Manchester Water District

Water System Plan

October 2025

Manchester Water District
Serving Our Community Since 1942

bhc CONSULTANTS
1601 Fifth Avenue, Suite 500
Seattle, WA 98101
P. 206.505.3400

ACKNOWLEDGEMENTS

The Water System Plan was developed under the direct supervision of Peter Cunningham, PE of BHC Consultants, LLC.

10/15/2025

Peter Cunningham, PE
Project Manager

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ES Executive Summary

ES.1 Purpose of the Plan

Manchester Water District's (District) water system is a major infrastructure system, much of which is invisible to the people that receive water from it. The water system requires qualified staff to operate and maintain an ongoing repair and replacement and capital improvement program to replace old components to meet the requirements mandated by federal and state laws. The primary purpose of the Manchester Water District Water System Plan (WSP) is to identify and schedule water system improvements that correct existing system deficiencies and ensure a safe and reliable supply of water to current and future customers. This WSP complies with Washington State Department of Health (DOH) regulations under Washington Administrative Code (WAC) 246-290-100, which requires water purveyors to update their water system plans every ten years.

The District's previous WSP was approved in 2007. This updated WSP reflects improvements and changes to the water system since the completion of the 2007 WSP.

A revised WSP was submitted to DOH in 2019, and comments were received July 19, 2019. This WSP addresses those comments to obtain 10-year approval from DOH.

ES.2 Changes Since the Last Water System Plan

The District's last Water System Plan was approved in 2007. Several changes have occurred since the last update that affect water system planning for the District.

- In 2007, WAC 246-290-100 required WSPs to be updated and submitted to DOH every six years. The WAC recently changed to allow WSPs to be updated every ten years.
- Implementation of the Revised Total Coliform Rule.
- Implementation of the Groundwater Rule.
- Implementation of the Lead and Copper Rule revision to include the lead service line inventory requirement.

- Implementation of the per- and polyfluoroalkyl substances (PFAS) monitoring requirement.

ES.3 Summary of Key Elements

The WSP presents a description of the existing water system and service area, a forecast of future water demands, policies and design criteria for water system operation and improvements, the operations and maintenance program, staffing requirements, a schedule of improvements, and a financial plan to accomplish the improvements. The WSP also includes several ancillary elements that include a water use efficiency program, a water quality monitoring plan, a wellhead protection plan, and a cross-connection control program. A summary of the key issues related to these elements is provided in the following sections.

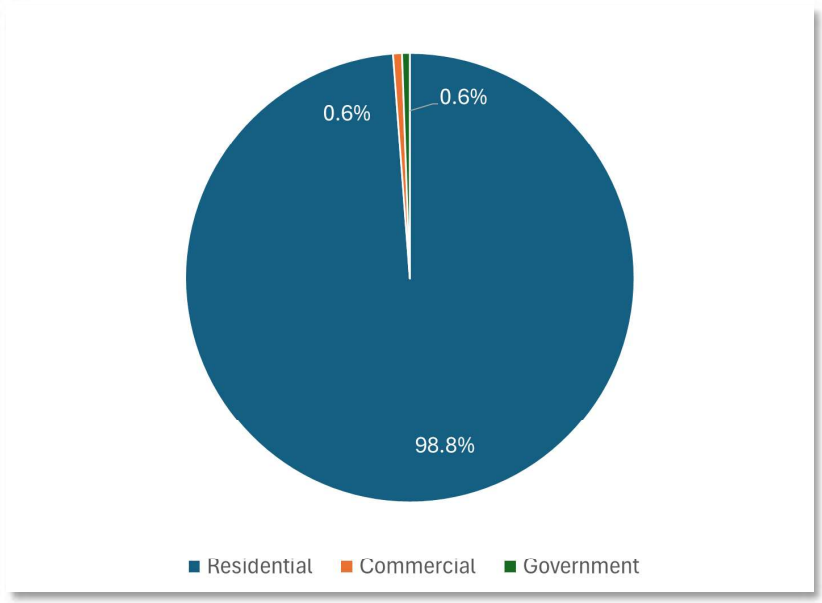
ES.3.1 Water Service Area

In 2023, the District provided water service to approximately 3,422 customer accounts within its existing water service area boundary, which extends beyond the District's corporate limits. The District is responsible for providing public water service, utility management, and water system development within the water service area. The District provides water service to mostly single-family residents, which make up approximately 98.8 percent of all accounts and approximately 94.1 percent of all water supplied, as shown in Figure ES-1.

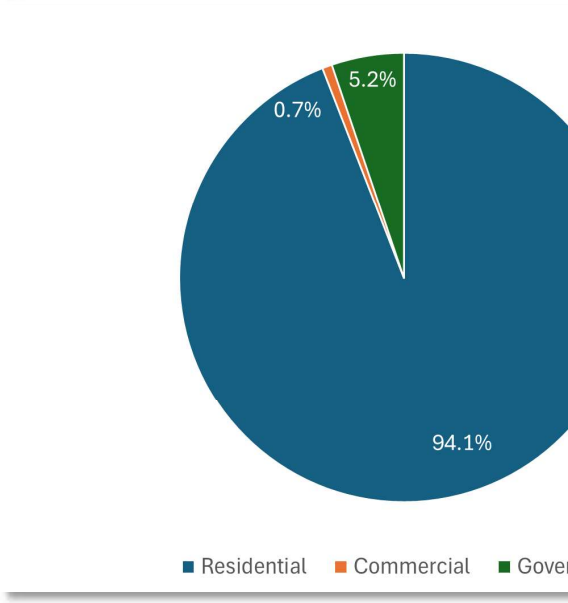
ES.3.2 Past Water Usage and Conservation

The District has experienced a trend of decreasing water demands per equivalent residential unit (ERU) since 2011. The District's rolling 3-year average distribution system leakage (DSL) is approximately 9.1 percent and lower from 2012 through 2023 and is less than the standard ten percent established by the Water Use Efficiency Rule. To meet the DSL standard, the District will continue to implement a progressive water main replacement and leak detection program to reduce system leaks, replace system-wide service meters, and increase monitoring of water used for construction and firefighting activities.

The District's per capita demand in 2023 was approximately 71 gallons per capita per day. The 2023 demand per capita is similar to other water systems in the Puget Sound area.



2023 Water Connections



2023 Water Consumption

Figure ES-1 Water Service Area

ES.3.3 Future Water Demands and Water Supply

Overall water demand within the District's system is expected to increase approximately 2 percent within the next ten years, and 2 percent within the next 20 years, depending on the amount of growth and future water use reductions from the District's conservation program. The District has sufficient water supply from its nine groundwater wells to meet the demand requirements of the system through 2045, as shown in Figure ES-2.

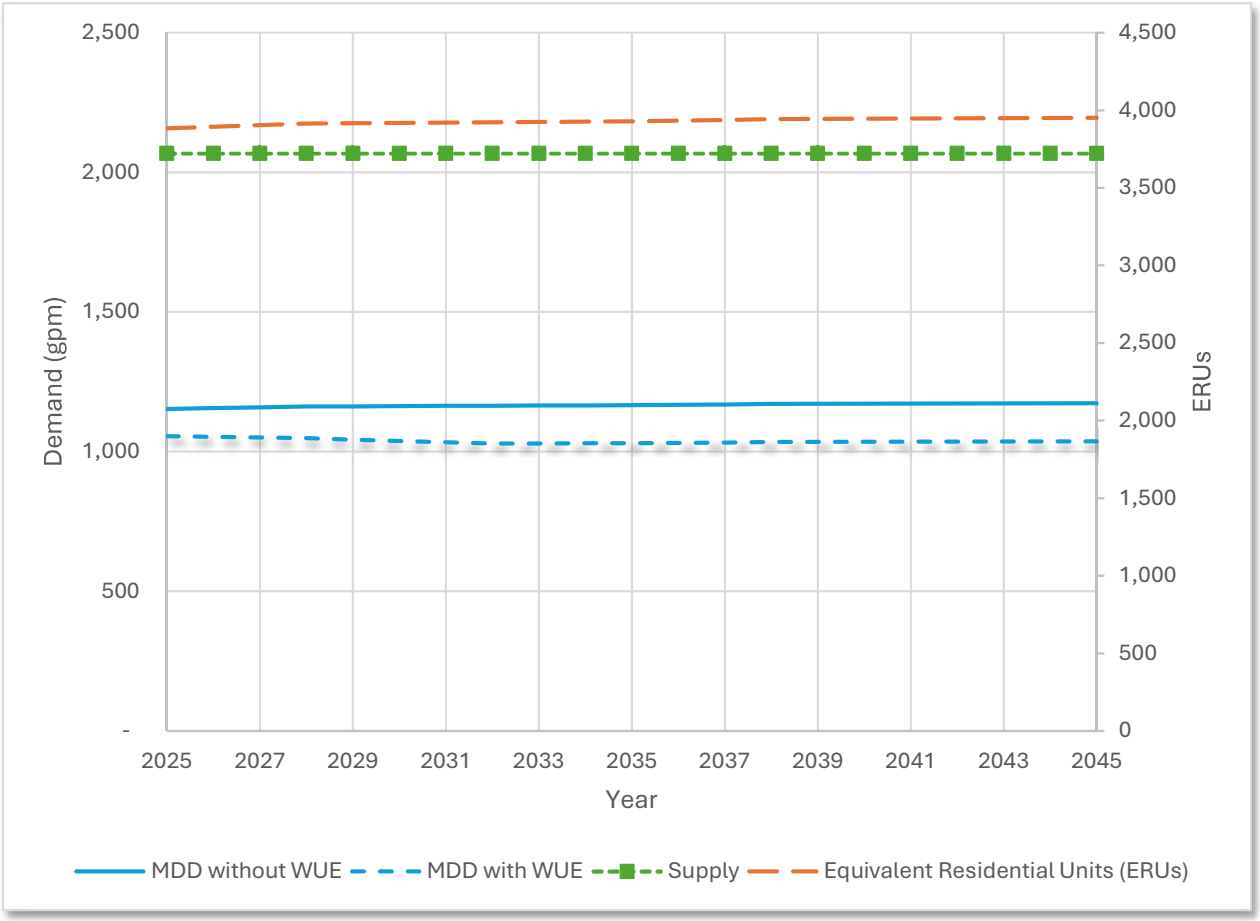


Figure ES-2 Future Water Demands

ES.3.4 Water Source and Quality

The District's drinking water is supplied from nine groundwater wells. Water rights from these sources are sufficient to meet the demand requirements of the existing demands and future demands through 2045.

The District is required to disinfect their entire distribution system due to past Total Coliform violations, and to monitor disinfection residual concentrations. Water is disinfected at Wells 1, 2, 4, 5R, 6, 7, 9, 10, and 11 to a residual chlorine level of 0.3 mg/L to 0.5 mg/L, and fluoridated at all sources except Well 4. The quality of the District's water supply has been good and has met or exceeded all drinking water standards, except for higher than allowable levels of manganese at Wells 4 and 10. A treatment facility for Well 10 is currently in design to reduce the level of manganese. The drinking water regulations are constantly changing and will require additional monitoring and reporting in the future in an effort to ensure safe drinking water for the public. Therefore, it is imperative that the District stays abreast of the regulations to maintain compliance.

ES.3.5 Operations and Maintenance

The District's operations and maintenance organization is staffed by well-qualified, technically trained personnel. District staff regularly participates in safety and training programs to keep abreast of the latest changes in the water industry and ensure a smooth and safe operation of the water system. The current staff of supervisory personnel and field crew has effectively operated the water system in the past. The District's current staffing level can adequately operate the water system; however, as the system expands, the need for additional staff will increase. The District will evaluate the need for additional staff on an ongoing basis as budget allows. The District currently has five full time employees (FTE) in operations and maintenance.

The District has taken several steps to prepare for emergency situations. An Emergency Response Plan and Vulnerability Assessment were developed by the District in 2005, and most recently updated in 2021, in accordance with the Public Health Security and Bioterrorism Preparedness and Response Act of 2002. The District has assessed the vulnerability of the major water system facilities for a number of emergency events and identified follow-up procedures to be carried out. The District is a member of the Washington Water/Wastewater Agency Response Network (WAWARN). The mission of WAWARN is to support and promote statewide emergency preparedness, disaster response, and mutual aid assistance for Washington's public and private water related utilities in the case of natural or man-made disasters.

ES.3.6 Water System Evaluation

The existing water system was evaluated to determine its ability to meet the policies and design criteria of the District and those mandated by DOH. The results of the evaluation are summarized below.

- The District has sufficient water supply and source capacity to meet both the existing and future water demands beyond 2045.
- The Cedar Avenue Booster Pump Station is an aging and undersized facility and in need of overall rehabilitation with a capacity of approximately 900 gpm.
- Wells 10 needs a treatment system to reduce the levels of manganese at Well 10. This system is in final design.
- Several areas of the system require replacement of existing water main to resolve deficiencies related to low fire flows, aging water main, and undesirable materials.
- Multiple pressure reducing station improvements are needed to provide adequate flow and pressure relief valves.
- Pressure zone improvements are needed to increase service pressures to meet minimum pressure requirements and reduce the amount of dead storage in the District's system.

ES.3.7 Proposed Water System Improvements and Financing Plan

Improvements to the water system are necessary, primarily to resolve existing system deficiencies, but also to accommodate the increase in water demands from future growth. Improvements identified for the first ten years of the capital improvement program (2026 through 2035) are estimated to cost approximately $16,100,000, which results in an average expenditure of approximately $1,610,000 per year. Improvements in the following ten years (2036 through 2045) are estimated to cost approximately $20,280,000.

The financial analysis is intended to illustrate the feasibility of funding the operation and maintenance and capital improvements recommended for the water system for the next ten years. It is projected that the 20-year capital improvements can be funded from a combination of sources that include capital revenues, interest earnings, and revenue bond proceeds. The District has established rates that are affordable to its customers and has earned a reputation for providing high-quality customer service and a reliable water supply. The District's sound financial policies will ensure that this same level of service will be provided for many years to come.

Chapter 1 Introduction

1.1 Water System Ownership and Management

Manchester Water District (District) is a municipal corporation that owns and operates a public water system within its corporate boundaries and designated retail water service area. Water system data on file at the Washington State Department of Health (DOH) for the District's system is shown in Table 1-1.

Table 1-1
Water System Ownership Information

Information Type	Description
System Type	Group A – Community – Public Water System
System Name	Manchester Water District
County	Kitsap
DOH System ID Number	50700 2
Owner Number	003566
Mailing Address	PO Box 98, Manchester, WA 98353
Physical Adress	8185 East Daniels Loop, Suite 111, Manchester, WA 98366
Contact	Mr. Tony Lang, General Manager
Contact Phone Number	(360) 871-0500

1.2 Overview of Existing System

At the end of 2023, the District provided service to approximately 3,422 customer connections, or 3,593 equivalent residential units (ERUs), within the District's water service area, which extends beyond the corporate boundaries. The corporate boundary comprises an area of approximately 3.6 square miles, and the water service area is approximately 10.8 square miles. The 2024 population served by the District was approximately 9,245.

Water supply to the District is provided by nine groundwater wells located within eight well fields. In 2014, Well 3 was removed from service and its water right was transferred to Wells 6 and 7. Well 4 is limited to operating eight hours per day at 50 gallons per minute (gpm) within each 24-hour period due to restrictions on its water right. Well 5R cannot be operated simultaneously with Well 9 because of interference between their aquifers, which are in hydraulic connection. The District owns one additional well, Well 12, which is not connected to the existing water system currently. Water storage is provided by five reservoirs that have a total capacity of 3.30 million gallons (MG). In addition, the District's water system has seven pressure zones with ten pressure reducing stations, two booster pump stations, and more than 50 miles of water main. A summary of 2023 water system data for the District's system is shown in Table 1-2.

Table 1-2
2023 Water System Data

Description	Data
Population	9,245
Water Service Area	10.8 square miles
Total Connections	3,422
Total ERUs	3,593
Demand per ERU	171 gallons per day
Annual Supply	236,939,000 gallons
Average Day Demand	451 gpm
Unaccounted-for Water	9.1%
Maximum Day/Average Day Demand Factor	2.50
Peak Hour/Maximum Day Demand Factor	1.68
Number of Pressure Zones	7
Number of Wells & Total Capacity	9 (2,067 gpm)
Number of Pump Stations & Total Capacity	2 (370 gpm)
Number of Reservoirs & Total Capacity	5 (3.30 MG)
Number of Pressure Reducing Stations	10
Total Length of Water Main	50 miles

1.3 Authorization and Purpose

The District authorized BHC Consultants, LLC (BHC) to prepare a water system plan as required by state law under Washington Administrative Code (WAC) 246-290-100. DOH provided comments on a draft water system plan submitted in 2019 but not approved. This plan addresses those DOH comments.

The District's previous Water System Plan (WSP) was prepared for the District in 2007. At that time, WAC 246-290-100 required water system plans to be updated and submitted to the DOH every six years. However, the District's population growth stalled in the interim, and DOH allowed the update to be delayed.

The WAC also changed to allow WSPs to be updated every ten years. The purpose of this updated Water System Plan is as follows.

- To evaluate existing water demand data and project future water demands.
- To analyze the existing water system to determine if it meets minimum requirements mandated by DOH and the District's own policies and design criteria.
- To identify water system improvements that resolve existing system deficiencies and accommodate future needs of the system for at least 20 years into the future.
- To prepare a schedule of improvements that meets the goals of the District's financial program.
- To evaluate past water quality and identify water quality improvements, as necessary.
- To document the District's operations and maintenance program.
- To prepare water use efficiency, cross-connection control, wellhead protection, and water quality monitoring plans.
- To comply with all other water system plan requirements of DOH.

1.4 Summary of WSP Contents

The following is a brief summary of the content of the chapters in this WSP.

- The **Executive Summary** provides a brief summary of the key elements of this WSP.
- **Chapter 1** introduces the reader to the District's water system, the objectives of the WSP, and its organization.
- **Chapter 2** presents the water service area, describes the existing water system, and identifies adjacent water purveyors.
- **Chapter 3** presents related plans, land use, and population characteristics.
- **Chapter 4** identifies existing water demands and projected future demands.
- **Chapter 5** presents the District's operational policies and design criteria.
- **Chapter 6** discusses the District's water source and water quality monitoring program.
- **Chapter 7** discusses the water system analyses and existing system deficiencies.
- **Chapter 8** discusses the District's operations and maintenance program.
- **Chapter 9** presents the proposed water system improvements, their estimated costs, and implementation schedule.
- **Chapter 10** summarizes the financial status of the District and presents a plan for funding the water system improvements.
- The **Appendices** contain additional information and plans that supplement the main chapters of the WSP.

