2,710,619	2,710,619	2,710,619
Total Existing Storage at 30 psi (gal)	4,553,690	4,553,690	4,553,690	4,553,690	4,553,690
Storage Surplus/(Deficiency) at 30 psi (gal)	**4,172,484**	**4,172,484**	**4,172,484**	**4,172,484**	**4,172,484**
Existing Storage Greater Than 20 psi (gal)					
Hoffman Storage Tank	2,437,286	2,437,286	2,437,286	2,437,286	2,437,286
LBA Tank	3,584,534	3,584,534	3,584,534	3,584,534	3,584,534
Total Existing Storage at 20 psi (gal)	6,021,820	6,021,820	6,021,820	6,021,820	6,021,820
Storage Surplus/(Deficiency) at 20 psi (gal)	**1,860,613**	**1,617,651**	**1,080,856**	**76,632**	**0**
Existing Storage Greater Than 10 psi (gal)					
Hoffman Storage Tank	3,031,500	3,031,500	3,031,500	3,031,500	3,031,500
LBA Tank	4,458,449	4,458,449	4,458,449	4,458,449	4,458,449
Total Existing Storage at 10 psi (gal)	7,489,949	7,489,949	7,489,949	7,489,949	7,489,949
Storage Surplus/(Deficiency) at 10 psi (gal)	**3,328,742**	**3,085,780**	**2,548,985**	**1,544,762**	**1,468,129**
Existing Storage Greater Than 0 psi (gal)					
Hoffman Storage Tank	3,600,000	3,600,000	3,600,000	3,600,000	3,600,000
LBA Tank	5,200,000	5,200,000	5,200,000	5,200,000	5,200,000
Total Existing Storage at 0 psi (gal)	8,800,000	8,800,000	8,800,000	8,800,000	8,800,000
Storage Surplus/(Deficiency) at 0 psi (gal)	**4,638,793**	**4,395,831**	**3,859,037**	**2,854,813**	**2,778,180**

Notes:

1. Projected demands taken from Chapter 3. ERUs calculated as Maximum Day Demand / Max Day ERU water use factor (282
2. PHD = (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18. C & F values obtained from DOH Water System Design
3. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
4. Multi-source credit assumes largest source is out of service (in this case, the South Sound booster station).
5. Required Operational Storage is based on Storage Tank level when pump turns on.
6. Required equalization storage = (PHD - Total Available Source) x 150 minutes. If total available source is greater than PHD, required equalizing storage is 0 gallons.
7. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
8. Required fire flow storage = 4,000 gpm x 4 hours.
9. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
10. Total required storage greater than 20 psi is equal to the total of operational, equalizing, fire flow, and standby storage.
11. Maximum ERUs with Available Storage, assuming a 20 psi minimum for standby storage.

Table 9.4 Evaluation of Storage Adequacy for Zone 338 (Considering Boulevard Storage Tank Only)

	Year				
	2020	**2026**	**2040**	**2070**	**Max [11]**
Projected Equivalent Residential Units (ERUs)	2,864	3,111	3,656	4,676	5,066
Projected Demand - Gallons per Day (gpd)[1]					
Average Day	435,270	472,772	555,626	710,629	770,102
Maximum Day	806,487	875,971	1,029,488	1,316,684	1,426,715
Peak Hour Demand (gpm)[2]	958	1,035	1,206	1,525	1,647
Available, Existing + Future Source (gpd)[3]					
South Sound Booster (2,300 gpm)	3,312,000	3,312,000	3,312,000	3,312,000	3,312,000
Fones Road Booster (1,930 gpm)	2,779,200	2,779,200	2,779,200	2,779,200	2,779,200
Shana Well and Corrosion Facility (760 gpm)	1,094,400	1,094,400	1,094,400	1,094,400	1,094,400
Hoffman Well #3 (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
Indian Springs Well (600 gpm)	864,000	864,000	864,000	864,000	864,000
Briggs Well (1,100 gpm)	0	0	1,584,000	1,584,000	1,584,000
Total Available Source (gpd)	9,489,600	9,489,600	11,073,600	11,073,600	11,073,600
Multi-Source Credit (gpd)[4]	6,177,600	6,177,600	7,761,600	7,761,600	7,761,600
Required Storage Calculations					
Operational Storage (gal)[5]	244,000	244,000	244,000	244,000	244,000
Equalizing Storage (gal)[6]	0	0	0	0	0
Standby Storage (gal)[7]	572,789	622,138	731,170	935,145	1,013,292
Fire Flow Storage (gal)[8]	960,000	960,000	960,000	960,000	960,000
Required Storage					
Greater than 30 psi at highest meter (gal)[9]	244,000	244,000	244,000	244,000	244,000
Greater than 20 psi at highest meter (gal)[10]	1,776,789	1,826,138	1,935,170	2,139,145	2,217,292
Existing Storage Greater Than 30 psi (gal)					
Boulevard Storage Tank	1,626,880	1,626,880	1,626,880	1,626,880	1,626,880
Total Existing Storage at 30 psi (gal)	1,626,880	1,626,880	1,626,880	1,626,880	1,626,880
Storage Surplus/(Deficiency) at 30 psi (gal)	**1,382,880**	**1,382,880**	**1,382,880**	**1,382,880**	**1,382,880**
Existing Storage Greater Than 20 psi (gal)					
Boulevard Storage Tank	2,217,292	2,217,292	2,217,292	2,217,292	2,217,292
Total Existing Storage at 20 psi (gal)	2,217,292	2,217,292	2,217,292	2,217,292	2,217,292
Storage Surplus/(Deficiency) at 20 psi (gal)	**440,503**	**391,153**	**282,121**	**78,147**	**0**
Existing Storage Greater Than 10 psi (gal)					
Boulevard Storage Tank	2,440,000	2,440,000	2,440,000	2,440,000	2,440,000
Total Existing Storage at 10 psi (gal)	2,440,000	2,440,000	2,440,000	2,440,000	2,440,000
Storage Surplus/(Deficiency) at 10 psi (gal)	**663,211**	**613,862**	**504,830**	**300,855**	**222,708**
Existing Storage Greater Than 0 psi (gal)					
Boulevard Storage Tank	2,440,000	2,440,000	2,440,000	2,440,000	2,440,000
Total Existing Storage at 0 psi (gal)	2,440,000	2,440,000	2,440,000	2,440,000	2,440,000
Storage Surplus/(Deficiency) at 0 psi (gal)	**663,211**	**613,862**	**504,830**	**300,855**	**222,708**

Notes:

1. Projected demands taken from Chapter 4. ERUs calculated as Maximum Day Demand / Max Day ERU water use factor (282
2. PHD = (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18. C & F values obtained from DOH Water System Design Manual.
3. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
4. Multi-source credit assumes largest source is out of service (in this case, the South Sound booster station).
5. Required Operational Storage is based on Storage Tank level when pump turns on.
6. Required equalization storage = (PHD - Total Available Source) x 150 minutes. If total available source is greater than PHD, required equalizing storage is 0 gallons.
7. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
8. Required fire flow storage = 4,000 gpm x 4 hours.
9. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
10. Total required storage greater than 20 psi is equal to the total of operational, equalizing, fire flow, and standby storage.
11. Maximum ERUs with Available Storage, assuming a 20 psi minimum for standby storage.

Table 9.5 Evaluation of Storage Adequacy for Zone 347

	Year				
	2020	2026	2040	2070	Max [11]
Projected Equivalent Residential Units (ERUs)	3,702	4,021	4,726	6,044	10,848
Projected Demand [1]					
Average Day	562,627	611,101	718,198	918,554	1,734,543
Maximum Day	1,042,459	1,132,274	1,330,708	1,701,936	3,363,397
Peak Hour Demand (gpm) [2]	1,220	1,320	1,541	1,953	3,456
Available, Existing + Future Source (gpd) [3]					
Eastside Booster (2,400 gpm)	3,456,000	3,456,000	3,456,000	3,456,000	3,456,000
Total Available Source (gpd)	3,456,000	3,456,000	3,456,000	3,456,000	3,456,000
Multi-Source Credit (gpd) [4]	2,880,000	2,880,000	2,880,000	2,880,000	2,880,000
Required Storage Calculations					
Operational Storage (gal) [5]	105,538	105,538	105,538	105,538	105,538
Equalizing Storage (gal) [6]	0	0	0	0	158,437
Standby Storage (gal) [7]	740,383	804,172	945,105	1,208,761	2,169,617
Fire Flow Storage (gal) [8]	120,000	120,000	120,000	120,000	120,000
Required Storage					
Greater than 30 psi at highest meter (gal) [9]	105,538	105,538	105,538	105,538	263,975
Greater than 20 psi at highest meter (gal) [10]	965,921	1,029,710	1,170,643	1,434,299	2,553,591
Existing Storage Greater Than 30 psi (gal)					
Eastside Storage Tank	1,943,887	1,943,887	1,943,887	1,943,887	1,943,887
Total Existing Storage at 30 psi (gal)	1,943,887	1,943,887	1,943,887	1,943,887	1,943,887
Storage Surplus/(Deficiency) at 30 psi (gal)	**1,838,349**	**1,838,349**	**1,838,349**	**1,838,349**	**1,679,912**
Existing Storage Greater Than 20 psi (gal)					
Eastside Storage Tank	2,553,591	2,553,591	2,553,591	2,553,591	2,553,591
Total Existing Storage at 20 psi (gal)	2,553,591	2,553,591	2,553,591	2,553,591	2,553,591
Storage Surplus/(Deficiency) at 20 psi (gal)	**1,587,671**	**1,523,882**	**1,382,948**	**1,119,292**	**0**
Existing Storage Greater Than 10 psi (gal)					
Eastside Storage Tank	3,163,296	3,163,296	3,163,296	3,163,296	3,163,296
Total Existing Storage at 10 psi (gal)	3,163,296	3,163,296	3,163,296	3,163,296	3,163,296
Storage Surplus/(Deficiency) at 10 psi (gal)	**2,197,375**	**2,133,586**	**1,992,652**	**1,728,996**	**609,704**
Existing Storage Greater Than 0 psi (gal)					
Eastside Storage Tank	3,430,000	3,430,000	3,430,000	3,430,000	3,430,000
Total Existing Storage at 0 psi (gal)	3,430,000	3,430,000	3,430,000	3,430,000	3,430,000
Storage Surplus/(Deficiency) at 0 psi (gal)	**2,464,079**	**2,400,290**	**2,259,357**	**1,995,701**	**876,409**

Notes:

1. Projected demands taken from Chapter 3. ERUs calculated as Maximum Day Demand / Max Day ERU water use factor (282
2. PHD = (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18. C & F values obtained from DOH Water System Design
3. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
4. Multi-source credit assumes largest source is out of service (in this case, a single pump in the Eastside booster station).
5. Required Operational Storage is based on Storage Tank level when pump turns on.
6. Required equalization storage = (PHD - Total Available Source) x 150 minutes. If total available source is greater than PHD, required equalizing storage is 0 gallons.
7. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
8. Required fire flow storage = 1,000 gpm x 2 hours.
9. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
10. Total required storage greater than 20 psi is equal to the total of operational, equalizing, fire flow, and standby storage.
11. Maximum ERUs with Available Storage, assuming a 20 psi minimum for standby storage.

Table 9.6 Evaluation of Storage Adequacy for Zone 264

	Year				
	2020	2026	2040	2070	Max [13]
Projected Equivalent Residential Units (ERUs)	1,733	1,882	2,212	2,829	24,394
Projected Demand[1]					
Average Day	263,371	286,062	336,196	429,984	4,018,390
Maximum Day	487,985	530,028	622,918	796,693	7,987,306
PHD (gpm)[2]	604	651	754	947	7,695
Available, Existing + Future Source (gpd)[3]					
10" Water Main (2,545 gpm)	3,664,800	3,664,800	3,664,800	3,664,800	3,664,800
Capitol Way PRV (1,310 gpm)	1,886,400	1,886,400	1,886,400	1,886,400	1,886,400
Brewery Well (1,000 gpm)	TBD	TBD	TBD	TBD	TBD
Total Available Source (gpd)	5,551,200	5,551,200	5,551,200	5,551,200	5,551,200
Multi-Source Credit (gpd)[4]	1,886,400	1,886,400	1,886,400	1,886,400	1,886,400
Required Storage Calculations					
Operational Storage (gal)[5]	435,000	435,000	435,000	435,000	435,000
Equalizing Storage (gal)[6]	0	0	0	0	575,940
Standby Storage (gal)[7]	346,580	376,441	442,413	565,833	6,150,380
Fire Flow Storage (gal)[8]	960,000	960,000	960,000	960,000	960,000
Required Storage					
Greater than 30 psi at highest meter (gal)[9]	435,000	435,000	435,000	435,000	1,010,940
Greater than 20 psi at highest meter (gal)[10]	1,741,580	1,771,441	1,837,413	1,960,833	8,121,319
Existing Storage Greater Than 30 psi (gal)					
Stevens Field Storage Tank	171,202	171,202	171,202	171,202	171,202
Meridian Storage Tanks[11]	1,395,980	1,425,841	1,491,813	1,615,233	7,500,000
Total Existing Storage at 30 psi (gal)	1,567,182	1,597,043	1,663,015	1,786,435	7,671,202
Storage Surplus/(Deficiency) at 30 psi (gal)	**1,132,182**	**1,162,043**	**1,228,015**	**1,351,435**	**6,660,262**
Existing Storage Greater Than 20 psi (gal)					
Stevens Field Storage Tank	304,519	304,519	304,519	304,519	304,519
Meridian Storage Tanks	1,395,980	1,425,841	1,491,813	1,615,233	7,500,000
Boulevard Storage Tank[12]	316,800	316,800	316,800	316,800	316,800
Total Existing Storage at 20 psi (gal)	2,017,300	2,047,160	2,113,132	2,236,552	8,121,319
Storage Surplus/(Deficiency) at 20 psi (gal)	**275,719**	**275,719**	**275,719**	**275,719**	**0**
Existing Storage Greater Than 10 psi (gal)					
Stevens Field Storage Tank	437,837	437,837	437,837	437,837	437,837
Meridian Storage Tanks	1,395,980	1,425,841	1,491,813	1,615,233	7,500,000
Boulevard Storage Tank	316,800	316,800	316,800	316,800	316,800
Total Existing Storage at 10 psi (gal)	2,150,617	2,180,477	2,246,450	2,369,870	8,254,637
Storage Surplus/(Deficiency) at 10 psi (gal)	**409,037**	**409,037**	**409,037**	**409,037**	**133,317**
Existing Storage Greater Than 0 psi (gal)					
Stevens Field Storage Tank	571,154	571,154	571,154	571,154	571,154
Meridian Storage Tanks	1,395,980	1,425,841	1,491,813	1,615,233	7,500,000
Boulevard Storage Tank	316,800	316,800	316,800	316,800	316,800
Total Existing Storage at 0 psi (gal)	2,283,934	2,313,795	2,379,767	2,503,187	8,387,954
Storage Surplus/(Deficiency) at 0 psi (gal)	**542,354**	**542,354**	**542,354**	**542,354**	**266,635**

Notes:

1. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (282 gpd/ERU).
2. PHD = (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18. C & F values obtained from DOH Water System Design
3. Available source assumes sources are operating for 24 hours in a day, at the maximum production rate.
4. Multi-source credit assumes largest source is out of service (in this case, the 10" water main).
5. Required Operational Storage is based on Storage Tank level when pump turns on.
6. Required equalization storage = (PHD - Total Available Source) x 150 minutes. If total available source is greater than PHD,
7. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
8. Required fire flow storage = 4,000 gpm x 4 hours
9. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
10. Total required storage greater than 20 psi is equal to the total of operational, equalizing, standby, and fire flow storage.
11. The operational, equalizing, and standby storage requirements for Zone 264 are supplied by the Meridian Storage Tanks. The Meridian Storage Tanks through the 10" water main account for 64% of the fire flow for the entire zone based on the capacity of
11. Supply from Zone 338, where the Boulevard Storage Tank is located, accounts for 33% of the fire flow for the entire zone, based on the capacity of the Capitol Way PRV (1,310 gpm).
12. Maximum ERUs with Available Storage, assuming a 20 psi minimum for standby storage.

Table 9.7 Evaluation of Storage Adequacy for Zone 226, Zone 298, and Zone 380

	Year				
	2020	2026	2040	2070	Max [11]
Projected Equivalent Residential Units (ERUs)	20,730	22,516	26,462	33,844	40,394
Projected Demand[1]					
Average Day	3,150,568	3,422,010	4,021,729	5,143,670	6,334,432
Maximum Day	5,837,505	6,340,445	7,451,629	9,530,409	12,077,035
Peak Hour Demand (gpm)[2]	6,548	7,107	8,342	10,651	12,701
Available, Existing + Future Source (gpd)[3]					
McAllister Wellfield (10,500 gpm)					
TW-22 (1,500 gpm)	2,160,000	2,160,000	2,160,000	2,160,000	2,160,000
PW-24 (2,900 gpm)	4,176,000	4,176,000	4,176,000	4,176,000	4,176,000
PW-25 (6,100 gpm)	8,784,000	8,784,000	8,784,000	8,784,000	8,784,000
Allison Well #19 (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well #13 (530 gpm)	763,200	763,200	763,200	763,200	763,200
Kaiser Rd. Well #1 (360 gpm)	0	0	0	0	0
Total Available Source (gpd)	17,179,200	17,179,200	17,179,200	17,179,200	17,179,200
Multi-Source Credit (gpd)[4]	8,395,200	8,395,200	8,395,200	8,395,200	8,395,200
Required Storage Calculations					
Operational Storage (gal)[5]	1,371,300	1,371,300	1,371,300	1,371,300	1,371,300
Equalizing Storage (gal)[6]	0	0	0	0	115,611
Standby Storage (gal)[7]	4,145,955	4,503,157	5,292,350	6,768,756	8,078,739
Fire Flow Storage (gal)[8]	960,000	960,000	960,000	960,000	960,000
Required Storage					
Greater than 30 psi at highest meter (gal)[9]	1,371,300	1,371,300	1,371,300	1,371,300	1,486,911
Greater than 20 psi at highest meter (gal)[10]	6,477,255	6,834,457	7,623,650	9,100,056	10,525,650
Existing Storage Greater Than 30 psi (gal)					
Fir 226 (north)	1,472,918	1,472,918	1,472,918	1,472,918	1,472,918
Fir 226 (south)	1,472,918	1,472,918	1,472,918	1,472,918	1,472,918
Bush 298	358,969	358,969	358,969	358,969	358,969
Elliott 298	1,367,501	1,367,501	1,367,501	1,367,501	1,367,501
Elliott 380	1,460,131	1,460,131	1,460,131	1,460,131	1,460,131
Total Existing Storage at 30 psi (gal)	6,132,437	6,132,437	6,132,437	6,132,437	6,132,437
Storage Surplus/(Deficiency) at 30 psi (gal)	**4,761,137**	**4,761,137**	**4,761,137**	**4,761,137**	**4,645,526**
Existing Storage Greater Than 20 psi (gal)					
Fir 226 (north)	2,500,000	2,500,000	2,500,000	2,500,000	2,500,000
Fir 226 (south)	2,500,000	2,500,000	2,500,000	2,500,000	2,500,000
Bush 298	965,563	965,563	965,563	965,563	965,563
Elliott 298	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Elliott 380	2,560,087	2,560,087	2,560,087	2,560,087	2,560,087
Total Existing Storage at 20 psi (gal)	10,525,650	10,525,650	10,525,650	10,525,650	10,525,650
Storage Surplus/(Deficiency) at 20 psi (gal)	**4,048,395**	**3,691,193**	**2,902,000**	**1,425,594**	**0**
Existing Storage Greater Than 10 psi (gal)					
Fir 226 (north)	2,500,000	2,500,000	2,500,000	2,500,000	2,500,000
Fir 226 (south)	2,500,000	2,500,000	2,500,000	2,500,000	2,500,000
Bush 298	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000
Elliott 298	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Elliott 380	3,660,044	3,660,044	3,660,044	3,660,044	3,660,044
Total Existing Storage at 10 psi (gal)	11,710,044	11,710,044	11,710,044	11,710,044	11,710,044
Storage Surplus/(Deficiency) at 10 psi (gal)	**5,232,788**	**4,875,587**	**4,086,394**	**2,609,987**	**1,184,394**
Existing Storage Greater Than 0 psi (gal)					
Fir 226 (north)	2,500,000	2,500,000	2,500,000	2,500,000	2,500,000
Fir 226 (south)	2,500,000	2,500,000	2,500,000	2,500,000	2,500,000
Bush 298	1,050,000	1,050,000	1,050,000	1,050,000	1,050,000
Elliott 298	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Elliott 380	4,760,000	4,760,000	4,760,000	4,760,000	4,760,000
Total Existing Storage at 0 psi (gal)	12,810,000	12,810,000	12,810,000	12,810,000	12,810,000
Storage Surplus/(Deficiency) at 0 psi (gal)	**6,332,745**	**5,975,543**	**5,186,350**	**3,709,944**	**2,284,350**

Notes:

1. Projected demands taken from Chapter 3. ERUs calculated as Maximum Day Demand / Max Day ERU water use factor (282
2. PHD = (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18. C & F values obtained from DOH Water System Design
3. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
4. Multi-source credit assumes largest source is out of service (in this case, PW-25 at McAllister Wellfield).
5. Required Operational Storage is based on Storage Tank level when pump turns on.
6. Required equalization storage = (PHD - Total Available Source) x 150 minutes. If total available source is greater than PHD, required equalizing storage is 0 gallons.
7. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
8. Required fire flow storage = 4,000 gpm x 4 hours.
9. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
10. Total required storage greater than 20 psi is equal to the total of operational, equalizing, fire flow, and standby storage.
11. Maximum ERUs with Available Storage, assuming a 20 psi minimum for standby storage.

Table 9.8 Evaluation of Storage Adequacy for Zone 380

	Year				
	2020	2026	2040	2070	Max [11]
Projected Equivalent Residential Units (ERUs)	5,757	6,253	7,349	9,399	9,106
Projected Demand[1]					
Average Day	874,995	950,382	1,116,939	1,428,531	1,408,654
Maximum Day	1,621,227	1,760,907	2,069,512	2,646,843	2,652,941
Peak Hour Demand (gpm)[2]	1,863	2,019	2,361	3,003	2,911
Available, Existing + Future Source (gpd)[3]					
Westbay Booster (2,075 gpm)	2,988,000	2,988,000	2,988,000	2,988,000	2,988,000
Elliot Booster (2,300 gpm)	3,312,000	3,312,000	3,312,000	3,312,000	3,312,000
Total Available Source (gpd)	6,300,000	6,300,000	6,300,000	6,300,000	6,300,000
Multi-Source Credit (gpd)[3]	2,988,000	2,988,000	2,988,000	2,988,000	2,988,000
Required Storage Calculations					
Operational Storage (gal)[5]	618,800	618,800	618,800	618,800	618,800
Equalizing Storage (gal)[6]	0	0	0	0	0
Standby Storage (gal)[7]	1,151,440	1,250,644	1,469,824	1,879,860	1,821,287
Fire Flow Storage (gal)[8]	120,000	120,000	120,000	120,000	120,000
Required Storage					
Greater than 30 psi at highest meter (gal)[9]	618,800	618,800	618,800	618,800	618,800
Greater than 20 psi at highest meter (gal)[10]	1,890,240	1,989,444	2,208,624	2,618,660	2,560,087
Existing Storage Greater Than 30 psi (gal)					
Elliot 380 Storage Tank	1,460,131	1,460,131	1,460,131	1,460,131	1,460,131
Total Existing Storage at 30 psi (gal)	1,460,131	1,460,131	1,460,131	1,460,131	1,460,131
Storage Surplus/(Deficiency) at 30 psi (gal)	**841,331**	**841,331**	**841,331**	**841,331**	**841,331**
Existing Storage Greater Than 20 psi (gal)					
Elliot 380 Storage Tank	2,560,087	2,560,087	2,560,087	2,560,087	2,560,087
Total Existing Storage at 20 psi (gal)	2,560,087	2,560,087	2,560,087	2,560,087	2,560,087
Storage Surplus/(Deficiency) at 20 psi (gal)	**669,847**	**570,643**	**351,463**	**(58,573)**	**0**
Existing Available Storage Greater Than 10 psi (gal)					
Elliot 380 Storage Tank	3,660,044	3,660,044	3,660,044	3,660,044	3,660,044
Total Existing Storage at Existing Volume (gal)	3,660,044	3,660,044	3,660,044	3,660,044	3,660,044
Storage Surplus/(Deficiency) at 10 psi (gal)	**1,769,804**	**1,670,599**	**1,451,420**	**1,041,383**	**1,099,956**
Existing Available Storage Greater Than 0 psi (gal)					
Elliot 380 Storage Tank	4,760,000	4,760,000	4,760,000	4,760,000	4,760,000
Total Existing Storage at Existing Volume (gal)	4,760,000	4,760,000	4,760,000	4,760,000	4,760,000
Storage Surplus/(Deficiency) at 0 psi (gal)	**2,869,760**	**2,770,556**	**2,551,376**	**2,141,340**	**2,199,913**

Notes:

1. Projected demands taken from Chapter 3. ERUs calculated as Maximum Day Demand / Max Day ERU water use factor (282 gpd/ERU).
2. PHD = (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18. C & F values obtained from DOH Water System Design Manual.
3. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
4. Multi-source credit assumes largest source is out of service (in this case, the Elliot booster station).
5. Required Operational Storage is based on Storage Tank level when pump turns on.
6. Required equalization storage = (PHD - Total Available Source) x 150 minutes. If total available source is greater than PHD, required equalizing storage is 0 gallons.
7. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
8. Required fire flow storage = 1,000 gpm x 2 hours.
9. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
10. Total required storage greater than 20 psi is equal to the total of operational, equalizing, fire flow, and standby storage.
11. Maximum ERUs with Available Storage, assuming a 20 psi minimum for standby storage.

Zone 347

Storage capacity is provided to Zone 347 by the Eastside Storage Tank. This storage facility provides sufficient capacity throughout the planning period, as shown in Table 9.5.

Zone 264

Zone 264 is primarily supplied by a 10-inch water main, which receives water from the Meridian Storage Tanks. Additional supply is provided by the Capitol Way pressure reducing valve (PRV), Boulevard Road/Cain Road PRV and the Henderson PRV that transfers water from Zone 338 and the Boulevard Storage Tank. Additional storage capacity is provided by the Stevens Field Storage Tank, which was constructed in 2007.

As shown in Table 9.6, the total storage capacity is sufficient to meet storage requirements throughout the planning period. The Meridian Storage Tanks and Stevens Field Storage Tank provide storage capacity for operational and equalization purposes. Hydraulic analyses indicate that fire flow storage is utilized equally from the three storage facilities available to the zone: Meridian, Stevens Field, and Boulevard Storage Tanks.