1.5 Definition of Terms

The following terms are used throughout this WSP.

Connection Charge: A one-time fee paid by a property owner when connecting to the District's system. It is made up of the General Facility Charge, Local Facilities Charge, and Meter Installation Charge.

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

Cross-Connection: Any physical connection, actual or potential, between a water system and any source of non-potable substance that presents the potential for contaminating the public water system.

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

- **Average Day Demand (ADD)**: The total amount of water delivered to the system in a year divided by the number of days in the year.
- **Maximum Day Demand (MDD)**: The maximum amount of water delivered to the system during a 24-hour time period of a given year.
- **Peak Hour Demand (PHD)**: The maximum amount of water delivered to the system, excluding fire flow, during a 1-hour time period of a given year. A system's peak hour demand usually occurs during the same day as the maximum day demand.

Distribution System Leakage: Water that is measured as going into the distribution system but not measured as going out of the system.

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

Fire Flow: The rate of flow of water required during fire fighting, which is usually expressed in terms of gallons per minute.

Front Footage Charge: The Front Footage Charge is assessed for unusual lot sizes or configurations, or for larger non-residential development, in lieu of the Local Facilities Charge.

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

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

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

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

Local Facilities Charge: A one-time fee paid by a property owner when connecting to the District's water system. The Local Facilities Charge provides for the reimbursement of a pro rata portion of the original cost of water system local distribution extensions.

Maximum Contaminant Level (MCL): The maximum permissible level of contaminant in the water that the purveyor delivers to any public water system user, measured at the locations identified under WAC 246-290-300, Table 3.

Meter Installation Charge: The meter installation charge for residential meters is a uniform charge that is based on historical costs of construction time incurred and materials used in installing a water service. Water meter installations greater than 1 inch in size are charged actual time, materials, and overhead costs.

Potable: Water suitable for human consumption.

Pressure Zone: A portion of the water system that operates from sources at a common hydraulic elevation. For example, the North 430 Zone refers to the District's higher pressure zone in the northern portion of the system that has reservoirs with an overflow elevation of 430 feet.

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

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

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

- operational storage;
- equalizing storage;
- standby storage;
- fire flow storage; and
- dead storage.

1.6 List of Abbreviations

The abbreviations listed in Table 1-3 are used throughout this WSP.

Table 1-3
Abbreviations

Abbreviation	Description
ADD	Average Day Demand
AWWA	American Water Works Association
BPS	Booster Pump Station
CCR	Consumer Confidence Report
CIP	Capital Improvement Program
DBP	Disinfection Byproduct
District	Manchester Water District
DOH	Washington State Department of Health
EPA	U.S. Environmental Protection Agency
ERU	Equivalent Residential Unit
fps	feet per second
GMA	Growth Management Act
gpm	gallons per minute
KPUD	Kitsap Public Utility District
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDD	Maximum Day Demand
MG	Million Gallons
mg/l	milligrams per liter
MGD	Million Gallons per Day
OSHA	Occupational Safety and Health Administration
PHD	Peak Hour Demand
PRV	Pressure Reducing Valve
psi	pounds per square inch
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SOC	Synthetic Organic Chemical
SWTR	Surface Water Treatment Rule
TTHM	Total Trihalomethanes
UGA	Urban Growth Area
USGS	United States Geological Survey
VOC	Volatile Organic Chemical
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act
WSP	Water System Plan

Chapter 2 Water System Description

2.1 Introduction

This chapter describes Manchester Water District's (District) existing and future water service areas, water service agreements, and provides a thorough description of the water system and its individual components. The results of the evaluation and analyses of the existing water system are presented in Chapter 7.

2.2 Water Service Area

2.2.1 History

The District was established in 1942. The original system was constructed in 1947 to serve the community of Manchester and a subdivision located south of the community. By the time the District's first Water System Plan (WSP) was adopted in 1970, water service was extended to approximately 800 customers who were supplied by 3 wells, a 37,000-gallon tank on Cedar Avenue, and a 100,000-gallon tank on

Banner Road. Since 1970, the District has prepared several updates to its WSP, replaced the original Cedar Avenue Tank with a larger 250,000-gallon tank, doubled the capacity of the Banner Road Tank with a new 200,000- gallon tank, and supplemented the system with additional storage and supply facilities. The distribution network also has expanded to serve areas outside the community of Manchester, from the Manchester Environmental Protection Agency (EPA) Laboratory to the Southworth Ferry Terminal.

2.2.2 Topography

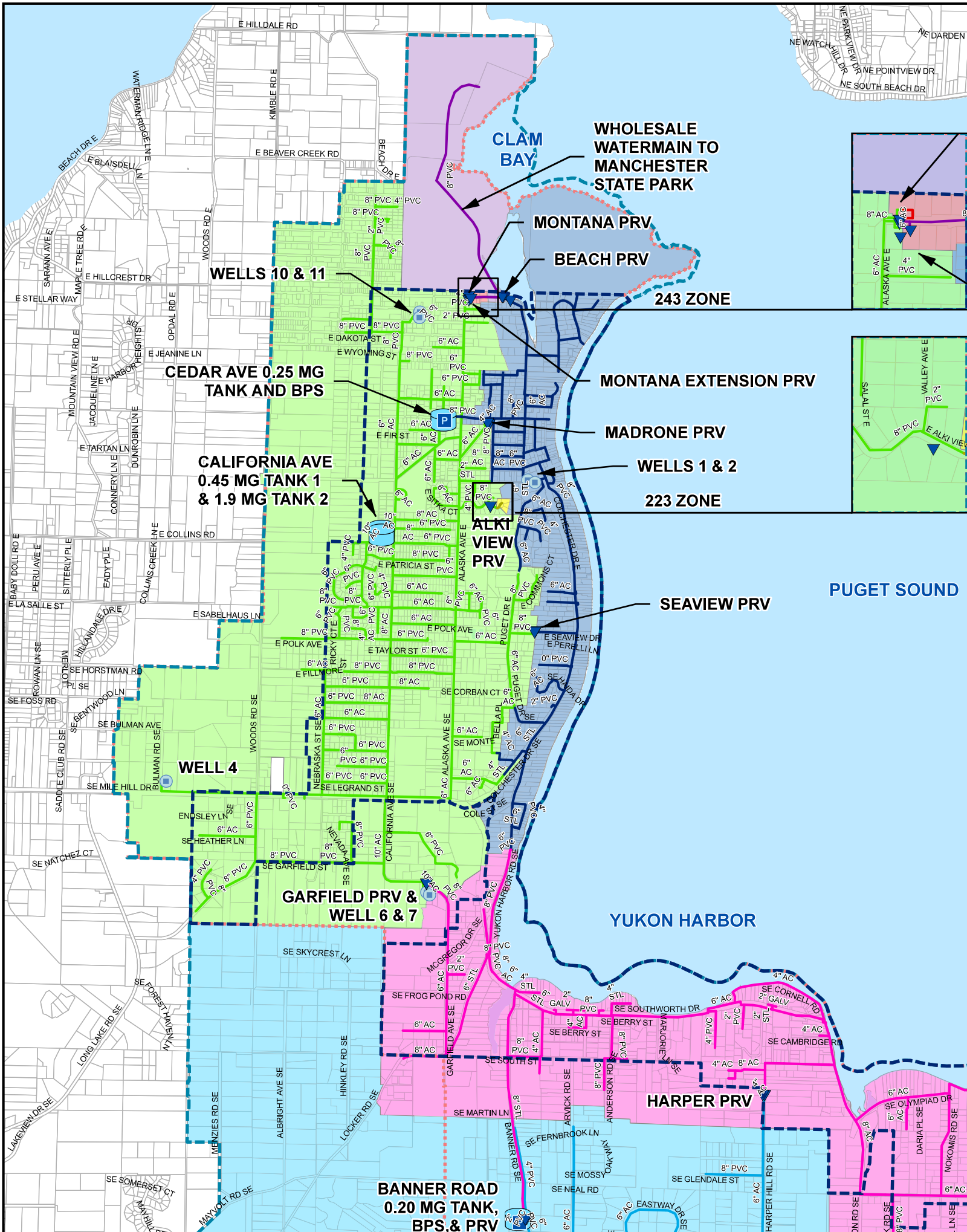
The topography of the District's retail water service area varies greatly in elevation. The lowest areas within the service territory are located along the District's easterly boundary with Puget Sound, where the elevation is approximately sea level. Elevations range from sea level in this portion of the service area to 365 feet along Sedgwick Road in the southern portion of the service area. Generally, the highest areas served are along the western and southern extents of the water system.

2.2.3 Water Service Area

The District is in the southeast portion of Kitsap County, Washington along the western shores of Puget Sound. The existing water distribution system extends south to SE Sedgwick Road, north to the EPA's Manchester Environmental Laboratory, west to SE Bulman Road, and east to the Puget Sound. Portions of the District's existing water distribution system extend beyond the corporate limits and within its defined water service area, as shown in Figure 2-1. The District's corporate boundary encompasses an area of approximately 3.2 square miles and represents those areas that have been annexed by the District. Requests for new water service outside the corporate limits will only be granted upon approval of a water service agreement.

The District's water service area boundary was defined in the 2005 *Kitsap County Coordinated Water System Plan* and is shown in Figure 2-3. The District is responsible for providing public water service, utility management, and water system development within this area. The water service area boundary extends south to SE Overra Road, north to approximately 500 feet north of Delaware Court E., west to SE Bulman Road, and east to the Puget Sound. The District's existing retail water service area boundary encompasses an area of approximately 10.5 square miles and is not anticipated to change in the future. The water service area boundary also represents the future retail water service area.

The District's existing water rights can be used throughout the defined water service area, per the 2003 Municipal Water Law, once this WSP showing the service area is approved by the Washington State Department of Health (DOH). According to the law, the place of use for the District's water rights is defined as the area served. Thus, the District can use its water rights outside of its corporate limits if the use is within the defined service area and all legal requirements defined in Revised Code of Washington (RCW) 90.03.386(2) have been met. With this WSP, the District is expanding the water right place of use to be the water service area in accordance with the Municipal Water Law. The District's service area is consistent with the legal requirements since the service area does not conflict with other adopted plans or regulations. Figure 2-3 displays the existing and future retail water service areas.


CLAM BAY
WHOLESALE WATERMAIN TO MANCHESTER STATE PARK
MONTANA PRV
BEACH PRV
243 ZONE
WELLS 10 & 11
MONTANA EXTENSION PRV
CEDAR AVE 0.25 MG TANK AND BPS
MADRONE PRV
WELLS 1 & 2
223 ZONE
CALIFORNIA AVE 0.45 MG TANK 1 & 1.9 MG TANK 2
ALKI VIEW PRV
SEAVIEW PRV
PUGET SOUND
WELL 4
GARFIELD PRV & WELL 6 & 7
YUKON HARBOR
HARPER PRV
BANNER ROAD 0.20 MG TANK, BPS,& PRV
E HILLDALE RD
E BEAVER CREEK RD
E HILLCREST DR
E STELLAR WAY
E JEANINE LN
E HARBOR HEIGHTS DR
E TARTAN LN
E COLLINS RD
E SABELHAUS LN
E LA SALLE ST
E BABY DOLL RD E
E PATRICIA ST
E POLK AVE
E TAYLOR ST
E FILLMORE ST
E SEAVIEW DR
E PERBELLI LN
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SE FOSS RD
SE BENTWOOD LN
SE BULMAN AVE
SE MILE HILL DR
SE LEGRAND ST
SE GARFIELD ST
SE HEATHER LN
SE NATCHEZ CT
SE SKYCREST LN
SE FROG POND RD
SE SOUTHWORTH DR
SE BERRY ST
SE CAMBRIDGE RD
SE SOUTH ST
SE MARTIN LN
SE FERNBROOK LN
SE MOSSY
SE NEAL RD
SE GLENDALE ST
SE SOMERSET CT
MAYVOLT RD SE
EASTWAY DR SE
SE CORBAN CT
SE MONTE
SE HODA DR
COLE ST SE
NE PARK VIEW DR
NE WATCH HILL DR
NE POINTVIEW DR
NE SOUTH BEACH DR
NE DARDEN
BEACH DR E
E BLAISDELL LN
WATERMAN RIDGE LN E
KIMBLE RD E
WOODS RD E
SARANN AVE E
MAPLE TREE RD E
OPDAL RD E
MOUNTAIN VIEW RD E
JACQUELINE LN E
DUNROBIN LN E
CONNERY LN E
COLLINS CREEK LN E
PERU AVE E
SITTERLY PL E
EADY PL E
HILLANDALE DR E
ROWAN LN SE
MERLOT PL SE
SADDLE CLUB RD SE
WOODS RD SE
BULMAN RD SE
NEBRASKA ST SE
ENOSLEY LN SE
NEVADA AVE SE
CALIFORNIA AVE SE
ALASKA AVE E
ALASKA AVE SE
SITKA CT
PUGET DR E
PUGET DR SE
COMMONS CT
CHESTER DR E
CHESTER DR SE
BELLA PL
YUKON HARBOR RD SE
MCGREGOR DR SE
GARFIELD AVE SE
MARJORIE LN SE
ANDERSON RD SE
ARVICK RD SE
BANNER RD SE
OAKWAY
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DARIA PL SE
NOKOMIS RD SE
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LONG LAKE RD SE
LAKEVIEW DR SE
SE FOREST HAVEN LN
MENZIES RD SE
ALBRIGHT AVE SE
HINKLEY RD SE
LOCKER RD SE
VALLEY AVE E
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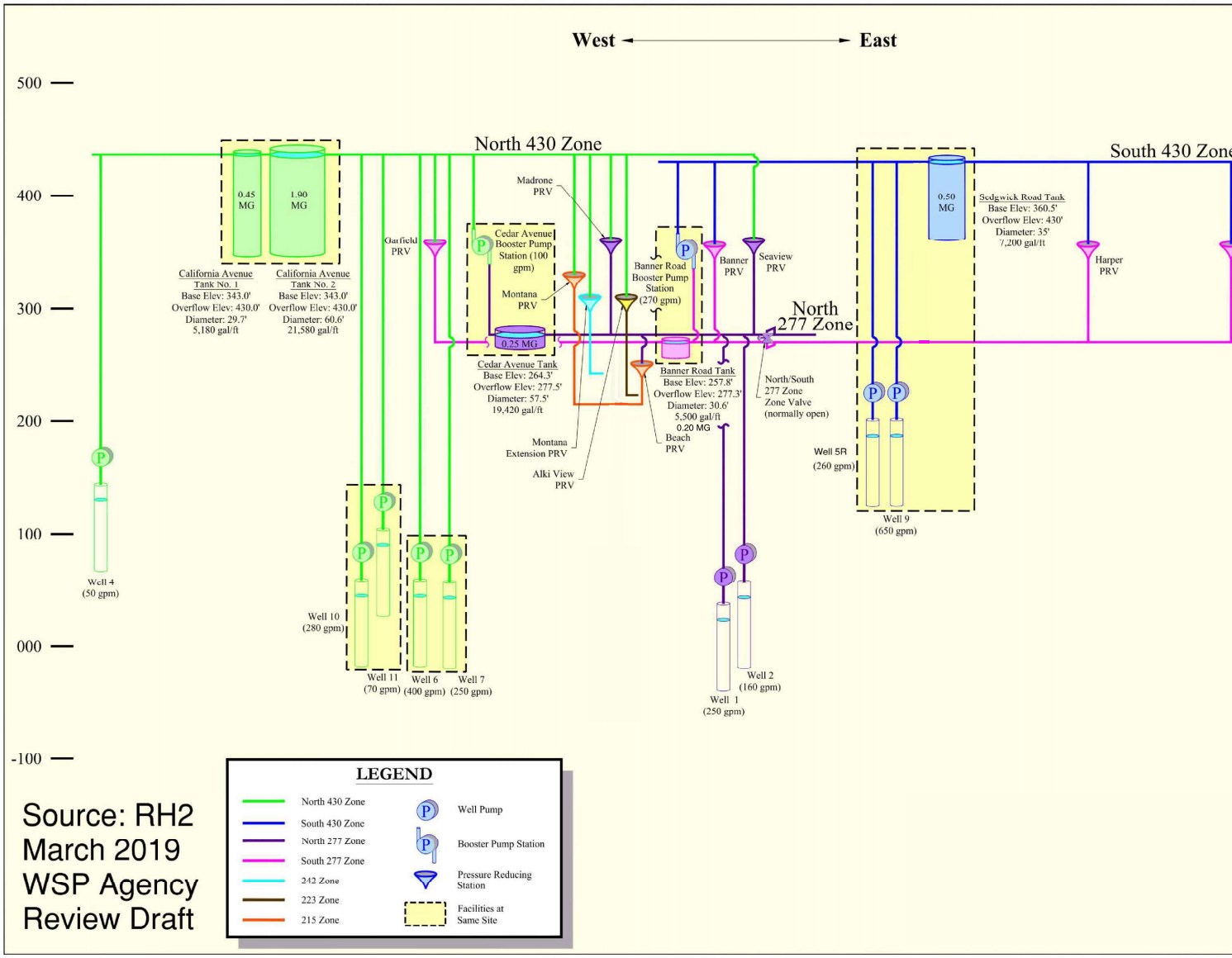