Zone 226, 298 and 380

The storage capacities for Zones 226, 298, and 380 are first analyzed together, due to the interconnectedness of these zones. The Percival Booster Pump Station can supply storage demands from the Fir Street Storage Tanks, supplied by McAllister Wellfield, to Zone 298. Additional sources are the two Allison wells. PRVs allow water to be supplied from the Elliott 380 Storage Tank to Zones 298 and 226. The Elliott 298 and Bush Storage Tanks provide additional storage for Zone 298 and through a PRV to Zone 226. As a combined system, there is sufficient storage through 2070, as shown in Table 9.7. Zone 380 must also be analyzed independently, since only the Elliott 380 Storage Tank provides storage capacity for this zone. The sources of supply to the zone are the Westbay and Elliot booster stations. Table 9.8 summarizes the analysis for Zone 380, indicating a minor storage deficiency at 20 psi by year 2070.

9.3 2021-2026 Storage Infrastructure Projects

The storage projects planned for 2021-2026 will help meet the Utility's Goal 6:

> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high-quality water to a growing community.**

Objective 6A is to design and construct infrastructure to ensure reliable delivery of water. Storage projects will implement Strategy 6A2: Develop and maintain storage and transmission/distribution infrastructure to ensure delivery of water at adequate pressure throughout the system and maintain required fire flow. Chapters 8 and 10 describe source and transmission/distribution infrastructure; Chapter 12 describes operations and maintenance of the infrastructure. Water quality strategies are in Chapter 11.

Based on the analysis in the previous section, the Utility's Capital Improvement Program for 2022-2041 includes the following storage projects. Project-level cost estimates and implementation schedule are in Chapter 13, Table 13.2.

- Elliot Reservoir Evaluation (380 Zone Storage Tank)
- Hoffman Court Reservoir Reconstruction
- Boulevard Road Reservoir Rehabilitation
- Eastside Reservoir Reconstruction

9.4 Reliability Analysis

The Utility's Level of Service (LOS) for system reliability is to maintain capacity to meet winter demands (inside water use only) with loss of the largest water source, with the largest water source defined as the McAllister Wellfield. Establishing a reliability LOS as the Utility has done, and demonstrating that it can be met, is not a water system plan requirement.

This section consists of a narrative discussion of the methodology and assumptions used to evaluate water system reliability during abnormal operating conditions, followed by evaluations of several scenarios, including the Utility's system reliability LOS standard. It provides an evaluation of the impact from loss of source of supply in each pressure zone and for the system as a whole. This analysis will be used by the Utility for emergency response planning purposes.

Reliability Analysis Methodology and Assumptions

The following methodology was used to evaluate the reliability of the Utility's water source and storage facilities:

- Summary tables are based upon capacity analysis tables generated for the source and storage evaluation in the WSP (Chapter 8 and Section 9.2 above). The methodology behind the source and storage evaluation described in Chapters 8 and Section 9.2 of the WSP is not repeated here. Similar pressure zone groupings, based on hydraulic connectivity, were used in this analysis.
- The reliability analysis focuses on the ability of the water system to support "winter demand", which is a proxy for indoor water usage. Winter demand was estimated by:
    - Calculating the average day demand (ADD) from January – April (i.e., months showing a winter demand pattern) of 2017 – 2019, based on analysis of well production data.
    - Dividing this value by the annual ADD for the same years.
    - The resulting ratio is 79 percent.
    - Applying 79 percent to the projected ADD for each pressure zone (or zone grouping) to determine winter demand for each pressure zone (or grouping) in future years.
- If a source of supply deficiency was identified in a scenario, the length of time in days that available standby storage can address the source deficiency was determined. If no supply deficiency was identified, the length of time is labeled as "n/a."
- Available standby storage is defined as the total storage available at a pressure of 20 psi or greater less equalizing, operational, and fire flow storage requirements in each pressure zone.
- The Hoffman, Indian Summer, and Kaiser Road wells are not pH-optimized and therefore may be unavailable to meet demands during abnormal conditions. Collectively, these are called the "non-pH-optimized" wells for scenarios where they are excluded.
- Additional notes regarding methodology are in the footnotes of Table 9.9. These footnotes are not repeated at the end of each table since the methodology is the same for each analysis.

Reliability Analysis Results

Scenario 1 – Full System

This scenario grouping analyzes the entire system.

Scenario 1a – McAllister Wellfield Offline

This scenario considers a loss of the McAllister Wellfield to supply the system. The Allison Wells, Shana Well and Corrosion Facility, Hoffman Well, Kaiser Rd. Well, and the Indian Summer Well are the remaining sources of supply. A future source from the Briggs Well is included in this scenario and comes online between 2026 and 2040. If a supply deficiency was identified, all storage tanks in the system were considered online to supplement supply. Table 9.9 presents the Scenario 1a evaluation results.

Without the McAllister Wellfield, there is a total remaining source capacity of 5.98 mgd which is sufficient to meet winter demands through 2026. By 2040, it is assumed the Briggs Well is online, and sources remain sufficient to meet demands. By 2070, sources will be insufficient to meet demands by 0.88 mgd. All available storage would be enough to support winter demands for 26.4 days.

Scenario 1b - McAllister Wellfield and Meridian Storage Tanks Offline

This scenario considers a loss of the McAllister Wellfield and the Meridian Storage Tanks. For the remainder of this reliability analysis, the McAllister-Meridian loss combination is described as a loss of the 36-inch transmission main (36-inch Main). The Allison Wells, Shana Park Well and Corrosion Facility, Hoffman Well, Kaiser Rd. Well, and the Indian Summer Well are the remaining sources of supply to the system. A future source from the Briggs Well is included in this scenario. If a supply deficiency was identified, all storage tanks in the system except Meridian were considered online to supplement supply. Table 9.10 presents the Scenario 1b evaluation results.

The source profile in the scenario matches that of Scenario 1a, so sources only become deficient in 2070. Without the Meridian Storage Tanks, standby storage can supplement sources for 18.3 days.

Scenario 1c – 36-inch Main and non-pH-Optimized Wells Offline

This scenario considers a loss of the 36-inch Main and the non-pH-optimized wells. The only available existing sources are the Allison Wells and the Shana Park Well and Corrosion Facility. A future source from the Briggs Well is included in this scenario. If a supply deficiency was identified, all storage tanks in the system except Meridian were considered online to supplement supply. Table 9.11 presents the Scenario 1c evaluation results.

Supplies are deficient in this scenario beginning in 2020 by 2.0 mgd, where storage could meet demands for 8.3 days. By 2040, with the activation of the Briggs Well, the supply shortage reduces to 1.9 mgd and storage could meet demands for 8.8 days. In 2070, the supply shortage grows to 3.7 mgd and storage could meet demands for 4.2 days.

Scenario 2 – Zones 417, 338, & 264

This scenario grouping analyzes the reliability of storage serving zones 417, 338, & 264. These zones are served by the Meridian Tanks, Hoffman Tank 417, LBA Tank 417, Stevens Field Tank 264, and Boulevard Tank 338.

Scenario 2a – 36-inch Main Offline

This scenario considers a loss of the 36-inch Main. Available sources are the Shana Park Well and Corrosion Facility, Hoffman Well, and Indian Summer Well. The Brewery Well source would serve this zone grouping. However, a timeline has not been established for development of that well and was therefore left out of the analysis. Table 9.12 presents the Scenario 2a evaluation results.

Sources are sufficient to meet demands through 2040. By 2070, sources are deficient by 0.3 mgd. Available standby storage can supplement supplies for 22.5 days.

Table 9.9. Scenario 1a Results

	Year			
	2020	**2026**	**2040**	**2070**
Equivalent Residential Units (ERU's)	43,129	46,844	55,054	70,412
Projected Demand - Gallons per Day (gpd) [1]				
Average Day	6,554,793	7,119,532	8,367,254	10,701,466
Winter Day	5,166,716	5,611,863	6,595,360	8,435,267
Source Capacity				
Available Existing Source [2] (gpd)				
McAllister Wellfield (10,500 gpm)				
TW-22 (1,500 gpm)	0	0	0	0
PW-24 (2,900 gpm)	0	0	0	0
PW-25 (6,100 gpm)	0	0	0	0
Allison Well #19 (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well #13 (530 gpm)	763,200	763,200	763,200	763,200
Shana Well and Corrosion Facility (760 gpm)	1,094,400	1,094,400	1,094,400	1,094,400
Hoffman Well #3 (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000
Indian Summer Well (600 gpm)	864,000	864,000	864,000	864,000
Kaiser Rd. Well #1 (360 gpm) [3]	518,400	518,400	518,400	518,400
Future Source (gpd)				
Briggs Well (1,100 gpm)[4]	0	0	1,584,000	1,584,000
Brewery Wellfield (2,172 gpm)[5]	TBD	TBD	TBD	TBD
Total Available Source (Existing + Future) (gpd)	**5,976,000**	**5,976,000**	**7,560,000**	**7,560,000**
Source Surplus/(Deficiency)	**809,284**	**364,137**	**964,640**	**(875,267)**
Total Storage to Meet Supply Deficiencies (gallons) [6]				
Meridian Reservoir No. 1	3,500,000	3,500,000	3,500,000	3,500,000
Meridian Reservoir No. 2	4,000,000	4,000,000	4,000,000	4,000,000
Fir St. North	2,500,000	2,500,000	2,500,000	2,500,000
Fir St. South	2,500,000	2,500,000	2,500,000	2,500,000
Hoffman 417	2,437,286	2,437,286	2,437,286	2,437,286
Boulevard 338	2,217,292	2,217,292	2,217,292	2,217,292
Eastside 347	2,553,591	2,553,591	2,553,591	2,553,591
Stevens Field 264	304,519	304,519	304,519	304,519
Bush 298	965,563	965,563	965,563	965,563
Elliot 298	2,000,000	2,000,000	2,000,000	2,000,000
Elliot 380	2,560,087	2,560,087	2,560,087	2,560,087
LBA 417	3,584,534	3,584,534	3,584,534	3,584,534
Unavailable Storage (gal) [7]				
Operational Portion	2,537,044	2,537,044	2,537,044	2,537,044
Fire Flow Requirement	960,000	960,000	960,000	960,000
Equalizing Portion	1,410,966	1,585,362	1,805,667	2,526,488
Total Available Storage to Supplement Sources [8]	**24,214,861**	**24,040,466**	**23,820,161**	**23,099,340**
Days Storage Can Supplement Sources [9]	**n/a**	**n/a**	**n/a**	**26.4**

Notes:

1 Projected demands taken from Chapter 3. ERUs calculated as MDD / Max Day ERU water use factor (282 gpd/ERU).

2 Assumes source pumps are operating at the maximum production rate.

3 Kaiser Road Well #1 is an emergency source and therefore may be used in an emergency loss-of-source scenario.

4 The Briggs well source is anticipated to be online between 2020 and 2034.

5 The Brewery well source is currently in development and the timing and estimated capacity has not been determined.

6 Represents the volume of water in each reservoir above 20 psi.

7 Represents storage reserved for standard operational, equalizing, and fire flow uses. See Chapter 9 for additional discussion of calculation of these storage component volumes.

8 Total Available Storage = Total Storage - Unavailable Storage

9 Number of days = -(Total Available Storage / Source Deficiency). If there is a source surplus, then this value is n/a, as storage is not required to meet daily winter demand.

Table 9.10 Scenario 1b Results

	Year			
	2020	**2026**	**2040**	**2070**
Equivalent Residential Units (ERU's)	43,129	46,844	55,054	70,412
Projected Demand - Gallons per Day (gpd)				
Average Day	6,554,793	7,119,532	8,367,254	10,701,466
Winter Day	5,166,716	5,611,863	6,595,360	8,435,267
Source Capacity				
Available Existing Source (gpd)				
McAllister Wellfield (10,500 gpm)				
TW-22 (1,500 gpm)	0	0	0	0
PW-24 (2,900 gpm)	0	0	0	0
PW-25 (6,100 gpm)	0	0	0	0
Allison Well #19 (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well #13 (530 gpm)	763,200	763,200	763,200	763,200
Shana Well and Corrosion Facility (760 gpm)	1,094,400	1,094,400	1,094,400	1,094,400
Hoffman Well #3 (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000
Indian Summer Well (600 gpm)	864,000	864,000	864,000	864,000
Kaiser Rd. Well #1 (360 gpm)	518,400	518,400	518,400	518,400
Future Source (gpd)				
Briggs Well (1,100 gpm)	0	0	1,584,000	1,584,000
Brewery Wellfield (2,172 gpm)	TBD	TBD	TBD	TBD
Total Available Source (Existing + Future) (gpd)	**5,976,000**	**5,976,000**	**7,560,000**	**7,560,000**
Source Surplus/(Deficiency)	**809,284**	**364,137**	**964,640**	**(875,267)**
Total Storage to Meet Supply Deficiencies (gallons)				
Meridian Reservoir No. 1	0	0	0	0
Meridian Reservoir No. 2	0	0	0	0
Fir St. North	2,500,000	2,500,000	2,500,000	2,500,000
Fir St. South	2,500,000	2,500,000	2,500,000	2,500,000
Hoffman 417	2,437,286	2,437,286	2,437,286	2,437,286
Boulevard 338	2,217,292	2,217,292	2,217,292	2,217,292
Eastside 347	2,553,591	2,553,591	2,553,591	2,553,591
Stevens Field 264	304,519	304,519	304,519	304,519
Bush 298	965,563	965,563	965,563	965,563
Elliot 298	2,000,000	2,000,000	2,000,000	2,000,000
Elliot 380	2,560,087	2,560,087	2,560,087	2,560,087
Log Cabin 417	3,584,534	3,584,534	3,584,534	3,584,534
Unavailable Storage (gal)				
Operational Portion	2,162,044	2,162,044	2,162,044	2,162,044
Fire Flow Requirement	960,000	960,000	960,000	960,000
Equalizing Portion	1,410,966	1,585,362	1,805,667	2,526,488
Total Available Storage to Supplement Sources	**17,089,861**	**16,915,466**	**16,695,161**	**15,974,340**
Days Storage Can Supplement Sources	**n/a**	**n/a**	**n/a**	**18.3**

Table 9.11 Scenario 1c Results

	Year			
	2020	**2026**	**2040**	**2070**
Equivalent Residential Units (ERU's)	43,129	46,844	55,054	70,412
Projected Demand - Gallons per Day (gpd)				
Average Day	6,554,793	7,119,532	8,367,254	10,701,466
Winter Day	5,166,716	5,611,863	6,595,360	8,435,267
Source Capacity				
Available Existing Source (gpd)				
McAllister Wellfield (10,500 gpm)				
TW-22 (1,500 gpm)	0	0	0	0
PW-24 (2,900 gpm)	0	0	0	0
PW-25 (6,100 gpm)	0	0	0	0
Allison Well #19 (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well #13 (530 gpm)	763,200	763,200	763,200	763,200
Shana Well and Corrosion Facility (760 gpm)	1,094,400	1,094,400	1,094,400	1,094,400
Hoffman Well #3 (1,000 gpm)	0	0	0	0
Indian Summer Well (600 gpm)	0	0	0	0
Kaiser Rd. Well #1 (360 gpm)	0	0	0	0
Future Source (gpd)				
Briggs Well (1,100 gpm)	0	0	1,584,000	1,584,000
Brewery Wellfield (2,172 gpm)	TBD	TBD	TBD	TBD
Total Available Source (Existing + Future) (gpd)	**3,153,600**	**3,153,600**	**4,737,600**	**4,737,600**
Source Surplus/(Deficiency)	**(2,013,116)**	**(2,458,263)**	**(1,857,760)**	**(3,697,667)**
Total Storage to Meet Supply Deficiencies (gallons)				
Meridian Reservoir No. 1	0	0	0	0
Meridian Reservoir No. 2	0	0	0	0
Fir St. North	2,500,000	2,500,000	2,500,000	2,500,000
Fir St. South	2,500,000	2,500,000	2,500,000	2,500,000
Hoffman 417	2,437,286	2,437,286	2,437,286	2,437,286
Boulevard 338	2,217,292	2,217,292	2,217,292	2,217,292
Eastside 347	2,553,591	2,553,591	2,553,591	2,553,591
Stevens Field 264	304,519	304,519	304,519	304,519
Bush 298	965,563	965,563	965,563	965,563
Elliot 298	2,000,000	2,000,000	2,000,000	2,000,000
Elliot 380	2,560,087	2,560,087	2,560,087	2,560,087
Log Cabin 417	3,584,534	3,584,534	3,584,534	3,584,534
Unavailable Storage (gal)				
Operational Portion	2,162,044	2,162,044	2,162,044	2,162,044
Fire Flow Requirement	960,000	960,000	960,000	960,000
Equalizing Portion	1,704,966	1,879,362	2,099,667	2,820,488
Total Available Storage to Supplement Sources	**16,795,861**	**16,621,466**	**16,401,161**	**15,680,340**
Days Storage Can Supplement Sources	**8.3**	**6.8**	**8.8**	**4.2**

Table 9.12 Scenario 2a Results

	Year			
	2020	**2026**	**2040**	**2070**
Equivalent Residential Units (ERU's)	18,697	20,308	23,867	30,525
Projected Demand - Gallons per Day (gpd)				
Average Day	2,841,598	3,086,421	3,627,327	4,639,242
Winter Day	2,239,847	2,432,824	2,859,185	3,656,811
Evaluation of Existing Sources				
Available Existing Source (gpd)				
McAllister Wellfield (10,500 gpm)				
TW-22 (1,500 gpm)	0	0	0	0
PW-24 (2,900 gpm)	0	0	0	0
PW-25 (6,100 gpm)	0	0	0	0
Shana Well and Corrosion Facility (760 gpm)	1,094,400	1,094,400	1,094,400	1,094,400
Hoffman Well #3 (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000
Indian Summer Well (600 gpm)	864,000	864,000	864,000	864,000
Future Source (gpd)				
Brewery Well (2,172 gpm)	TBD	TBD	TBD	TBD
Total Available Source (Existing + Future) (gpd)	**3,398,400**	**3,398,400**	**3,398,400**	**3,398,400**
Source Surplus/(Deficiency)	**1,158,553**	**965,576**	**539,215**	**(258,411)**
Available Storage to Meet Supply Deficiencies (gallons)				
Meridian Reservoir No. 1	0	0	0	0
Meridian Reservoir No. 2	0	0	0	0
Hoffman 417	2,437,286	2,437,286	2,437,286	2,437,286
Stevens Field 264	304,519	304,519	304,519	304,519
Boulevard 338	2,217,292	2,217,292	2,217,292	2,217,292
Log Cabin 417	3,584,534	3,584,534	3,584,534	3,584,534
Unavailable Storage (gal)				
Operational Portion	685,206	685,206	685,206	685,206
Fire Flow Requirement	960,000	960,000	960,000	960,000
Equalizing Portion	532,806	608,409	775,444	1,087,930
Total Available Storage to Supplement Sources	**6,365,619**	**6,290,016**	**6,122,981**	**5,810,494**
Days Storage Can Supplement Sources	**n/a**	**n/a**	**n/a**	**22.5**

Scenario 2b – 36-inch Main and non-pH-optimized Wells Offline

This scenario considers a loss of the 36-inch Main and non-pH-optimized wells. The Shana Park Well and Corrosion Facility is the only available source. The Brewery Well source would serve this zone grouping. However, a timeline has not been established for development of that well and was therefore left out of the analysis. Table 9.13 presents the Scenario 2b evaluation results.

Sources are deficient to meet demands by 1.1 mgd in 2020. Storage could make up for this deficiency for 5.3 days. The deficiency increases throughout the planning period to 2.6 mgd in 2070, where storage could supplement supplies for 2.2 days.

Table 9.13 Scenario 2b Results

	Year			
	2020	**2026**	**2040**	**2070**
Equivalent Residential Units (ERU's)	18,697	20,308	23,867	30,525
Projected Demand - Gallons per Day (gpd)				
Average Day	2,841,598	3,086,421	3,627,327	4,639,242
Winter Day	2,239,847	2,432,824	2,859,185	3,656,811
Evaluation of Existing Sources				
Available Existing Source (gpd)				
McAllister Wellfield (10,500 gpm)				
TW-22 (1,500 gpm)	0	0	0	0
PW-24 (2,900 gpm)	0	0	0	0
PW-25 (6,100 gpm)	0	0	0	0
Shana Well and Corrosion Facility (760 gpm)	1,094,400	1,094,400	1,094,400	1,094,400
Hoffman Well #3 (1,000 gpm)	0	0	0	0
Indian Summer Well (600 gpm)	0	0	0	0
Future Source (gpd)				
Brewery Well (2,172 gpm)	TBD	TBD	TBD	TBD
Total Available Source (Existing + Future) (gpd)	**1,094,400**	**1,094,400**	**1,094,400**	**1,094,400**
Source Surplus/(Deficiency)	**(1,145,447)**	**(1,338,424)**	**(1,764,785)**	**(2,562,411)**
Available Storage to Meet Supply Deficiencies (gallons)				
Meridian Reservoir No. 1	0	0	0	0
Meridian Reservoir No. 2	0	0	0	0
Hoffman 417	2,437,286	2,437,286	2,437,286	2,437,286
Stevens Field 264	304,519	304,519	304,519	304,519
Boulevard 338	2,217,292	2,217,292	2,217,292	2,217,292
Log Cabin 417	3,584,534	3,584,534	3,584,534	3,584,534
Unavailable Storage (gal)				
Operational Portion	685,206	685,206	685,206	685,206
Fire Flow Requirement	960,000	960,000	960,000	960,000
Equalizing Portion	772,806	848,409	1,015,444	1,327,930
Total Available Storage to Supplement Sources	**6,125,619**	**6,050,016**	**5,882,981**	**5,570,494**
Days Storage Can Supplement Sources	**5.3**	**4.5**	**3.3**	**2.2**

Scenario 3 – Zone 347; Eastside Booster Station Offline

Storage in Zone 347 is supplied by the Eastside 347 Tank. This scenario considers a loss of the Eastside Booster Station. The Eastside Booster Station is the sole source of water to the 347 zone; therefore, the zone would rely only on storage to meet demands should this scenario occur. Table 9.14 presents the Scenario 3 evaluation results.

The source deficiency in 2020 is 0.4 mgd, which the Eastside Tank could provide for 4.8 days. The supply deficiency increases to 0.7 mgd in 2070, where storage could provide supplies for 2.8 days.

Table 9.14 Scenario 3 Results

	Year			
	2020	**2026**	**2040**	**2070**
Equivalent Residential Units (ERU's)	3,702	4,021	4,726	6,044
Projected Demand - Gallons per Day (gpd)				
Average Day	562,627	611,101	718,198	918,554
Winter Day	443,482	481,691	566,109	724,036
Available Existing Source (gpd)				
Eastside Booster (2,400 gpm)	0	0	0	0
Total Available Source (gpd)	0	0	0	0
Source Surplus/(Deficiency)	**(443,482)**	**(481,691)**	**(566,109)**	**(724,036)**
Available Storage to Meet Supply Deficiencies (gallons)				
Eastside 347	2,553,591	2,553,591	2,553,591	2,553,591
Unavailable Storage (gal)				
Operational Portion	105,538	105,538	105,538	105,538
Fire Flow Requirement	120,000	120,000	120,000	120,000
Equalizing Portion	183,043	198,012	231,085	292,956
Total Available Storage to Supplement Sources	**2,145,010**	**2,130,041**	**2,096,969**	**2,035,097**
Days Storage Can Supplement Sources	**4.8**	**4.4**	**3.7**	**2.8**

Scenario 4 – Zones 226, 298, & 380

This scenario grouping analyzes the reliability of storage serving zones 226, 298, and 380. These zones are served by the Fir Street Tanks, Bush Tank 298, Elliot Tank 298, and Elliot Tank 380.

Scenario 4a – Zones 226, 298, & 380; 36-inch Main Offline

This scenario considers a loss of the 36-inch Main. Available sources are the Allison Wells and Kaiser Well. Table 9.15 presents the Scenario 4a evaluation results.

Sources are sufficient to meet demands in 2020. By 2026, sources are deficient by 0.1 mgd, and storage could supplement this shortage for 61.8 days. The source deficiency increases to 1.5 mgd by 2070, where storage could supplement sources for 4.6 days.

Table 9.15 Scenario 4a Results

	Year			
	2020	**2026**	**2040**	**2070**
Equivalent Residential Units (ERU's)	20,730	22,516	26,462	33,844
Projected Demand - Gallons per Day (gpd)				
Average Day	3,150,568	3,422,010	4,021,729	5,143,670
Winter Day	2,483,387	2,697,347	3,170,066	4,054,420
Evaluation of Existing Sources				
Available Existing Source (gpd)				
McAllister Wellfield (10,500 gpm)				
TW-22 (1,500 gpm)	0	0	0	0
PW-24 (2,900 gpm)	0	0	0	0
PW-25 (6,100 gpm)	0	0	0	0
Allison Well #19 (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well #13 (530 gpm)	763,200	763,200	763,200	763,200
Kaiser Rd. Well #1 (360 gpm) [3]	518,400	518,400	518,400	518,400
Total Available Source (gpd)	**2,577,600**	**2,577,600**	**2,577,600**	**2,577,600**
Source Surplus/(Deficiency)	**94,213**	**(119,747)**	**(592,466)**	**(1,476,820)**
Total Storage to Meet Supply Deficiencies (gallons) [6]				
Fir 226 (North)	2,500,000	2,500,000	2,500,000	2,500,000
Fir 226 (South)	2,500,000	2,500,000	2,500,000	2,500,000
Bush 298	965,563	965,563	965,563	965,563
Elliot 298	2,000,000	2,000,000	2,000,000	2,000,000
Elliot 380	2,560,087	2,560,087	2,560,087	2,560,087
Unavailable Storage (gal)				
Operational Portion	1,371,300	1,371,300	1,371,300	1,371,300
Fire Flow Requirement	960,000	960,000	960,000	960,000
Equalizing Portion	713,717	797,541	982,738	1,329,201
Total Available Storage To Supplement Sources	**7,480,632**	**7,396,809**	**7,211,612**	**6,865,148**
Days Storage Can Supplement Sources	**n/a**	**61.8**	**12.2**	**4.6**

Scenario 4b – Zones 226, 298, & 380; 36-inch Main and non-pH-optimized Wells Offline

This scenario considers a loss of the 36-inch Main and non-pH-optimized wells. The Allison Wells are the only available source for the zone grouping. Table 9.16 presents the Scenario 4b evaluation results.

Sources are deficient to meet demands by 0.4 mgd in 2020. Storage could make up for this deficiency for 17.5 days. The deficiency increases throughout the planning period to 2.0 mgd in 2070, where storage could supplement supplies for 3.4 days.