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Manchester WATER DISTRICT

Existing Syster
Profile
Manchester Water Sys
September 2025

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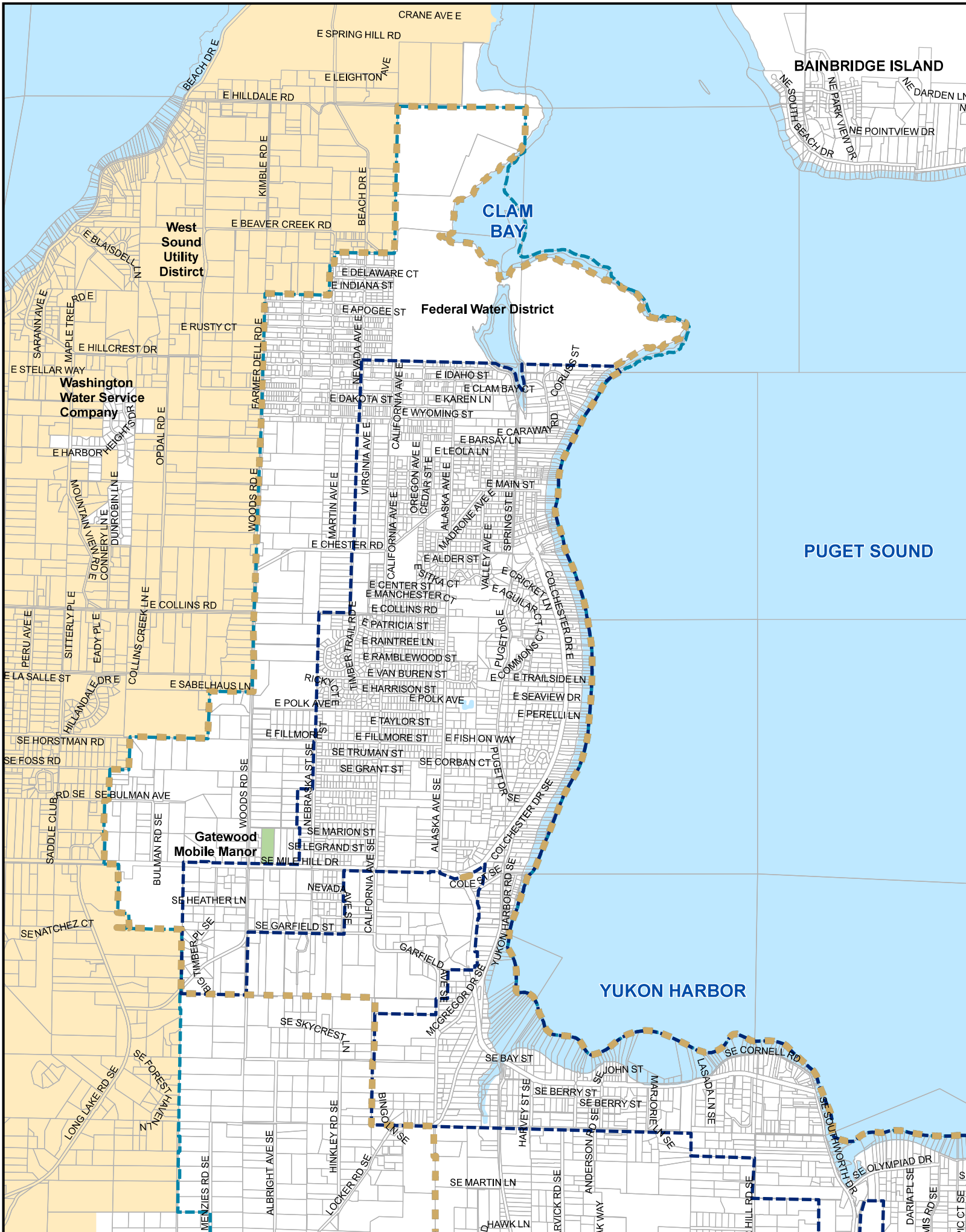
BAINBRIDGE ISLAND
CLAM BAY
PUGET SOUND
YUKON HARBOR
West Sound Utility Distirct
Federal Water District
Washington Water Service Company
Gatewood Mobile Manor
CRANE AVE E
E SPRING HILL RD
E LEIGHTON AVE
E HILLDALE RD
BEACH DR E
KIMBLE RD E
E BEAVER CREEK RD
E BLAISDELL LN
E DELAWARE CT
E INDIANA ST
E APOGEE ST
E RUSTY CT
E HILLCREST DR
E STELLAR WAY
SARANN AVE E
MAPLE TREE RD E
FARMER DELL RD E
NEVADA AVE E
CORLISS ST
E IDAHO ST
E CLAM BAY CT
E DAKOTA ST
E KAREN LN
E WYOMING ST
E CARAWAY RD
E BARSAY LN
E LEOLA LN
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OPDAL RD E
WOODS RD E
CALIFORNIA AVE E
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MADRONE AVE E
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E CHESTER RD
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VALLEY AVE E
SITKA CT
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COLCHESTER DR E
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MOUNTAIN VIEW RD E
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DUNROBIN LN E
PERU AVE E
SITTERLY PL E
EADY PL E
COLLINS CREEK LN E
TIMBER TRAIL RD E
E PATRICIA ST
E RAINTREE LN
E RAMBLEWOOD ST
E VAN BUREN ST
PUGET DR E
E COMMONS CT
E TRAILSIDE LN
E SEAVIEW DR
E PERELLI LN
E LA SALLE ST
HILLANDALE DR E
E SABELHAUS LN
RICKY CT
E HARRISON ST
E POLK AVE
E TAYLOR ST
E FILLMORE ST
E FISH ON WAY
SE HORSTMAN RD
SE FOSS RD
SE TRUMAN ST
SE GRANT ST
SE CORBAN CT
PUGET DR SE
COLCHESTER DR SE
SADDLE CLUB RD SE
SE BULMAN AVE
WOODS RD SE
BULMAN RD SE
NEBRASKA ST SE
ALASKA AVE SE
SE MARION ST
SE LEGRAND ST SE
SE MILE HILL DR
COLE SPIT SE
YUKON HARBOR RD SE
NEVADA AVE SE
CALIFORNIA AVE SE
SE HEATHER LN
SE NATCHEZ CT
SE GARFIELD ST
TIMBER PL SE
BIG
GARFIELD AVE SE
MCGREGOR DR SE
SE SKYCREST LN
SE BAY ST
SE JOHN ST
SE CORNELL RD
LASADA LN SE
MARJORIE LN SE
SE BERRY ST
HARVEY ST SE
ANDERSON RD SE
SE SOUTHWORTH DR
SE OLYMPIAD DR
LONG LAKE RD SE
SE FOREST HAVEN LN
BINGO LN SE
HINKLEY RD SE
LOCKER RD SE
ALBRIGHT AVE SE
MENZIES RD SE
SE MARTIN LN
HAWK LN
HILL RD SE
DARIA PL SE
NE SOUTH BEACH DR
NE PARK VIEW DR
NE POINTVIEW DR
NE DARDEN LN

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2.3 Water Service Agreements

2.3.1 Water Service Area Agreement

All water purveyors located within a Critical Water Supply Service Area (CWSSA) are required to have a water service area agreement that identifies the external boundary of their service area. Water service area agreements are typically developed and signed during the development or update of a coordinated water system plan. All of Kitsap County (County) was declared a CWSSA on March 2, 1987. The *Kitsap County Coordinated Water System Plan*, which documents the District's water service area boundary, was first completed in November 1992, and its most recent update was approved by DOH on June 27, 2005. A signed copy of the District's water service area agreement is included in Appendix A.

2.4 Satellite System Management

A Satellite Management Agency (SMA) is defined as a person or entity that is certified by DOH to own or operate more than one public water system without the necessity for a physical connection between such systems. SMAs were created to stop the proliferation of small water systems, many of which could not meet federal and state water quality and water system planning regulations. Based on the success of SMAs, DOH made recommendations to the legislature to include rules for designating entities as qualified SMAs. In July 1995, Senate Bill 5448 became law that governs approval of new water systems and sets forth requirements for SMAs. The goal of the new law is to ensure that the people of this state will receive safe and reliable water supplies in the future from professionally managed or properly operated water systems. SMAs can provide three different levels of service:

1. Ownership of the satellite system;
2. Operations and management of the satellite system; and
3. Contract services only.

The service can be provided to new systems, existing systems that are no longer viable, or existing systems placed into receivership status by DOH.

The District is on DOH's List of Approved Satellite Management Agencies as SMA #132, and operates two Group B water systems. The Krystal Woods water system is supplied by one 40 gallons per minute (gpm) groundwater well and approved for a maximum of 6 service connections. This system is located on the 1050 block of SE Woods Road. The Forest Meadows water system is located on the 7000 block of SE Sedgwick Road and is approved for six service connections. The system currently serves five residences.

The District is not open to owning, operating, or owning new water systems. The SMA Checklist is included as Appendix P.

2.5 Existing Water Facilities

This section provides a detailed description of the existing water system and the current operation of the facilities. The analyses of the existing water facilities are presented in Chapter 7.

General water system facility data are summarized on the DOH Water Facilities Inventory (WFI) form contained in Appendix B.

2.5.1 Pressure Zones

The District currently serves customers within an elevation range of approximately sea level in areas along the shores of Puget Sound to approximately 365 feet along SE Sedgwick Road in the southern portion of the system. The wide range of elevations requires that the water pressure be increased or reduced to maintain pressures that are safe and sufficient to meet the system's flow requirements. The District achieves this by dividing the water system into seven distinct pressure zones, as shown in Figure 2-1.

Well 1 Buildings

The pressures in four of the District's seven pressure zones are regulated by reservoir levels, as illustrated in the hydraulic profile, Figure 2-2. Pressures in the North 430 Zone are established by the surface water level in the California Avenue Tanks. The North 430 Zone serves the northwestern portion of the service area, with the majority of the zone lying west of Alaska Avenue E and north of SE Garfield Street. This zone has a maximum hydraulic elevation of 430 feet and serves customers within an elevation range of approximately 120 to 340 feet. Although the South 430 Zone has the same maximum hydraulic elevation as the North 430 Zone, the two pressure zones are not connected and operate independently. The South 430 Zone is in the southern portion of the District's service area and primarily serves customers located south of SE Southworth Drive. The surface water level in the Sedgwick Road Tank establishes pressures within the zone, and service elevations range from approximately 150 to 365 feet.

Well 2 Chemical Feed and SCADA Building

Pressures in the North 277 Zone are established by the surface water level in the Cedar Avenue Tank. The zone is in the northeastern region of the District, along the shores of the Puget Sound, and primarily serves the area east of Alaska Avenue E, north of SE Mile Hill Drive, and south of E Montana Street. The North

277 Zone has a maximum hydraulic elevation of 277 feet and serves customers within an elevation range of sea level to approximately 200 feet.

The South 277 Zone also has a maximum hydraulic elevation of 277 feet. The South 277 Zone primarily serves customers in the vicinity of SE Southworth Drive along the shores of Yukon Harbor and in the Southworth area. The surface water level in the Banner Road Tank establishes pressures within the zone, and service elevations range from sea level to approximately 210 feet. A zone valve located on the northwest corner of Yukon Harbor Road SE and McGregor Road S., is used to isolate the South 277 Zone from the North 277 Zone. However, the District currently operates the system with this zone valve open, such that the two zones operate as one.

The District's smallest pressure zones, the 242 Zone, the 223 Zone, and the 215 Zone, are supplied water through pressure reducing stations that regulate pressures to maintain a maximum hydraulic elevation within the zone. The Montana pressure reducing valve (PRV) supplies water to the 215 Zone from the North 430 Zone. Water is supplied to the 215 Zone from the North 277 Zone through the Beach PRV. The 215 Zone primarily commercial and government customers north of E. Montana Street, within an elevation range of sea level to approximately 120 feet. The Alki View PRV supplies water to the 223 Zone from the North 430 Zone and serves customers at the eastern end of Alki View Court within an elevation range of approximately 100 feet to 120 feet. The 242 Zone is supplied by the Montana Extension PRV. The 242 Zone serves customers within an elevation range of approximately 70 feet to 130 feet along E Montana Street from Alaska Avenue E to the easterly terminus of the roadway.

2.5.2 Supply Facilities

Introduction

Water supply to the District's water system is provided by 9 wells. A detailed description of each well source is provided below.

Water Treatment

The District provides fluoridated water to its customers on a system-wide basis. With the exception of Well 4, fluoridation is achieved at each of the well buildings through a fluoride injection system that consists of a sodium fluoride solution holding tank and a metering pump to automatically regulate the flow of sodium fluoride in proportion to the water supplied by the well. The metering pumps maintain a target residual for fluoride of 0.7 milligrams per liter (mg/L), and the fluoridation levels are monitored at each station by District staff on a daily basis to prevent sodium fluoride overfeed to the water system. Well 4 is not equipped with a fluoridation system because of its minimal flow rate and water right restrictions. Well 4 is only operated in conjunction with other sources of supply so that its produced water is blended with fluoridated water.

The District is required to provide routine disinfection and maintain a detectable level of chlorine on a system-wide basis due to past Total Coliform Violations. A detectable residual disinfection concentration is defined as at least 0.2 milligrams per liter (mg/L). Chlorine is added to Wells 1 and 2, 5R, 9, 10, and Well 11 via direct injection of a 12.5-percent sodium hypochlorite solution (NaOCl) solution at a target free residual of 0.3 to 0.5 mg/L. Chlorination is achieved at Wells 4, 6, and 7 by injection of a 12.5-percent NaOCl solution to oxidize hydrogen sulfide that occurs naturally in the aquifer. Metering pumps in the respective pump houses maintain a target free residual of 0.5 mg/L.

The District monitors disinfection residuals throughout their water system, including the South 277 Zone, South 430 Zone, North 277 Zone, and North 430 Zone. The District has a telemetry system which provides alarms for high and low chlorine level conditions at each of the well chlorination stations.

Wells 1 and 2

Wells 1 and 2 are located at separate but adjacent sites. Well 1 (DOH Source 1, DOE Well Tag No. APO507), the District's oldest well, is located at 2081 Spring Street, adjacent to the District's office on a site that is fenced and secure. The well is located in a wood building that houses the mechanical and electrical equipment. The chlorination and fluoridation equipment are in a storage building immediately adjacent to the well house.

Well 1 was first drilled in 1946 and reconditioned in 2007. The 8-inch diameter, 140-foot-deep well has a current capacity of approximately 250 gpm, which is delivered by a submersible pump powered by a 30 horsepower (hp) motor.

Well 2 (DOH Source 2, DOE Well Tag No. AAB484) is located on a site adjacent to Well 1 and the District's Operations office, on the northwest corner of Puget Drive E and Colchester Drive E. The forested site is partially fenced. A wood building houses the well's mechanical and electrical equipment, while the flow meter, chlorination, and fluoridation equipment are in a second wood building.

Well 2 is an artesian well that was originally constructed in 1947 and reconditioned in 2006. The 8-inch-diameter well is 110 feet deep and has a current supply rate of 160 gpm, which is delivered by a submersible pump powered by a 20 hp motor.

Wells 1 and 2 power sources are configured so both wells can be operated during power outages by the connection of a portable generator located at the shop facility. When Wells 1 and 2 are operated simultaneously, the production of the two wells decreases to a combined capacity of 400 gpm. Wells 1 and 2 provide water supply to the North 277 Zone and are controlled by the surface water level in the Cedar Avenue Tank.

Well 4

Well 4 (DOH Source 4, DOE Well Tag No. AAB486) is located adjacent to Mile Hill Drive at 1545 Bulman Road SE on a fenced and secure site. The well is located in a concrete masonry unit (CMU) building that houses the mechanical, electrical, and chlorination equipment for the well. The District also utilizes a separate room in the well building for chlorine injection equipment. The site does not have standby power or a power receptacle to enable connection of a portable generator.

The 12-inch diameter, 257-foot-deep Well 4 was drilled in 1973 and has a current capacity of 50 gpm. Supply from Well 4 is delivered by a vertical turbine pump with a 7.5 hp motor that was installed in 1990. The well is also equipped with two 100-gallon hydro-pneumatic tanks to provide surge protection for a small system that Well 4 originally served. Well 4 provides water supply to the North 430 Zone and is controlled by a timer, which restricts the well to pumping 50 gpm for a maximum of 8 hours per day, as required by the well's water right. Tests have found manganese in excess of the maximum contaminant level (MCL) of 0.05 mg/L.

Well 4 Pump Room

Well 5R (Previously Well 5 and 8 Well Field)

Well 5R (DOH Source 15, DOE Well Tag No. BCS880) has replaced the Wells 5 (DOE Well Tag No. AAB448) and 8 (DOE Well Tag No. AAB490) Well Field located at 8500 SE Sedgwick Road on a fenced and secure site that is shared with the Sedgwick Road Tank and Well 9. Wells 5 and 8 have been decommissioned.

A CMU building houses Well 5's mechanical, electrical, and treatment equipment. Well 5R is in hydraulic connection with Well 9, and does not run at the same time as Well 9. Well 5R has a pumping capacity of 250 gpm.

A dedicated treatment room in Well 5R's building contains a chlorination system. The fluoridation system is located in a corner of the mechanical and electrical control room. Well 5R provides water supply to the South 430 Zone and will be controlled by the surface water level in the Sedgwick Road Tank. This site has a common power receptacle and transfer switch that it shares with Well 9 to enable connection to a portable generator.

Well 5R Building & Treatment Building

Wells 6 and 7 Well Field

Wells 6 (DOH Source 6, DOE Well Tag No. AAB488) and 7 (DOH Source 7, DOE Well Tag No. AAB489) are located in the Garfield Well Field (DOH Source 14) on a fenced and secure site at 2160 Garfield Street E. The site has a power receptacle and transfer switch to enable connection to a portable generator which is stored in an adjacent garage building.

Wells 6/7 Treatment Building & Storage Shed

A CMU building houses Well 6's mechanical, electrical, and treatment equipment. The treatment equipment consists of chlorination and fluoridation systems for both Wells 6 and 7. The fluoridation equipment is located in the same room as Well 6's mechanical and electrical equipment, while the chlorination equipment is located in an adjacent room within the building. The District constructed a wood structure adjacent to the main well building to house the wellhead for Well 6. Well 6 is an 8-inch-diameter well that is 507 feet deep and was constructed in 1979. A new submersible 60 hp motor was installed in 2023, producing at a rate of 400 gpm.

The mechanical and electrical equipment for Well 7 is housed in a wood building. Well 7 is an 8-inch diameter, 493-foot-deep well that was drilled in 1983. The well has a current capacity of 250 gpm that is delivered via a submersible pump powered by a 40 hp motor that was installed in 2012.

Mechanical Equipment for Well 7

Wells 6 and 7 provide water supply to the North 430 Zone and are controlled by the surface water level in the California Avenue Tanks.

Well 9

Well 9 (DOH Source 9, DOE Well Tag No. AAB491) is located at 8500 SE Sedgwick Road on a fenced and secure site that is shared with the Sedgwick Road Tank and Well 5R. The site has a power receptacle and transfer switch to enable connection of a portable generator. A CMU and wood building house the well's mechanical, electrical, and treatment equipment.