Table 9.16 Scenario 4b Results

	Year			
	2020	**2026**	**2040**	**2070**
Equivalent Residential Units (ERU's)	20,730	22,516	26,462	33,844
Projected Demand - Gallons per Day (gpd)				
Average Day	3,150,568	3,422,010	4,021,729	5,143,670
Winter Day	2,483,387	2,697,347	3,170,066	4,054,420
Evaluation of Existing Sources				
Available Existing Source (gpd)				
McAllister Wellfield (10,500 gpm)				
TW-22 (1,500 gpm)	0	0	0	0
PW-24 (2,900 gpm)	0	0	0	0
PW-25 (6,100 gpm)	0	0	0	0
Allison Well #19 (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well #13 (530 gpm)	763,200	763,200	763,200	763,200
Kaiser Rd. Well #1 (360 gpm) [3]	0	0	0	0
Total Available Source (gpd)	**2,059,200**	**2,059,200**	**2,059,200**	**2,059,200**
Source Surplus/(Deficiency)	**(424,187)**	**(638,147)**	**(1,110,866)**	**(1,995,220)**
Total Storage to Meet Supply Deficiencies (gallons) [6]				
Fir 226 (North)	2,500,000	2,500,000	2,500,000	2,500,000
Fir 226 (South)	2,500,000	2,500,000	2,500,000	2,500,000
Bush 298	965,563	965,563	965,563	965,563
Elliot 298	2,000,000	2,000,000	2,000,000	2,000,000
Elliot 380	2,560,087	2,560,087	2,560,087	2,560,087
Unavailable Storage (gal)				
Operational Portion	1,371,300	1,371,300	1,371,300	1,371,300
Fire Flow Requirement	960,000	960,000	960,000	960,000
Equalizing Portion	767,717	851,541	1,036,738	1,383,201
Total Available Storage To Supplement Sources	**7,426,632**	**7,342,809**	**7,157,612**	**6,811,148**
Days Storage Can Supplement Sources	**17.5**	**11.5**	**6.4**	**3.4**

Scenario 4c – Zones 226, 298, & 380; 36-inch Main, non-pH-optimized Wells, and Fir Street Tanks Offline

This scenario considers a loss of the 36-inch Main, non-pH-optimized wells, and the Fir Street Tanks. The Allison Wells are the only available source for the zone grouping. Table 9.17 presents the Scenario 4c evaluation results.

The source deficiency profile is identical to that in scenario 4c. However, the loss of the Fir Street Tanks reduces the ability for storage to meet demands. In 2020, available storage in this scenario can supplement supplies for 5.7 days. This reduces to 0.9 days by 2070.

Table 9.17 Scenario 4c Results

	Year			
	2020	**2026**	**2040**	**2070**
Equivalent Residential Units (ERU's)	20,730	22,516	26,462	33,844
Projected Demand - Gallons per Day (gpd)				
Average Day	3,150,568	3,422,010	4,021,729	5,143,670
Winter Day	2,483,387	2,697,347	3,170,066	4,054,420
Evaluation of Existing Sources				
Available Existing Source (gpd)				
McAllister Wellfield (10,500 gpm)				
TW-22 (1,500 gpm)	0	0	0	0
PW-24 (2,900 gpm)	0	0	0	0
PW-25 (6,100 gpm)	0	0	0	0
Allison Well #19 (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well #13 (530 gpm)	763,200	763,200	763,200	763,200
Kaiser Rd. Well #1 (360 gpm)	0	0	0	0
Total Available Source (gpd)	**2,059,200**	**2,059,200**	**2,059,200**	**2,059,200**
Source Surplus/(Deficiency)	**(424,187)**	**(638,147)**	**(1,110,866)**	**(1,995,220)**
Total Storage to Meet Supply Deficiencies (gallons) [6]				
Fir 226 (North)	0	0	0	0
Fir 226 (South)	0	0	0	0
Bush 298	965,563	965,563	965,563	965,563
Elliot 298	2,000,000	2,000,000	2,000,000	2,000,000
Elliot 380	2,560,087	2,560,087	2,560,087	2,560,087
Unavailable Storage (gal)				
Operational Portion	1,371,300	1,371,300	1,371,300	1,371,300
Fire Flow Requirement	960,000	960,000	960,000	960,000
Equalizing Portion	767,717	851,541	1,036,738	1,383,201
Total Available Storage To Supplement Sources	**2,426,632**	**2,342,809**	**2,157,612**	**1,811,148**
Days Storage Can Supplement Sources	**5.7**	**3.7**	**1.9**	**0.9**



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Chapter 10 - Transmission and Distribution Infrastructure

Transmission and distribution projects help meet the City of Olympia Drinking Water Utility's (Utility) Goal 6:

Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high-quality water to a growing community.

The 2021-2026 strategy for transmission and distribution projects is to develop and maintain storage and transmission/distribution infrastructure to ensure delivery of water at adequate pressure throughout the system and maintain required fire flow.

Other projects for improving the infrastructure are discussed in Chapter 8 (Source Infrastructure) and Chapter 9 (Storage Infrastructure). Water quality strategies are in Chapter 11, and operations and maintenance strategies are in Chapter 12.

This chapter describes the existing transmission and distribution systems, evaluates their ability to meet current and projected needs, and identifies projects to be constructed in 2021-2026. Washington State Department of Health (DOH) rules on storage facilities are in Chapter 173-160 WAC and Chapter 246-290 WAC, Part 3 (design of public water systems). Detailed specifications are in the DOH Water System Design Manual.

10.1 Existing Transmission/Distribution System

The Utility maintains an extensive system of piping, booster pump stations, and related facilities to convey water at sufficient pressures and appropriate flows to customers in seven pressure zones. Chapter 1, Map 1.4 shows the locations of pressure zones and key transmission and distribution system facilities. Figure 1.5 is a hydraulic schematic of the system.

The following tables summarize major transmission and distribution system components. Table 10.1 is an inventory of distribution piping, by pressure zone, size, and material. Table 10.2 is an inventory of equipment at each booster pump station, Table 10.3 is an inventory of backup generators for emergency power supply, and Table 10.4 is an inventory of pressure reducing valve (PRV) stations. Table 10.5 lists emergency interties the Utility maintains with neighboring utilities.

Table 10.1 Transmission and Distribution Piping Inventory

Diameter (in)	Ductile Iron (ft)	PVC (ft)	Asbestos Cement (ft)	Concrete (ft)	Cast iron (ft)	Galvanized iron (ft)	Plastic (ft)	Steel (ft)	Poly (PE) (ft)	HDPE (ft)	Unk	All Materials (ft)
Unk	946	167	0	0	0	0	0	0	1,486	0	129,673	132,272
<2	94	4,362	0	0	0	17,589	10,766	0	149,071	2,054	25,456	209,392
2	2,415	91,288	3,490	0	759	30,612	11,218	3	9,324	8,785	6,740	164,636
2.5	0	1,193	0	0	0	566	73	0	0	0	234	2,066
3	5	2,056	0	0	172	1,017	73	0	31	106	461	3,921
4	3,260	33,751	29,444	0	6,614	179	1,008	42	54	39	1,210	75,601
6	56,269	125,906	217,448	0	59,197	132	0	6	0	300	2,028	461,286
8	84,823	356,804	125,464	0	24,702	0	0	0	0	3,259	14,631	609,683
10	11,681	53,400	56,661	0	26,088	0	0	0	0	1,285	172	149,287
11	0	23	0	0	0	0	0	0	0	0	0	23
12	104,115	69,363	75,667	0	21,801	0	15	145	0	0	879	271,985
14	10	759	0	0	0	0	0	61	0	0	0	830
16	30,841	0	0	0	5,812	0	0	0	0	0	621	37,274
18	200	0	0	0	0	0	0	0	0	0	0	200
20	63	0	0	0	0	0	0	0	0	0	7	70
24	138	74	0	0	14	0	0	118	0	0	0	344
30	893	0	0	0	0	0	0	0	0	0	0	893
36	3,334	0	0	33,794	0	0	0	8,846	0	0	21	45,995
All Diameters	**299,086**	**739,147**	**508,174**	**33,794**	**145,161**	**50,094**	**23,153**	**9,221**	**159,967**	**15,828**	**182,132**	**2,165,757**

Note: The piping breakdown by size and material reflects piping in the City's GIS system as of December 2020.

Table 10.2 Booster Pump Station Inventory

Booster Pump Location	Pump Type	Pump Model	Pump Size (hp)	Installed Capacity (gpm)	Installed Capacity (Mgd)	Head (feet)	Install Date
Zone 417							
South Sound Booster Station	Centrifugal	PACO 16-50707-140101-190	50	1,000	1.44	139	2000
	Centrifugal	PACO Impeller Dia. 6.9	50	1,000	1.44	139	2000
	Centrifugal	PACO	50	1,000	1.44	139	2000
Total					3.38		
Fones Road Booster Station	Centrifugal	Weinman/Crane Model # 5L1-60P24-Y2DPCT Impeller Dia. 12.625 Motors: Baldor Duty Master	50	1,000	1.44	139	2017
	Centrifugal	Weinman/Crane Model # 5L1-60P24-Y2DPCT Impeller Dia. 12.625 Motors: Baldor Duty Master	50	1,000	1.44	139	2017
	Centrifugal	Weinman/Crane Model # 5L1-60P24-Y2DPCT Impeller Dia. 12.625 Motors: Baldor Duty Master	50	1,000	1.44	139	2017
Total					2.81		
Shana Park	Variable Speed Centrifugal	Johnston – 96J90009	125	1,000	1.44	270	1996
Zone 347							
Eastside Booster Station	Centrifugal	PACO	50	1,000	1.44	135	1988
	Centrifugal	PACO	50	1,000	1.44	135	1988
	Centrifugal	PACO	50	1,000	1.44	135	1988
Total					2.88		
Zone 380							
West Bay Booster Station	Centrifugal	Weinman/Crane pumps Model # 4LVM4SW750P62NSFUFC	75	1,000	1.44	220	2018
	Centrifugal	Weinman/Crane pumps Model # 4LVM4SW750P62NSFUFC	75	1,000	1.44	220	2018
	Centrifugal	Weinman/Crane pumps Model # 4LVM4SW750P62NSFUFC	75	1,000	1.44	220	2018
Total					3.46		
Zone 380							
Elliott Booster Station	Centrifugal	PACO	20	600	0.86	100	1977
	Centrifugal	PACO	50	1,000	1.44	100	1986
Total					2.30		
Goldcrest	Centrifugal	PACO	3	40	0.06	78	1994
	Centrifugal	PACO	5	90	0.13	78	1994
Total					0.19		
Booster Pump Location	**Pump Type**	**Pump Model**	**Pump Size (hp)**	**Installed Capacity (gpm)**	**Installed Capacity (Mgd)**	**Head (feet)**	**Install Date**
Zone 417							

	Centrifugal	Johnston – 96J5007	50	700	1.01	212	1996
Percival Booster Station	Centrifugal	Peerless – 5AE14	60	1,000	1.44	155	2009
	Centrifugal	Peerless – 5AE14	60	1,000	1.44	155	2009
	Centrifugal	Peerless – 5AE14	60	1,000	1.44	155	2009
Total					7.42		

Table 10.3 Backup Generator Inventory

Location	Address	Capacity (KW)	Tank Size (gal)	Generator ID/ Serial No.	Install/ Purchase Date
Meridian Storage Tanks	9621 Pacific Ave	80	125	B080154942	
Allision Springs Well	205 Delphi Rd	250	400	Portable #1428	1999
Elliott Booster Station	3700 20th Ave NW	40	275		
Maintenance Center	1401 Eastside St SE	2 units @ 60 each	100	Portable #1426 & Portable #1427	1999 1999
Fir Street Reservoirs	724 Fir ST SE	125	550		
South Sound Booster Station	808 Wier St SE	125	195	G090017881- Portable #1622	2009
McAllister Wellfield	10630 St. Claire cut off Rd SE	500	850		
Percival Booster Station	1125 Deschutes Pkwy SW	250	(2 tanks) 120+500		
LBA Tank	3355 Morse Merryman Rd			A180299494	
Fones Road Booster Station	3506 6th Ave SE			F170201310	

Table 10.4 Pressure Reducing Valve Inventory

Name	Type	Inlet Pressure	Discharge Pressure	Purpose
Yelm Highway	Cla-Val	95 psi	60 psi	Allows supply from Zone 417 into Zone 338 along Yelm Highway at reduced pressure.
Henderson Park Dr	Cla-Val	100 psi	55 psi	Allows supply from Zone 338 into Zone 264 at reduced pressure. It is on a 4-inch line and is of limited capacity.
Plymouth Street	Cla-Val	75 psi	50 psi	Allows supply from Zone 380 into Zone 298 at reduced pressure. Under normal conditions, the smaller 2-inch line supplies flow; the larger 8-inch line opens only during high-demand times.
Bowman Avenue	Cla-Val	80 psi	45 psi	Allows supply from Zone 380 into Zone 298 at reduced pressure. Under normal conditions, the smaller 2-inch line supplies flow; the larger 6-inch line opens only during high-demand times.
Elliot Avenue	Cla-Val	95 psi	65 psi	Allows supply from Zone 380 into Zone 298 at reduced pressure. Under normal conditions, the smaller 2-inch line supplies flow; the larger 8-inch line opens only during high-demand times.
26th Avenue	Cla-Val	95 psi	65 psi	Allows supply from Zone 380 into Zone 298 at reduced pressure. Under normal conditions, the smaller 2-inch line supplies flow; the larger 8-inch line opens only during high-demand times.
Cooper Point Road	Cla-Val	95 psi	50 psi	Allows supply from Zone 380 to feed water at reduced pressure (approximately the same as Zone 298) to Evergreen State College and other developments north of 20th Avenue.
Kenyon	Cla-Val	80 psi	45 psi	Allows supply from Zone 380 into Zone 298 at reduced pressure. Under normal conditions, 6-inch line opens only during high-demand times.
Cain Road	Cla-Val	105 psi	70 psi	Allows supply from Zone 417 into Zone 338 at reduced pressure. Under normal conditions, the smaller 2-inch line supplies flow; the larger 6-inch line opens only during high-demand times.
59th Court	Cla-Val	95 psi	60 psi	Allows supply from Zone 417 into 59th Court at reduced pressure. Supply is through a 4-inch line. When maintenance is necessary, supply is through a 2-inch maintenance line.
60th Court	Cla-Val	100 psi	60 psi	Allows supply from Zone 417 into 60th Court at reduced pressure. Supply is through a 4-inch line. When maintenance is necessary, supply is through a 2-inch maintenance line.
Capitol Way	Cla-Val	70 psi	40 psi	Allows supply from Zone 338 into Zone 264. Under normal conditions, the smaller 2-inch line supplies flow; the larger 6-inch line opens only during high-demand times.
Raft Hill	Cla-Val	90 psi	45 psi	Allows supply from Zone 298 into Zone 226. Under normal conditions, the smaller 2-inch line supplies flow; the larger 8-inch line opens only during high-demand times.
Fir St				Allows supply from Stevens field line off 36” transmission main into Zone 226.

Table 10.5 Existing Emergency Interties

Location	Pipe Size and Type	Intertie Utility, Size and Type
Sleater-Kinney Road NE and 6th Avenue NE	10-inch, AC	Lacey, 10-inch, PVC
Sleater-Kinney Road SE (near McDonald's)	12-inch, AC	Lacey, 12-inch, PVC
Sleater Kinney & Pacific Avenue	36-inch, CONC	Lacey, 6-inch, UNK
8002 Pacific Ave SE (Mt. Aire Booster)	10-inch, PVC	Lacey, 10-inch, PVC
Crosby Boulevard SW and Mottman Road	8-inch, AC	Tumwater, 8-inch, AC
Carlyon Avenue and Capitol Boulevard	10-inch, AC	Tumwater, 10-inch, CI
Seahawk & Pacific Avenue	36-inch, CONC	Thurston PUD, 12-inch PVC
4600 Martin Way	2-inch, PVC	Candlewood Water System, 2-inch, PVC

AC = Asbestos Cement

CI = Cast Iron

DI = Ductile Iron

CONC = Concrete

UNK = Unknown

Transmission System

A 36-inch diameter welded steel transmission line conveys water from McAllister Wellfield to the Meridian Storage Tanks. The pipe from the Wellfield to the McAllister Springs was constructed in 2013 and extends about 4,000 feet north from the Wellfield within a 60-foot-wide easement. The pipe crosses beneath the BNSF Railroad tracks in a 54-inch diameter steel casing, crosses under Old Pacific Highway within a 48-inch steel casing, and proceeds to the west where it connects to the existing steel pipe west of the Springs before terminating at the Meridian Storage Tanks. The pipeline from the Springs to the Meridian Storage Tanks was installed in 1949. The original pipe that was cut to make the connection with the new pipe from the Wellfield is in good condition. The coating on the inside and outside is in good shape. The cut steel looked almost new.

Water is then conveyed from the Meridian Storage Tanks into the Utility's distribution system via a 36-inch reinforced-concrete pipeline extending 37,750 feet (7.2 miles) to its terminus at the Fir Street Storage Tanks. The majority of this transmission line consists of the original pipe installed in 1949. The capacity of this pipeline, when operating as a gravity line, is approximately 22.7 million gallons per day (Mgd). The Utility is currently conducting a condition assessment of the pipeline which is scheduled to be completed in 2022.

There are numerous connections into the transmission line between the Meridian and Fir Street Storage Tanks. The largest connections are:

- One 12-inch intertie able to provide emergency water to the City of Lacey from the 36-inch main located at Pacific Avenue and Mountain Aire Road, west of Marvin Road through the Lacey pump station.
- One intertie able to provide emergency water to Thurston PUD No. 1 at the Tanglewilde and Thompson Place neighborhoods.
- Two 12-inch connections that feed the Fones Road and South Sound booster pump stations, which feed Zones 417 and 338.
- One 10-inch connection along Pacific Avenue that can serve the South Sound Shopping Center commercial complex in an emergency.

After passing into the Fir Street Storage Tanks, or through one of the connections listed above, water is then conveyed into the distribution system as described below.

Distribution System

Topography within the Utility's water service area varies in elevation from near sea level in the downtown area to 275 feet on the east side and 310 feet on the west side. As a result, seven major pressure zones have been developed to maintain adequate pressures throughout the service area. Below is a description of each pressure zone, including pumping, piping and storage; for locations, see Map 1.4 in Chapter 1.

Zones 417 and 338

These pressure zones serve the eastern and southeastern portions of the City, covering a large area ranging from the Yelm Highway area on the south to 26th Avenue Northeast on the north. They are bordered on the east by the City limits and on the west by Zones 347, 264 and 226, all of which are at lower elevations.

Zone 417 is served by the Hoffman Storage Tank and LBA Storage Tank. Zone 338 is served by the Boulevard Road Storage Tank. Ground elevations in Zone 417 vary from 150 to 277 feet above sea level, and in Zone 338 from 160 to 243 feet.

Supply to Zone 417 is through a 12-inch connection to the 36-inch transmission line at Pacific Avenue and Fones Road, and a 12-inch connection to the 36-inch main at Pacific Avenue and Weir Street. The Fones Road and South Sound Booster Pump Stations boost water into Zone 417 at these locations, respectively.

PRV stations at the intersection of Cain Road and 22nd Street, and at Yelm Hwy and Blvd Rd allow water to move from Zone 417 to Zone 338.

Zone 347

Zone 347 supplies water to the northeastern section of the City of Olympia, most of which lies north of Interstate-5. The zone is bounded on the northwest by Budd Inlet, on the southwest by approximately Central Street, on the east by Boulevard Road and South Bay Road, and on the north by the water service area boundary.

Water supplied to Zone 347 is normally pumped from the 36-inch transmission main through the Eastside Booster Pump Station into the Eastside Storage Tank. In an emergency, water can also be supplied from the 36-inch transmission main immediately prior to entering the Fir Street Storage Tanks. Gravity flow from the Eastside Storage Tank serves the zone with maximum pressures within the system established by the overflow elevation of 347 feet. The ground surface in Zone 347 ranges from 110 to 204 feet in elevation.

Zone 264

Zone 264 covers the South Capitol area of the City of Olympia. Capitol Lake is the western border, with the south and east boundary formed by Interstate-5. This area lies just south of the City of Olympia's central business zone, with the State's Capitol Campus on the north end, extending southward into residential areas.

The distribution system serving Zone 264 is composed of two distinct sectors, presently interconnected by a 10-inch diameter pipe and a PRV from the 338 Zone at Capitol Way at the I-5 Bridge and a PRV at Henderson. The smaller sector lies south and east of Interstate-5 and serves a low-density residential area adjacent to Watershed Park and the Olympia Public Works Department Maintenance Center. The larger sector is north of Interstate-5 and supplies water to the Capitol Campus area. The ground surface in Zone 264 ranges from 16 to 165 feet in elevation.

The water supply to Zone 264 is withdrawn from the 36-inch transmission main at the point where it enters the Fir Street Storage Tanks (Zone 226). Water flows by gravity through a 16-inch line, reduced to a 10-inch line to enter the smaller sector of the distribution network.

The Stevens Field Storage Tank (Zone 264) is filled directly from the distribution system. The hydraulic grade of the water entering Zone 264 at the Fir Street valve chamber is determined by the grade in the 36-inch transmission line. It is typically 280 to 290 feet at current rates of demand. Consequently, the Stevens Field Storage Tank water is used primarily during high demands, when localized distribution system pressures drop below the 264-foot overflow level.

Zone 226

The downtown central business area encompassed by Zone 226 has the lowest elevations within the entire system. This area is heavily commercial, with many businesses located near sea level along Budd Inlet and near the Port of Olympia. Numerous government and retail buildings are in this zone, as well as residential customers to the east and northeast. The elevation of the ground surface in Zone 226 varies from zero to 150 feet above sea level.

Water is delivered to this zone by gravity from the 36-inch transmission main to the underground Fir Street Storage Tanks. This site also houses a storage tank and booster pumps for Zone 347, the diversion valves for Zone 264 and a PRV at Fir Street. Additionally, backup water is feed to Zone 226 from Zone 298 through the Raft Hill PRV.

Overflow elevations of 226 feet for both storage tanks control maximum static pressure for this zone. Discharges from the storage tanks flow through 16-inch and 12-inch mains on 8th Street into the distribution network. There are several closed connections between Zone 226 and the adjacent pressure zones. In every case, emergency use of these interties would allow only one-way flow of water into Zone 226.

Zones 298 and 380

Almost all of the Utility's water service area west of Capitol Lake is within Zones 298 and 380. One exception is the portion of Zone 226 that rims the west side of Budd Inlet. There are residential and commercial customers in the two zones, with commercial water users concentrated along Harrison Avenue and between Harrison Avenue, Black Lake Boulevard and Cooper Point Road. The static hydraulic grade for Zone 298 is based on the 298-foot overflow elevation of the Bush and Elliott Storage Tanks. The Evergreen State College is the only west-side contract customer served from a 12-inch main through a pressure reducing valve extended along Kaiser Road on the northern end of Zone 298.

Zone 380 is served by the West Bay Booster Pump Station and the Elliott (380) Storage Tank. Zone 298 is served by Kaiser Well 1(emergency source) and Allison Springs Wells 13 and 19; PRVs from Zone 380; and the Elliott (298) and Bush (298) Storage Tanks.

There is sufficient pressure from the Elliott (380) Storage Tank to serve the higher elevated areas of the west side. The only exception is several of the higher homes in the Goldcrest subdivision and some homes in the Cooper Crest subdivision, which continue to be served from the Elliott Booster Pump Station.

10.2 Capacity Analysis

The ability of the existing transmission and distribution system to meet pressure and flow requirements under current and future demand conditions was evaluated for this Plan. This section presents the design criteria upon which the analysis was based, followed by a description of the hydraulic model calibration and a discussion of the evaluation results.

Design Criteria

To ensure that the transmission and distribution system is in compliance with state regulations for pressure during peak hour demand and during fire flows, the Utility uses these key design criteria:

- Minimum residual pressure in the system during peak hour demand, where all equalizing storage has been depleted and all sources are operating, is 30 pounds per square inch (psi) as required by DOH.

- Minimum pressure at the site of a fire flow during maximum day demand, where the volume of water used for fire suppression and equalizing storage has been depleted, is 20 psi. The zone-wide minimum for residual pressure during a fire flow event is also 20 psi, as required by DOH.
- Maximum head loss in any pipe is 10 feet per 1,000 feet of pipe, with the potential for this being exceeded during transient conditions (e.g., fire flow).
- A maximum of 20 homes may be connected to a looped 2-inch main (connected at both ends to the water system grid); a maximum of 10 homes may be connected to a dead-end 2-inch main where the length of pipe is less than 400 feet and fire hydrants are not required.
- The minimum pipe diameter is 6 inches for looped and 8 inches for dead-end lines where fire hydrants are required.
- Valve spacing distance is a maximum of 600 feet, and hydrant spacing is a maximum of 600 feet for single family and duplex homes and 300 feet elsewhere, in conformance with City of Olympia Development Guidelines.

The minimum fire flow goal is 1,000 gallons per minute (gpm) for residential areas during maximum daily demand. Fire flow goals vary depending on the type of construction and are building-specific in non-residential areas.

Hydraulic Model Calibration

The Utility has developed a hydraulic model using Bentley Systems' WaterCAD water system modeling software. First prepared in the mid-1990s, the model has been routinely used for system analysis and is often calibrated during Water System Plan updates. The accuracy of the model is also checked periodically during its use between times of formal calibration. The model is calibrated by comparing recent fire flow data and pressure checks throughout the distribution system to the model output. No detailed calibration of the hydraulic model was conducted as part of this Water System Plan update. This is because an extensive calibration effort was conducted in 2013, as part of the prior update. Minimal changes have occurred to the distribution system since then, and pressure checks have been done, as noted above. Therefore, the model was used in its existing state to support the system analysis for this Water System Plan update.
The 2013 calibration effort for the previous update to this Water System Plan consisted of obtaining field fire flow test data from 12 test sites, at least one in each pressure zone. During the field fire flow tests, static and residual pressure readings were taken from just upstream of the flowing hydrant and pressure readings were monitored at strategic locations within the tested zone. During the time of testing, the telemetry system was used to identify key system parameters, such as booster pump operational status and storage tank levels, for input into the hydraulic model.

Field results were then compared with modeled results to determine model accuracy. Results of the model calibration indicated that modeled static and residual pressures were within 5 psi of the observed pressures in all pressure zones. At three sites, the pressure difference was greater than 5 psi between the observed residual pressure and the modeled residual pressure; the static pressures were the same between the observed and the modeled data. One site in Zone 417 had a 7 psi difference; one site in Zone 226 had an 8 psi difference; and one site in Zone 380 had an 8 psi difference. The model did not match the field conditions for residual pressure in these cases. Other sites in these zones were well within 5 psi of the observed and modeled residual pressure differences. Upon further inspection, it was determined the sites chosen for the fire flows were not the best locations for truly representative flows and sufficient stresses on the system. Still, the pressure differences were less than 10 percent, so the Utility is satisfied the model is well calibrated. Table 10.5 summarizes the results of the model calibration.

Table 10.5 Model Calibration Data Summary

Location	Pressure Zone	Observed (Field) Data [1]			Model (Simulated) Data [2]		
		Static Pressure (psi)	Residual Pressure (psi)	Flow (gpm) [3]	Static Pressure (psi)	Residual Pressure (psi)	Flow (gpm)
Prestwick	417	95	91	1,501	95	84	1,501
Lister	417	110	58	1519	102	82	1519
Eagle Bend	338	64	58	1163	66	58	1163
Evanston	347	76	68	1178	79	68	1178
Columbia	264	77	70	1343	75	67	1343
Hearthfire	226	90	85	1424	90	77	1424
Schneider	226	95	80	1384	90	77	1384
East of Evergreen	298	58	50	1120	56	50	1120
29th Court	298	60	49	964	59	46	964
Arcadia	298	91	57	1087	87	57	1087
Fern	380	80	71	1138	76	67	1138
Hudson	380	60	50	979	60	42	979

1. As measured during field fire flow tests conducted on December 17 and 18, 2013.
2. Hydrant flows and system parameters (pump operations and storage tank levels) were input to match field conditions. Simulated pressures are based on modeling 2013 maximum day demands throughout the distribution system.
3. As calculated based on pitot pressure gauge readings.

Evaluation of Transmission/Distribution Capacity

To evaluate transmission and distribution system capacity, two types of analyses were conducted using the Utility's computer-based hydraulic model:

- Peak hour demand (PHD) conditions were analyzed to determine if the 30 psi requirement is met throughout the system.
- Fire flow simulations were performed under maximum daily demand conditions (MDD), to determine the quantity of flow available at a single point while maintaining a 20 psi minimum residual pressure zone-wide.

Both types of analyses were conducted at 2020, 2026 (6-year), and 2040 (20-year) demand levels, based on the water demand forecast in Chapter 3.

The demands for both types of analyses come from the demand forecast discussed in further detail in Chapter 3. For each analysis year, the total zone demand was globally distributed throughout each zone based on the total number of junctions in each respective zone. The demand per junction for average day demands (ADD), MDD, and PHD for each year is shown below in Table 10.6.

Table 10.6 Zone Junction Demands

	ADD, gpm			MDD, gpm			PHD, gpm		
	2020	2026	2040	2020	2026	2040	2020	2026	2040
Zone 226	1.34	1.47	1.76	2.49	2.73	3.25	4.20	4.58	5.42
Zone 264	1.24	1.37	1.65	2.31	2.54	3.06	4.19	4.57	5.40
Zone 298	1.31	1.44	1.72	2.43	2.67	3.19	3.97	4.35	5.19
Zone 338	1.06	1.13	1.15	1.97	2.09	2.13	3.36	3.57	3.63
Zone 347	1.11	1.19	1.21	2.06	2.20	2.24	3.48	3.69	3.76
Zone 380	1.35	1.48	1.76	2.50	2.74	3.26	4.15	4.53	5.37
Zone 417	1.61	1.77	2.10	2.99	3.27	3.90	4.86	5.31	6.31

Next, the largest customers and their demands were determined based on recent years' billing data. The top 15 customers where then allocated throughout the model based on each associated address. A mix of existing and new junctions were used to represent the largest customers in the model. In order to accurately reflect the zone demands, the demand from the largest customers were subtracted from the zone-wide demands before allocating them to individual junctions.

Table 10.7: Largest Customer Demands

Customer	Zone	Address
LOTT CLEAN WATER ALLIANCE	226	500 ADAMS ST NE
CITY OF OLYMPIA	264	1401 COLUMBIA ST SW
WASH-DEPT OF ENTERPRISE SERVIC	264	1400 CAPITOL WAY S
WASHINGTON-EVERGREEN STATE COL	298	2725 KAISER RD NW
MPT OF OLYMPIA CAPELLA LLC	298	3900 CAPITAL MALL DR SW
BENDER EQUITIES INC	298	3138 OVERHULSE RD NW
BREIT ACG MF WOODLAND LLC	298	800 YAUGER WAY SW
OCEAN FRONT-CAMBRIDGE LLC	380	2323 9TH AVE SW
OCEAN FRONT-CAMBRIDGE LLC	380	1100 FERN ST SW
EVERGREEN VISTA 1 OWNER LP	380	1209 FERN ST SW
NARDI, MATTHEW R TRUSTEE	417	1202 FONES RD SE
SISTERS OF PROVIDENCE IN WA	417	413 LILLY RD NE
COLONIAL ESTATES LLC	417	3700 14TH AVE SE
SISTERS OF PROVIDENCE IN WA	417	413 LILLY RD NE BLDG
SISTERS OF PROVIDENCE IN WA	417	413 LILLY RD NE #2 METER

Peak Hour Demand Conditions

In general, the distribution system is capable of maintaining pressures greater than 30 psi during peak hour demand, under both current and future demand conditions.

The only exception is a small portion of Zone 298 located just west of Ken Lake in the Park Drive area. Here, pressures drop to between 15 and 20 psi during peak hour demand affecting approximately 10 existing households. Each affected household has chosen to add its own booster pump to increase water pressures.

Since minimum pressure of 20 psi is provided for this existing system, an upgrade to the system in the area is not required. A large acreage above Park Drive was purchased by the City of Olympia for a park, therefore, no development in the area is anticipated to occur in the near future. As part of development occurring in the area south of Highway 101 on Kaiser Road, a pump station and storage tank will be required to address this deficiency.

Pressures along East Bay Drive, at the boundary of Zones 347 and 226, are currently at approximately 100 psi during peak hour demand conditions. The planned installation of a PRV station along East Bay Drive will allow for water to pass from Zone 347 to Zone 226 and will alleviate high pressure situations. This has been included in the 20-year Capital Improvement Program.

Fire Flow Conditions

In general, the distribution system is capable of providing required fire flows while maintaining residual zone pressures greater than 20 psi during maximum daily demand, under both current and future demand conditions. Of a total of approximately 3,125 nodes in the hydraulic model, less than five percent (168 nodes), are unable to provide sufficient fire flows while maintaining pressures greater than 20 psi. The majority of these nodes are located in areas where fire hydrants are not present, that is, on small (less than 4-inch diameter) mains or along the 36-inch transmission main where there are no services.

The only exceptions to this condition are in discreet areas within the western portion of Zone 264, where available fire flows are lower than required. This is a result of a hydraulic "bottleneck" in the transmission piping that conveys water from the 36-inch main into this pressure zone. To resolve this, the CIP includes a project to install a new 16-inch main roughly parallel to a 10-inch diameter portion of this water main. This will remove the limitation and result in sufficient flows to Zone 264.

The other exception is in a small portion of Zone 298 located just west of Ken Lake in the Park Drive area, where the fire flows are lower than required. As mentioned earlier in the Peak Hour Demand Conditions discussion, any future development, such as that in Kaiser Road south of Highway 101, a pump station and storage tank will be required to address this deficiency.

Available fire flows are sufficient along West Bay Drive and have been improved during high demand days with the addition of a PRV station that was installed at Raft Avenue near West Bay Drive in 2010. This allows water to flow from Zone 298 to Zone 226, supporting fire flows in this area.

10.3 Transmission/Distribution Projects

The transmission and distribution infrastructure projects planned for 2022-2041 will help meet the Utility's Goal 6:

> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high-quality water to a growing community.**

Objective 6A is to design and construct infrastructure to ensure reliable delivery of water.
Planned transmission/distribution projects will implement Strategy 6A2: Develop and maintain storage and transmission/distribution infrastructure to ensure delivery of water at adequate pressure throughout the system and maintain required fire flow. Chapters 8 and 9 describe source and storage infrastructure; Chapter 12 describes operations and maintenance of the infrastructure. Water quality strategies are in Chapter 11.

The projects described below are included in the 2022 - 2027 Capital Improvement Program (CIP) presented in Chapter 13. Project-level cost estimates have been prepared for each project. These costs and the anticipated implementation schedule for each project are presented in Table 13-2.

All projects will be designed according to the City of Olympia's Engineering Design and Development Standards.

The following project addresses the fire flow capacity problem identified the capacity analysis.

- **Eastside Street and Henderson Boulevard Water Main Extension**

  New 16-inch main to replace an existing 10-inch pipe that presents a bottleneck in the Zone 264 distribution system. The replacement line will connect to an existing 16-inch main at Eastside Street, where it originates as a tap off the 36-inch transmission main near the Fir Street Storage Tanks. The new line will then extend approximately 3,500 feet through the City of Olympia's Maintenance Center property, including a creek crossing, and across Henderson Boulevard, terminating at an existing 12-inch main that feeds a portion of Zone 264 west of Henderson.

Additional non-capacity related transmission and distribution system projects have been identified during development of this Water System Plan. The 2021 - 2041 Capital Improvement Program includes the following projects which include transmission or distribution needs associated with source or storage projects, as well as water system projects timed with other public works improvements, such as street upgrades. Many projects involve replacement of aging asbestos cement (AC) piping, which is brittle and more prone to failure than other types of pipe material.

- **Distribution System Oversizing**

  This project involves oversizing distribution pipelines associated with specific development-related improvements. Oversizing provides additional capacity to anticipate future needs that may be greater than at the time of development. Funds are applied to developer projects to cover the additional costs of oversizing.

- **Pressure Reducing Valves (PRVs) – East Bay Drive**

  Installation of PRV stations to reduce high pressures along East Bay Drive and allow water to flow from Zone 347 to Zone 226.

- **Fones Road Water Main Construction**

  Replacement of an AC water main in Fones Road from Pacific Avenue to 18th Avenue during planned roadway construction. This project reduces AC piping in the system and will provide cost savings when coordinated with the roadway project.

- **Indian Summer Extension to Rich Road**

  Installation of a water main, extending from the existing 12-inch main on Prestwick Lane by Indian Summer Well 20, southwest to the Bonneville Power Administration lines, then west along the power line access road to the existing 12-inch main on Rich Road.

- **Decatur 298 Zone Connection**

  Replacement of the water main from Evergreen Park Lane to 15th Avenue SW associated with the utility bridge at Percival Creek. The water main will be removed from the utility bridge and rerouted along Decatur Street.

- **Elliott Avenue Water Main Replacement**

  This project will replace a water main on Elliott Avenue in conjunction with a sidewalk construction project.

- **Additional Isolation Valves Installation on the 36-inch Main**

  The project will install seismically actuated isolation valves at various locations along the City's 36-inch transmission main. The seismic valves will isolate large volume of water in the pipe into discrete, smaller volumes to avoid loss of water and to reduce the potential of localized flooding and damage where breaks may occur. The project will mitigate the loss of essential services (potable and firefighting water) to residents and businesses that would result from a moderate or severe earthquake causing a failure to the City's transmission pipelines.

- **36-inch Main Condition Assessments and Enhancements**

  This project will complete a condition assessment of the 36" watermain that supplies water from the Meridian storage tanks and discharges into the storage tanks on Fir Street at Seventh Avenue.

- **Cardinal Drive Water Main Extension**

  This project will design and construct a drinking water main extension along Cardinal Drive. The project will allow the Utility to serve the Cooper's Glen apartment complex through a master meter. Currently, the apartment complex is served water through a deduct meter from the Evergreen State College system.

- **Zone 417 to 347 PRV Stations Installation**

  This project will improve water quality in the area and improve water circulation and redundancy in this region of the water distribution system.

- **AC and Aging Pipe Replacement**

  This project is an annual effort to replace substandard asbestos cement pipe throughout the City of Olympia. Each year, based on maintenance records, the Utility chooses which pipes to replace based on age and material. Currently 40 percent of the City's water system is comprised of AC pipe which is prone to leaking and breaks.

- **Distribution Main Condition Assessment**

  This project is part of the asset management program to assess the condition and reliability of the distribution mains, in order to prioritize repair or replacement.

- **PRV Telemetry (Radio-Based**)

  This project will enable data from the pressure reducing valves to be transmitted to the telemetry system by radio. Data such as upstream and downstream pressures and valve positions (opened or closed) will enable efficient and reliable operation of the valves and ensure that fire flow is available when needed.

- **New PRV Installations**

  This project will construct new PRVs throughout the water system based upon an evaluation of needs and alternatives to alleviate high pressure situations, support fire flows and to provide additional supply especially when storage is limited.

- **Small Diameter Water Main Replacement**

  This project is an annual effort to replace existing small diameter substandard water mains with larger diameter piping.

Chapter 13 lists additional developer-funded projects with schedules driven primarily by development-related activities: Kaiser Road pump station, storage tank and water main extensions; and main extensions on Cooper Point Road, Log Cabin Road, South Bay, and 26th Avenue.



Water Quality

Chapter 11

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CHAPTER 11 - WATER QUALITY PROGRAM

The primary responsibility of the Water Quality Program is to ensure compliance with federal and state drinking water regulations and to help meet the Drinking Water Utility's Goal 2:

Water is delivered at pressures required by the Washington State Department of Health and meets Safe Drinking Water Act standards.

This goal is consistent with the City's Comprehensive Plan Goal GU7 and Policy PU7.2.

Water Quality Program objectives for 2021-2026 are:

- Maintain 100 percent compliance with all state and federal monitoring requirements.
- Respond to customer water quality concerns promptly and maintain accurate records.
- Support the groundwater protection network by monitoring groundwater quality and levels.

The Water Quality Program has met or surpassed all state and federal drinking water regulations, including implementing the Stage 2 Disinfection By-Products, Groundwater, and Lead and Copper Revision Rules. The Water Quality Program is designed to maintain past program successes by continuing to meet all state and federal monitoring and treatment requirements.

11.1 Water Quality Regulations

Chapter 2 gives an overview of the current and proposed federal and state regulations under which the City operates. The rules governing drinking water quality, deriving from the federal Safe Drinking Water Act (SDWA), are especially complex and extensive. In Washington they are implemented by the State Department of Health (DOH). Regulations currently in effect are summarized in Table 11.1.

Table 11.1 Safe Drinking Water Act - Summary of Current Rules Affecting the City

SDWA Rule	Parameters Affected[1]	EPA Rule Publication Date and Location in Chapter 246-290 WAC
Monitoring – Source		
National Primary and Secondary Drinking Water Standards	Bacteriological, IOC, VOC, SOC, Asbestos, Radionuclides, THMs, Lead/Copper, Phase II/V	Phases I – V promulgated 1987 – 1992; Part 4, 300 - 320
Arsenic	Arsenic	February 2002, Part 4, 300 - 310
Groundwater Rule	Fecal indicators in groundwater	January 2007, Part 4, 300 – 320
Radionuclide Revision	Radionuclides	December 2000, Part 4, 300 - 320
The Fifth Unregulated Contaminant Monitoring Rule (UCMR)	Various contaminants considered for potential future regulations	UCMR 5 – December 2021 2012
Monitoring – Distribution System		
Phase II Rule	Asbestos	January 1991, Part 4, Part 4, 300 - 320
Revised Total Coliform Rule	Bacteriological	February 2013, . **78** FR **10269, Vol. 78, No. 30**
Stage 2 Disinfection By-Products (DBP)	TTHMs and HAA5	January 2006, Part 4, 300 – 320
America's Water Infrastructure Act (AWIA)	Over 30 programs affected with ongoing implementation	October, 2018
Revised Consumer Confidence Rule	Consumer Information	EPA Memorandum, January, 2013
Monitoring – Quality at the Tap		
Revised Lead and Copper Rule (LCR)	Lead and copper	January 2021 , Part 4, 300 – 320;
Administrative Requirements – Public Information		
Consumer Confidence Report Rule, Alternative Delivery Interpretative Memo	Compliance results, violations, and variances	January 2013, Part 7 Subpart B
Public Notification (PN)	Maximum contaminant levels exceeded	May 2000, Part 7 Subpart A

1. Inorganic chemical (IOC), Volatile organic chemical (VOC), Synthetic organic chemical (SOC), Total trihalomethanes (TTHMs), and Haloacetic acids (HAAs).

As shown, the rules cover two main areas, monitoring and public information. They include:

- Monitoring requirements
    - Water at the source for bacterial contaminants, organic and inorganic compounds and radionuclides.
    - Water in the distribution system for bacterial contaminants, chlorine residual, asbestos and the presence of disinfection by-products.
    - Water at the consumer's tap for lead and copper levels.
- Administrative requirements to notify the public of excessive contaminant levels and results of water quality testing.

Regulations and Revisions to be implemented 2021-2026

Since the 2015-2020 Water System Plan, new federal rules and rule revisions have come into effect: Final Revised Lead and Copper Rule, the PFAS Rule and the Fifth Unregulated Contaminant Monitoring Rule (UCMR 5), the Drinking Water Laboratory Data Report Rule (Lab Rule), and the American Water Infrastructure Act (AWIA). These rule changes and their implications for Olympia's Drinking Water Utility are discussed below.
Final Revised Lead and Copper Rule

In January 2021, the final Revised Lead and Copper Rule was promulgated. EPA has extended the effective date of this rule to receive further public input. The extension goes until June of 2021 and may be extended until December 2021.

Changes to the lead and Cooper Rule include:

- A new lead trigger level of 10ppm which effects new required Corrosion control studies or additional studies for systems who already have corrosion control and exceed the 10ppm
- New lead service line inventory identifying and categorizing all service lines before and after the water meter.
- Making the service line inventory available to customers.
- Creating a lead service line replacement plan, if necessary, based on the service line inventory.
- Required testing in schools and childcare facilities.
- New criteria for choosing sampling locations.
- Increased public notification of lead test results and annual notification to customers with lead service lines.

This rule will have a significant impact on the Water Utility. If the rule is finalized and adopted by December 2021, the Utility will prepare a compliance plan in early 2022, with implementation of the compliance plan expected to begin by mid- 2022. Depending on any changes to the rule that could occur after completion of this WSP, the Utility anticipates its first implementation task will be completion of a service line inventory.

Per-and Polyfluoroalkyl Substances Rule (PFAS)

Per-and Polyfluoroalkyl Substances (PFAS) are a family of chemicals that are in many consumer products, stain, water and nonstick coatings and certain types of firefighting foams. These chemicals are persistent in the environment and are found in the air, soil, and water. There is no current Federal maximum containment level for PFAS compounds, although EPA has begun rulemaking - see section 11.3. Because of the serious health concerns of PFAS, Washington State Department of Health set State Action Levels (SAL) for PFOA, PFOS, PFNA, PFBS, and PFHxS. The City will begin sampling in October 2023. This sampling requirement overlaps with the required PFAS sampling included in the UCMR 5 rule. This will help with staff time and sampling costs required by both rules.

New Fifth Unregulated Contaminant Monitoring Rule (UCMR 5)

The US Environmental Protection Agency (USEPA) uses the Unregulated Contaminant Monitoring (UCM) program to collect data for suspected contaminants present in drinking water for which no health-based standards have been set under the Safe Drinking Water Act (SDWA). Every five years, USEPA reviews the list of contaminants, largely based on the Contaminant Candidate List. The UCMR 5 requires all systems serving more than 10,000 people to conduct monitoring for 30 chemicals, including 29 PFAS Substances and 1

metal/pharmaceutical. The time frame for sampling is 2023-2025. The Utility will comply with the sampling and reporting requirements.

Drinking Water Laboratory Data Report Rule (Lab Rule)

DOH revised the Drinking Water Laboratory Data Report Rule to remove duplication of the Washington State Department of Ecology's (Ecology's) requirements for Accreditation of Environmental Laboratories, Chapter 173-50 WAC. The rule revision no longer applies to the technical capability of a lab to perform drinking water analysis and added reporting requirements to ensure consistent, reliable reporting of data. The rule was adopted in May 2018.

In November 2019 the Lab Rule was opened for rulemaking to included language and templates for test reporting and analysis for PFAS substances in correlation with the upcoming State PFAS Rule. The rule revisions should be finalized by the end of 2021.

America's Water Infrastructure Act (AWIA) (Continued Implementation)

In 2018 Congress passed the America's Water Infrastructure Act. This included major revisions to the Safe Drinking Water Act with more than 30 mandated programs. AWIA address improvements in drinking water and water quality, increases infrastructure investments, improves public health, and increases jobs which should help the economy. EPA has been tasked with implementing these changes and has started with tasking water systems with a population of more than 3300 to:

- Conduct a Risk and Resilience Assessment (RRA)
- Prepare or revise an Emergency Response Plan (ERP)
- Submit a certification letter upon completion to the U.S. Environmental Protection Agency (U.S. EPA) for each (RRA and ERP)
- Review, update, revise as necessary and submit a recertification for both at least every 5 years thereafter
- Maintain records (keep copies of RRA and ERP and any updates for 5 years after certification submittal)

EPA is also currently working on Amendments to the Emergency Planning and Community Right-to-Know Act, Water Infrastructure Improvements for the Nation (WIIN) Act Grant Program, and Asset Management and Capacity Development Strategies.

The Water Utility has completed the RRA and ERP and submitted the certifications of each by the required deadlines.

The City will continue to monitor the EPA's progress in implementing this Act and comply with the changes and new rules.

Future Regulations Under Development or Review

As of 2021, six regulations were still in proposed regulatory status: the Carcinogenic Volatile Organic Compound Rule, DOH Drinking Water Laboratory Data Report Rule, Fourth Unregulated Contaminant Monitoring Rule, Long Term Lead and Copper Rule, Perchlorate and Radon rules.

Carcinogenic Volatile Organic Compound (cVOC) Rule

In February 2011, EPA identified cVOCs as the first group of contaminants to be regulated as a group (up to 16 cVOCs), as opposed to one at a time under the agency's 2010 Drinking Water Strategy. The intent of regulating by group is to provide public health protection more quickly and to allow utilities to more effectively and

efficiently plan for improvement. The Rule is delayed into 2015 and potentially even later. The Utility will continue monitoring the development of this rule and sample accordingly.

EPA third six-year review

The Safe Drinking Water Act (SDWA) requires EPA to review each National Primary Drinking Water Regulation (NPDWR) at least once every six years and revise them, if appropriate. The purpose of the review, called the Six-Year Review, is to identify those NPDWRs for which current health effects assessments, changes in technology, and/or other factors provide a health or technical basis to support a regulatory revision that will maintain or strengthen public health protection.

EPA has completed the third six-year review and has determined that the following are a candidate for revision due to new available information: Chlorite, Cryptosporidium, Giardia lambia, Halo acetic Acids (HAA5) Heterotrophic Bacterial, Legionella, Total Trihalomethanes (TTHM) and Viruses (under the SWTR). This includes:

- Stage 1 and Stage 2 Disinfectants and Disinfection Byproduct Rules (DBPR)
- Surface Water Treatment Rules (SWTR)
- Interim Enhanced Surface Water Treatment Rule (IESWTR)
- Long Term 1 Enhanced Surface Water Treatment Rule (LT1)

The Utility will continue to monitor EPAs progress on revisions or new regulations.

EPA forth six-year review

EPA has begun the fourth Six-Year Review process. Throughout the Six-Year Review process, EPA will review and assesses new data, information and technologies and identifies NPDWRs which may be appropriate for revision. The Six-Year Review 4 results are anticipated to be completed in early 2023.

Chromium (Total/Hexavalent Chromium (under review)

EPA is still in the process of reviewing the human health impacts and deciding if Hexavalent chromium (chromium-6 needs its own MCL. Total chromium (which including chromium-6 and chromium-3) has an MCL of 0.1 mg/L. Chromium is an odorless and tasteless metallic element.

Chromium is found naturally in rocks, plants, soil and animals. Chromium-3 is an essential human dietary element. Chromium-6 occurs naturally in the environment from the erosion of natural chromium deposits. It can also be produced by industrial processes.

The Utility will continue to monitor the potential development of the MCL.

Perchlorate

USEPA was in the process of evaluating advice from the Science Advisory Board on approaches to derive a maximum contaminant level for perchlorate. In July 2020 EPA determined perchlorate does not meet the criteria for regulation under the SDWA. This decision was based on the best available science and steps EPA, states and public water systems have taken to reduce perchlorate levels.

America's Water Infrastructure Act (AWIA) Upcoming Actions

As EPA continues to implement this Act and the following rule and report will be next.

The Water System Restructuring Rule

This rule authorizes primacy agencies to mandate restructuring assessments for public water systems that frequently violate health-based standards. These systems are either unable to attempt or have attempted and failed to feasibly comply with the regulations. The rule must also deprescribe liability protection for the PWS that is consolidating with the failing PWS.

Small System Report to Congress

EPA is developing a report to congress that summarizes compliance with National Primary Drinking Water Regulations for public water systems (PWSs) serving fewer than 1,000 persons that have been identified as historically significant non-compliers (HSNCs).

Radon Rule

Radon exposure from drinking water is very small compared to radon in soil under homes. The proposed rule provides for a multimedia approach to address the public health risks from radon in drinking water and from indoor air, as well as setting a Maximum Contaminant Level (MCL) of 300 picocuries per liter (pCi/L). EPA is also proposing an alternative approach to complying with the rule by allowing a higher alternative MCL of 4000 pCi/L when accompanied by a multimedia mitigation program to address radon risks in indoor air. (This would apply if DOH chooses to develop an EPA-approved enhanced indoor air program.)

EPA withdrew the MCL proposal and reported to Congress in 2012. No new information is available on the EPA website.

11.2 Water Quality Program Activities

The primary activities of the Water Quality Program described in this section are:

- Monitoring
- Treatment
- Program management

Monitoring

The Utility performs monitoring for the purposes of compliance with federal and state requirements, surveillance of ambient groundwater quality, and ensuring reclaimed water disinfection.

Compliance Monitoring

The Utility routinely collects over 1,400 compliance samples a year to satisfy Safe Drinking Water Act requirements. This activity includes source monitoring and distribution system monitoring.

Monitoring frequencies for coliform, lead and copper, asbestos, disinfection byproducts, and chemicals (IOCs, VOCs, and SOCs) are done according to the most recent DOH Water Quality Monitoring Schedule.

All Olympia sources meet all primary MCLs. Exceedances associated with secondary MCLs for iron and manganese are discussed in the section titled *Water Quality Exceedances*.

Source Monitoring

Source monitoring includes sampling from the locations required by WAC 246-290-300 and to the schedule outline in the Code of Federal Registry (CFR) 40 and WAC 246-290-300, 310, and 320. Source monitoring includes both permanent and seasonal sources. The City is granted source monitoring waivers, where appropriate, based on low susceptibility to contamination. These waivers include:

- Three years for pesticides, and soil fumigants.

- Six years for VOCs.
- Nine years for IOC and herbicides.
- No monitoring required for dioxin, endothal, glyphosate, diquat and insecticides.

See Appendix 11-1 for the Triggered Source Monitoring Plan, Appendix 11-2 for the Coliform Monitoring Plan, and Appendix 11-3 for the Stage 2 Disinfection By-Products Monitoring Plan Lead and Copper Monitoring Plan.

Distribution System Monitoring

The water in the distribution system is monitored for total coliform, disinfectant residual, disinfection by-products (total trihalomethanes and haloacetic acids), alkalinity, and asbestos. Field readings for pH and temperature are also collected.

Coliform: The number of total coliform samples required is based on the population served. As required, the Utility collects a minimum of 80 distribution system samples monthly from dedicated sampling stations. Each week, 20-23 samples are collected throughout the distribution system. The distribution samples are chosen to represent each pressure zone and the far ends of the system. See Appendix 11-1, Triggered Source Monitoring Plan, for additional information regarding routine, repeat and special purpose sampling, a system sampling map, and a discussion of what constitutes a violation. The Utility has maintained compliance with the Total Coliform Rule since its inception.