Drilled in 1987, Well 9 is a 16-inch diameter, 310-foot-deep well. The well has a current capacity of 650 gpm, which is delivered by a vertical turbine pump powered by a 75 hp motor.

Well 9 is in hydraulic connection to Well 5R and only operates during higher demand summer months. During the period when Well 9 is operating, Well 5R is manually taken offline.

A dedicated treatment room in Well 9's CMU building contains a stationary chlorination system. The fluoridation system is located in the same room as Well 9's mechanical and electrical equipment. When Well 9 is online, the well provides water supply to the South 430 Zone and is controlled by the surface water level in the Sedgwick Road Tank.

Well 9 Building and Treatment Building

Well 10

Well 10 (DOH Source 10, DOE Well Tag No. AAC743) is located at 7265 E Last Refuge Way on a site that is shared with Well 11, with which it is in hydraulic connection. The Well 10 wellhead and pump are in a below-grade concrete vault, while the well's electrical equipment is located in a CMU building adjacent to

the vault. The CMU building also houses the electrical and treatment equipment for Well 11. The site does not have standby power or a power receptacle to enable connection of a portable generator.

Well 10 and 11 Interior Piping

The 8-inch diameter, 350-foot-deep Well 10 was drilled in 1988 and has a current capacity of 280 gpm. Supply from Well 10 is delivered by a submersible pump with a 50 hp motor that was replaced in 2009. Well 10 provides water supply to the North 430 Zone and is controlled by the surface water level in the California Avenue Tanks. Because of the relatively high manganese levels in the water produced by the well, it is operated only in conjunction with other sources. A filtration system is being designed to remove manganese and is expected to be operational in 2026.

Well 11

Well 11 (DOH Source 11, DOE Well Tag No. AAB493) is located at 7265 E Last Refuge Way on a site that is shared with Well 10, with which it is in hydraulic connection. The Well 11 wellhead and pump are located in a below-grade concrete vault, while the well's electrical and fluoridation equipment are located in a CMU building adjacent to the vault. The CMU building also houses the electrical equipment for Well 10. The site does not have standby power or a power receptacle to enable connection of a portable generator.

Well 11 Wellhead

The 8-inch diameter, 269-foot-deep Well 11 was drilled in 1989 and has a current capacity of 70 gpm. Supply from Well 11 is delivered by a submersible pump with a 15 hp motor that was replaced in 2008. Well 11 provides water supply to the North 430 Zone and is controlled by the surface water level in the California Avenue Tanks.

Well 12

Well 12 was purchased by the District from Kitsap Public Utility District (KPUD). The well, which was used as a test well by KPUD for groundwater monitoring, is located on Sedgwick Road between Anderbar Road SE and Banner Road SE. Well 12 was drilled in 1997, is 10 inches in diameter, and 990 feet deep. The well property was recently sold in 2017 to a private owner and the monitoring well is now maintained by the Department of Ecology. The well was never connected to the District's water system.

Well 12 Wellhead

2.5.3 Pump Station Facilities

The District has two booster pump stations that operate during emergency conditions to provide water supply from a lower pressure zone to a higher pressure zone. A detailed description of each booster pump station is provided below.

Banner Road Booster Pump Station

The Banner Road Booster Pump Station (BPS) was constructed in 1999. The BPS is located on Banner Road, approximately 1,900 feet north of Sedgwick Road on a site that is shared with the Banner Road Tank. A wood building houses the booster pump station's mechanical and electrical equipment. The pump station has one centrifugal pump that is used to pump water from the Banner Road Tank into the South 430 Zone. The BPS is operated manually as a backup supply facility to the South 430 Zone during emergency conditions. The pump is rated at 270 gpm and powered by a 30 hp motor. The Banner Road Booster Pump Station does not have standby power or a power receptacle to enable connection of a portable generator.

Banner Road Booster Pump Station

Cedar Avenue Booster Pump Station

The Cedar Avenue BPS was constructed in 1973 and is located at 2343 Cedar Street E on a site that is shared with the Cedar Avenue Tank. A below-grade vault houses the pump's mechanical equipment, while the electrical equipment is located in a CMU/wood shed on the north side of the reservoir. The BPS has one submersible pump that is used to pump water from the Cedar Avenue Tank to the North 430 Zone. The BPS is operated manually as a backup supply facility to the North 430 Zone during emergency conditions. The pump is rated at 100 gpm and powered by a 7.5 hp motor. The Cedar Avenue Booster Pump Station does not have standby power or a power receptacle to enable connection of a portable generator.

2.5.4 Storage Facilities

The District's water system has five storage facilities that float off of the pressure zone they serve and provide flow into the system by gravity. A detailed description of each storage facility is provided below.

Banner Road Tank

The Banner Road Tank is located at 4210 Banner Road SE on a site that is shared with the Banner Road BPS. The tank provides 200,000 gallons of water storage directly to the 277 Zone. The storage capacity of the Banner Road Tank is also available to the South 430 Zone through the Banner Road BPS. The 42-foot diameter, 24-foot-tall steel tank was constructed in 2015 and provides approximately 10,250 gallons of storage per foot height. The tank's base elevation is approximately 257.8 feet, and the overflow elevation is 277.3 feet.

Banner Road Tank and Booster Pump Station

The Banner Road Tank operating level is regulated primarily via pressure reducing stations transferring water from the South 430 High Zone to the South 277 Low Zone. The tank level is monitored through a 4-20 milliamp (mA)/20ma pressure transducer and the District's Supervisory Control and Data Acquisition (SCADA) system, or visually by an exterior-mounted tank level indicator. The tank is supplied through a single 12-inch-diameter water main that serves as the tank's common inlet and outlet pipe. The tank is also equipped with an internal GridBee stainless steel circulating pump to maintain water quality during low demand periods.

California Avenue Tank Nos. 1 and 2

The two California Avenue Tanks are located at 1698 California Avenue E and provide water storage directly to the North 430 Zone. Recent improvements were made to the seismic restraint on the reservoirs, which was damaged in the 2001 Nisqually Earthquake. The seismic improvements completed in 2003 included a new foundation and partial shell for California Avenue Tank No. 1 and repair of the seismic anchor chairs on California Avenue Tank No. 2.

California Avenue Tank No. 2

The 29.7-foot-diameter, 87-foot-tall steel California Avenue Tank No. 1 was constructed in 1974 and provides approximately 450,000 gallons of total water storage, or approximately 5,180 gallons of water storage per foot height. The tank's base elevation is approximately 343.0 feet, and the overflow elevation is 430.0 feet. The tank is supplied via a 10-inch-diameter water main that serves as the tank's common inlet and outlet pipe.

California Avenue Tank No. 2 was constructed in 1997 and provides approximately 1,900,000 gallons of total water storage, or approximately 21,580 gallons of water storage per foot height. The 60.6-foot-diameter, 87-foot-tall steel tank's base elevation is approximately 343.0 feet, and the overflow elevation is 430.0 feet. The tank is supplied via a single 10-inch-diameter water main that serves as the tank's common inlet and outlet pipe.

During normal operation, the tank supply line valves are open to a common single pipe connected to the distribution system, and the operating water level in each tank is identical. The tank levels are monitored through a 4-20 mA/20ma pressure transducer and the District's SCADA system, or visually by exterior-mounted tank level indicators. The reservoir level is transmitted to the Field Operations Building via a leased-line telemetry. The SCADA system central processing unit then controls the wells that supply the two California Avenue reservoirs.

The District leases elevated space on each of the two tanks to various wireless service providers. Along with the elevated space, communications equipment is stored at ground level in individual fenced enclosures operated and maintained by the service providers.

Cedar Avenue Tank

The Cedar Avenue Tank is located at 2343 Cedar Street E on a site that is shared with the Cedar Avenue Booster Pump Station. The tank provides 250,000 gallons of water storage directly to the North 277 Zone. The storage capacity of the Cedar Avenue Tank is also available to the North 430 Zone through the Cedar Avenue Booster Pump Station. The 57.5-foot-diameter, 13.2-foot-tall steel tank was constructed in 1980 and provides approximately 19,420 gallons of storage per foot height. The tank's base elevation is approximately 264.3 feet, and the overflow elevation is 277.5 feet.

Cedar Avenue Tank and SCADA Building

The Cedar Avenue Tank is equipped with a single 8-inch-diameter water main that serves as the tank's common inlet and outlet pipe. The tank is anchored for seismic events per 1980 standards.

In 2007, the District added a wood-framed structure and underground meter vault at the north side of the tank to house the reservoir level control equipment. The reservoir level is transmitted to the Field Operations Building via leased-line telemetry. The SCADA system central processing unit then controls the wells that supply the Cedar Avenue Tank.

Sedgwick Road Tank

The Sedgwick Road Tank is located at 8500 SE Sedgwick Road on a site that is shared with Well 5R and 9. The tank provides 500,000 gallons of water storage directly to the South 430 Zone. The 35-foot-diameter, 69.5-foot-tall steel tank was constructed in 1976 and provides approximately 7,197 gallons of storage per foot height. The tank's base elevation is approximately 360.5 feet, and the overflow elevation is 430.0 feet.

Sedgwick Road Tank

The Sedgwick Road Tank is equipped with an exterior level gauge, and a single 10-inch diameter water main serves as the tank's common inlet and outlet pipe. The reservoir level is transmitted to the Field Operations Building via leased-line telemetry. The SCADA system central processing unit then controls the wells that supply the tank.

The Sedgwick Road tank and its seismic restraint were damaged in the 2001 Nisqually Earthquake and subsequently repaired in 2003. The extent of the improvements included a new foundation and partial shell to increase the thickness of the steel in the lower portion of the tank. A 10,000-gallon hydro-pneumatic tank was installed adjacent to the reservoir to regulate pressures in the South 430 Zone while the tank was offline during the construction of the seismic improvements. The hydro-pneumatic tank now serves as a backup storage facility to the South 430 Zone in the event that the Sedgwick Road Tank is taken out of service for maintenance or emergency purposes. The hydro-pneumatic tank is manually operated and currently offline.

2.5.5 Distribution and Transmission System

The District's water service area contains more than 50 miles of water main ranging in size from 2 inches to 10 inches in diameter. As shown in Table 2-1, nearly half of the water main (approximately 48.9 percent) within the service area is 6 inches in diameter, and an additional 38.1 percent of all water main is 8 inches in diameter.

Table 2-1
Water Main Size Inventory

Diameter (Inches)	Length (Feet)	% of Total
3 or Smaller	5,555	2.1%
4	25,430	9.6%
6	130,341	48.9%
8	101,502	38.1%
10	3,453	1.3%
Totals	**266,281**	**100%**

As shown in Table 2-2, approximately 51.6 percent of the water main in the system is asbestos cement. All other water main is constructed of ductile iron, galvanized iron, polyvinyl chloride (PVC), or steel. All new water main installations are required to use Class 52 ductile iron pipe in accordance with the District's development and construction standards.

Table 2-2
Water Main Material Inventory

Material	Length (Feet)	% of Total
Asbestos Cement	137,517	51.6%
Ductile Iron	58,514	22.0%
Galvanized Iron	842	0.3%
PVC	50,229	18.9%
Steel	19,179	7.2%
Totals	**266,281**	**100%**

The life expectancy of water main is generally 50 years. Approximately 27 percent of water main in the District's system was constructed in the 1960s or prior and is reaching its life expectancy. Most of this water main is asbestos cement water main that was installed in the early 1960s. Approximately 25 percent of the District's water main was installed in the 80s and 90s.

2.5.6 Pressure Reducing Stations

Pressure reducing stations are connections between adjacent pressure zones that allow water to flow from a higher pressure zone to a lower pressure zone by reducing the pressure of the water as it flows through the station, thereby maintaining a safe range of pressures in the lower zone. A pressure reducing station is essentially a below-grade vault (typically concrete) that normally contains two pressure reducing valves, piping, and other appurtenances. Pressure reducing stations sometimes also contain a pressure relief valve. The pressure reducing valve hydraulically varies the flow rate through the valve (up to the flow capacity of the valve) to maintain a constant pressure on the downstream side of the valve for water flowing into the lower pressure zone.

Pressure reducing stations can function as an active supply facility by maintaining a continuous supply of water into a lower zone that has no other source of supply, such as a well or reservoir. Pressure reducing stations also function as standby supply facilities that are normally inactive (no water flowing through them). The operation of this type of station typically triggered by a drop in water pressure near the downstream side of the station and is only needed to supply additional water to a lower zone during a fire flow situation. The pressure setting of the control valve within the station allows it to remain closed during normal system operation and open only during high demand conditions, like fire flows, to provide the additional supply needed.

The District's water system has a total of ten pressure reducing stations, as shown in profile view in Figure 2-2. Two of these pressure reducing stations actively supply water to the 215 Zone from the North 430 Zone and the North 277 Zone and serve as the 215 Zone's only source of supply. If water was supplied from either of the higher zones directly to the 215 Zone, high pressure problems would exist. Likewise, two other small PRVs actively supply water from the North 430 Zone to function as the only sources of supply to the lower 242 zones that they serve. One of these PRVs serves the 242 Zone, while the other provides water supply to the 223 Zones.

Since the South 277 Zone does not have other active sources of supply, several pressure reducing stations within the zone function as active supply facilities to continuously provide water to the zone. Others function as standby supply facilities and only operate during fire flow situations or peak demand events. Three of the pressure reducing stations that provide water to the South 277 Zone are supplied by the South 430 Zone, while one supplies water to the zone from the North 430 Zone.

Two other pressure reducing stations provide water to the North 277 Zone from the North 430 Zone during fire flow situations and occasionally during peak demand events. A listing of all pressure reducing stations and related data is contained in Appendix B.

2.5.7 Water System Interties

Water system interties are physical connections between two adjacent water systems. Interties are normally separated by a closed isolation valve or control valve. Emergency supply interties provide water from one system to another during emergency situations only. An emergency situation may occur when a water system loses its main source of supply or a major transmission main and is unable to provide a sufficient quantity of water to its customers. Normal supply interties provide water from one system to another during non-emergency situations and are typically supplying water at all times.

The District currently has no interties. However, the District is considering constructing interties with adjacent West Sound Utility District (WSUD) to increase reliability in the two water systems. If agreed between the two utilities, it is anticipated that two interties will be constructed: 1) near the intersection of Bulman Road SE and Mile Hill Drive, where water could be purchased from WSUD to feed the Manchester North 430 Zone; and 2) A second intertie has been proposed near the intersection of Nevada Avenue E and Delaware Court E., which would supply WSUD from the District's North 430 Zone. In each case, a metered pressure reducing station would be constructed to monitor the volume of water purchased.

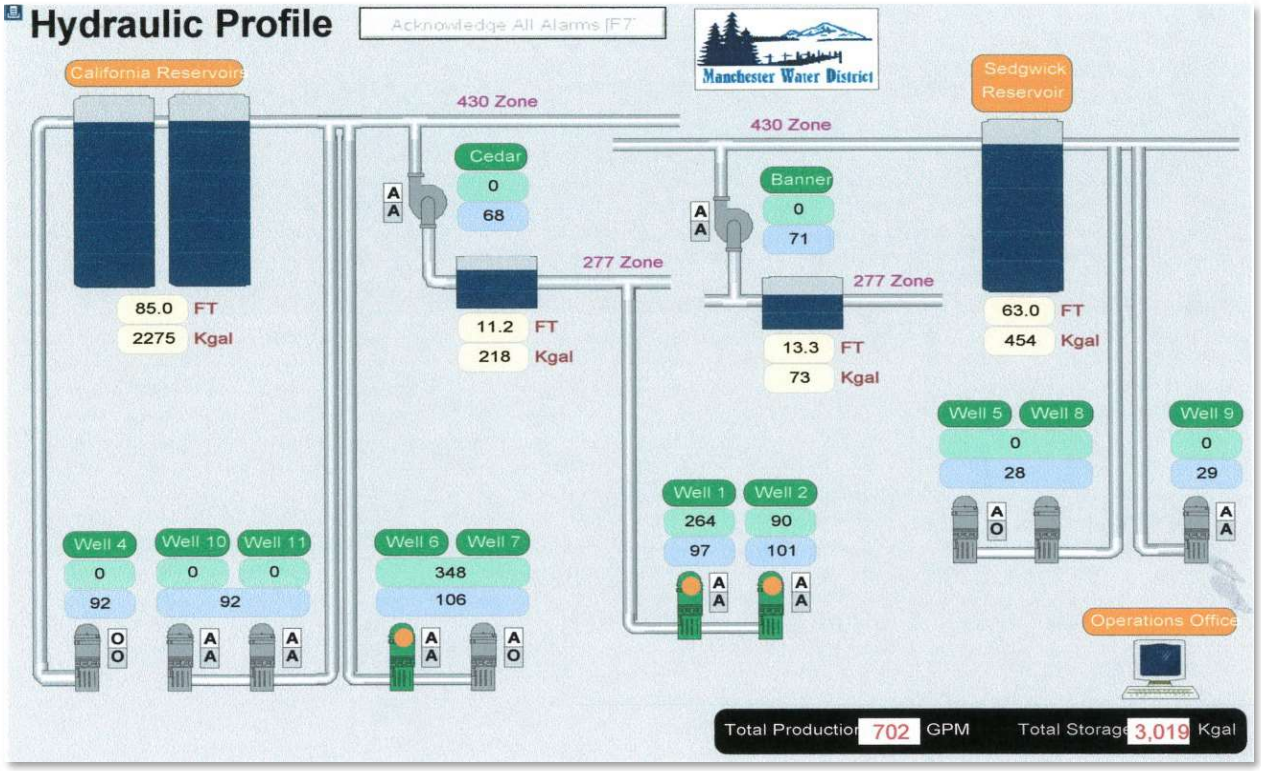
2.5.8 Supervisory Control and Data Acquisition (SCADA)

Successful operation of any public water system requires gathering and using accurate water system information. A Supervisory Control and Data Acquisition (SCADA) system gathers information and can efficiently control a system by automatically optimizing facility operations. A SCADA system also provides

instant alarm notification to operations personnel in the event of equipment failure, operational problems, flood, fire, or other emergency situations.

In 2008, the District completed the installation of a SCADA system. The system consists of a master telemetry unit at the District Operations Complex that communicates with remote telemetry units located at each well, booster pump station, and tank site. The new system provides automated control and alarm monitoring, as well as totalizing of events, flows, and run times. The transmitting and receiving telemetry units communicate with each other using dedicated leased telephone lines. There is also a human machine interface (HMI) terminal located at the District's Operations Complex that allows service technicians to interpret graphic displays of system functions and control each well, booster pump station, and reservoir level remotely.