Disinfection By-Products: The Utility monitors for disinfection by-products from two dedicated sampling locations. These locations were selected based on a 960-hour trace simulation using Bentley WaterGems hydraulic modeling software.

See Appendix 11-3 for additional information regarding this sampling.

Asbestos: About 25 percent of the City's distribution system is asbestos-cement pipe, which can contribute fibers under corrosive water conditions. Asbestos cement piping is gradually being replaced with ductile iron. The Utility collects one monitoring sample every nine years from sections of the distribution system where asbestos is most likely to be found. The next monitoring round will be in 2027.

Monitoring at the Tap

DOH currently requires monitoring at the tap for lead and copper at a frequency based on when a home was built (between 1982 and 1987) and if it has copper plumbing. The Resvised Lead and Copper Rule will require a service line materials inventory to be completed and sample locations will be chosen based on the service line materials. After installing aeration towers for McAllister Wellfield water the Utility returned to baseline lead and copper sampling completing 2 sets of 60 lead and copper samples 6 months apart. Due to low concentration of lead and copper the Utility is now on reduced monitoring consisting of 30 samples every 3 years. Monitoring results from 2019were below the action levels for both copper and lead, as shown in Table 11.2.

Table 11.2 Lead and Copper Monitoring, 2012 Results

Contaminant	Amount Detected	Range	Number of Sites Above Action Level[1]	
Copper	90% of the homes tested had copper less than 0.11 ppm	0.001-0.189 ppm	0	0
Lead	90% of the homes tested had lead less than 1 ppb	0-7 ppb	0	0

1.The action level for lead is 0.015 mg/L and 1.3 mg/L for copper. (When the concentration of a contaminant exceeds the "action level", treatment or other action by the water system is required.)

Groundwater Protection Monitoring

Groundwater monitoring is part of the Utility's Source Protection Program (Chapter 7). This monitoring tracks background aquifer water quality and groundwater level trends using samples from a network of monitoring wells, which are different from City production wells. See the current groundwater monitoring schedule in Table 11.3 for McAllister Wellfield, Table 11.4 for East Olympia, and Table 11.5 for West Olympia. Table 11.6 shows which monitoring wells have pressure transducer data loggers that continuously measure groundwater levels to track aquifer capacity and the effects of pumping and drought.

The City has three groundwater monitoring networks:

- McAllister Wellfield (S16)
- East Olympia for Shana Park Well 11 (S10) and Indian Summer well 20 (S12)
- West Olympia for Allison Springs Well 13 (S09) and Well 19 (S11)

Sample results show little to no increase in nitrate levels below the City's goal of 5mg/L in the Shana Park area. All other sample results for volatile organics, inorganic chemicals, synthetic organic chemicals, and herbicides are non-detectable or well below the maximum contaminant level for all three networks. See Chapter 7 for more information about the Utility's groundwater monitoring networks.

Table 11.3 Sampling Schedule for McAllister Wellfield DWPA Monitoring Well Network

Owner Name	Quarterly Sampling Events[1]
	Nitrate
City of Olympia, MW-2S	1,3
Private, Peterson, MW-Pete	3
Private, Troche, MW-Troc	3
Private, St. Clair Vistas, MW-StCl	3
City of Olympia, McAllister Wellfield	1,3,4

Scheduled as follows: 1 = 1st Quarter (January – March), 2 = 2nd Quarter (April-June), 3 = 3rd Quarter (July – September), 4 = 4th Quarter (October-December).

Table 11.4 Sampling Schedule for East Olympia DWPA Monitoring Well Network

Owner's Name	Quarterly
	Nitrate
City of Olympia, Indian Summer Well 20, S12	3,4
City of Olympia, Shana Park Well 11, S10	3,4
City of Olympia, MW-25	3
City of Olympia, MW-26	3
City of Olympia, MW-27	3

1. Scheduled as follows: 1 = 1st Quarter (January – March), 2 = 2nd Quarter (April-June), 3 = 3rd Quarter (July – September), 4 = 4th Quarter (October-December).
2. Collect isotope samples twice a year for two years and then re-evaluate the need to continue.

Table 11.5 Sampling Schedule for West Olympia DWPA Monitoring Well Network

Owner Name	Quarterly Sampling Events[1]
	Nitrate
City of Olympia, MW-18	3
City of Olympia, MW-22	1,3
City of Olympia, MW-23	1,3
City of Olympia, MW-24	3
City of Olympia. MW-28	1,3,4
City of Olympia, Allison Springs Well 13 (S09)	1,3,4
City of Olympia, Allison Springs Well 19 (S11)	1,3,4

Scheduled as follows: 1 = 1st Quarter (January – March), 2 = 2nd Quarter (April-June), 3 = 3rd Quarter (July – September), 4 = 4th Quarter (October-December).

Table 11.6 Continuous Groundwater Level Monitoring Network

Owner Name	DWPA
City of Olympia, MW-2D	McAllister Wellfield
Nisqually Tribe, MW-17	McAllister Wellfield
City of Olympia, MW-25	East Olympia
City of Olympia, MW-26	East Olympia
City of Olympia, MW-27	East Olympia
City of Olympia, MW-18	West Olympia
City of Olympia, MW-22	West Olympia
City of Olympia, MW-23	West Olympia
City of Olympia, MW-24	West Olympia
City of Olympia, MW-28	West Olympia

Reclaimed Water Monitoring

The City shares responsibilities for compliance with requirements of Ecology's reclaimed water permit issued to the LOTT Clean Water Alliance (which includes Lacey, Olympia, Tumwater and Thurston County). The two primary water quality issues are ensuring adequate cross connection control and maintaining a detectable amount of chlorine residual. Because the City owns the pipeline that provides reclaimed water to the Port of

Olympia, monitoring for detectable total chlorine residual is required monthly during the irrigation season. Also, an annual inspection of both the south and north reclaimed water pipelines is done by the City's Cross Connection Control Specialist to verify no cross connections have occurred. See Chapter 6 for details on the City's Reclaimed Water Program.

Analytical Services

Following are the certified water quality laboratories the City uses for biological and chemical testing and analysis. In case of an emergency or for after-hours services, Dragon Analytical Laboratory is used for both bacteriological and chemical analysis.

Bacteria and Nitrate Testing Laboratory

Thurston County
County Courthouse Building 1
2000 Lakeridge Dr. SW
Olympia, WA 98502
360.867.2631
360.589.3674 after hours

Chemical Testing Laboratory

Edge Analytical Laboratory
1620 S Walnut
Burlington, WA 98223
800.755.9295
360.757.1402 fax

Water Quality Exceedances – Iron and Manganese

The City has excellent water quality when it comes to meeting primary drinking water standards that affect health. There are also secondary drinking water standards, which cover things like iron and manganese. The presence of iron and manganese in the drinking water is from minerals naturally occurring in the groundwater. The secondary standard is exceeded at two Olympia wells, creating aesthetic concerns such as taste, odor and staining on fixtures, but there are no health concerns.

The Hoffman Well 3 (S08) is a seasonal source and rarely used due to high levels of iron (0.4 mg/L – 0.89 mg/L) and manganese (0.103 mg/L – 0.162 mg/L). If it were to become a permanent source, treatment would be required.

The Kaiser Well 1 (S03) is an emergency source and was physically disconnected from the water system on June 23, 2015. It also has iron above the secondary MCL of 0.3 mg/L (0.65 mg/L).

Treatment

The City provides mandatory and optional treatment to its sources, as described below. Table 11.7 summarizes current and future treatment methods of chlorine disinfection and aeration for corrosion control.

Table 11.7 Treatment Equipment and Types

Location	Equipment	Treatment Type
Allison Springs Well 13 (S09) and Well 19 (S11)	• Chlorine injection • Chlorine analyzer • pH meter	• Chlorine gas • Aeration tower
Indian Summer Well 20 (S12)	• Chlorine Injection • Chlorine analyzer • pH meter	• Chlorine gas to be installed in 2022
McAllister Wellfield (S16)	• Chlorine injection • Chlorine analyzer • pH meter	• Chlorine gas • Aeration towers at Meridian Storage Tank site
Shana Park Well 11 (S10)	• Chlorine injection • Chlorine analyzer • pH meter	• Chlorine gas • Aeration tower

Aeration – Corrosion Control – Water Quality Parameter Optimization

The City is required under the Lead and Copper Rule (LCR) to sample for lead and copper at selected tap sites throughout the distribution system. The City has been in compliance with the LCR since 1996 when the Utility installed aeration treatment at Allison Springs Well 13 (S09) and Well 19 (S11) and Shana Park Well 11 (S10). The purpose of aeration is to remove carbon dioxide gas dissolved in the water, thereby increasing the pH and reducing copper corrosion.

In February 2011, DOH notified the Utility that because of a change in category under the LCR, Olympia's water system is now designated as a large system (i.e. it provides water to over 50,000 customers). This change requires optimal water quality parameters on sources with treatment. This means the Utility needs to operate all of its aeration treatment facilities so the pH will be "optimized" and be above 7.0. This keeps the water from being corrosive and leaching lead and copper from plumbing systems. System-wide optimization for corrosion control is also desired. The City submitted data to DOH for Allison Springs Well 13 (S09) and Well 19 (S11) and Shana Park Well 11 (S10). A minimum pH of 7.0 is assigned as the optimal water quality parameter for the entry points at these wells.

As part of the McAllister Wellfield corrosion control study, Kaiser Well 1 (S03) and Indian Summer Well 20 (S12) were also evaluated by the engineering firm of Gray and Osborne. The results showed that Indian Summer Well (S12), with a relatively high pH of approximately 7.6, is already above the 7.5 pH target for the distribution system and is considered optimized for corrosion control. Kaiser Well 1 (S03) produces water with a low pH at 6.4 – 6.6 and must be treated. The study indicates the target pH in the distribution system of 7.5 or greater is expected. DOH approved the corrosion control study (ODW Project #13-0611) in August 2013.

The Utility compared the life-cycle cost of aeration towers and adding caustic soda at the Kaiser Well (S03). Given the high capital, operational and maintenance costs of treatment, and the low production capacity (360 gpm) of the well, the City designated it as an emergency source and will leave it untreated.

Disinfection with Chlorine Gas

The Utility is using chlorine disinfection at all active production wells to prevent a reduction of the distribution system chlorine residual. Shana Park Well 11 (S10),is the only production well required to show a chlorine residual of 1.07 mg/L to achieve a contact time (CT) of six or greater.

As mentioned above under Water Quality Exceedances, water from Hoffman Well 3 (S08) contains iron and manganese at concentrations exceeding secondary MCLs. In 2007, a pilot test was conducted using a trailer-mounted pilot-scale filtration plant at the well, using pyrolusite (manganese oxide) as the filtration media. Iron dropped from 0.46 mg/L to 0.13 mg/L (a 73 percent removal rate) while manganese dropped from 0.15 mg/L to 0.015 mg/L (a 95 percent removal rate). See Chapter 13 for scheduled installation of iron and management treatment removal.

Program Management

Water quality program management includes responding to complaints, generating reports and keeping records.

Responding to Customer Complaints

Typically, the Water Quality Program receives about 20 complaints a year, primarily reports of sediment in the water, low pressure, and taste and odor concerns.

The Water Quality Specialist responds to water quality complaints. Depending on the nature of the complaint, other Utility staff may respond, such as the Water Quality Monitoring Assistant, the Cross Connection Control Specialist or Water Operations staff.

Water quality complaints are investigated by phone or field visits, and the collected information is entered into the Utility's Water Quality database. The field response includes measuring pH, temperature and chlorine residual. If illness is suspected, staff collects a bacteriological sample and suggests that the customer call his/her primary health care provider.

Record Keeping and Reporting

Water quality and operational records are maintained according to WAC 246-290-480 and 485, as shown in Table 11.8. All records bear the signature of the operator in charge of the water system or the operator's representative. These records are available for inspection by DOH and will be sent to DOH if requested. Records are kept digitally on paper, or both depending on the data.

Reports are submitted as required by WAC 246-290-480(1)(a) and summarized in Table 11.9. Most records are kept in hard copy, although water quality results are kept in both hard copy and electronic format. Records entered into the Water Quality database are backed up each night.

Table 11.8 Record Keeping Requirements

Type	Frequency	Description	Other
Three-year retention cycle			
Chlorine residuals	Daily	SCADA system records data on flow, pH, chlorine residual and temperature of sources.	Manual readings of pH, temperature and chlorine residual taken as part of coliform distribution system sampling and entered into the Water Quality database.
Other information as specified by DOH	N/A		
Other operational or analytical records	N/A		
Public Notices and Certifications	N/A	In response to violations of primary drinking water standards, including Tier 1 violations or DOH orders. Tier 1	Public notices are kept electronically, and a hard copy filed in the DOH file located in the Water Quality office.

Type	Frequency	Description	Other
		violations are those that can cause acute illness, a waterborne disease outbreak or inadequate treatment. Tier 1 violations require notification to the public within 24 hours.	
Violations of primary drinking water standards	N/A	Records of actions taken by the City to correct the violation, including any public notifications.	
Water treatment performance	Daily	Includes type and quantity of chemicals used, amount of water treated and results of analyses.	
Five-year retention cycle			
Bacteriological analysis	Monthly	Laboratory results are entered into the Water Quality database.	At the end of each calendar year, all bacterial analyses slips are archived. The destruction date is labeled on each box.
Invalidation of groundwater source sample	N/A		
Lowest residual disinfectant concentration	N/A	Record the date and duration of any failure to maintain DOH-prescribed minimum residual disinfectant concentration for more than four hours.	
Ten-year retention cycle			
Source meter readings	Monthly		
Sanitary survey or special purpose investigation reports	Once every five years or as needed	An on-site review of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of water system to produce and distribute safe drinking water.	Reports are kept in a fireproof file cabinet.
Minimum disinfection residual	N/A	DOH specified minimum disinfection residual.	
Corrective action	N/A	Record of each corrective action taken that is associated with a primary drinking water standard. This includes any related public notifications.	
Other			
Project reports, construction documents, inspection reports and related drawings	In perpetuity	A document that describes why a project is being proposed and includes engineering design calculations showing how the project will meet its objectives.	Project reports and construction documents are retained and archived through the Public Works Engineering department.
Monitoring Plans	N/A		Keep for the same period of time as the records of analyses taken under the plan are required to be kept for bacteriological or chemical parameters.

Table 11.9 Reporting Requirements

Type	Requirement	Description
Bacteriological	Monthly	Notify DOH within 10 days of being notified by the laboratory of coliform positive results and by close of business when notified by the laboratory of fecal coliform or *E. coli* positive results. If the purveyor is notified of the results after normal close of business, purveyor to notify DOH before the end of the next business day.
Correction Action	30 days	Notify DOH within 30 days of completing correction action(s).
Disinfection residual	Monthly	Report monthly samples taken as part of total coliform distribution monitoring.
Lead and Copper	Semi-annual	Submit daily pH readings for Allison Springs and Shana Park Corrosion Control Facilities and quarterly alkalinity and manual pH reading from the distribution system.
Monitoring waivers	During each monitoring cycle or as directed by DOH	In 2012, DOH updated its model for granting organic waivers and applied monitoring waivers to all eligible sources.
Primary violation that is a Tier 1	24 hours	Notify DOH of any Tier 1 violation: • Distribution system sample violation when fecal coliform or *E. coli* are present. Failure to test for fecal coliform or *E. coli* after initial total coliform distribution system sample tests positive. • Nitrate, nitrite or total nitrate and nitrite maximum contaminant level violation or failure to take a confirmation sample. • Waterborne disease outbreak or other waterborne emergency. • Detection of *E. coli*, enterococci, or coliphage in a groundwater source sample. • Other violations or situations determined by DOH.
Primary violation that is not Tier 1	48 hours	Notify DOH of failure to comply with any national primary drinking water regulation, including failure to comply with monitoring requirements.
Reports	Monthly	Chlorination reports due before the tenth day of the following month (Shana Park).
Reports	Biannual	Water quality parameter report (LCR compliance). Due January 10th and July 10th of each year for the preceding six-month monitoring period.
Source meter readings	Made available to DOH upon request	SCADA system readings are imported into the Water Quality database.
Water Rights	Annually	By the 31st of January annual production numbers for Allison Springs, Shana Park and Indian Summer Wells must be entered into the Ecology database. Daily aquifer levels for Indian Summer well and monthly aquifer levels from the wellfield wells must be sent to Ecology.
Water Facilities Inventory Form	Update annually and within 30 days of any changes	A form summarizing characteristics of the water system.

11.3 Emerging Issues

This section addresses several issues that will affect the City's Water Quality Program during 2021-2026:

- Water quality impact of the future Briggs Well water
- Water quality impact of the future Brewery Wellfield water
- Elevated nitrate in Shana Park Well 11 (S10)

Water Quality Impact of Future Briggs Well

Water quality from a test well drilled at Briggs Village indicates the aquifer contains manganese in concentrations at or above the recommended secondary MCL. Because the City has secured adequate water rights from other sources to meet supply needs for at least 50 years, the timing to develop the Briggs Well is uncertain. Ecology recently approved extending the Notice to Construction for a third time, until July 1, 2024. During this planning period, the Utility will further evaluate the timing for developing this well (see Chapter 4).

Water Quality Impact of Future Brewery Wellfield

RH2 Engineering, Inc. was retained by the three cities of Tumwater, Lacey and Olympia to evaluate the infrastructure and assess the water quality of the wellfield at the former Olympia Brewery. The first evaluation phase of this project was completed in November 2012 and included water quality testing and assessment of the need for water quality treatment. See Chapter 4. The Utility anticipates no impact to Olympia's water quality from the Brewery water.

Nitrates

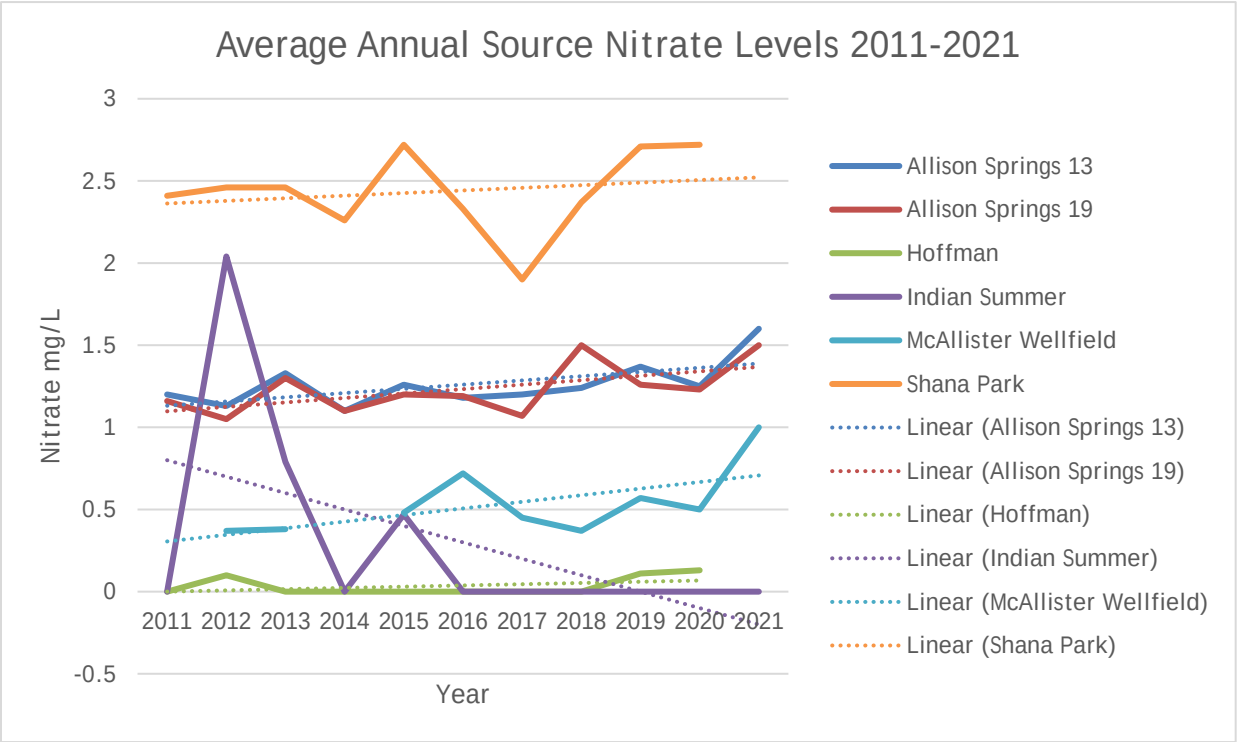
The Utility is required to sample all source wells annually for nitrates. Additional nitrates are collected at surrounding groundwater monitoring wells and some sources. Figure 11.1 shows the last 10 years of nitrate data for the source wells. All of the wells are below the 5mg/L goal the Utility has set for itself. Shana Park Well #11 has the highest average nitrate levels while Hoffman Well #3 has the lowest. All wells, with the exception of Indian Summer Well #20, have increased in nitrate levels over the last 10 years. See Chapters 4 and 8 for additional information about the Utility's current project to drill a pilot well at LBA to investigate a possible relocation of the Shana Park Well #11.

The Utility will continue to monitor nitrates at the sources and corresponding monitoring wells.

Changing Lead and Copper Rule

Two changes to the Lead and Copper Rule include the Lead and Copper Rule Revisions (LCRR) and the Lead and Copper Rule Improvements (LCRI). The first part of the LCCR is the Lead Service Line Inventory (LSLI). The City is currently working on this requirement and has hired a consultant to assist with compliance with the rule by October 15, 2024. The EPA is currently working on the Lead and Copper Rule Improvements and are anticipating finalizing the rule by October 2024. See Section 11.1 for additional information. Changes to the Lead and Copper Rule are expected to require the Utility to conduct a lead service line inventory and make the inventory available to customers, among other requirements. If the rule is finalized and adopted by December 2021, the Utility will prepare a compliance plan in early 2022. See Section 11.1 for additional information.

Figure 11.1 Source Nitrate Trends



Per and Polyfluoroalkyl Substance Rule (PFAS)

Because of the serious health concerns of PFAS, the Washington State Department of Health decided to regulate PFOA, PFOS, PENA, PFBS and PFHxS by setting State Action Levels. See Section 11.1 for additional information.

In March 2023, EPA proposed a National Primary Drinking Water Regulation (NPDWR) to establish a legally enforceable MCL for six PFAS contaminants. These include PFOP, PFAS, PENA, HFPO-DA, PFHxS and PFBS. EPA anticipates finalizing this rule by the end of 2023. The Utilty will continue to monitor this rule development and come into compliance when required.

11.4 Water Quality Projects

The project listed below is included in the 2021-2026 Capital Improvement Program (CIP) presented in Chapter 13. Project-level cost estimates and the anticipated implementation schedule for each project are in Table 13-2.

- Replace the Indian Summer Well on-site chlorine generation system with a more reliable hypochlorite system (2022)
- Shana Park water quality study

An additional project is included for implementation after 2020:

- Design and construction of hypo-chlorination and iron/manganese removal for the Hoffman Well (S08)



Operations & Maintenance

Chapter 12

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Chapter 12 - Operations and Maintenance Program

The primary role of the City of Olympia Drinking Water Utility's (Utility) Operations and Maintenance (O&M) Program is to operate and maintain the infrastructure that extracts water from groundwater sources, stores it for future use, and transports the water through the distribution and delivery system to Utility customers. The O&M Program is also responsible for the maintenance of all reclaimed water lines inside the City of Olympia.

The O&M Program helps meet the Utility's Goal 6:

> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high-quality water to a growing community.**

The program also implements City of Olympia Comprehensive Plan Goal GU7.

Objectives for improving the infrastructure are discussed in Chapter 8 (Source Infrastructure), Chapter 9 (Storage), and Chapter 10 (Transmission/Distribution Infrastructure). Water quality strategies are in Chapter 11, and Chapter 6 addresses the Reclaimed Water Program. O&M Program objectives for 2021-2026 are to:

- Continue to improve the maintenance management program, including preventive maintenance, repairs, and replacements.
- Continue to improve the emergency response program and maintain facility security.
- Continue to improve O&M program management, including safety and asset management.

Priorities for 2021-2026 include more fully developing the asset management program, completing Automatic Meter Reader (AMR) implementation, bringing leak detection in-house and continuing to meet Level of Service Standards (LOS).

12.1 Operations and Maintenance Regulations

The O&M Program is guided by a number of state regulations. Details on the Utility's compliance with operator certification requirements and other applicable regulations are presented below.

Operator Certification

The Washington State Department of Health (DOH) requires that all "Group A Community" and "Non-transient non-community" water systems have a certified operator. Certifications are mandatory for staff members who are in direct charge of a public water system or major segments of the system, and who are responsible for monitoring or improving water quality. (See Chapter 70.119 RCW and Chapter 246-292 WAC.)

DOH requires mandatory certification as shown in Table 12.1.

Table 12.1 Mandatory Certifications

Position	Classification
Water Operations Supervisor	Water Distribution Manager (WDM) 4
Pump Stations Supervisor and Water Purveyor	WDM 4, Water Treatment Plant Operator (WTPO) 1
Water Operations Lead Workers	WDM 3
Water Quality Specialist	WTPO 1
Water Monitoring Specialist	WTPO 1

A WTPO 2 certification will be required should the Utility install iron or manganese treatment (Chapter 11, Section 11.2).

The Utility supports certification on a voluntary basis of individuals interested in the Water Distribution Manager (WDM), Cross Connection Specialist (CCS) and Backflow Assembly Tester (BAT) classifications. These voluntary certifications demonstrate staff incentive and competence and are an index of the professionalism and expertise available to efficiently operate the Olympias water system.

The Utility currently meets the certification requirements for the size and complexity of its water system. Table 12.2 lists Utility staff with mandatory certification requirements and their certification status. Table 12.2 will be updated as needed to reflect current staff with mandatory certification requirements. Although not listed in Table 12.2, additional Utility staff have also obtained various levels of certification on a voluntary basis.

Table 12.2 Water Operations and Water Quality Staff Water Certifications

Name	Certification Number	State Certification	Mandatory Certification
Cole, Jeremy	10219	WDM 4, CCS, WTPO 1,	X
Curley, Daisy	11502	WTPO 1	X
Larson, Jacob	11740	WDM 4, CCS, BAT	X
Main, Ed	10739	WDM 2, WTPO 1	X
Norton, Dave	7875	WDM 3, CCS	X
Reimers, Cheri	9485	WDM 4, CCS, WTPO 1	X
Vessey, Mike	7809	WDM 4, CCS, WTPO 1	X
Witt, Ken	10319	WDM 3, CCS,	X
Woods, Eric	10802	WDM 4, WTPO 1	X

Acronyms: WTPO=Water Treatment Plan Operator, WDM=Water Distribution Manager, BAT=Backflow Assembly Tester, and CCS=Cross Connection Specialist.

Other Regulations

Chapter 246-290 WAC, Part 5 contains detailed regulations covering operations and maintenance, system reliability, emergency response, and metering. The Utility's compliance with these regulations is described in the following section.