Individual SCADA control panels located at each of the District's pump stations and reservoirs also allow service technicians to modify control settings from each site. In addition to enhanced automated control, the SCADA system also logs historical system operations data that can be used for long- term planning and asset management.



SCADA System HMI Main Screen

2.5.9 Water System Operation and Control

The North 277 Zone is supplied with water from Wells 1 and 2. The operation of the wells is controlled by the surface water level in the Cedar Avenue Tank, via the SCADA system. The Madrone and Seaview PRVs can also supply the North 277 Zone, though their setpoints will cause them to remain closed during normal demand conditions. The PRVs are set to supply water to the North 277 Zone from the North 430

Zone upon a suppressed level in the Cedar Avenue Tank or during a localized drop in pressure, such as during a fire flow.

The South 277 Zone is supplied with water through a series of four pressure reducing stations that supply water to the zone from the North 430 Zone and the South 430 Zone. The operation of the pressure reducing stations is determined by the surface water level in the Banner Road Tank and the level of demand in the zone.

When the zone valve between the North 277 Zone and the South 277 Zone is set to the open position, as is the current operation, the two zones operate essentially as one zone. The facilities operate in the same manner as described for their independent operation; however, the Cedar Avenue Tank and the Banner Road Tank operate in conjunction with each other to dictate the operation of all supply facilities for the two zones.

The 215 Zone is supplied with water continuously from the North 430 Zone through the Montana PRV.

The Beach PRV functions as a lag supply facility for the 215 Zone and is set to supplement supply from the Montana PRV during a localized drop in pressure. The Alki View PRV supplies the 223 Zone with water continuously from the North 430 Zone. The 242 Zone is supplied with water continuously from the North 430 Zone through the Montana Extension PRV.

Wells 4, 6, 7, 10, and 11 supply the North 430 Zone, and their operation is controlled by the surface water level in the California Avenue Tanks, via the SCADA system. The water right granted for Well 4 restricts its operation to a maximum of 8 hours per day. The Cedar Avenue Booster Pump Station transfers water from the Cedar Avenue Tank to the North 430 Zone, as needed, via the SCADA system. It is intended to supplement supply to the North 430 Zone during emergency conditions.

The South 430 Zone is supplied with water from Well 5R and 9. Well 9 operates during periods of higher demands, generally from June through October. During this time, Well 5R is manually taken offline. As demands decrease in the system and the District reverts to its winter operation, Well 9 is manually taken offline while Well 5R is turned on. The surface water level in the Sedgwick Road Tank controls the operation of the well(s) that are online, via the SCADA system. The Banner Road Booster Pump Station is also controlled by the Sedgwick Road Tank surface water level, via the SCADA system, to transfer water from the Banner Road Tank to the South 430 Zone, as needed to supplement supply to the zone during emergency conditions.

2.5.10 Asset Management

Previously Asset Management was being tracked through inventory spreadsheets located on the District's server on an annual basis. Starting in 2024, the District implemented AssetTiger to track their fleet, inventory, assets worth more than $300, and highly desirable items. The District purchases barcode tags from AssetTiger and subsequently have access to their software for tracking and inputting information. The District is using a combination of AssetTiger for tracking the majority of the items and spreadsheets for tracking brass and water meters. Original costs are tracked for newly purchased items. The District has not yet implemented tracking of asset age, condition, life expectancy, or criticality.

2.6 Adjacent Water Systems

The largest water system adjacent to the District's water service area is WSUD. Several smaller water systems are located in the vicinity of the District's water service area. Other small water systems located adjacent to or within the District's service area boundary are shown in Figure 2-3. A brief description of each water system follows.

2.6.1 West Sound Utility District

Formerly known as Annapolis Water District, the WSUD water system is located west of the District's service area boundary and serves more than 18,000 customers. WSUD is supplied with water from 15 groundwater wells that are chlorinated and fluoridated.

2.6.2 Gatewood Mobile Manor

The Gatewood Mobile Manor water system is located within the District's water service area boundary and outside of the District's corporate limits. The water system serves a residential population of approximately 46 people through approximately 23 connections. One groundwater well provides water supply to the system. There are no current plans for interties with this system. The Gatewood Mobile Manor water system is located within the District's water service area; however, the two systems do not have a signed service area agreement in place at this time.

2.6.3 Kitsap Public Utility District

KPUD owns and operates two separate water systems adjacent to the District's service area, which are located to the south and southwest of the District. KPUD began providing utility service as a water system manager in the 1970s through the assumption of several small, privately owned water systems and municipal water districts. In the late 1980s, KPUD was designated the lead agency for development of the County's *Coordinated Water System Plan* and the County's *Ground Water Management Plan*. In the process, KPUD initiated a comprehensive, county-wide water resource monitoring program that includes well water levels, rainfall, stream flow, and a Well Identification Number program. KPUD currently provides water service to over 50,000 people throughout Kitsap County. There are no plans for interties between KPUD's water systems and the District.

2.6.4 Washington Water Service Company

The Washington Water Service Company owns and operates numerous water systems throughout western Washington. Within Kitsap County, the Washington Water Service Company owns and operates 84 systems with a total of approximately 3,538 active connections. Approximately 109 wells and 38 reservoirs provide water supply and storage to these systems. Three separate water systems owned and operated by the Washington Water Service Company are located adjacent to the District's water service area and lie along the District's southerly and westerly boundaries. There are no plans for interties between Washington Water Service Company's water systems and the District.

Chapter 3 Land Use and Population

3.1 Introduction

The Manchester Water District (District) service area boundary encompasses approximately 11.0 square miles within unincorporated Kitsap County (County) and includes the Village of Manchester (Manchester), a Limited Area of More Intense Rural Development (LAMIRD). The County establishes land use regulations for the area served by the District. The Kitsap County Comprehensive Plan, which was completed in 1998, updated in 2006, and is amended annually, was developed to meet the requirements of the State of Washington Growth Management Act (GMA). The final draft 2024 Comprehensive Plan was published in December 2024. The GMA requires, among other things, consistency between land use and utility plan implementation.

This Chapter demonstrates the compatibility of the District's Water System Plan (WSP) with other plans, identifies the designated land uses within the existing service area, and identifies population projections within the District's planning area.

3.2 Compatibility with Other Plans

3.2.1 Introduction

To ensure that the WSP is consistent with the land use policies that guide it and other related plans, the following planning documents were examined.

- Growth Management Act.
- Kitsap County Comprehensive Plan.
- Manchester Community Plan (included in the Kitsap County Comprehensive Plan).

- Kitsap County-wide Planning Policy.
- Kitsap County Coordinated Water System Plan.

3.2.2 Growth Management Act

The State of Washington GMA of 1990, and its 1991 and 1993 amendments, defined four goals relevant to this WSP, as follows.

- Growth should be in urban areas.
- There should be consistency between land use and utility plans and their implementation.
- There should be concurrency of growth with public facilities and services.
- Critical areas should be designated and protected.

Urban Growth Area

The GMA requires that the County and other jurisdictions cooperate in designating Urban Growth Areas (UGA). As part of the development of the County's Comprehensive Plan, the County designated UGAs that would accommodate projected population growth for the County and provide resource conservation. The District does not lie within a UGA designated by the County.

Consistency

The GMA requires consistency planning from two perspectives. First, it requires consistency of plans among jurisdictions. This means that plans and policies of the District and the County must be consistent (Revised Code of Washington (RCW) 36.70A.100). Second, it requires that the implementation of the plan be consistent with the County's Comprehensive Plan (RCW 36.70A.120).

The 2003 Municipal Water Law also requires that water system plans are consistent with local plans and regulations. The signed Consistency Statement Checklist from the County, included in Appendix C, documents the determination of the County that this WSP is consistent with the County's plans and regulations.

Concurrency

Concurrency means that adequate public facilities and services must be provided at the time growth occurs. For example, growth should not occur where schools, roads, and other public facilities are overloaded. Concurrency ensures that public dollars are used efficiently and quality of life is preserved. To achieve this objective, the GMA directs growth to areas already served or readily served by public facilities and services (RCW 36.70A.110). It also requires that when public facilities and services cannot be maintained at an acceptable level of service, new development should be prohibited.

Critical Areas

The GMA requires that critical areas be designated and protected. Critical areas include fish and wildlife habitat, flood zones, aquifer recharge areas, streams, creeks, wetlands, and other surface water, and geologic hazard areas such as steep slopes and liquefaction zones. Appendix D contains a State Environmental Policy Act (SEPA) checklist that addresses other environmental concerns.

3.2.3 Kitsap County Comprehensive Plan

The Land Use Element of the County's final draft 2024 Comprehensive Plan is the County's vision of how growth and development should occur over a 20-year planning horizon. While the Land Use Element's goals and policies set forth general standards for locating land uses, the County's Comprehensive Plan Land Use Map, which has been reproduced and is shown in Figure 3-1, indicates geographically where certain types of uses may be appropriate. The Land Use Map is a blueprint for development of an area, whereas the zoning code is the regulatory means for implementing development.

The Land Use Element articulates many of the same goals and concerns of the GMA. Like the GMA, the Land Use Element seeks to accommodate growth while preserving the County's character and protecting environmentally sensitive areas. It seeks to promote a strong local economy and vital commercial, industrial, and military districts by focusing economic development within them and establishing development guidelines. The Utilities Element ensures that new development will be adequately serviced without compromising existing levels of service, similar to the principal of concurrency as defined in the GMA.

The District encompasses an area of approximately 7,057 acres (11.0 square miles) within the County. Undeveloped lots exist within the District's water service area and infilling is expected and encouraged in these areas.

3.2.4 Manchester Community Plan

The County's 2012 Comprehensive Plan designated a portion of the District's service area as an area of more intensive rural development to address the specific needs of the urbanized downtown area of Manchester, which has been established within the rurally designated community and is shown in Figure 3-2. A sub-area plan for the Manchester area, titled the Manchester Community Plan, was subsequently prepared by the County and designated the area of more intensive rural development as the Manchester Rural Village. The Manchester Community Plan was updated with the County's 2024 Comprehensive Plan. The Manchester Community Plan includes many of the same elements as the County's 2024 Comprehensive Plan; however, it focuses on the specific needs and unique features of the Manchester Rural Village. The Manchester Community Plan also establishes distinctly tailored and detailed guidelines and policies for the future development of the area.

3.2.5 Kitsap County-wide Planning Policy

The Kitsap County Board of Commissioners adopted the Kitsap County-wide Planning Policies (CPP) on August 10, 1992. Since then, the CPPs have been amended several times, with the last amendment occurring on 2015. The County has adopted CPPs that promote contiguous and orderly development and establish provisions for urban services, as well as policies for joint county and city UGA planning. The CPPs also guide development in rural and unincorporated Kitsap County, including Manchester. The County's policy goals seek to reduce urban sprawl, protect rural areas, encourage a vital diversified economy, provide affordable housing throughout the County, and coordinate protection of environmentally sensitive areas.

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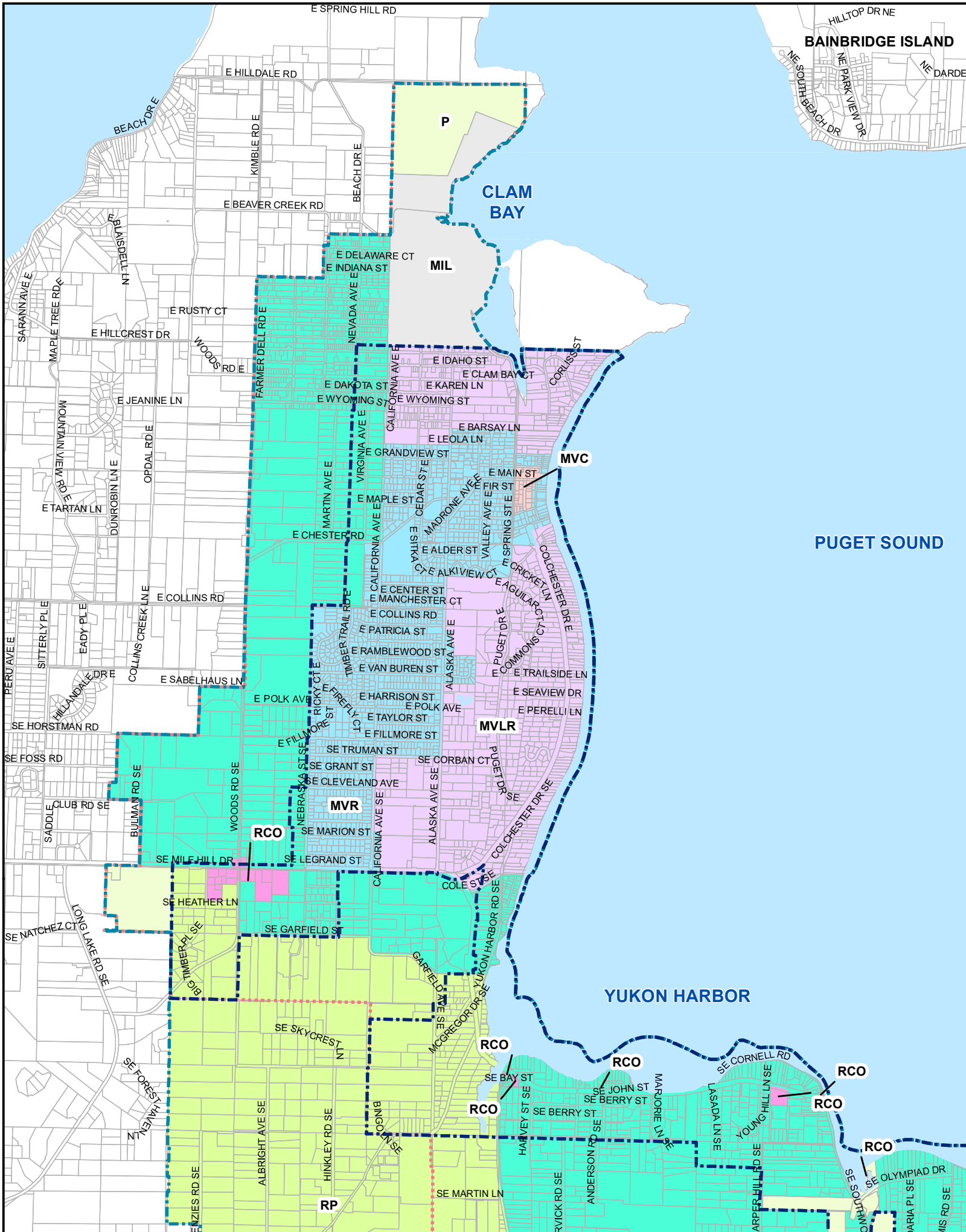
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MOUNTAIN VIEW RD E
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E JEANINE LN
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E RAMBLEWOOD ST
E VAN BUREN ST
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E PUGET DR E
E COMMONS CT
E TRAILSIDE LN
E SEAVIEW DR
E PERELLI LN
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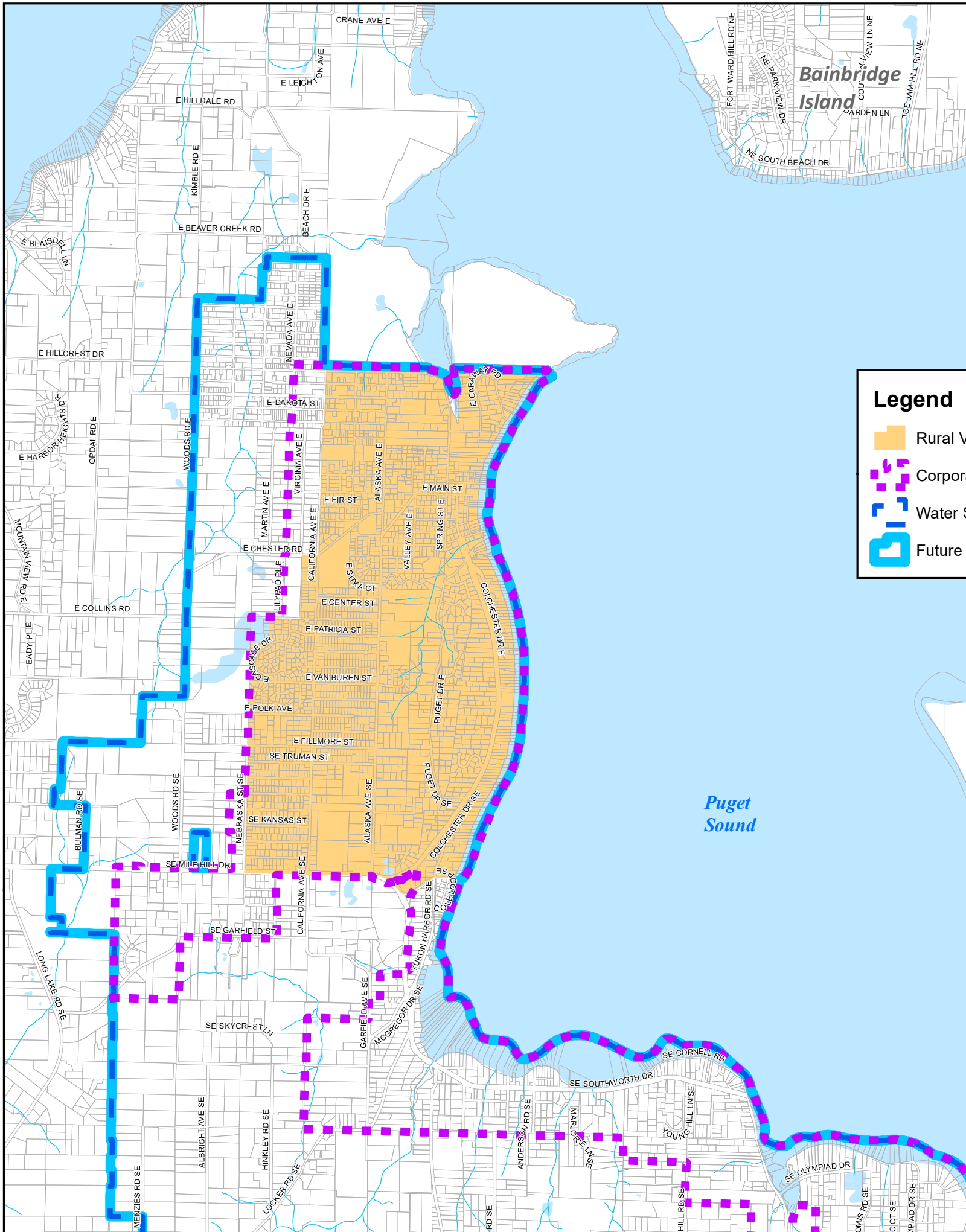
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3.2.6 Kitsap County Coordinated Water System Plan

The Kitsap County Coordinated Water System Plan (CWSP) is the result of a study performed under the direction of the Kitsap County Water Utility Coordinating Committee (WUCC) and the County. The members of the WUCC include County Commissioners, the County Department of Community Development, the County Health District, and representatives from all public water systems with more than 50 service connections that provide service within the Critical Water Supply Service Area (CWSSA). In 1987, the County Commissioners declared all of Kitsap County a CWSSA.