As required by Chapter 246-294 WAC, the Utility maintains a Drinking Water Operating Permit for the water system.

The City of Olympia Municipal Code (OMC 13.04) gives the Utility the legal authority to implement and enforce a Cross Connection Control program. Specific requirements are in the City of Olympia's Engineering and Development Standards (EDDS).

12.2 O&M Program Activities

The O&M Program is the most publicly visible component of the Utility, with staff in the field operating and maintaining water storage facilities, pumping equipment, valves, pipes, hydrants, and meters.

O&M staff visually inspects or uses telemetry to remotely monitor critical system components; provide routine maintenance, repair, and replacement services; maintain accurate system maps and records; and develop and test the Utility's Emergency Response Plan. In addition, O&M staff makes sure there is adequate water volume to meet fire protection and peak flow needs, thereby maintaining system reliability, performance, and water quality.

The Program manages:

- Seven water supply sources (McAllister Wellfield, five production wells and one emergency well)
- Six booster pump stations (Fones, South Sound, Eastside, Percival, Elliott, Westbay)
- 12 storage tanks
- Over 430 miles of transmission and distribution pipe
- Approximately 3,000 fire hydrants
- Approximately 12,000 valves
- Approximately 21,000 service connections (as of 2020)

In addition to maintenance management, activities include reclaimed water system management, cross connection control, emergency response, and program management to address safety issues, asset management, and upgrading and replacing service meters.

Maintenance Management

The O&M Program currently uses a straightforward, subjective assessment of service levels related to the program's core functions, such as hydrant maintenance, valve exercise, pipe flushing, new service installations, and maintenance of pump stations, source facilities and water meters. The staff is organized into two crews: one responsible for supply, storage, and pump station maintenance; and one responsible for the transmission and distribution system piping.

Supply, Storage and Pump Station Maintenance

The pump station staff is responsible for all pump stations and other mechanical equipment and facilities at the supply sources and storage tanks (Chapter 8 and Chapter 9). The following activities are described in this section:

- General building and grounds maintenance.
- Electrical repair and maintenance.
- Exercise, flushing and inspection of equipment.
- Scheduling of equipment maintenance.
- General maintenance, repair or replacement of parts or equipment.
- Interior tank cleaning (supported by contractors).

- Inspection, scheduling, and repair of treatment equipment (that is, chlorine pumps, injector, analyzers, and pressure regulators) and changing out chlorine tanks.
- Telemetry alarm checks, repairs, loading programs, re-calibration, upgrades.

Preventive maintenance is scheduled. Breaks are fixed immediately. Equipment is replaced when it becomes unreliable.

Transmission and Distribution System Maintenance

The distribution system staff is responsible for maintaining the pipes that make up the transmission and distribution systems (Chapter 10). The Utility currently contracts leak detection activities but is considering purchase of its own detecting and assessing equipment for the system. Detection efforts indicate the occurrence of very few leaks. Most leaks are associated with hydrant bleeders and valve packing, all of which have been repaired. The O&M Program will evaluate the frequency of future leak detection efforts. See Chapter 3, Section 3.2 for an explanation of how the Utility accounts for leakage in forecasting future demand. See Chapter 5, Section 5.2 for the role of controlling leakage in the conservation program.

Maintenance activities are described below for:

- Valves
- Service lines and Sample Stations
- Hydrants
- Water meters

Preventive maintenance is done on a schedule. Breaks and other problems are immediately fixed. Replacements occur on a limited basis.

Valve Maintenance

Distribution system staff exercise and flush the system's approximately 12,000 valves on a three-year cycle. The staff is also responsible for installing new valves and handling general maintenance and replacement activities.

Preventive maintenance is based on a rotating schedule by area. Breaks and other problems are immediately fixed.

Service Line Maintenance

Water distribution staff is responsible for abandoning, installing, replacing, repairing, and relocating service lines. Service line maintenance is a low priority and only becomes a high priority when breaks and other service losses occur; these issues are immediately addressed. This group also installs new sampling stations and replaces old ones when requested by Water Quality Program staff.

Hydrant Maintenance

The water distribution staff is responsible for flushing, exercising, installing, raising/adjusting, replacing, or relocating the system's approximately 3,000 hydrants. The flushing schedule is once every three years. Preventive maintenance is a high priority to avoid leaks and breaks, and to make sure the hydrants are functional for firefighting.

Water Meter Maintenance

Meter readers in the Water Operations Section, with assistance from the distribution crew as needed, are responsible for installing, maintaining, and replacing meters. The Water Distribution crews work annually to

replace up to 1,000 aged meters to ensure accurate readings. Water distribution crews also respond to after-hours customer service calls for turning meters on and off. Preventive meter maintenance is rarely done. Breaks and other problems are immediately fixed when reported. The Meter Reading system is an Itron AMR system where 90 percent of meters are read via a fixed network and the remaining 10 percent are read via a mobile system.

Reclaimed Water System Maintenance

The water distribution staff is responsible for initial flushing of all reclaimed water lines at the beginning of the irrigation season, re-painting valve box covers, and making any needed line repairs. See Chapter 6 for additional information regarding the Utility's reclaimed water system and program.

Cross Connection Control

Cross connection control is needed to ensure the potable drinking water system is protected from potential back siphonage and backpressure, from the customers' point of service. Staff continued with efforts outlined in the 2009 Water System Plan and further refined in the 2015 Water System Plan to improve enforcement and annual testing. An evaluation of remaining unprotected 2009 Water System Plan Table 9 High Health Hazard Premises identified 75 facilities needing premises isolation. One need remains:

- Replacing backflow management software allowing testers to input their own results into the software program.

By the end of 2020, all known 2009 Water System Plan Table 9 facilities had achieved premises isolation, and annual testing reached 97 percent.

OMC 13.04 gives the Utility the legal authority to implement and enforce a Cross Connection Control Program. This authority includes requiring regular inspections and testing on all backflow assemblies within the City of Olympia's jurisdiction. Any device found not functioning properly must be promptly repaired or replaced; otherwise, the Utility may deny or discontinue water service to the premises.

The City of Olympia EDDS outline the specific requirements for cross connection controls for new construction and remodels.

The Utility's *Cross Connection Control Procedures Manual* (Appendix 12-1**)** provides details on how the program is implemented, including hazard evaluations, notification activities, inspections, testing and repairs.

Emergency Response

A variety of emergencies may threaten the Utility's ability to deliver safe and reliable drinking water. The purpose of emergency response planning is to identify specific response actions to be taken during an emergency that will maintain quantity and quality of water, protect employees, minimize disruption to the public and preserve property. To continuously improve staff knowledge, processes and procedures, staff from throughout the Utility participate in periodic emergency "table-top" exercises of a region-wide, city-wide or utility-wide scale.

Emergency Response Plan

The Utility's Emergency Response Plan (ERP) was updated concurrently with this Water System Plan to be consistent with America's Water Infrastructure Act (AWIA) of 2018 requirements. Under the AWIA, the Utility was required to complete a Risk and Vulnerability Assessment (RRA) by December 2020 and to complete a revised emergency response plan taking into account the findings of the RRA by June 30, 2021. In addition to being consistent with the findings of the December 2020 RRA, the ERP follows an "all hazards" approach to emergency planning. This means that whatever the emergency might be, the same formula, outlined in the ERP, is used to respond. The ERP was developed using the Incident Command (IC) structure to ensure smooth communication between the Utility and the City of Olympia's Emergency Operations Center. The ERP also provides details on the Utility's internal and external communication procedures, threat evaluation, replacement equipment, chemical supplies, employee safety protocols and returning to normal operations. For a complete list of ERP components, see the ERP Table of Contents (Appendix 12-2). The ERP itself contains 14 appendices, including a priority customer list, emergency contact list, equipment inventory, hazard analysis, water quality reporting forms, and critical facility schematics and operational specifics. Also contained in ERP appendices are:

- **Contingency Plan** to supply water from other sources if a water supply needs to be abandoned or temporarily shut down.
- **Water Shortage Response Plan** if water supplies become limited due to a contamination event (Chapter 5, Section 5.2).
- **Spill Response Plan** for responding to immediate or short-term threats.

The ERP outlines details of the Contingency, Spill Response and Water Shortage Plans, so staff can be prepared to maintain water supply to customers if one or more supply sources should be lost or some other major infrastructure failure occurs. Each plan is described below.

In addition to the ERP, a field guide was developed to provide quick and practical direction to field staff on how to respond to a variety of emergency situations. Because of its sensitive nature, the field guide and several sections of the ERP are not publicly available. The Utility's Water Purveyor maintains these documents.

In addition to maintaining planning documents, the Utility has prepared in the following specific ways for an immediate, short-term or long-term event that might impact a Utility water supply:

- Drinking Water Utility ERP and IC system in place, including the ability to communicate with first responders during spill events.
- Trained staff ready to respond, with clear understanding for the ERP, the IC system, and their roles during emergencies.
- Working relationships with first responders within DWPAs and participation on the Local Emergency Planning Committee (Table 12.3).
- Mutual Aid Agreement in place with Fort Lewis for spill response, and mutual aid and inter-tie agreements in place with the City of Tumwater and Thurston PUD No 1 to receive emergency water if needed (Chapter 4).
- Protocols in place for isolating the potentially contaminated source, sampling the source to determine levels of contamination, and modeling and evaluating a contaminant plume.
- Arrangements for environmental monitoring support from all potential first responders.
- System in place to communicate with customers about the event, risks and actions the Utility is taking.

Contingency Plan

A water supply could be lost due to contamination of a water source or damage to a source or transmission line due to natural events like an earthquake or human-caused threats. To prevent contaminants from reaching a supply source, it may be necessary to stop pumping operations until corrective actions can be completed. Under extreme circumstances, the Utility may need to permanently abandon or temporarily shut down a source because of source contamination. The Utility successfully secured approval from the Washington Department of Ecology (Ecology) to transfer McAllister Springs and Abbott Springs water rights to the new McAllister Wellfield, which went on-line in 2014. This action greatly reduced the vulnerability of the City's main water source since the McAllister Wellfield is more protected than the McAllister Springs.

Contamination risks are described in Chapter 7. Hazardous material spills or discharges can result in contamination of a single well or an entire wellfield. Loss of supply at McAllister Wellfield through a source or supply wells would not have as dramatic an impact. However, if loss occurred during peak season, some curtailment would be needed.

The Utility's Level of Service (LOS) standard for system reliability is to maintain capacity to meet winter demand (inside water use only) with loss of the largest water source, with the largest water source defined as the McAllister Wellfield. Currently the winter demand is approximately 5.2 million gallons a day. To determine if the Utility could meet its system reliability LOS standard, a Reliability Analysis was conducted as a component of this Water System Plan. This Reliability Analysis found that without the McAllister Wellfield, there is sufficient source capacity system-wide to meet winter demands through 2026. By 2040, sources remain sufficient to meet demands system-wide, with the addition of the Briggs Well source. See Section 9.4 for additional information on the Reliability Analysis, including results by pressure zone. The Reliability Analysis shows that this standard is within the Utility's current and planned capacity (Chapter 3). See Section 12.3 for more on Levels of Service.

Standby (or emergency) storage in each pressure zone provides some system reliability (Chapter 9). The Utility's reliability LOS standard requires supply capacity in addition to this storage capacity. Also, interties with the cities of Lacey and Tumwater plus with Thurston PUD No 1 can provide water during an emergency under certain conditions.

Water Shortage Response Plan

If necessary, in the event of loss of water supply, the Utility could implement the Water Shortage Response Plan (Appendix 5-2) for complete curtailment of all outside and non-essential water use, a strategy that would still allow customers to meet basic needs for consumption, sanitation and general commerce, depending upon level of source unavailability (see Section 9.4 for additional information). The restriction on outdoor water use would need to be strictly enforced to ensure that indoor uses are not affected.

The Water Shortage Response Plan establishes procedures to follow if curtailment is required and outlines four progressive levels of curtailment: advisory, voluntary, mandatory, and emergency.

Spill Response Plan

Although contingency planning is designed to address longer-term impacts from water supply contaminating events, by default it also provides tools for responding to immediate or short-term threats. Thus, through the ERP, the Utility has companion emergency incident and spill response procedures in place to minimize impact to the Utility's water supplies. A critical component of emergency response is solid relationships and effective communication with neighboring and regional partners, particularly with respect to the Utility's DWPAs, since some DWPAs extend beyond Olympia city limits (Chapter 7, Section 7.3).

The existing mutual aid agreements, multi-jurisdictional response planning coordination, and multi-agency response capabilities are important tools in planning for and responding to emergency incident and spill events.

Incident Response Example – Transportation Spills

As an example of implementing incident response, transportation spills of hazardous materials are rated as "high" in the Utility's contaminant source inventories (Chapter 7, Section 7.4, Appendix 7-1, Appendix 7-2, and Appendix 7-3). Risk from transportation spills is most threatening to the Allison Springs Well 13 (S09) and Well 19 (S11), Indian Summer Well 20 (S12), McAllister Wellfield (S16), and the planned Briggs Well (Table 7.2).

First response to spills that occur along transportation corridors is the responsibility of the Washington State Patrol, in coordination with local fire districts and Ecology. The Washington State Patrol acts as IC for all jurisdictions when a spill occurs on a transportation route. Because the Utility's DWPAs are located both within and outside Olympia city limits, local response to spills may be under the jurisdiction of the Olympia Fire Department and other fire department(s) or fire district(s). For example, Thurston County Fire District 3 (Lacey), District 6 (East Olympia), District 9 (McLane) and the Tumwater Fire Department all have a potential role in local emergency management planning and spill response in DWPAs outside the Olympia's boundaries. The address or location of the incident reported to Thurston County's 911 Emergency Dispatch Center usually determines the jurisdictional authority.

First Responder Jurisdictions

Table 12.3 indicates the jurisdictions that could potentially be designated as the "first responder" for each of the Utility's DWPAs located within and outside of Olympia city limits.

Table 12.3 Spill Response First Responder Jurisdictions

Olympia Supply Source	First Responder Jurisdictions
McAllister Wellfield (S16)	Washington State Patrol – Incident Command (IC) Fire District No. 3 – Lacey
Shana Park Well 11 (S10)	Washington State Patrol (IC) Fire District No. 3 – Lacey Fire District No. 6 – East Olympia
Indian Summer Well 20 (S12)	Washington State Patrol (IC) Fire District No. 3 – Lacey Fire District No. 6 – East Olympia
Hoffman Well 3 (S08)	Washington State Patrol (IC) Olympia Fire Department Fire District No. 3 – Lacey
Briggs Well (planned)	Washington State Patrol (IC) Olympia Fire Department Tumwater Fire Department
Allison Springs Well 13 (S09)	Washington State Patrol (IC) Olympia Fire Department Fire District No. 9 – McLane
Allison Springs Well 19 (S11)	Washington State Patrol (IC) Olympia Fire Department Fire District No. 9 – McLane
Kaiser Well 1 (S03)	Washington State Patrol (IC) Olympia Fire Department Fire District No. 9 – McLane
State and Federal Highways and Railroads	Washington State Patrol (IC)

Operations and Maintenance Program Management

Program management activities include developing and implementing Standard Operating Procedures (SOPs), conducting an employee safety program, developing an asset management program, planning to upgrade and replace service meters and planning for energy efficiency upgrades.

Standard Operating Procedures

SOPs are reviewed and updated every three years. For the most critical activities, these SOPs provide detailed steps on completing the activity, including safety and health considerations.

SOPs were also developed for reclaimed water, dealing with such issues as startup procedures, inspection and testing of backflow devices, and identifying unauthorized connections. Each Operations and Water Quality vehicle contains a binder with up-to-date copies of the SOPs, Emergency Action Plans (EAPs) and Fall Protection Plans. The Water Resources Director, Water Purveyor and Water Operations, Pump Stations and Engineering and Planning Supervisors also have copies of these documents in their offices.

Safety Program

The Utility has an active safety program guided by the City's Safety Coordinator. A safety committee meets monthly to monitor and discuss ways to improve safety. The committee reviews accidents or near misses as well as new training opportunities and regulations. Monthly trainings for staff are given by either the Safety Coordinator or an experienced outside professional. Some of the training topics include:

- Personal protection equipment
- Flagging
- Cranes, hoists and rigging
- Fall protection
- Lock out procedures
- Confined space procedures
- Respiratory protection
- Handling asbestos
- Chlorine systems

The Utility has developed an action plan to ensure implementation of the Public Works Department's *Employee Safety and Health Handbook*. The action plan identifies priority elements of the handbook which are routinely discussed at staff meetings. Material Safety Data Sheets for chemicals used are located next to the safety bulletin board, along with safety and first aid equipment. The Standard Operating Procedures include protocols for fall protection and safely dealing with such hazardous tasks as handling asbestos pipe and changing chlorine cylinders.

Asset Management

During the last planning period, the Utility hired the consulting firm HDR Engineering, Inc. to help identify the next steps for the Utility to develop a more comprehensive approach for managing its infrastructure assets. The resulting *Asset Management Strategy*, October 8, 2014, included a review of the Utility's current asset management business processes and the immediate, near-term and long-term actions the Utility could take to continue to develop and refine its asset management program.

Since 2014, the Utility has completed fundamental foundational tasks in implementing an Asset Management Program, including:

Infrastructure Mapping: All Utility assets have been included in the City's GIS mapping system.

Risk of Failure: Beginning in 2015, the Utility began using its GIS mapping system to evaluate the risk of failure for various system assets. In the case of buried assets (e.g. pipes, valves), the evaluation takes into account an asset's age, size, material type and location (proximity to arterial roadways, structures, associated soil acidity, depth to groundwater, ground slope and zoning type) to determine an asset's risk of failure. Buried assets are evaluated and condition rated when they are exposed for repair, replacement, or extension. Exposed infrastructure (e.g. pumps, reservoirs) are evaluated based on factors such as condition, age and maintenance records. Reservoir interiors are inspected and cleaned on a 5-year cycle. The Utility uses the results of its evaluation process during capital facility plan development to ensure the Utility is focusing on replacement of its highest-risk assets.

Workorder Software: In 2019, the Utility implemented the use of CityWorks software for work order and asset management. CityWorks allows for scheduling of regular preventive maintenance, documenting of work performed, and recording of condition information each time an asset is accessed for inspection or repair. The condition information gathered through CityWorks is then used by Utility staff to further evaluate and prioritize infrastructure renewal and replacement needs.

Useful Life and Renewal and Replacement Costs: In 2021, the Utility estimated effective useful life and renewal and replacement costs for pipes, hydrants, services, reservoirs, and pump stations. To estimate

effective useful life, the Utility used American Water Works Association (AWWA) estimated effective life guidelines compared against asset installation dates. Renewal and replacement costs were then derived for each asset class using Olympia-specific estimated unit costs for renewal or replacement costs. The resulting preliminary forecast of 50-year renewal and replacement needs has been considered during this water system planning process and will continue to be refined in the future.

While the Utility has made much progress to date, the Utility will continuously refine its asset management program in the future. Additional information about planned asset management program implementation activities can be found in Appendix ES1 Plan Implementation, Staffing and Monitoring.

Meter Program

The Utility has two full-time staff who read approximately 20,000 meters and perform other meter related service work. Approximately 98 percent of meters are read and billed bi-monthly, while the remaining two percent (typically larger accounts) are read and billed monthly.

Energy Efficiency

The Utility recently contracted with an Energy Savings Company (ESCO) through the State Department of Enterprise Services Energy Savings Performance Contracting (ESPC) program to perform a preliminary energy audit of our water facilities. Recommendations for energy savings measures included optimization of well and booster pump station operations. This is done with in-house staff any time a new facility is put into service, or an existing facility is upgraded. Additionally, the Utility will seek to incorporate energy efficiency into future capital improvement projects for both new facility designs, as well as existing station rehabilitation projects.

12.3 Summary of O&M Deficiencies

The Utility no identified OM deficiencies for the planning period.

12.4 O&M Recommendations

During this planning period Olympia will focus on continuing to develop our asset management program, conducting emergency “table-top” exercises and post emergency debriefings, and addressing distribution system leakage (DSL) to keep our 3-year DSL rolling average under 10 percent.



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Chapter 13 - Capital Improvement Program

The City of Olympia Drinking Water Utility (Utility) uses the Capital Improvement Program (CIP) to plan strategically for investments in capital projects over a 20-year planning horizon. As part of the budgeting process each year, the Olympia City Council adopts a Capital Facilities Plan which describes the projects and anticipated funding needs for the next 6-year planning horizon and appropriates funds for the upcoming year.

The City of Olympia defines a capital project as a structure, improvement, piece of equipment, land or other major asset that has a useful life of at least three years and a project cost that exceeds $5,000. In some instances, therefore, projects included in the CIP may be funded through the Utility's operating budget.

The Capital Improvement Program helps meet the Utility's Goal 6:

> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high-quality water to a growing community.**

This chapter describes the methodology used in developing the CIP and presents the costs and schedules for projects planned for implementation in 2022-2041 (and including projects that started in 2021 or earlier). Other projects are described for which schedules are primarily dependent on the timing of future development. The Utility considers this CIP as it prepares its list of capital projects for incorporation into the annually updated and adopted City of Olympia Capital Facilities Plan.

13.1 Development of CIP

To develop the CIP, Utility staff first identified projects that address water system needs or deficiencies. These projects were then prioritized through a formal evaluation process. Generally, projects of higher priority were scheduled for implementation within the six-year planning horizon. Cost estimates for these projects were then developed and escalated to the anticipated year of implementation. Each of these steps is described below.

Project Prioritization

The Utility developed a protocol to systematically compare and prioritize the wide range of potential capital projects. The protocol provides a consistent basis for characterizing the benefits from capital projects, comparing projects, and documenting the reasons why certain projects are selected for funding. The Utility then used this protocol in a workshop attended by staff responsible for various Utility functions to refine the list of projects to be included in the CIP.

The prioritization process considered eight criteria, intended to address the primary benefits provided by typical Utility capital projects. Each criterion has an associated scoring system used to calculate a project priority score. In addition to the raw scores, each of these criteria was weighted. This allowed some criteria to more strongly influence how projects were selected and prioritized.

The eight criteria and the weights selected during the priority-setting workshop are shown in Table 13.1.

Table 13.1 Project Prioritization Criteria

Criteria	Weight
Regulatory Requirements and Binding Commitments	10
Reliability/Protection of Prior Investments	8
Cost Control or Cost-Sharing Opportunities	7.5
Safety and Security	7.5
Growth/Expansion	5
Environmental Stewardship	4
Water Quality (non-regulatory)	3
Information Benefits	3

The results of the prioritizing process were then reviewed by Utility management, along with an assessment of other information including potential impacts on the Utility's finances, to finalize the schedule of capital projects included in the 2022-2041 CIP.

Cost-Estimating Methodology

Total project-level cost estimates have been developed for each capital project included in the 2022-2041 CIP. Many cost estimates were generated during development of the 2015 Water System Plan, and have been escalated to 2021 values, according to the Engineering News Record (ENR) cost indices. For newly developed project cost estimates, each cost includes the following components:

- **Base construction cost.** Includes all labor and material costs needed to construct a project.
- **Construction contingency.** Considers the uncertainties associated with estimating project costs at this planning level, calculated as 25 percent of the total of base construction plus sales tax.
- **Design engineering.** Includes City and consultant design costs, and other related costs, such as permitting and construction administration. For most projects, this is calculated as 25 percent of the base construction cost. However, for projects with more complex design or permitting needs, a higher percentage of the base construction cost is used.

These elements are summed to determine the total project-level cost estimate for a project, expressed in July 2021 dollars. Where applicable, design and construction costs are depicted spanning multiple years, to reflect the phasing typically used for larger projects.

13.2 2022-2041 Planned Projects

The Utility has identified capital projects planned for implementation between 2022 and 2041. In addition, potential projects with schedules driven primarily by development-related activities have been identified.

Table 13.2 presents the schedule of CIP projects planned for implementation between 2022 and 2031. Descriptions of each project are organized by project type. Developer-contributed projects are not included in this table, as they will not require City funding; they are described in the narrative project list. While projects which were worked on in 2021 have been included in Table 13.2, project narratives have not been provided for projects that were completed. Additionally, project totals do not include year-2021 costs.

The year 2022 projects received appropriations from the Olympia City Council through the adopted 2022-2027 Capital Facilities Plan, while all other projects reflect future needed appropriations. The Utility will

consider the CIP shown in Table 13.2 as it prepares its list of capital projects for incorporation into the annually updated and adopted City of Olympia Capital Facilities Plan. It is through the Capital Facilities Plan that the appropriations needed to implement the CIP are approved. Map 13.1 depicts approximate project locations.

The largest projects included in the first six years of the CIP (2022-2027) are:

- Boulevard Road Reservoir Rehabilitation Construction
- Eastside Reservoir Reconstruction
- Fones Road Water Main Construction

In addition to these and other capital projects, the CIP includes significant investment in ongoing rehabilitation and replacement of system assets such as small diameter water mains, and aging and asbestos cement piping. Specific project decisions for these annual programs are made through the Utility's Asset Management Program.