The purpose of the CWSP is to assist the areas' water utilities in establishing an effective process for planning and developing public water systems and restricting the proliferation of small public water systems. The CWSP accomplishes this by establishing future service area boundaries, minimum design standards, service review procedures, appeals procedures, long-term regional water supply strategies, a water conservation program and goals, and the satellite system management program. As can be seen in the following sections of this WSP, the District has established policies, design criteria, and goals that meet or exceed the requirements and goals of the CWSP. In 2005, the County Commissioners adopted the 2005 Revised Regional Supplement to the CWSP in Resolution No. 090-2005. The regional supplement includes all recent and past adjustments to the District's retail water service area.

3.3 Land Use

The District provides water service to an area designated by the County as an area of more intensive rural development. This area, the Manchester Rural Village, encompasses approximately 1,074 acres. The District's water service area is much larger than this, with 7,057 total acres, while the District's corporate limit encompasses an area of approximately 2,056 acres. The Land Use Map shown in Figure 3-1 guides development within the County. Therefore, the Land Use Map is utilized by the District to anticipate future growth and demand levels in particular sections throughout its service area.

The area served by the District is primarily residential. Approximately 99.2 percent of the District's service area that lies within the Manchester Rural Village boundary is designated for residential use. Approximately 0.8 percent of the Manchester Rural Village area is designated for commercial use.

Within the water service area and outside of the Manchester Rural Village, a similar portion of land use, approximately 94.0 percent, is designated for residential use. Approximately 0.4 percent of this land area is designated for commercial use; approximately 4.3 percent of this land is designated for military use; and the remaining 1.3 percent of this land area is designated as parks.

3.4 Population

3.4.1 Population Forecasting

The Office of Financial Management (OFM) conducts annual population forecasts at the county level for the State of Washington. Current projections extend to the year 2050. The OFM provides three levels of population projections, which are designated as high, intermediate, and low forecasts. The intermediate population forecast represents the most likely population scenario. The range varies according to the ease of forecasting in each particular county. Factors include birth and death rates, and migration patterns.

Individual counties are required to create population projections for use in comprehensive plans. These projections must be consistent with OFM projections and approved by the Growth Management Hearings Board. These projections are usually conducted at the county level, and then are subdivided between jurisdictions (usually cities). All jurisdictions within a county must agree on how the population projections are allocated before these numbers are adopted.

The Puget Sound Regional Council (PSRC) also creates its own set of population projections that cover 10-year intervals. PSRC projections are useful because of the size of the projection areas used. The PSRC provides population projections at the county level and at a smaller level for areas called Forecast Analysis Zones (FAZ). The PSRC uses census tracts as the base unit to create FAZs. The census tract may be broken into several FAZs or comprised of only one FAZ, depending on the population density in each census tract (e.g., high population areas are usually broken into several FAZs). Population data within each FAZ is further subdivided into several categories, including single-family, multi-family, income level, employment, and land area.

The population information presented in the following sections was based on PSRC data since the FAZs provide a more accurate estimate of population data within the District's service area than the County-wide information available from OFM.

The historical population was derived by applying the average household size for the District's service area to the number of residential connections served by the District. The average household size for the District was calculated from the weighted average of data from two FAZ boundaries located within the District's service area. The Southworth/Manchester FAZ 9015 comprises approximately 98 percent of the District's service area, while the Port Orchard FAZ 9002 comprises approximately 2 percent of the District's service area. The weighted average household size for the District's service area based on PSRC data was approximately 2.59 persons per household in 2015.

Similar to the average household size computation, future growth rates for the District were calculated from a weighted average of growth rates projected for FAZ 9015 and FAZ 9002. The resultant weighted average growth rates were then applied to the historical population to derive the District's future population estimates.

Once the historical and projected populations were estimated for the District, a comparison was performed on the county-wide projections from each agency to confirm consistency, as required. The differences between the two projections were minimal; therefore, they were considered to be consistent with each other.

3.4.2 Household Trends

As stated previously, the District provides water service to a primarily residential community. In 2015, the District served 3,217 residential connections. The weighted average household size in the District's service area was 2.59 persons per household in 2015, which was slightly higher than the average household size in the County of 2.40 persons per household, based on OFM data. This reflects the higher occupancy rate in portions of the District compared to the rest of the County. PSRC data indicates a continual decrease in household size within the District as the Manchester area continues to grow and gradually shifts from a rural to a suburban area.

3.4.3 Existing and Future Population

The County has experienced rapid development and population growth over the last 40 years. The population of the County increased more than 22 percent from 1990 to 2000, resulting in an average annual increase of approximately 2.03 percent. From 2000 to 2010, growth in the County has slowed to an average of 0.80 percent annually, and from 2010 to 2015 further slowed to 0.56 percent annually based on OFM data. The population served by the District averaged an annual increase of approximately 1.26 percent from 1990 to 2000, and 1.15 percent since 2000.

Table 3-1 illustrates the historical population growth since 2020 and the projected future growth of the total population served by the District. The populations extrapolated from OFM data using PSRC growth rates were compared with the Kitsap County's final draft 2024 Comprehensive Plan and are 2.4 percent higher in 2045.

Based on PSRC projections, the future annual growth rate of the population served by the District is expected to decrease from 1.15 percent in 2015 to 0.21 percent over the 20-year planning period. These growth rates are generally slightly above the County-wide forecasts, as shown in Table 3-1, indicating that the population of the District will continue to grow at a rate consistent with the County as a whole, and indicating that the population projections are in line with County estimates.

In its 2007 WSP, the District's projected 2010 population was 9,375, and the 2024 projected population was 12,603. However, in 2024, the population of the District was actually 9,245, much lower than the projected population in the 2007 WSP. As shown in Table 3-1, the population served by the District is now expected to grow to approximately 9,463 people in 10 years (2035) and to approximately 9,519 people in 20 years (2045). Growth projections are now lower than those projected in the 2007 WSP.

Table 3-1
Population Trends and Projections

Year	Population (PSRC Estimates)[1]	Population (County Estimates)[2]
2020	8,832	8,832
2021	8,933	8,850
2022	9,036	8,868
2023	9,140	8,887
2024	9,245	8,905
2025	9,352	8,923
2026	9,376	8,942
2027	9,400	8,960
2028	9,424	8,979
2029	9,430	8,997
2030	9,435	9,016
2031	9,441	9,034
2032	9,446	9,053
2033	9,452	9,072
2034	9,457	9,090
2035	9,463	9,109
2036	9,469	9,128
2037	9,474	9,147
2038	9,480	9,165
2039	9,485	9,184
2040	9,491	9,203
2041	9,496	9,222
2042	9,502	9,241
2043	9,508	9,260
2044	9,513	9,279
2045	9,519	9,299

Notes:
1) Populations shown from 2035 onward are extrapolated from 2035 using the 0.06 percent growth rate from PSRC.
2) Extrapolated from 2020 using the 0.21 percent growth rate for rural areas in Kitsap County's final draft Comprehensive Plan.

Chapter 4 Water Demands

4.1 Introduction

A detailed analysis of system demands is crucial to the planning efforts of a water supplier. A demand analysis first identifies current demands to determine if the existing system can effectively provide an adequate quantity of water to its customers under the most crucial conditions, in accordance with federal and state laws. A future demand analysis identifies projected demands to determine how much water will be needed to satisfy future growth of the water system and continue to meet federal and state laws.

Demands on the water system determine the necessary size of storage reservoirs, supply facilities, water mains, and treatment facilities. Several types of demands were analyzed for Manchester Water District's (District) water system and are addressed in this chapter, including average day demand (ADD), maximum day demand (MDD), peak hour demand (PHD), fire flow demand, future demands, and a water use efficiency (WUE) demand reduction forecast.

The magnitude of water demands is typically based on three main factors: 1) population; 2) weather; and 3) water use classification. Population and weather have the two largest impacts on water system demands. Population growth has a tendency to increase the annual demand, whereas high temperatures have a tendency to increase the demand over a short period of time. Population does not solely determine demand, because different populations use varying amounts of water. The use varies based on the number of users in each type of customer class, land use density, and irrigation practices. WUE efforts will also impact demands and can be used to accommodate a portion of system growth without increasing a system's supply capacity.

4.1.1 Certificate of Water Availability

In accordance with the requirements of the Growth Management Act (GMA), the District must identify that water is available prior to the County issuing a building permit. A Certificate of Water Availability (CWA) is issued if there is sufficient water supply to meet the domestic water service and fire flow requirements of

the proposed building. The requirement for providing evidence of an adequate water supply was codified in 1990 and updated in 2018 under Revised Code of Washington (RCW) 19.27.097 in the Building Code section. The current document for guidance is Publication #331-597 *Guidance for Local Government: Physical and Potable Water Availability*.

4.2 Current Population and Service Connections

4.2.1 Residential Population Served

The District's existing retail water service area is primarily residential, as described in Chapter 3. The 2024 residential population served by the District is estimated to be approximately 9,245 people. The computation of this number and a more detailed discussion of the District's population and household trends are contained in Chapter 3.

In 2023, the District provided water service to an average of 3,422 customer accounts, of which approximately 3,381, or 98.8 percent, were residential customers; 41 accounts, or 1.2 percent, were commercial customers, school, industrial, or government customers.

4.2.2 Water Use Classifications

The District divides all water customers into three different classes for billing purposes. These classes are residential, commercial, and government. The residential class includes predominantly single-family residential customers, with 35 multi-family residential service connections.

The commercial class includes customers such as restaurants, schools, churches, and grocery stores, whereas the government class serves customers such as the U.S. Environmental Protection Agency's (EPA) Manchester Laboratory, the National Oceanic and Atmospheric Administration (NOAA), the U.S. Navy, and the Washington State Ferries Southworth ferry terminal. The District also serves mixed-use units through two connections as of 2024. The demand analysis that follows will report on the water use patterns of these three user groups.

4.3 Existing Water Demands

4.3.1 Water Consumption

Water consumption is the amount of water used by all customers of the system, as measured by the customers' meters. Table 4-1 shows the historical average number of connections, average annual consumption, and average daily consumption per connection of each customer class for the District from 2012 through 2023. Data was not available for 2024.

Table 4-1
Average Annual Metered Consumption and Service Connections

Year	Customer Class		
	Residential[1]	Commercial[2]	Government
Average Number of Connections			
2012	3,185	22	20
2013	3,195	33	20
2014	3,207	47	20
2015	3,217	47	20
2016	3,251	47	20
2017	3,291	40	20
2018	3,322	35	20
2019	3,330	35	20
2020	3,345	35	21
2021	3,358	35	21
2022	3,361	29	19
2023	3,381	22	19
Average Annual Consumption (Gallons)			
2012	184,024,336	1,714,977	6,241,290
2013	180,459,615	1,745,144	5,600,665
2014	176,620,213	1,722,345	5,759,076
2015	187,756,580	1, 953,611	7,578,766
2016	182,895,597	2,060,740	8,748,062
2017	191,965.941	1,793,726	8,300,960
2018	191,387,096	1,703,937	8,107,348
2019	187,551,441	1,930,476	9,348,339
2020	194,570,949	1,672,887	6,926,031
2021	204,050,914	1,440,513	7,659,101
2022	189,264,114	2,071,788	8,370,314
2023	192,401,817	1,445,166	10,639,485
Average Daily Consumption Per Connection (gal/day/conn)			
2012	158	214	855
2013	155	147	767
2014	151	100	789
2015	160	114	1,038
2016	154	120	1,195
2017	160	123	1,137
2018	158	133	1,111
2019	154	151	1,281

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As shown in Figure 4-1 and Figure 4-2, the residential class represents approximately 98.8 percent of all connections and 94.1 percent of total system consumption. The slightly higher proportion of residential connections to consumption is due to the lower consumption per connection of the residential customers as compared to the government and commercial customers. As shown in Table 4-1, the residential customers use an average of approximately 156 gallons per day per connection, compared to the commercial customers that use an average of approximately 180 gallons per day per connection, and the government customers that use an average of approximately 1,534 gallons per day per connection. The higher consumption of government customers is expected since these are customers where one connection typically serves several buildings.

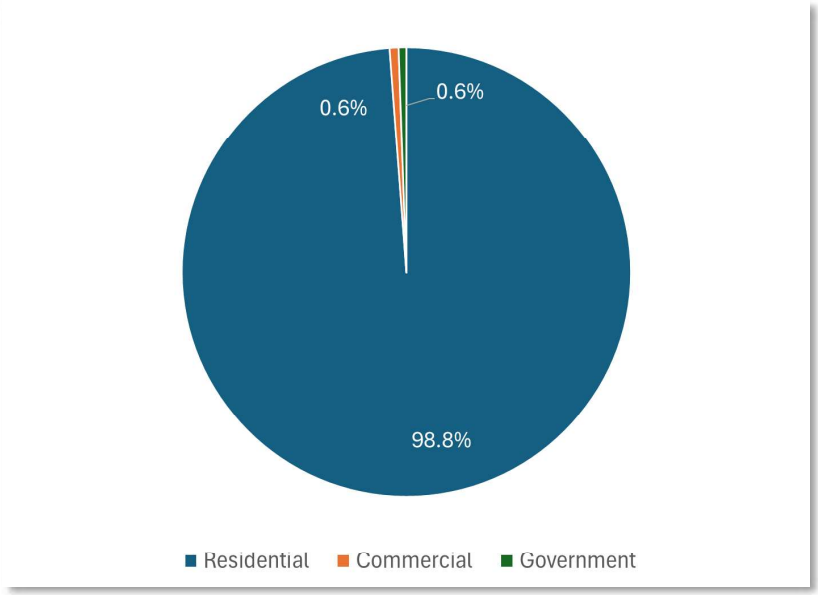

Figure 4-1 2023 Water Connections by Customer Class

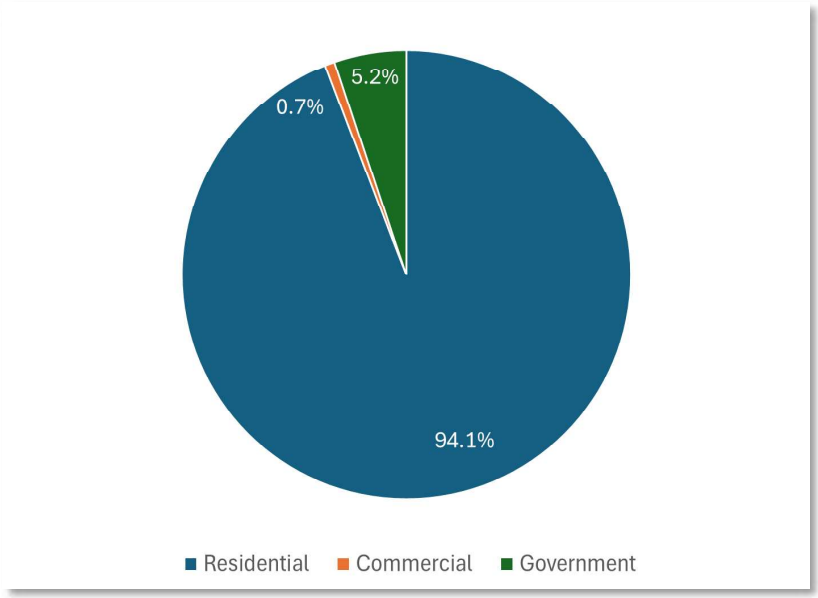

Figure 4-2 2023 Water Consumption by Customer Class

Table 4-2 shows the largest water users of the system in 2023 and their total amount of metered consumption for the year. The total water consumption of these ten water accounts represented approximately 5.3 percent of the system's total consumption in 2023. The list of accounts in the table consists of schools, commercial facilities, government facilities, and large estates. As with all water system customers, the District promotes water conservation efforts to the largest water users to ensure that water is used as efficiently as possible. These WUE efforts include conservation block rates and customer education. Additional information on the District's WUE program is contained in Appendix E.

Table 4-2
2023 Largest Water Users

Name	Address	Annual Consumption (Gallons)
Kitsap County Public Works	8020 E Caraway Road	2,495,403
EPA	7767 E Hilldale Drive	2,404,461
South Kitsap School District #402	1901 E California Avenue	1,443,834
John Sedgwick Middle School	8995 SE Sedgwick Road	1,119,083
Single Family	10012 SE Southworth Drive	670,492
Washington State Ferries	12000 SE Southworth Drive	667,470
NOAA	7305 E Beach Drive	653,954
Kitsap County Public Works	2375 E Colchester Drive	515,656
Single Family	3510 SE Arvick Road	420,174
Single Family	7754 SE Monte Bella Place	412,447
Largest Water Users Total:		**10,802,975**
Water System Total:		**204,486,467**
Percent of Total:		**5.3%**

4.3.2 Water Supply

Water supply, or production, is the total amount of water supplied to the system, as measured by the meters at each supply source. Water supply is different than water consumption in that water supply is essentially the recorded amount of water put into the system and water consumption is the recorded amount of water taken out of the system. The measured amount of water supply of any system is typically larger than the measured amount of water consumption, due to non-metered water use and water loss, i.e., distribution system leakage (DSL).

Table 4-3 shows the total amount of water supplied to the District's system from 2005 through 2024 and the calculated ADD for each year. In general, the District experienced a variable but overall consistent ADD over the time period as a whole.