Table 13.2 2021-2031 Capital Improvement Program

Code	Project Name	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Subtotal 2022-2031	Subtotal 2032-2041	Subtotal 2022-2041
Water Source (WS)															
WS-1	Briggs Well Development			100	1,600								1700	0	1700
WS-2	McAllister Wellfield Mitigation – Deschutes River Basin	20	75	40	40	40	40	40	40	40	40	40	435	400	835
WS-3	Wellhead Protection Program Capture Zone Refinement												0	200	200
WS-4	Groundwater Monitoring Wells	61	200	10									210	0	210
WS-5	Olympia Brewery Source Engineering Analysis and Development		400										400	0	400
WS-6	Indian Summer Well Chlorination System Replacement	21	50							609			659	0	659
WS-7	Hoffman Well Treatment Facility Construction											500	500	3100	3600
WS-8	McAllister Domestic Replacement Well	10	115										115	0	115
WS-9	Deschutes Watershed Restoration		166										166	0	166
WS-10	Sole Source Aquifer Designation			50									50	0	50
WS-11	Shana Park Well VFD Replacement		130										130	0	130
WS-12	Allison Well VFD Replacement			190									190	0	190
WS-13	Rancho Serino Mitigation		50										50	0	50
WS-14	McAllister Wellfield Phase 2												0	3000	3000
Water Storage (ST)															
ST-1	Hoffman Court Reservoir Reconstruction										250	3100	3350	3200	6550
ST-2	Boulevard Road Reservoir Rehabilitation Construction	8	4000	50									4050	0	4050
ST-3	Eastside Reservoir Reconstruction						435	4500	2000				6935	0	6935
ST-4	Elliot Reservoir (380 Zone Tank) Evaluation			18									18	0	18
ST-5	*Telecommunications Feasibility Analysis		24										24	0	24
N/A	Elliot Avenue Reservoir Seismic Retrofits	518	10										10	0	10
N/A	Fir Street Reservori Seismic Retrofits	1400	10										10	0	10
Transmission and Distribution (TD)															
TD-1	Distribution System Oversizing		30	30	30	30	30	30	30	30	30	30	300	300	600
TD-2	Pressure Reducing Valves (PRVs) Installation – East Bay												0	310	310
TD-3	Fones Road Water Main Construction	36	100	2650	50	7							2807	0	2807
TD-4	Indian Summer Water Main Extension to Rich Road												0	753	753
TD-5	Decatur 298 Zone Connection									150	465		615	0	615
TD-6	Eastside Street and Henderson Boulevard Water Main Extension				163	1464							1627	0	1627
TD-7	Elliot Avenue Water Main Replacement					308	208						516	0	516
TD-8	Additional Isolation Valves Installation on the 36-inch Main		50	19	300	18							387	0	387
TD-9	Cardinal Drive Water Main Extension	27	25									500	525	0	525
TD-10	Zone 417 to 347 PRV Stations Installation				50	260							310	0	310
TD-11	36-inch Main Condition Assessments and Enhancements	130	386										386	0	386
TD-12	New PRV Installations			40		40		40					120	0	120

Code	Project Name	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Subtotal 2022-2031	Subtotal 2032-2041	Subtotal 2022-2041
Restoration and Renewal Projects (RR)															
RR-1	Small Diameter Water Mains	53	570	300	300	350	522	522	522	522	522	522	4652	5220	9872
RR-2	Asphalt Overlay Adjustments		15	15	15	15	15	15	15	15	15	15	150	150	300
RR-3	Storage Tank Coatings (Interior/Exterior)							600					600	0	600
RR-4	Booster Station Upgrades/Rehabilitation				250	525	50						825	0	825
RR-5	AC and Aging Pipe Replacements	56	500	200			1000	1000	1000	1000	1000	1000	6700	10000	16700
RR-6	PRV Telemetry (Radio-Based) Installation		23										23	0	23
RR-7	Distribution Main Condition Assessment		25	25	25	25	25	25	25	25	25	25	250	250	500
RR-8	On-site Generator Replacement Plan					100							100	0	100
RR-9	Asset Management Program		60	60	60	60	60	60	60	60	60	60	600	600	1200
RR-10	Corrosion Control (Aeration) Tower Condition Assessment & Upgrades							15					15	0	15
RR-11	*Water Meter Replacement	180	180	180	180	180	180	180	180	180	180	180	1800	1800	3600
RR-12	*McAllister Mitigation - Woodland Creek	20	20	20	20	20	20	20	20	20	20	20	200	200	400
RR-13	Fire Suppression Systems Installations at Allison Well Site and Shana Park			100									100	0	100
RR-14	Security and Remote Systems Program Enhancement	4	258	58	58	58	58	58	58	58	58	58	780	580	1360
RR-15	*Leak Detention Program Analysis		20	155									175	0	175
RR-16	*Tank Inspection and Cleaning		24	36	24	24	36						144	0	144
N/A	Franklin Street Water Main Replacement	380	150										150	0	150
N/A	Aging Water Main Replacement	2											0	0	0
N/A	Percival Creek Bridge Repairs	16	25										25	0	25
Planning (PL)															
PL-1	*Water System Plan Update						250	250					500	0	500
PL-2	Infrastructure Pre-Design and Planning	2	150	150	150	150	150	150	150	150	150	150	1500	1500	3000
TOTAL		**2944**	**7841**	**4496**	**3315**	**3674**	**3079**	**7505**	**4100**	**2859**	**2815**	**6200**	**45884**	**31563**	**77447**

Notes:

(1) In July 2021 dollars. Costs that are annual (or at least repeated) expenditures are shown in this column as one year's worth of cost.

* Represents projects funded from the Utility's operating budget.

Supply Source Projects

The following are source-related capital projects that address deficiencies or needs described in previous chapters, as referenced in each project description.

- **WS-1 Briggs Well Development** (anticipated 2023 - 2024; estimated $1,700,000)

  Description: Drilling an additional groundwater supply well in the Briggs Urban Village area. Water rights were previously purchased and transferred to the well. Drilling was originally scheduled in 2008; however, the project has been delayed primarily due to the need for costly iron and manganese treatment. The Utility, in 2019, obtained approval to extend the water rights development schedule until 2024. The well, which will pump into Zone 338, is anticipated to provide 1,100 gpm of source capacity. There is potential that in lieu of drilling a new well, the water rights may be transferred to another location as part of other water supply development projects. The Utility will make this determination as further CIP and water supply planning occurs.

  Justification/Need: Additional source enhances supply redundancy and reliability for Zones 417 and 338 (Chapter 8).

- **WS-2 McAllister Wellfield Mitigation – Deschutes River Basin** (ongoing, estimated $40,000 annually)

  Description: The Utility is implementing a water rights mitigation plan associated with the development of the McAllister Wellfield. One of the plan components involves the restoration of riparian land adjacent to the Deschutes River. This property, previously known as Smith Ranch, is jointly owned by the cities of Olympia, Lacey, and Yelm. Although as of year-end 2020, the Utility, in concert with the Nisqually Indian Tribe, has completed the bulk of the requirements outlined in the McAllister Wellfield Mitigation Plan, the Utility continues to have ongoing operations and maintenance obligations associated with this jointly owned property. The Utility will continue to work with the cities of Lacey and Yelm to determine appropriate long-term management and/or ownership arrangements for the property.

  Justification/Need: Supports implementation of the McAllister Wellfield Mitigation Plan and will exhibit a level of environmental stewardship desired by the Utility through improvement of water quality and aquatic habitat (Chapter 4).

- **WS-3 Wellhead Protection Program Capture Zone Refinement** (anticipated 2033, approximately $200,000 every ten years)

  Description: Periodic refinement of the time-of-travel zones previously delineated for the groundwater sources of supply.

  Justification/Need: Supports protection of the Utility supply sources (Chapter 7).

- **WS-4 Groundwater Monitoring Wells** (project started, estimated $210,000 in 2022/2023)

  Description: Installation of up to 10 new wells as part of the groundwater monitoring program. Additionally, the project includes the installation of the LBA Pilot Well to determine whether to relocate Shana Park Well 11 as recommended in the Shana Park Well Contingency Plan (completed in 2018). The LBA Pilot Well will be installed according to the City's resource protection/monitoring well standards.

  Justification/Need: Supports the City's monitoring of groundwater quality and ability to protect its groundwater sources of supply (Chapter 7).

- **WS-5 Olympia Brewery Source Engineering Analysis and Development** (anticipated 2022 - 2025; estimated $400,000 for engineering analysis; estimated $6,275,000 for construction)

Description: Consultant services associated with an engineering evaluation of possible operational and source development options for the Brewery water source. This is a joint effort with the Cities of Lacey and Tumwater.

Justification/Need: Supports need for long-term supply development and diversification (Chapter 8).

- **WS-6 Indian Summer Well Chlorination System Replacement** (design has started, construction anticipated 2029; estimated $609,000)

  Description: Construct new chlorine injection and secondary containment systems for disinfection at the Indian Summer Well 20 (S12), to replace the existing on-site chlorine generation system.

  Justification/Need: The current sodium hypochlorite generation chlorination system at the site is difficult to operate and maintain, which has been problematic for the City (Chapter 11).

- **WS-7 Hoffman Well Treatment Facility Construction** (anticipated 2031-2033; estimated $3,600,000)

  Description: Design and construction of hypo-chlorination and iron/manganese removal for the Hoffman Well 3 (S08). There is potential that in lieu of providing treatment of the Hoffman well source, the water rights may be transferred to another location as part of other water supply development projects. The Utility will make this determination as further CIP and water supply planning occurs.

  Justification/Need: Supports need for high quality water from this source (Chapter 11).

- **WS-8 McAllister Domestic Replacement Well** (project started, anticipated completion in 2022; estimated $115,000 in 2022)

  Description: The City of Olympia currently owns and maintains a potable water well that provides water service to a residence at 9820 Pacific Highway SE near the McAllister Wellfield. This project will drill and equip a new residential well and replaces a domestic well located on Nisqually Indian Tribe property.

  Justification/Need: Eliminates the existing well that the Utility owns and maintains.

- **WS-9 Deschutes Watershed Restoration** (anticipated 2022; estimated $166,000)

  Description: This project will provide financial support to the Budd/Deschutes Watershed Environmental Stewardship Coalition consistent with the Utility's McAllister Wellfield Mitigation Agreement. This project must be included in the CIP until such time the Watershed Environmental Stewardship Coalition is formed and payment is made.

  Justification/Need: Binding funding commitment.

- **WS-10 Sole Source Aquifer Designation** (anticipated 2023; estimated $50,000)

  Description: Pursue acquiring a sole source aquifer designation for the aquifer McAllister Wellfield withdraws from.

  Justification/Need: Protects the aquifer from potentially damaging development and land uses. This project was defined in the Risk and Resilience Analysis as a mitigation measure for water quality risks at the McAllister Wellfield.

- **WS-11 Shana Park Well VFD Replacement** (anticipated 2022; estimated $130,000)

  Description: This project will replace the existing variable frequency drive (VFD) that allows for the operation of Shana Park well pump at varied speeds.

Justification/Need: The current VFD is very old, no longer manufactured, and replacement parts cannot be obtained. The VFD needs to be replaced before it reaches end of its service life. This project will increase the efficiency of the well pump, lower the energy costs of running the pump, and prolong the life of the pump.

- **WS-12 Allison Well VFD Replacement** (anticipated 2023; estimated $190,000)

  Description: This project will replace the two existing variable frequency drives (VFDs) that allow for the operation of Allison well pump at varied speeds.

  Justification/Need: The current VFDs are very old, no longer manufactured, and replacement parts cannot be obtained. The VFDs need to be replaced before they reach the end of their service lives. This project will increase the efficiency of the well pumps, lower the energy costs of running the pumps, and prolong the life of the pumps.

- **WS-13 Rancho Serino Mitigation** (anticipated 2022; estimated $50,000)

  Description: This project will construct a fence on property jointly owned by the City of Lacey.

  Justification/Need: This project will protect Woodland Creek from development consistent with the Utility's McAllister Wellfield Mitigation Agreement.

- **WS-14 McAllister Wellfield Phase 2** (anticipated 2039 - 2040; estimated $3,000,000)

  Description: This project will construct the well(s) and ancillary infrastructure necessary to increase production at the McAllister Wellfield. Production under Phase 2 of the McAllister Wellfield is anticipated to begin in approximately 2030 when the Nisqually Indian Tribe begins producing from their well or wells located at the McAllister Wellfield. Production will also be increased as necessary to meet anticipated additional demands by Utility customers, currently planned for 2039-2040. Production, under Phase 2, is estimated at 19.6 MGD for the Utility (the full quantity of the McAllister Springs water rights) and 0.5 MGD for the Nisqually Indian Tribe (partial quantity of the Abbott Springs water permit), which amounts to about 77 percent of the full build-out production rate of the McAllister Wellfield.

  Justification/Need: This project is needed to address growth and system reliability.

Storage Projects

The following are storage-related capital projects that address deficiencies or needs described in Chapter 9.

- **ST-1 Hoffman Court Reservoir Reconstruction** (anticipated 2030-2032; estimated $6,550,000)

  Description: This project will replace the existing Hoffman Court Reservoir to address deficiencies in interior/exterior coating systems and structural components, as well as comply with current seismic code.

  Justification/Need: The 2019 evaluation of the reservoir finds the tank seismically deficient according to current codes and in the event of a design-level earthquake, the reservoir would likely sustain significant damage and be rendered unusable causing storage deficiency for Zone 417 and 338. The project will prolong and enhance system reliability.

- **ST-2 Boulevard Road Reservoir Rehabilitation Construction** (project started; construction anticipated 2022; estimated $4,050,000 beginning in 2022)

  Description: This project will rehabilitate the Boulevard Road Reservoir to address deficiencies in interior/exterior coating systems and structural components, as well as complete recommended seismic retrofits.

Justification/Need: The project will prolong service life and enhance system reliability. A State Revolving Fund loan has been received for this project.

- **ST-3 Eastside Reservoir Reconstruction** (anticipated 2026-2028; estimated $6,935,000)

  Description: This project will replace the existing Eastside Reservoir to address deficiencies in interior/exterior coating systems and structural components, as well as comply with current seismic code

  Justification/Need: The 2021 evaluation of the reservoir finds the tank seismically deficient according to current codes and in the event of a design-level earthquake, the reservoir would likely sustain significant damage and be rendered unusable causing storage deficiency for Zone 347. The project will prolong and enhance system reliability.

- **ST-4 Elliot Reservoir (380 Zone Tank) Evaluation** (anticipated 2023; estimated $18,000)

  Description: This project will involve conducting a condition assessment and seismic evaluation of the 380-zone tank to determine deficiencies in interior/exterior coating systems and structural components. The evaluation is expected to result in rehabilitation recommendations including scheduling considerations.

  Justification/Need: The project will inform the Utility of required renewal and replacement needs to prolong service life and enhance system reliability.

- **ST-5 Telecommunications Feasibility Analysis** (anticipated 2022; estimated $24,000)

  Description: This project will involve an analysis of monopole tower construction, management and ownership at select Utility owned locations as an alternative to placement of private telecommunication infrastructure on Utility owned storage infrastructure.

  Justification/Need: The density of current telecommunication infrastructure in some locations impedes Utility maintenance activities and limits the placement of new infrastructure. Future planned reservoir improvement projects will require the relocation of telecommunication infrastructure. Private telecommunication infrastructure construction and maintenance activities pose security concerns to the Utility.

Transmission and Distribution Projects

The following transmission and distribution-related capital projects address deficiencies or needs described in Chapter 10.

- **TD-1 Distribution System Oversizing** (ongoing, $30,000 annually)

  Description: Oversizing of distribution pipeline projects associated with development-related improvements. This project provides additional capacity to anticipate future needs that may be greater than at the time of development. Funds are applied to developer projects to cover the additional costs of oversizing.

  Justification/Need: Supports prudent sizing of distribution facilities to accommodate anticipated future needs and avoids the need to replace undersized facilities in the future.

- **TD-2 Pressure Reducing Valves (PRVs) Installation – East Bay Drive** (anticipated 2032, estimated $310,000)

  Description: Installation of PRV stations to reduce high pressures along East Bay Drive and allow water to flow from Zone 347 to Zone 226.

  Justification/Need: Addresses high-pressure situations along East Bay Drive.

- **TD-3 Fones Road Water Main Construction** (project started; anticipated 2022 - 2025, estimated $2,807,000 beginning in 2022)

  Description: Replacement of an AC water main in Fones Road from Pacific Avenue to 18th Avenue during planned roadway construction.

  Justification/Need: Removes AC piping, which is brittle and prone to breaking, from the system. Coordinated with roadway project to take advantage of cost efficiencies and minimize traffic disruptions.

- **TD-4 Indian Summer Water Main Extension to Rich Road** (anticipated 2034-2035, estimated $753,000)

  Description: Installation of a water main, extending from the existing 12-inch main on Prestwick Lane by Indian Summer Well 20, southwest to the Bonneville Power Administration lines, then west along the power line access road to the existing 12-inch main on Rich Road.

  Justification/Need: Provides distribution system looping in this part of the system.

- **TD-5 Decatur 298 Zone Connection** (anticipated 2029-2030, estimated $615,000)

  Description: Replacement of the water main from Evergreen Park Lane to 15th Avenue SW associated with the utility bridge at Percival Creek. The Percival Creek Utility Bridge was severely damaged on February 7, 2020, when a tree fell and struck the middle span breaking the water (and sewer) main attached to the underside of the bridge. Although the bridge and water (and sewer) main have been brought back to pre-disaster function the utility bridge continues to be susceptible to storms and damage from earthquakes. Timing of this project is impacted by the sewer utility's planned Percival Creek Utility Bridge Sewer Main Horizontal Directional Drilling project. The water main will be removed from the utility bridge and rerouted along Decatur Street.

  Justification/Need: Replaces an asset that was damaged in a February 2020 storm and which continues to be vulnerable to storms and damage from an earthquake. Removes aging AC piping to improve system reliability.

- **TD-6 Eastside Street and Henderson Boulevard Water Main Extension** (anticipated 2024 - 2025, estimated $1,627,000)

  Description: New 16-inch main to replace an existing 10-inch pipe that presents a bottleneck in the Zone 264 distribution system. The replacement line will connect to an existing 16-inch main at Eastside Street, where it originates as a tap off of the 36-inch transmission main near the Fir Street Storage Tanks. The new line will then extend approximately 3,500 feet through the City of Olympia's Maintenance Center property, including a creek crossing, and across Henderson Boulevard, terminating at an existing 12-inch main that feeds a portion of Zone 264 west of Henderson. Timing of the project is expected to be further informed following the completion of a Maintenance Center Replacement Study.

  Justification/Need: Increases fire flow and pressures in the westerly portion of Zone 264 during high demand periods.

- **TD-7 Elliot Avenue Water Main Replacement** (anticipated 2025 - 2026, estimated $516,000)

  Description: This project will replace a water main on Elliot Ave in conjunction with a sidewalk construction project.

  Justification/Need: Realizes costs savings since project is occurring in conjunction with a transportation improvement project.

- **TD-8 Additional Isolation Valves Installation on the 36-inch Main** (anticipated 2022 - 2025, estimated $387,000)

  Description: The project will install seismically actuated isolation valves at various locations along the City's 36-inch transmission main.

  Justification/Need: The seismic valves will isolate large volume of water in the pipe into discrete, smaller volumes to avoid loss of water and to reduce the potential of localized flooding and damage where breaks may occur. The project will mitigate the loss of essential services (potable and firefighting water) to residents and businesses that would result from a moderate or severe earthquake causing a failure to the Utility's transmission pipelines. To fund the project, the Utility has applied for a FEMA grant. Project costs reflect Utility cost-share only.

- **TD-9 Cardinal Drive Water Main Extension** (project started; construction anticipated 2031, estimated $525,000)

  Description: This project will design and construct a drinking water main extension along Cardinal Drive.

  Justification/Need: The project will allow the Utility to serve the Cooper's Glen apartment complex through a master meter. Currently, the apartment complex is served water through a deduct meter from the Evergreen State College system.

- **TD-10 Zone 417 to 347 PRV Station Installation** (anticipated 2024-2025, estimated $310,000)

  Description: This project will install two or more pressure reducing valves from pressure zone 417 to pressure zone 347.

  Justification/Need: This project will improve water quality in the area and improve water circulation and redundancy in this region of the water distribution system.

- **TD-11 36-inch Main Condition Assessments and Enhancements** (project started; estimated $25,000 in 2022)

  Description: This project will complete field exploration and excavation details to expose the 36" watermain in a few key locations which, when implemented, will result in a condition assessment of the 36" watermain that supplies water from the Meridian storage tanks and discharges into the storage tanks on Fir Street at Seventh Avenue. The condition assessment work planned for under this project will occur in conjunction with project TD-8.

  Justification/Need: Locations for new valves and other watermain repairs or modifications to improve the transmission main's reliability and resilience will be identified for future action.

- **TD-12 New PRV Installations (anticipated 2023, estimated $40,000 every two years)**

  Description: This project will construct new PRVs throughout the water system based upon an evaluation of needs and alternatives. Potential projects requiring analysis include, but are not limited to, new PRV(s) in the 264 to 226 zone and in the 298 zone to address potential future source deficiencies and for system reliability. This project will also support small land development projects.

  Justification/Need: PRVs transfer water from higher pressure zone to lower pressure zone at sufficient pressures and appropriate flows to alleviate high pressure situations, support fire flows, provide additional supply especially when storage is limited or not available, and provide backup supply especially in an emergency, therefore, increase distribution system reliability.

Restoration and Renewal Projects

The following operations and maintenance-related capital projects address deficiencies or needs described in Chapter 12.

- **RR-1 Small Diameter Water Main Replacements** (ongoing, funding varies annually and is estimated to increase to $522,000 annually)

  Description: Replacement of existing small diameter substandard water mains with larger diameter piping. Funds also provide for hydraulic modeling and installation of valves and vaults.

  Justification/Need: Increases reliability of the distribution system to maintain domestic and fire flows at required minimum pressures.

- **RR-2 Asphalt Overlay Adjustments** (ongoing, estimated $15,000 annually)

  Description: Adjustments needed to raise water system components to street level in conjunction with annual asphalt overlay/street reconstruction.

  Justification/Need: Adjusts water system structures and related components as required during some asphalt overlay and street reconstruction projects.

- **RR-3 Storage Tank Coating (Interior/Exterior)** (anticipated 2027, estimated $600,000)

  Description: Periodic maintenance of interior and exterior linings and painting. Each storage tank is scheduled for recoating approximately every 15-20 years. The Bush tank, which has been repeatedly subjected to vandalism with graffiti, is identified under this project. A 5-year project for tank inspection and cleaning, a separate project under this renewal and replacement category, will identify other tanks for inclusion to this storage tank coating project.

  Justification/Need: Maintains reliable water quality and increases longevity of storage tanks.

- **RR-4 Booster Station Upgrades/Rehabilitations** (anticipated 2024-2026, estimated $825,000)

  Description: Routine upgrades to existing booster stations occur between 10 to 20 years; work includes replacing pumps and making large-scale upgrades to mechanical, electrical and instrumentation systems. Upgrade to Eastside Booster Station is identified under this project, which is scheduled with the Eastside tank construction. The Elliot Booster Station and South Sound Booster Station are currently identified for planned future upgrades.

  Justification/Need: Increases reliability of booster stations.

- **RR-5 AC and Aging Pipe Replacements** (ongoing, funding amount varies and is estimated to increase to $1,000,000 annually)

  Description: Replacement of aging water mains and those constructed of asbestos cement (AC) with new piping. Funds also provide for hydraulic modeling and installing valves and vaults. The 2021-2026 WSP reflects a significant increase in funding for this annual program. Program dollars for years 2023-2025 will be used to fund project TD-3 and TD-7.

  Justification/Need: Increases the reliability of the distribution system and reduces the potential for leaks in older parts of the system.

- **RR-6 PRV Telemetry** (Radio-Based) Installations (anticipated 2022, estimated $23,000)

  Description: Installation of radio-based telemetry instrumentation in PRV vaults.

  Justification/Need: Improves system operation and efficiency by increasing the ability to monitor flows through PRVs. This improves understanding of system operation and provides detailed water usage data to calibrate the hydraulic model.

- **RR-7 Distribution Main Condition Assessments** (ongoing, estimated $25,000 annually)

  Description: Implementation of activities, to be defined through the Asset Management Program (Project RR-9), to assess the condition of transmission and distribution system mains. Funds will support annual evaluation of discreet lengths of pipes. The results will be used to identify larger capital projects that will then be prioritized and implemented as funds are available.

  Justification/Need: Provides information on system condition and identifies project priorities that will improve reliability of the distribution system.

- **RR-8 On-Site Generator Replacement** Plan (anticipated– 2025, estimated $100,000)

  Description: Replacement of on-site backup power generators near the end of their useful life. Power generator's expected useful life is about 20 years. Allison Springs' backup generator replacement is identified under this project.

  Justification/Need: Increases reliability of facilities supported by on-site generators.

- **RR-9 Asset Management Program** (ongoing, estimated $60,000 annually)

  Description: Implementation of the Utility's formal asset management program. Funds cover activities such as program administration, condition assessment, asset planning and development. The results of this program will define the details of some of the other projects listed in this section, such as RR-1, RR-3, RR-4, RR-5, and RR-8.

  Justification/Need: Supports pro-active management of the system's assets which includes replacement, rehabilitation, and maintenance of the Utility's water system to ensure it is reliable.

- **RR-10 Corrosion Control (Aeration) Tower Condition Assessment & Upgrades** (anticipated 2027, estimated $15,000)

  Description: Condition assessment of all existing corrosion control towers, to determine necessary upgrades to mechanical, electrical and instrumentation systems.

  Justification/Need: Increases reliability of corrosion control towers.

- **RR-11 Water Meter Replacement** (ongoing, estimated $180,000 annually)

  Description: Replacement of water service meters and radio transmitter units associated with the citywide automated meter reading (AMR) system that have exceeded their useful life span. Units will be replaced in a phased manner at an approximately 18 to 20-year replacement cycle.

  Justification/Need: Increases metering accuracy, maintains reliable AMR system functionality, reduces operational costs associated with meter reading, improves customer service through reduced reading errors, and supports water conservation efforts by enhancing ability to track and characterize water consumption.

- **RR-12 McAllister Mitigation - Woodland Creek** (ongoing, estimated $20,000 annually)

  Description: Funds the Utility's share of the operations and maintenance of a facility jointly owned with the City of Lacey as part of the McAllister Water Rights Mitigation Plan. The Woodland Creek Groundwater Recharge Facility (completed in 2014) infiltrates reclaimed water into the shallow groundwater aquifer in the Woodland Creek area, partly offsetting impacts of groundwater withdrawals at the McAllister Wellfield. (See also Chapter 6.)

  Justification/Need: Supports continued operation of the McAllister Wellfield and is required as part of the mitigation plan.

- **RR-13 Fire Suppression System Installations at Allison Well and Shana Park Well Sites** (expected 2023, estimated $100,000)

Description: Install fire suppression infrastructure at the two sites to act as a line of first defense against fires, either natural or man-made.

Justification/Need: The Utility's Risk and Resiliency Assessment concluded that fire suppression systems at the Allison Site and Shana Well had a positive cost-benefit ratio; the cost of installing fire suppression systems provided a long-term cost saving benefit in preventing destructive fire.

- **RR-14 Security and Remote Systems Program Enhancement** (ongoing; estimated $258,000 in 2022 and $58,000 annually)

  Description: This project will provide enhancement to the security and remote monitoring systems of Drinking Water Utility sites. Enhancements under the project could include, but are not limited to, cameras for facility monitoring, tamper proof fencing, access control systems, alarm notification systems and/or security card readers.

  Justification/Need: Addresses security concerns at Utility facilities. The Utility's Risk and Resiliency Assessment concluded that security and remote systems enhancements provided a long-term cost saving benefit in preventing initial sabotage of the Utility's critical infrastructure.

- **RR-15 Leak Detection Program Analysis** (anticipated 2022-2023; estimated $175,000)

  Description: This project will focus on taking preemptive measures to address water loss in the Utility's distribution system.

  Justification/Need: Addresses distribution system leakage and helps the Utility to meet its climate change mitigation goals through reduced power use. The Utility is anticipating developing an in-house leak detection annual program during the planning period.

- **RR-16 Tank Inspection and Cleaning** (anticipated 2022-2027; estimated $144,000)

  Description: Full internal and external inspection of storage tanks. Periodic cleaning of tanks with need based on internal inspections.

  Justification/Need: The project will identify defects and potential structural and seismic deficiencies for further expert evaluation and perform minor repairs or recommend replacements for increased longevity of storage tanks. Tank cleaning will maintain reliable water quality.

Planning Projects

The following planning projects support implementation of the other CIP items listed above.

- **PL-1 Water System Plan Update** (anticipated 2026 - 2027, estimated $500,000)

  Description: Updates to the Water System Plan, which are required every six years by the Washington State Department of Health.