Table 4-3
Historical Water Supply and System Demand

Year	Annual Supply (Gallons)	Average Day Demand (gpm)
2005	229,816,863	437
2006	244,387,902	465
2007	216,888,122	413
2008	215,258,120	410
2009	221,388,800	421
2010	203,738,000	388
2011	218,830,300	416
2012	212,454,000	404
2013	201,606,000	384
2014	196,241,000	373
2015	201,294,600	383
2016	210,426,000	399
2017	218,159,000	415
2018	225,654,000	429
2019	217,495,000	414
2020	220,578,000	419
2021	237,598,000	452
2022	227,024,000	432
2023	236,939,167	451
2024	219,773,000	418

Table 4-4 presents the computation of the existing system per capita demand, based on 2023 data. As shown in the upper portion of the table, the residential population served by the District's water system was approximately 9,140 in 2023. The calculation of the District's residential population is described in further detail in Chapter 3. This population number and the District's total water supply in 2023 were used to arrive at the existing per capita demand of 71 gallons per day (gpd). The 2023 demand per capita is similar to other water systems in the Puget Sound area.

Table 4-4
Existing Per Capita Demand

Existing System	Per Capita
2023 Residential Population Served Computation	
2023 Residential Units	3,381
Average Household Size (People Per Unit)[1]	2.70
Calculated 2023 Residential Population Served	9,140
2023 Total Annual Supply	
2023 Total Annual Supply (Gallons)	236,939,000
Existing Per Capita Demand (gal/day/capita)	**71**

Note:
1) Based on Puget Sound Regional Council data for the District's service area.

Table 4-5 shows the average demand of each of the District's seven pressure zones, based on 2023 water demand data. Almost half of the water system demand is in the North 430 Zone, as shown in Table 4-5. This does not include distribution system loss (DSL).

Table 4-5
2023 Demands by Pressure Zone

Pressure Zone	2023 Annual Demand (Gallons)	Average Day Demand (gpm)	Percent of Total Demand (%)
North 430 Zone	98,226,631	187	48.0
South 430 Zone	17,928,969	35	8.8
North 277 Zone	39,252,965	75	19.2
South 277 Zone	44,233,100	85	21.6
242 Zone	329,922	1	0.2
223 Zone	141,225	1	0.1
215 Zone	4,373,651	9	2.1
Total	**204,486,467**	**393**	**100%**

Like most other water systems, the District's water use varies seasonally. Figure 4-3 shows the historical amount of water supplied to the District's system for each month from 2012 to 2024.

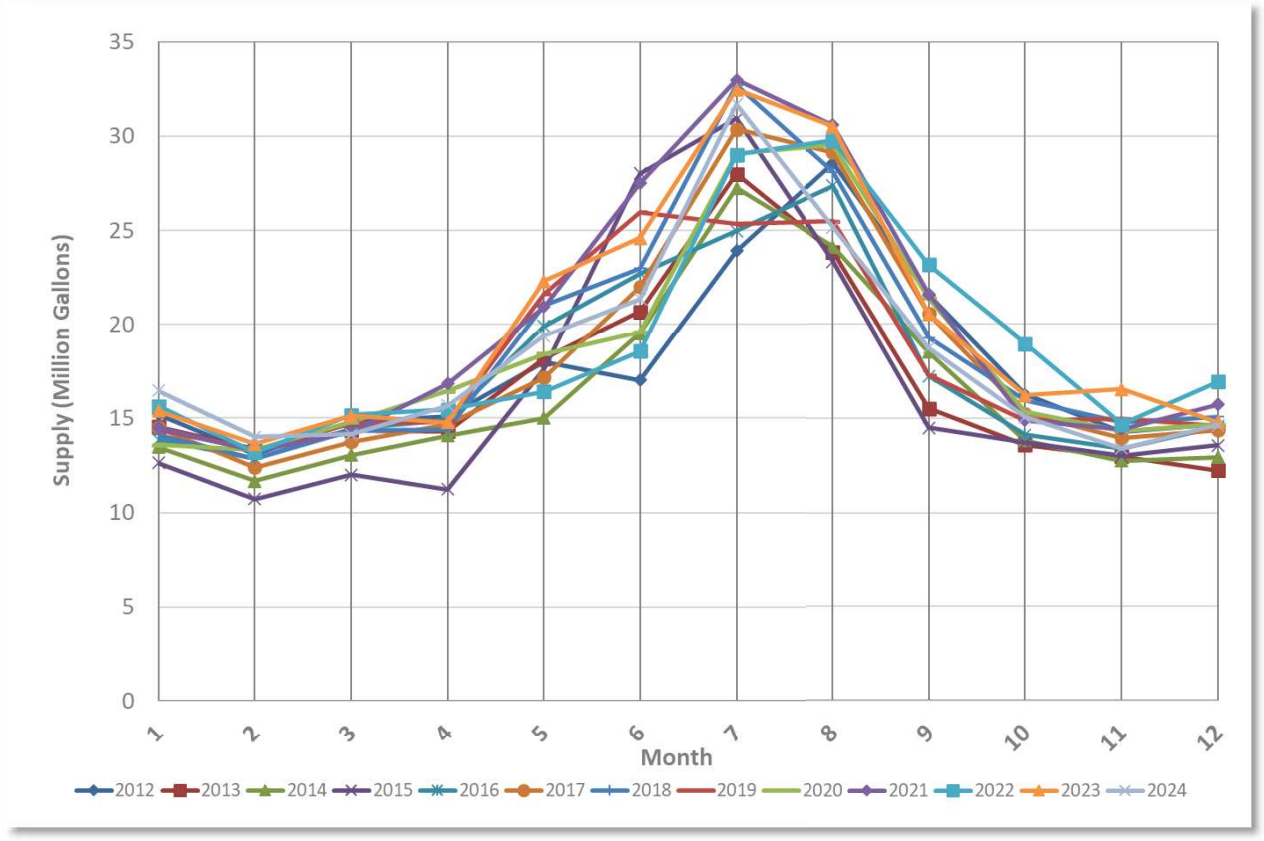

Figure 4-3 Historical Monthly Water Supply

As shown in Figure 4-3, water supply increases significantly during summer months, primarily due to irrigation. The District's highest water use typically occurs in July and August. On average, the amount of water supplied during these two months is approximately 25 percent of the total supply for the entire year. Water production from Well No. 1, Wells No. 6 and 7, and Well No. 9 are increased to meet the additional demand during these peak periods, as shown in Figure 4-4.

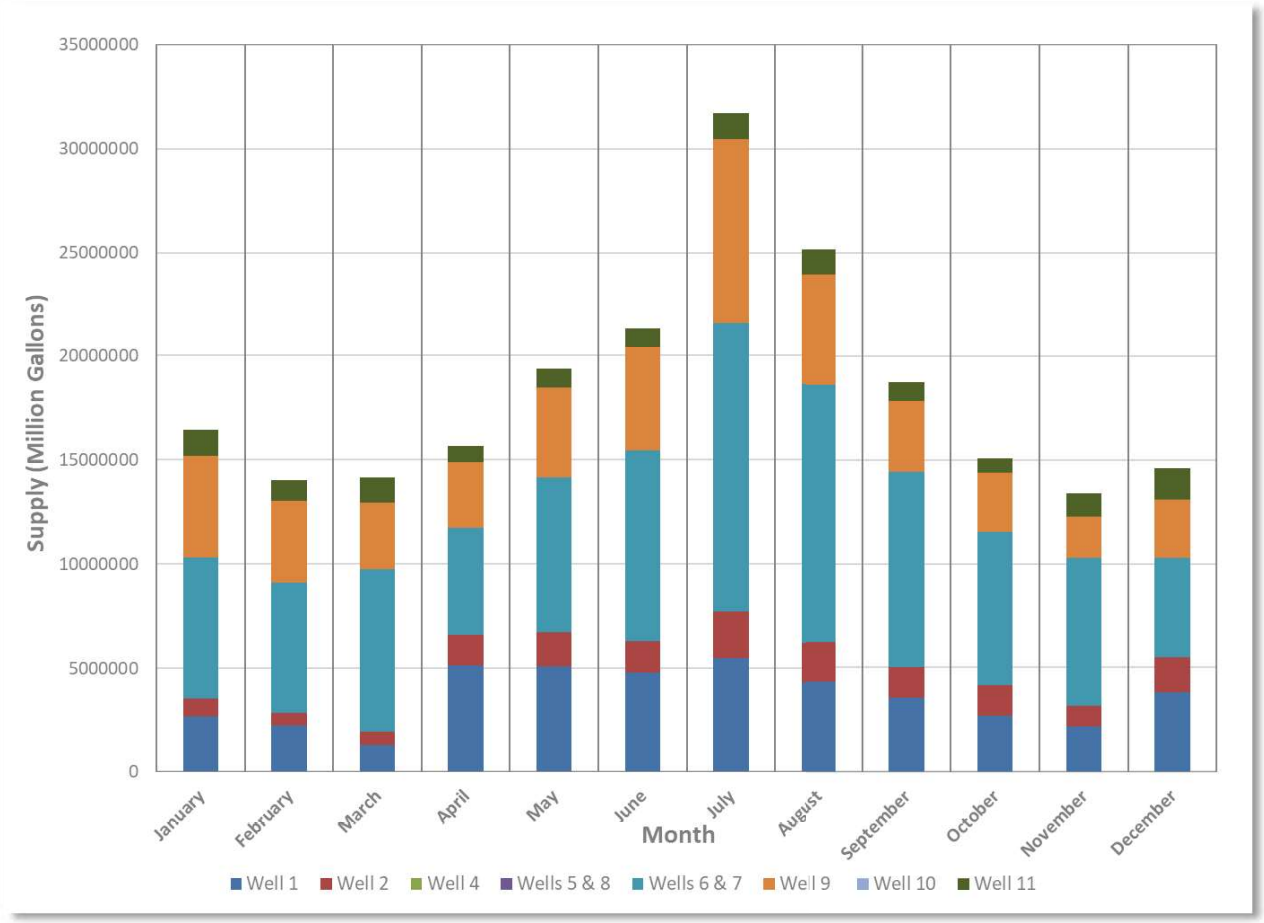

Figure 4-4 2024 Monthly Water Supply by Source

Distribution System Leakage

The amount of DSL in a water system is calculated as the difference between the amount of water supply and the amount of authorized water consumption. There are many sources of DSL in a typical water system, including water system leakage; inaccurate supply metering; inaccurate customer metering; illegal water system connections or water use; fire hydrant use; water main flushing; and malfunctioning telemetry and control equipment resulting in reservoir overflows. Several of these types of usages, such as water main flushing and fire hydrant usage, may be considered authorized uses if they are tracked and estimated. Although real losses from the distribution system, such as reservoir overflows and leaking water mains, should be tracked for accounting purposes, these losses must be considered leakage. The WUE Rule established a DSL standard of 10 percent or less based on a 3-year rolling average. Table 4-6 reports the District's DSL for 2012 through 2023.

The amount of DSL in the District's system varied significantly from 2012 through 2023, as shown in Table 4-6.

Table 4-6
Distribution System Leakage

Type	Year									
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	Authorized Consumption (1,000 Gallons)									
Metered Customer Use	191,981	187,805	184,102	197,289	193,704	202,051	201,198	198,830	203,170	213,15
Other Authorized Consumption	3,088	9,105	840	1,693	2,344	1,627	3,079	2,293	1,548	3,493
Total Authorized Consumption	195,068	196,910	184,942	198,982	196,049	203,677	204,277	201,124	204,718	216,64
	Total Supply (1,000 Gallons)									
Total Supply	212,454	201,606	196,241	201,295	210,426	218,159	225,654	217,495	220,578	237,59
	Distribution System Leakage									
Total DSL (1,000 gallons)	17,396	4,696	11,299	2,313	14,377	14,482	21,377	16,371	15,860	20,95
Total DSL (%)	8.2	2.2	5.8	1.1	6.8	6.6	9.5	7.5	7.2	8.8
Rolling 3-Year Average DSL (%)	9.0	8.4	5.4	3.1	4.6	4.9	7.6	7.9	8.1	7.8

The rolling 3-year average of approximately 9.1 percent and lower from 2021 through 2023 is less than the standard of 10 percent established by the WUE Rule. To meet the DSL standard, the District will continue to implement the WUE measures discussed in the WUE Program contained in Appendix E. These measures include a progressive water main replacement and leak detection program to reduce system leaks, system-wide service meter replacements, and increased monitoring of water used for construction and firefighting activities.

The DSL that the District has experienced is likely from leaking water mains, unauthorized hydrant and water service use, firefighting, and meter inaccuracies.

Equivalent Residential Units

The demand of each customer class can be expressed in terms of equivalent residential units (ERUs) for demand forecasting and planning purposes. One ERU is equivalent to the amount of water used by one residential connection. The number of ERUs represented by the demand of the other customer classes is determined from the total demand of the customer class and the unit demand per ERU from the residential demand data.

Table 4-7 presents the computed number of ERUs for each customer class from 2012 through 2023 for the District's service area. The demands shown are based on supply data that was computed from the consumption of each customer class and the system DSL and authorized consumption. The average demand per ERU from 2012 through 2023 was 171 gpd. This is within the typical range in the Puget Sound. The average demand per ERU of 171 gpd will be used later in this chapter to forecast ERUs in future years based on estimated future demands. This demand per ERU value will also be used to determine the capacity (in terms of ERUs) of the existing system in Chapter 7.

Average Day Demand

Average Day Demand (ADD) is the total amount of water delivered to the system in a year divided by the number of days in the year. The ADD is determined from historical water use patterns of the system and can be used to project future demand within the system. ADD data is typically used to determine standby storage requirements for water systems. Standby storage is the volume of a reservoir used to provide water supply under emergency conditions when supply facilities are out of service. Water production records from the District's wells and wholesale sources were reviewed to determine the systems ADD. The system's ADD from 2005 through 2024 is shown in Table 4-3.

Table 4-7
Equivalent Residential Units

Year	Average Number of Connections	Annual Supply (Gallons)	Demand Per ERU (gal/day/ERU)	
Residential				
2012	3,185	203,649,253	175	
2013	3,195	193,720,396	166	
2014	3,207	188,266,266	161	
2015	3,217	191,568,683	163	
2016	3,251	198,684,124	167	
2017	3,291	207,259,520	173	
2018	3,322	214,650,156	177	
2019	3,330	205,157,411	169	
2020	3,345	211,242,304	173	
2021	3,368	217,332,113	177	
2022	3,367	222,959,756	181	
2023	3,381	206,806,393	168	
Average 2012 - 2023			**171**	
Commercial				
2012	22	1,897,867	175	
2013	33	1,873,383	166	
2014	47	1,835,913	161	
2015	47	1,993,276	163	
2016	47	2,238,634	167	
2017	47	1,936,730	173	
2018	40	1,911,050	177	
2019	35	2,111,696	169	
2020	35	1,816,224	173	
2021	35	1,534,273	177	
2022	22	1,658,574	181	
2023	22	1,538,411	168	
Government				
2012	20	6,906,880	175	
2013	20	6,012,221	166	
2014	20	6,138,821	161	
2015	20	7,732,641	163	
2016	20	9,503,242	167	
2017	20	8,962,749	173	
2018	20	9,092,794	177	
2019	20	10,225,894	169	

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Maximum Day Demand

Maximum Daily Demand (MDD) is the maximum amount of water used throughout the system during a 24-hour time period in a given year. The MDD typically occurs on a hot summer day when lawn watering is occurring throughout much of the system. In accordance with Washington Administrative Code (WAC) 246-290-230 – Distribution Systems, the distribution system must provide fire flow at a minimum pressure of 20 pounds per square inch (psi) during MDD conditions. Supply facilities (i.e., wells, booster pump stations, interties) are typically designed to supply water at a rate that is equal to or greater than the system's MDD.

The MDD is typically determined from the combined flow of water into the system from all supply sources and reservoirs on the peak day. Daily water production records and chart recordings of reservoir levels were reviewed to determine the system's MDD. The District's MDD occurred on July 29, 2022, during a heat wave. As shown in Table 4-8, the MDD of the system on July 29, 2022 was 958 gallons per minute (gpm).

Table 4-8
Peak Day Demands and Peaking Factors

Peak Day Demand Data		
Demand Type	**Date**	**Demand (gpm)**
Average Day Demand (ADD)	2022	382
Maximum Day Demand (MDD)[1]	July 29, 2022	958
Peak Hour Demand (PHD)[2]	N/A	1,612
Peaking Factors		
Description		**Factor**
Maximum Day Demand/Average Day Demand (MDD/ADD)		2.50
Peak Hour Demand/Maximum Day Demand (PHD/MDD)		1.68
Peak Hour Demand/Average Day Demand (PHD/ADD)		4.22

Notes:
1) Maximum Day is most frequently a hot, dry weekend day proceeded by a series of hot, dry days.
2) Peak Hour is most frequently between 7 p.m. and 9 p.m. on a hot, dry day.

Peak Hour Demand

Peak Hour Demand (PHD) is the maximum amount of water used throughout the system, excluding fire flow, during a 1-hour time period in a given year. In accordance with WAC 246-290-230 – Distribution Systems, new public water systems or additions to existing systems must be designed to provide domestic water at a minimum pressure of 30 psi during PHD conditions. Equalizing storage requirements are typically based on PHD data.

Hourly water production and reservoir level records were not available to review to evaluate, so the Water System Design Manual Equation 3-1 was used to calculate system PHD. As shown in Table 4-8, the District's PHD, was calculated to be 1,612 gpm. The PHD is typically between 7 p.m. and 9 pm on a hot, dry summer day.

Table 4-8 also shows the peaking factors of the water system based on the ADD, MDD, and PHD data presented. The MDD/ADD ratio of 2.50 is at the high end of the typical range of 1.2 to 2.5 for most systems. The estimated PHD/MDD ratio of 1.68 within the typical range of 1.5 to 2.0 for most systems. These peaking factors will be used later in this chapter in conjunction with projected ADDs to project future MDDs and PHDs of the system.

4.3.3 Fire Flow Demand

Fire flow demand is the amount of water required during firefighting as defined by applicable codes. Fire flow requirements are established for individual buildings and expressed in terms of flow rate (gpm) and flow duration (hours). Fighting fires imposes the greatest demand on the water system because a high rate of water must be supplied over a short period of time, requiring each component of the system to be properly sized and configured to operate at its optimal condition. Adequate storage and supply is useless if the transmission or distribution system cannot deliver water at the required rate and pressure necessary to extinguish a fire.