  Justification/Need: This is a regulatory requirement and also ensures the Utility is planning sufficiently to meet future needs and is investing wisely in its infrastructure.

- **PL-2 Infrastructure Pre-Design and Planning** (ongoing, estimated 150,000 annually)

  Description: Perform pre-design evaluation and analysis of water system project alternatives.

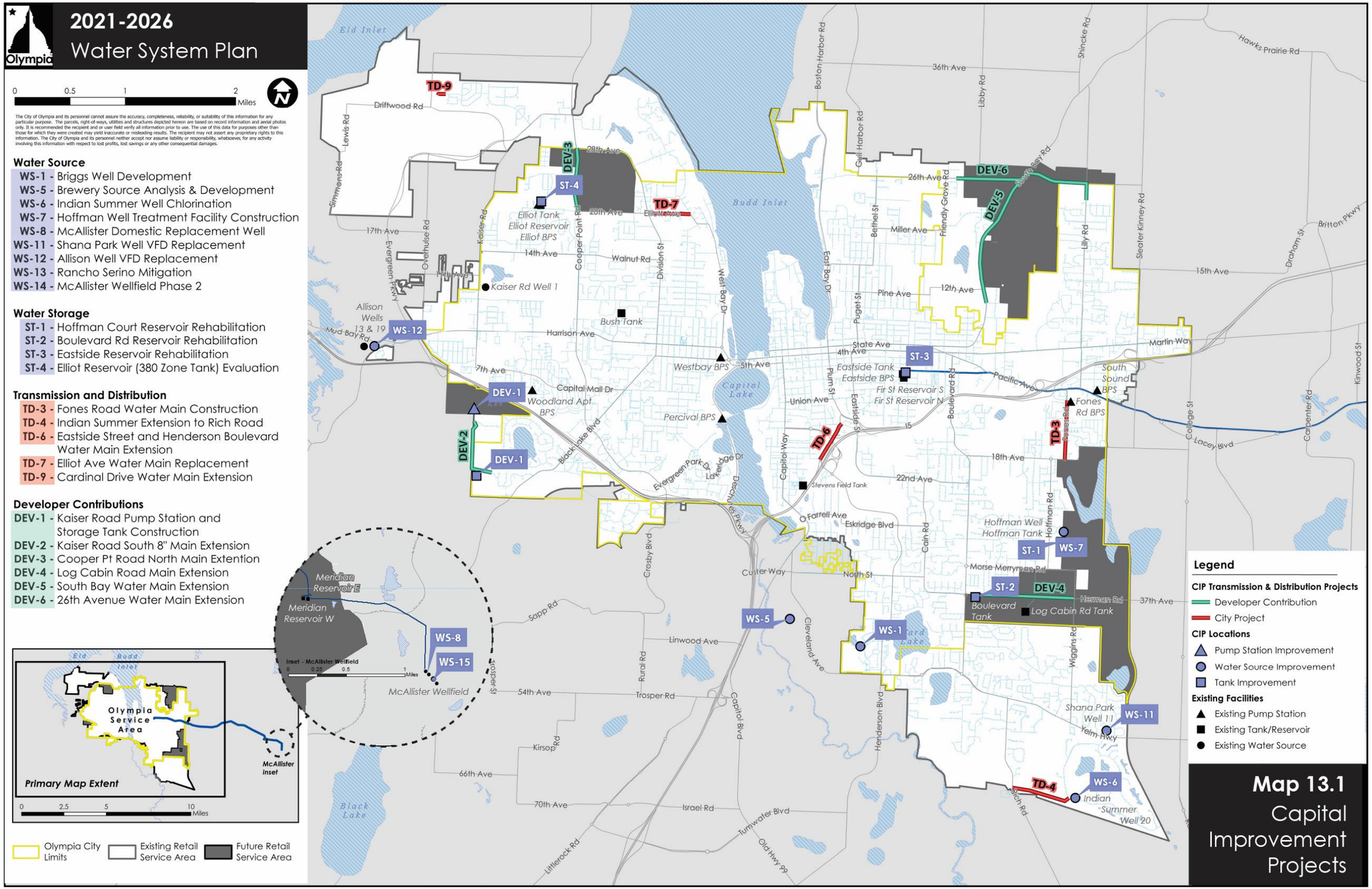
  Justification/Need: Evaluates project needs and costs of CIP projects prior to appropriation in the annual Capital Facilities Plan, in order to refine information provided in the CIP. Projects funded under this ongoing project could include, but are not limited to, evaluations of new PRVs location needs (see TD-14) and evaluations of the need for, and possible location of, new storage reservoirs/tanks, particularly in the 347 and 380 zones.

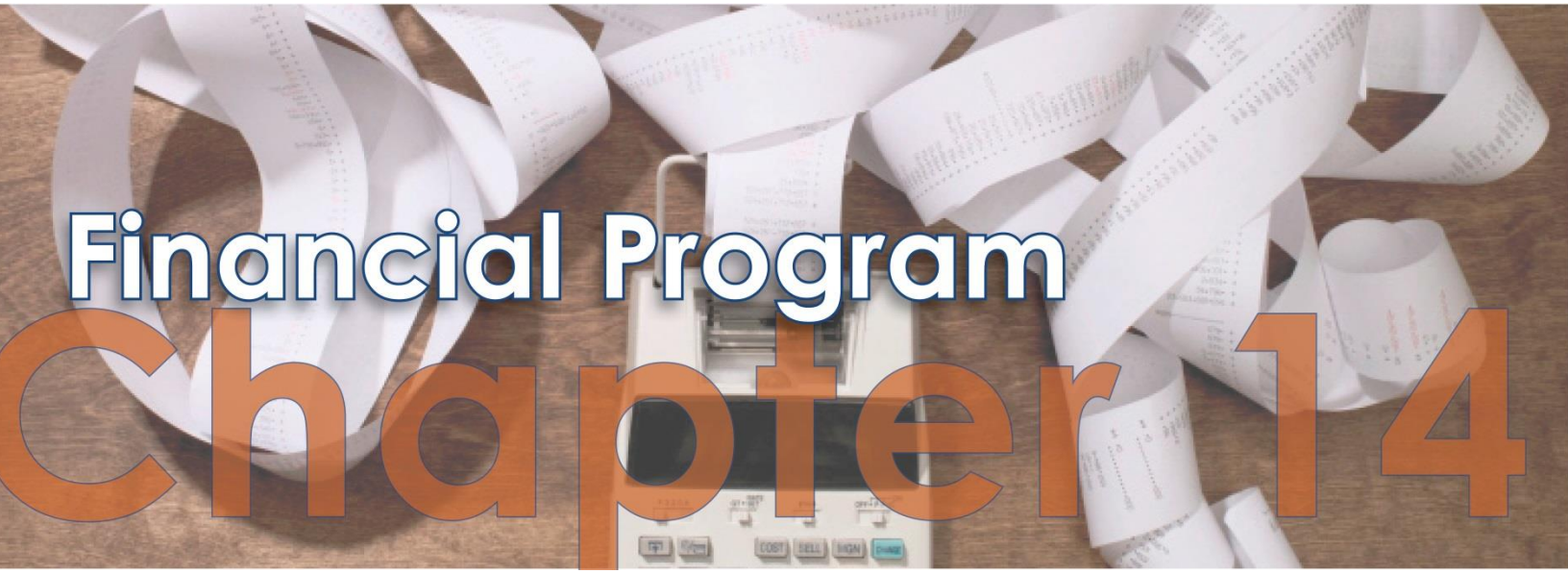
Development-Related Projects

The following projects will be implemented as part of private development projects. Scheduling of these improvements will depend on the timing of development activity. Development-related projects are not included in Table 13.2 since no City funds are required.

- **DEV-1 Kaiser Road Pump Station and Storage Tank Construction.** This pump station and storage tank will be constructed as part of development in the area south of Highway 101 on Kaiser Road. While these facilities will primarily serve future development, they will also address deficiencies in the distribution system's ability to provide adequate pressures during peak hour demand conditions to a small area of Zone 298, as described in Chapter 10.
- **DEV-2 Kaiser Road South (8-inch) Main Extension**. Installation of 1,000 lineal feet of 8-inch water main, extending from the future Kaiser Road Storage Tank to Park Avenue.
- **DEV-3 Cooper Point Road North Main Extension**. Installation of 3,000 lineal feet of 12-inch water main, extending north in Cooper Point Road.
- **DEV-4 Log Cabin Road Main Extension**. Installation of 4,350 lineal feet of 16-inch water main, extending from the existing 12-inch main at the south end of Van Epps Drive, east to the existing 12-inch main on Wiggins Road by 7th Avenue.
- **DEV-5 South Bay Water Main Extension**. Installation of 10,650 lineal feet of 12-inch water main.
- **DEV-6 26th Avenue Water Main Extension.** Installation of 2,900 lineal feet of 12-inch water main, extending from the existing 12-inch main on 26th Avenue by Huber Lane, east on 26th to a proposed 12-inch main in South B.

Map 13.1 Capital Improvement Project





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Appendix

14-1 Financial Analysis

Chapter 14 - Financial Program

This chapter describes the current finances of the City of Olympia Drinking Water Utility (Utility) and summarizes its financial policies and the funding needed to implement this Plan. A detailed financial analysis was performed by the Utility's financial consultant, FCS Group (Appendix 14-1). The results indicate that the overall financial condition of the Utility remains healthy. The Utility continues to be guided by water conservation and sustainability policies along with sound and prudent financial management principles.

The Utility's financial program is designed to meet the Utility's Goal 7:

> **Drinking Water Utility finances are managed responsibly, and costs are recovered equitably based on customer use.**

Objectives for 2021-2026 are:

- Set rates that accurately reflect financial policies and recover the cost of providing services to each customer class.
- Manage Utility rates and connection fees consistent with the City's guiding principles of growth paying for growth.
- Use debt financing responsibly to support needed capital facility investments and "smooth" rate impacts.

Further direction is provided for this chapter by the City's Comprehensive Plan. In particular, Utilities Goal 2 and its associated policies help guide the Utility's financial program.

As required by state regulations (WAC 246-290-100), this chapter demonstrates the Utility's financial viability by providing: a summary of past income and expenses, a balanced budget, a funding plan, and consideration of a rate structure addressing affordability and conservation.

14.1 Current Financial Status

This section reviews the Utility's operating revenue and expenses, balance sheet and budget. The Utility's financial consultant, FCS Group, concluded that the Utility's operating condition remained strong as of December 2021. Revenues, including fund balance, were sufficient to meet expenditures.

Operating Revenue and Expenses

Comparative financial statements for the most recently available six years (2016-2021) are summarized in Table 14.1.

Table 14.1 Summary of Fund Resources and Uses Arising from Cash Transactions

	2016	2017	2018	2019	2020	2021
OPERATING REVENUES:						
Charges for Services	$ 13,342,974	$ 13,892,835	$ 14,613,205	$ 13,762,645	$ 14,523,551	$ 15,526,919
Intergovernmental Revenues	-	-	20,913	166,049	11,680	260,903
Miscellaneous Revenues	225,946	245,609	277,944	275,367	332,748	326,815
Total Operating Revenues	$ 13,568,920	$ 14,138,444	$ 14,912,062	$ 14,204,060	$ 14,867,979	$ 16,114,636
OPERATING EXPENSES:						
Operations & Maintenance	$ 1,776,354	$ 2,924,761	$ 1,725,841	$ 5,447,293	$ 8,292,028	$ 4,177,676
Administration & Overhead	5,527,049	5,314,906	5,668,328	2,471,720	1,670,406	2,735,712
Taxes	1,387,979	1,835,147	1,923,390	2,069,633	2,031,788	2,365,660
Compensated Absences	12,894	17,767	4,291	-	-	-
Depreciation & Amortization	2,056,237	2,074,623	2,053,954	2,090,032	2,157,098	2,127,169
Total Operating Expenses	$ 10,760,513	$ 12,167,204	$ 11,375,804	$ 12,078,678	$ 14,151,320	$ 11,406,216
OPERATING INCOME (LOSS)	*$ 2,808,407*	*$ 1,971,240*	*$ 3,536,258*	*$ 2,125,382*	*$ 716,659*	*$ 4,708,420*
NON-OPERATING REVENUES (EXPENSES)						
Investment Earnings	$ 46,257	$ 77,308	$ 184,624	$ 363,891	$ 240,264	$ (67,956)
Proceeds	-	-	-	243,209	1,567,248	1,693,676
Debt Service	-	-	-	(1,279,331)	(1,290,030)	(1,408,158)
Loss on Plant	(2,132)	(28,278)	19,806	-	-	-
Interest Expense & Fiscal Charges	(175,297)	(220,035)	(369,804)	(328,696)	(310,495)	(333,320)
Total Non-Operating Revenues (Expenses)	$ (131,172)	$ (171,005)	$ (165,374)	$ (1,000,927)	$ 206,987	$ (115,758)
NET INCOME (LOSS) BEFORE CONTRIBUTIONS AND TRANSFERS	*$ 2,677,235*	*$ 1,800,235*	*$ 3,370,884*	*$ 1,124,455*	*$ 923,646*	*$ 4,592,662*
Capital Contributions	302,400	139,550	121,300	353,150	457,881	421,600
Operating Transfers - In	868,550	3,620,810	1,513,009	8,472,597	1,247,294	2,897,373
Operating Transfers - Out	(2,407,223)	(5,174,066)	(3,050,352)	(10,416,696)	(2,804,263)	(4,450,201)
TOTAL NET INCOME (LOSS)	*$ 1,440,962*	*$ 386,529*	*$ 1,954,841*	*$ (466,493)*	*$ (175,442)*	*$ 3,461,434*
TOTAL NET POSITION AS OF JANUARY 1	$ 53,491,480	$ 54,934,628	$ 55,323,342	$ 57,280,369	$ 57,497,743	$ 57,130,823
NET INCOME (LOSS)	1,440,962	386,529	1,954,841	(466,493)	(175,442)	3,461,434
PRIOR PERIOD ADJUSTMENT	-	-	-	-	-	3,971,735
TOTAL NET POSITION AS OF DECEMBER 31	$ 54,932,442	$ 55,321,157	$ 57,278,183	$ 56,813,876	$ 57,322,301	$ 64,563,992
O&M Coverage Ratio	*126.1%*	*116.2%*	*131.1%*	*117.6%*	*105.1%*	*141.3%*
Net Operating Income as a % of Operating Revenue	*20.7%*	*13.9%*	*23.7%*	*15.0%*	*4.8%*	*29.2%*

Revenue from water sales increased 16.37 percent overall between 2016 and 2021, while consumption per connection decreased slightly between 2016 (283 gallons per day per connection) and 2019 (275 gallons per day per connection) as shown in ***Chapter 3*** and remained relatively flat between 2019 and 2021 (278 gallons per day per connection) Water rates increased by 17.3 percent during the period 2016 and 2021, suggesting that water usage declined despite a growing customer base.

The O&M Coverage Ratio, which is defined as the total operating revenue divided by total operating expenses, was 141.3 percent in 2021. The Utility has maintained ratios of 100 percent or greater since 2010, indicating that revenues more than cover expenses.

The City's practice is to maintain a minimum balance in the operating fund equal to 25 percent of annual operating revenues. Any accumulation of operating fund balance over 30 percent is transferred to the capital fund. This policy aims to provide liquid "working capital" to accommodate cash balance fluctuations associated with differences in revenue and expense cycles, along with other unforeseen variations in revenues or costs.

Assets and Liabilities

The Drinking Water Utility maintains a balance sheet of current and long-term assets and liabilities. Between 2016 and 2021, total assets increased from $69.67 million to $88.76 million. Over the same period, current and long-term liabilities increased from $14.73 million to $24.67 million.

FCS Group concluded that the Utility's ratio of unrestricted current assets to current liabilities remained healthy as of the end of 2021 at 20.3. This ratio measures the Utility's ability to pay short-term obligations; the industry benchmark ratio is 2.0 or above. The Utility's ratio has not fallen below 6.0 during the six-year period.

14.2 Rates and Rate Structure

Drinking Water rates are composed of a fixed monthly "ready-to-serve" charge based on meter size, plus a volume charge per hundred cubic feet (ccf) of metered water usage. The variable usage charge is designed to increase a customer's water bill progressively with increasing levels of consumption, sending a price signal that encourages water conservation. Single-family residences pay volume charges based on an inverted four-tier structure. Multi-family, commercial and irrigation customers pay a seasonal volume charge with winter rates for November-June and summer rates for July-October.

A series of moderate rate increases (cumulative adjustment of 6.7 percent in 2023 and 5 percent thereafter per year) are proposed in order to accommodate projected operating and capital needs during the 2023-2027 time period. This results in a cumulative increase of roughly 29 percent over a five-year period. A number of factors drive the need for the proposed rate increases. Primary among these are the loss of the City of Lacey and Thurston PUD 1 as wholesale water customers after 2015, increases in debt service associated with the City's 2013 Bond and Drinking Water State Revolving Fund (DWSRF) loans for the LBA, Fir, Elliot and Boulevard tanks , as well as assumed additional DWSRF loans required to fund new capital projects during the planning period.

The Washington Department of Health and Department of Commerce Public Works Board use an affordability index to prioritize low-cost loan awards depending on whether rates exceed 2.0 percent of the median household income for the service area. U.S. Census Bureau data indicates that median household income for the City of Olympia was $63,185 in 2020 dollars. Inflating the median household income by 5.16 percent based on the 2021 annual average increase in the CPI-W for the Seattle-Tacoma-Bellevue Metropolitan Area approximation a 2021 median household income of $66,443. This corresponds to a maximum annual water bill of $1,328.86, or $110.74 monthly. Based on an average residential monthly usage of 6 ccf, an average monthly residential bill would increase from $31.35 (2023 rate increase assumption) to $39.05 (2027 rate increase assumption), which is still significantly below the monthly 2021 threshold and suggests an affordable water rate structure.

There has been a growing consensus in the Drinking Water industry that median household income is of limited value in assessing the impacts of utility rates on customers with income levels far below an area's median income level. As discussions about rate affordability continue to evolve, two alternative metrics have been gaining traction as providing a more meaningful basis for evaluating affordability. These metrics include quantifying the amount of time that someone earning minimum wage would need to work in order to pay their combined water and wastewater bill and expressing the combined water and wastewater bill at 50 gallons per connection per day as a percentage of the disposable income of a home in the 20th income percentile after accounting for the cost of food, housing, power, healthcare, and taxes. Additional information about these metrics can be found in ***Appendix 14.1***

14.3 Capital Funding Strategy

For the 2022-2027 planning period, the proposed capital facilities projects will cost an estimated total of $28 million (or $34 million adjusted for inflation), as shown in ***Chapter 13, Table 13.2.*** The Utility funds its capital program using resources in the following priority order:

1. Accumulated capital reserves.
2. Annual revenue collections from general facility charges (GFCs).
3. Annual resources from rates earmarked for system reinvestment funding.
4. Annual transfers of excess resources (over minimum balance targets) from the Operating Fund, if any.
5. Interest earned on Capital Improvement Fund balances and other miscellaneous capital resources.
6. Revenue bond financing.

General facility charges (GFCs) are imposed on new customers connecting to the system as a condition of service and are in addition to any other costs related to connecting a customer to the water system. The GFC is typically based on a blend of historical and planned future capital investment in system infrastructure. Its underlying premise is that growth (future customers) will pay for growth-related costs that the Utility has incurred (or will incur) to provide capacity to serve new customers. GFC revenues provide a source of cash funding for the capital facilities plan (CFP).

FCS Group calculated an updated GFC as part of the financial analysis for this Plan. This analysis suggests that the GFC per ERU (equivalent residential unit) should increase by $1,206 or about 27.2 percent from the 2022 charge of $4,433. This increase is explained by the addition of assets and the accrual of interest on existing assets since 2011, as well as the addition of projects from the current CFP. In addition to funding the capital program with charges to new customers, the Utility requires existing ratepayers to support the City's full cost of providing service, including annual depreciation expense on existing Utility assets. Existing customers benefit from a system of infrastructure that has been funded through a combination of sources; this infrastructure deteriorates over its useful life and will eventually fail, requiring replacement.

The 2015-2020 WSP included a financial strategy that the Utility would move toward increasing annual depreciation funding from 45% of current depreciation to 75% of depreciation by 2020. In practice, the Utility targeted capital funding at $1.4 million, or approximately 65% of current depreciation. This WSP's financial analysis was prepared to achieve an annual funding level of $3.7 million, or 131 percent of depreciation by 2027. While this approach does not ensure full cash funding of system replacements, it provides a reasonable basis for equitably charging current customers for the use and decline in value of the system. It is consistent with standard accounting practices and is a commonly used benchmark in the industry.

The Utility manages its capital fund reserves according to the following policy: the Capital Fund is assumed to maintain a minimum reserve balance equal to 5 percent of active capital appropriations as a capital contingency reserve. This policy intends to provide a source of funding for unanticipated capital needs, such as cost overruns.

Analysis performed by FCS Group, shown in Table 14.2, indicates that the Utility will have enough cash resources to pay for the projected capital costs using its cash resources and loan proceeds to fund the remainder of the Fir, Elliot and Boulevard Reservoir projects and anticipated loan proceeds to fund capital projects in 2026 and 2027. In the event that CFP project costs exceed the estimates developed by staff, or cash or loan funding sources fall short of projections, the Utility will consider deferring projects as an alternative to incurring debt.

Table 14.2 Proposed CFP Funding Strategy

Planned Funding Strategy	2022	2023	2024	2025	2026	2027	Total
DWSRF Loan Proceeds	$ 2,658	$ -	$ -	$ -	$ 3,629	$ 1,371	$ 7,658
Cash Funding	4,702	4,589	4,621	4,262	-	8,419	26,593
Total	$ 7,360	$ 4,589	$ 4,621	$ 4,262	$ 3,629	$ 9,790	$ 34,251

Capital Fund (Fund 461)	2022	2023	2024	2025	2026	2027
Beginning Balance	$ 8,116,332	$ 5,076,988	$ 2,108,964	$ 563,475	$ 245,559	$ 5,967,818
Plus: Interest Earnings	-	-	-	-	-	-
Plus: GFC Revenue	907,621	921,043	934,665	948,487	962,514	692,036
Plus: Net Debt Proceeds	2,658,320	-	-	-	5,000,000	-
Plus: System Reinvestment Funding	700,000	700,000	1,400,000	1,900,000	2,600,000	2,700,000
Plus: Transfer of Operating Fund Surplus Balance	55,191	-	740,413	1,095,671	788,748	1,005,245
Less: Capital Expenditures	(7,360,476)	(4,589,067)	(4,620,566)	(4,262,074)	(3,629,003)	(9,789,960)
Ending Balance	**$ 5,076,988**	**$ 2,108,964**	**$ 563,475**	**$ 245,559**	**$ 5,967,818**	**$ 575,139**
Minimum Balance (Contingency)	***$ 368,024***	***$ 229,453***	***$ 231,028***	***$ 213,104***	***$ 181,450***	***$ 489,498***

14.4 Evaluation of Revenue Requirements

The revenue requirement analysis determines the annual revenue required to fund the projected operating expenses, capital costs, and policy-based requirements (e.g., reserve funding, system reinvestment funding). In this evaluation, "revenue sufficiency" is defined by the following tests:

- **Cash Flow Test**: Rate revenue and other operating revenues must be sufficient to meet the utility's projected cash needs, including O&M, debt service, system reinvestment funding, and any reserve funding needed to meet the minimum balance target for the Operating Fund. The utility may have negative net cash flow when an explicit decision is made to use reserves to phase or "smooth" rate increases – in this analysis, the minimum balance requirement for the Operating Fund limits how far the Operating Fund balance can be drawn down for this purpose.
- **Coverage Test**: As previously noted, the City's revenue bond covenants require that the City's "net revenue" is equal to at least 1.25 times annual revenue bond debt service.

Table 14.3 summarizes the annual revenue requirement forecast through 2027.

Table 14.3: Revenue Requirement Forecast

Revenue Requirement Analysis	2022	2023	2024	2025	2026	2027
Revenues						
Rate Revenue At Existing Rates	$ 14,530	$ 14,691	$ 14,855	$ 15,021	$ 15,190	$ 15,382
Other Operating Revenues	443	417	419	422	425	428
Total Revenues	$ 14,972	$ 15,108	$ 15,274	$ 15,444	$ 15,615	$ 15,809
Expenses						
Operating Expenses	$ 11,342	$ 11,874	$ 12,009	$ 12,323	$ 12,709	$ 13,204
Debt Service	3,255	3,413	2,471	2,450	2,428	2,748
System Reinvestment Funding	700	700	1,400	1,900	2,600	2,700
Total Expenses	$ 15,297	$ 15,988	$ 15,880	$ 16,672	$ 17,737	$ 18,652
Net Surplus (Deficiency)	$ (324)	$ (880)	$ (606)	$ (1,228)	$ (2,121)	$ (2,843)
Annual Rate Adjustment		*6.7%*	*5.0%*	*5.0%*	*5.0%*	*5.0%*
Cumulative Rate Adjustment		*6.7%*	*12.0%*	*17.6%*	*23.5%*	*29.7%*
Rate Revenue After Rate Adjustments	$ 14,530	$ 15,676	$ 16,643	$ 17,671	$ 18,763	$ 19,949
Net Cash Flow After Rate Adjustments	$ (324)	$ (18)	$ 959	$ 1,090	$ 1,005	$ 1,154
Coverage After Rate Adjustments	2.46	2.77	8.64	9.68	10.70	11.58
Ending Operating Fund Balance	*$ 3,403*	*$ 3,384*	*$ 3,603*	*$ 3,597*	*$ 3,813*	*$ 3,961*
Minimum Balance Required	*$ 2,836*	*$ 2,969*	*$ 3,002*	*$ 3,081*	*$ 3,177*	*$ 3,301*
Ending Capital Fund Balance	*$ 5,077*	*$ 2,109*	*$ 563*	*$ 246*	*$ 5,968*	*$ 575*
Minimum Balance Required	*$ 368*	*$ 229*	*$ 231*	*$ 213*	*$ 181*	*$ 489*

Table 14.3 indicates that at existing rates, operating revenues are sufficient to cover O&M and debt service with capacity for a modest amount of system reinvestment. The rate increases shown in Table 14.3 will be needed to generate cash funding for the capital facilities plan – the Capital Fund balance is projected to remain only slightly above the minimum target (5 percent of the projected CFP expenditures) beginning in 2025, with the higher ending balance in 2026 being attributable to the assumed $5 million DWSRF loan.

14.5 2022-2027 Financial Program

The overall financial condition of the City's Drinking Water Utility remains healthy. The City continues to be guided by a policy of water conservation and sustainability along with sound and prudent financial management principles. While the proposed 2023-2027 rates represent an increase over current rates, the overall rates and resulting billings to the City's customers fit within this policy framework.

This financial strategy will enable the City to achieve a reasonable balance between its goals of offering its customers affordable rates while encouraging water conservation through prudent pricing signals and a projected operating and capital facilities plan that will meet the needs of the Utility over the next six years.