General fire flow requirements were established for the different land use categories to provide a target level of service for planning and sizing future water facilities in areas that are not fully developed. The general fire flow requirement for each land use category is shown in Table 4-9. The water system analyses presented in Chapter 7 are based on an evaluation of the water system for providing sufficient fire flow in accordance with these general fire flow requirements. The fire flow requirements shown in the table do not necessarily equate to actual existing or future fire flow requirements. Improvements to increase the available fire flow to meet actual fire flow requirements greater than those shown in the table shall be the responsibility of the developer.

Table 4-9
General Fire Flow Requirements

Land Use Category	Fire Flow Requirement (gpm)	Flow Duration (Hours)
Single-family Residential	500	0.5
Medium-density Residential	1,000	2
Schools	1,500	2
Commercial	1,500	2
Government	1,500	2

4.4 Future Water Demands

4.4.1 Basis for Projecting Demands

Future demands were calculated from the system's per capita demand computations shown in Table 4-4 and the projected population data from Chapter 3. These demands include DSL. Future demand projections were computed with and without a further reduction in water use from WUE measures included in the District's WUE Program (Appendix E). A calculated future per capita demand of 171 gallons per ERU (gperu) was used for all demand projections without WUE. 171 gperu is the average of 2012 through 2023.

The District's water use reduction goal is to reduce per capita demand by 5% over 10 years, with the base year of 2022 having 66 gallons per capita per day (gpcd). This results in a reduction to 62.7 gpcd by 2032. Projected demands with and without WUE are shown in Table 4-10.

4.4.2 Demand Forecasts and WUE

Table 4-10 presents the 10-year and 20-year water demand forecast for the District's water system. The future ADDs were projected based on population estimates for the given years and the estimated demand per capita values. The future MDDs and PHDs shown were computed from the projected ADDs and the peaking factors shown in Table 4-8. The future demand projections are also shown with and without estimated additional reductions in water use from achieving the WUE goals presented in the previous section.

The analysis and evaluation of the existing water system with proposed improvements, as presented in Chapters 7 and 9, are based on the 10-year and 20-year projected demand data without WUE reductions. This ensures that the future system will be sized properly to meet all requirements, whether or not additional water use reductions from WUE are achieved. However, the District will pursue reductions in per capita water use by implementing the WUE Program contained in Appendix E of this Water System Plan.

Table 4-11 presents the existing and projected ERUs of the system. The 10-year and 20-year ERU forecast is based on the projected water demand data. The projected water demand and ERU data from Table 4-10 and Table 4-11 are also shown graphically in Figure 4-5.

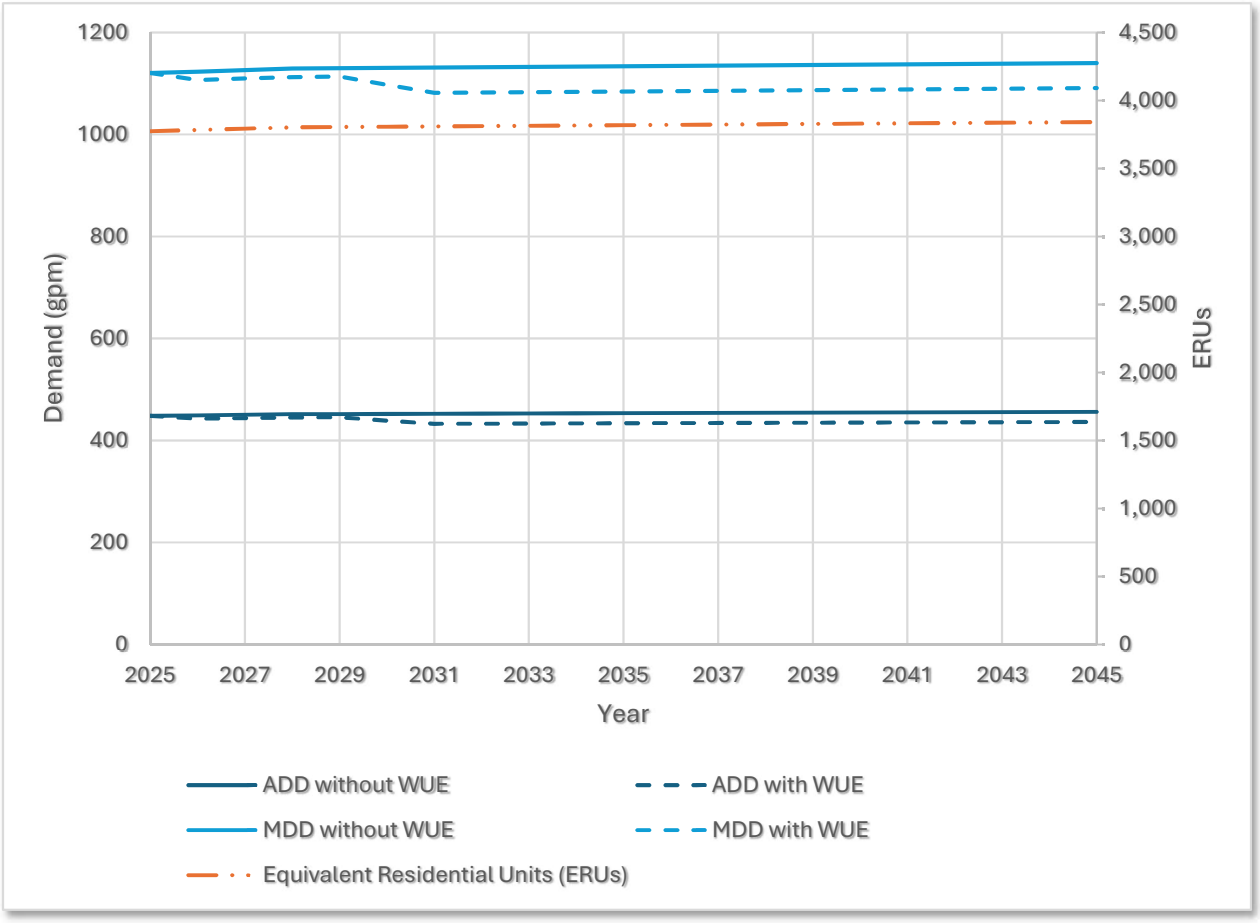

Figure 4-5 Future Water Demand and ERU Projections

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Table
Future Water Dem

Description	2025	2026	2027	2028	2029
Population in Water Service Area	9,352	9,376	9,400	9,424	9,430
					D
ADD without WUE	71	71	71	71	71
ADD with WUE	65.0	64.7	64.4	64.0	63.7
Demand without WUE	461	462	463	465	465
Demand with WUE	422	421	420	419	417
Demand without WUE	1,153	1,156	1,159	1,162	1,162
Demand with WUE	1,056	1,053	1,050	1,047	1,043
Demand without WUE	1,937	1,942	1,947	1,952	1,953
Demand with WUE	1,773	1,769	1,764	1,760	1,752

Notes:

1) The 2012 to 2023 Average ADD of 71 gpcd is used for projections.
2) An MDD/ADD peaking factor of 2.50 was used to calculate the MDD.
3) A PHD/MDD peaking factor of 1.68 was used to calculated PHD.

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Table
Future ERU

Description	2025	2026	2027	2028	2029
ADD without WUE	461	462	463	465	465
Demand per ERU without WUE	171	171	171	171	171
Total System	3,883	3,893	3,903	3,913	3,915

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Chapter 5 Policies and Design Criteria

5.1 Introduction

Manchester Water District (District) operates and plans water service for the District's residents and businesses according to the design criteria, laws, and policies that originate from the seven sources shown in Table 5-1, which are listed in descending order from those with the broadest authority to the narrowest.

Table 5-1
Regulatory Agencies

Agency	Design Criteria/Laws/Policies
U.S. Department of Health & Human Services	Federal Regulations
U.S. Environmental Protection Agency	Federal Regulations
Washington State Department of Health	State Regulations
Washington State Department of Ecology	State Regulations
Kitsap County	County Regulations
District Board of Commissioners	Administrative Policies
American Water Works Association	Design Criteria

These laws, design criteria, and policies guide the District's operation and maintenance of the water system on a daily basis, and its planning for growth and improvements. Their overall objective is to ensure that the District provides high quality water service at a fair and reasonable cost to its customers. They also set the standards the District must meet to ensure that the water supply is adequate to meet existing and future water demands. The system's ability to meet these demands is detailed in Chapter 7, and the recommended improvements are identified in Chapter 9.

The highest three governmental entities establishing policies and laws – the U.S. Government, Washington State, and Kitsap County – establish requirements in statutes, regulations, or ordinances. The District's Board of Commissioners adopts regulations and policies that cannot be less stringent or in conflict with those established by governments above them. The District's policies take the form of resolutions, memoranda, and operational procedures, many of which are summarized in this chapter.

The policies associated with the following categories are presented in this chapter.

- Supply.
- Customer Service.
- Facility.
- Financial.
- Organizational.

5.2 Supply Policies

5.2.1 Quality Protection

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

5.2.2 Cross-Connection Control

- The District has a responsibility to protect the public water system from contamination due to cross-connections. Cross-connections that can be eliminated will be eliminated.
- The District has a cross-connection control program for eliminating cross-connections. A copy of the Manchester Water District *Cross-Connection Control Plan* is contained in Appendix F.
- The District has staff that is certified for backflow prevention and inspection.
- The District will comply with the backflow prevention assembly installation and testing requirements as indicated in Washington Administrative Code (WAC) 246-290-490, and as published in the manual entitled *Cross Connection Control Manual Accepted Procedure and Practice*, Pacific Northwest Section, American Water Works Association (AWWA).

5.2.3 Quantity

- The District will plan for saturation of its supply sources so that future water resource limitations can be handled effectively.
- The District will ensure that the capacity of the system, including wells, pump stations and transmission mains, is sufficient to meet the peak day demand of the system.

5.2.4 Fire Flow

The District will plan to provide at least the following minimum fire flows for future development in accordance with the Kitsap County Building and Fire Code.

- Single-Family Residential: 500 gallons per minute (gpm) for 30-minute duration
- Medium Density Residential: 1,000 gpm for 2-hour duration
- School: 1,500 gpm for 2-hour duration
- Commercial/Government: 1,500 gpm for 2-hour duration

Actual fire flow requirements, as determined by the local fire marshal, may differ from those shown based on factors such as proposed use, building size, and construction. Improvements to increase the available fire flow to meet actual fire flow requirements greater than those shown shall be the responsibility of the developer. An email from the Kitsap County Fire Marshal describing fire flow requirements is included as Appendix Q.

5.2.5 Water Use Efficiency

- The District will promote the efficient and responsible use of water and will conserve water.

- The Manchester Water District *Water Use Efficiency Program*, which is contained in Appendix E, describes the District's current conservation program.

5.2.6 Regional Participation

- The District will participate in regional supply management and planning activities to protect the environment, reduce cost of service, and improve reliability, water quality, and quantity. The District will participate in the following regional activities.
  - Kitsap Watershed Planning for Water Resource Inventory Area (WRIA) 15.
  - Kitsap County Water Utility Coordinating Committee.
  - Water Purveyors Association of Kitsap (WaterPAK).
- Participation in these activities includes attending meetings, providing information for studies, and performing water quality monitoring tasks as needed.

5.3 Customer Service Policies

5.3.1 Duty to Serve, Water Service and Connection

- The District will provide retail water service to all property within its defined Retail Water Service Area (RWSA) in a timely and reasonable manner, consistent with applicable District resolutions and policies, the Municipal Water Law, DOH rules and regulations and other applicable federal, state and local laws, unless a special agreement with an adjacent purveyor exists, due to topography or other limiting factors. Pursuant to RCW 43.20.260, as a municipal water supplier as defined in RCW 90.03.015, the District has a duty to provide retail water service within its RWSA if:
  - The District has sufficient capacity to serve the water in a safe and reliable manner as determined by DOH.
  - District water service can be available in a timely and reasonable manner.
  - The service request is consistent with adopted local plans and development regulations.
  - The District has sufficient water rights and other sources of supply to provide the service.
- The District will strive to provide potable water service to the customers within the District's water service area, provided all policies related to service can be met.
- All proposed developments within the District's water service area shall connect directly to the District's water system, unless deemed unfeasible by the District at the time of the request.
- Water system extensions required to provide water service to proposed developments shall be approved by the District and must conform to the District's adopted design criteria, and construction standards and specifications, as shown in the developer extension program for the District. All costs of the extension shall be borne by the developer or applicant.
- Water service can be extended within the water service area if the project is in compliance with the District's utility regulations and policies, and Kitsap County's adopted land use plan, zoning, and development regulations.

- Requests for new water service begin with a Water Service Estimate and/or Meter Application. These documents include property location, meter size, owner information, and other data. The District then determines if water is available, or what will be necessary to serve the property. When the meter connection is requested, the Meter Application will be reviewed by the General Manager, or designee, and final costs shall be determined. Once meter connection fees are paid, including but not limited to installation charges, and General and Local Facilities Charges, and required system extensions/improvements are completed, a Binding Certificate of Water Availability for final approval on short plats, subdivisions, septic/sewer designs, and building site applications will be prepared and returned to the applicant within 2 weeks. Service installation is scheduled upon receipt of payment. The turnaround time for service installations, once the service is paid for, is typically within 30 days.
- The Binding Certificate of Water Availability shall expire 2 years from the date of issuance, and a Non-Binding Certificate of Water Availability shall expire 1 year from the date of issuance.
- For water service applications outside of the District's corporate limits but within the water service area, the applicant will follow the steps for a standard meter connection. The applicant also must complete an Outside District Agreement form and obtain a water service agreement from the District.
- Water system capacity will be evaluated at the time of water service application. The District will use the capacity analysis contained in Chapter 7 of this Water System Plan (WSP) to evaluate source of supply, storage, and water rights capacity available to the applicant.
- Water system capacity, pressure, and fire flow will be considered when providing water availability to applicants.
- Delays resulting from non-technical conditions that affect the District's ability to provide new water service are the responsibility of the applicant. These conditions include, but are not limited to, environmental assessments and local regulations.
- Time extensions in regard to water availability shall be granted in accordance with the associated permit requirements. When extensions are denied, the disputes are handled through the District's dispute resolution process. Disputes can be brought to the Board of Commissioners for discussion.
- Individual wells may be installed on existing platted lots within the District's service area if the District determines it unfeasible to provide a direct connection to the District's water system at the time of the request. This will be determined on a case-by-case basis depending on where the parcel is compared to the distribution system. Kitsap Public Health Department (KPHD) determines if the property owner can drill a well if the District can't provide service or if the property owner doesn't want to extend the closest water main.

5.3.2 Annexations

- Provision of service will be provided per the adopted extraterritorial utility policy. The District will follow state guidelines in the assumption of facilities in annexation areas.

5.3.3 Temporary Services

- Temporary service is not allowed.

5.3.4 Emergency Service

- Compliance with standards may be temporarily deferred for emergency water service.
- Policy criteria may be waived for emergency service.

5.3.5 Planning Boundaries

- For planning purposes, the District will use the designated service area boundary established by agreement as a result of the Kitsap County Coordinated Water System Plan.
- The District will follow State of Washington guidelines in assuming portions of adjacent water systems as a result of annexation.

5.3.6 Satellite System Management

- The District manages two satellite systems. The District will not provide satellite system management or ownership services to any more satellite systems within the District's water service area.

5.4 Facility Policies

This section describes the planning criteria and policies used to establish an acceptable hydraulic behavior level and a standard of quality for the water system. Additional criteria are contained in the District's Construction Standards, a copy of which is included in Appendix G of this WSP.

5.4.1 Minimum Standards

All proposed developments within the District's service area shall conform to the District's adopted design criteria, construction standards, and specifications.

5.4.2 Pressure

- The District will endeavor to maintain a minimum pressure of 40 pounds per square inch (psi) at customer meters during normal demand conditions, excluding a fire or emergency.
- The District will endeavor to maintain a maximum pressure of 120 psi in the water mains during normal demand conditions, excluding pressure surges. Individual residences are responsible for reducing pressures over 80 psi.
- The District will endeavor to maintain a minimum pressure of 30 psi at customer meters during all demand conditions, excluding a fire or emergency.
- During fire conditions, the minimum pressure at customer meters and throughout the remainder of the system will be 20 psi.
- During a failure of any part of the system, the maximum pressure will not exceed 150 psi.

5.4.3 Velocities

- During normal demand conditions, the velocity of water in a water main should be less than 5 feet per second (fps).

- During emergency conditions such as a fire, and for design purposes, the velocity of water in a water main may exceed 5 fps but may not exceed 10 fps.

5.4.4 Storage

- Storage within the distribution system must be of sufficient capacity to supplement supply when system demands are greater than the supply capacity (equalizing storage), and maintain sufficient storage for proper pump operation (operational storage), fire suppression (fire flow storage), and other emergency conditions (standby storage).
- Standby storage must be located above the elevation that yields a 20 psi service pressure to the highest service in the zone under peak hour demand conditions.
- Fire flow storage must be located above the elevation that yields a 20 psi service pressure to all services in the zone under peak day demand conditions.
- The District will provide sufficient standby storage for an emergency condition in which a major supply source is out of service. The volume of storage will be sufficient to maintain uninterrupted supply to the system during the emergency condition.
- The District will provide sufficient storage for a fire condition equal to the system's maximum fire protection water demand and the required duration.
- The District will have high water level and low water level alarms at the District office.
- Reservoir levels are displayed at the District office through SCADA in addition to the physical level indicators displayed on the exterior of each reservoir.
- Storage facilities will be located in areas where they will satisfy the following requirements.
    - Minimize fluctuations in system pressure during normal demands.
    - Maximize use of storage facilities during fires and peak demands.
    - Improve the reliability of supply to the District.

5.4.5 Transmission and Distribution

- Unless deemed impractical, transmission and distribution mains will be looped to increase reliability and fire flow capacity, and decrease head losses.
- All mains will comply with the generally recognized design criteria from the AWWA and Washington State Department of Health guidelines that follow.
    - All new construction will be in accordance with the District's Construction Standard, a copy of which is included in Appendix G of this WSP.
    - All materials coming into contact with potable water are required to be NSF 61 certified.
    - All chemicals used for treatment or disinfection are required to be NSF 60 certified.
    - Distribution system design assumes that adequately sized service lines will be used. All residential service lines will be 1-inch or larger.

- The minimum diameter of distribution mains will be 8 inches. Water mains not required to carry fire flow, as determined by the District, may be a smaller diameter. All water mains will be ductile iron pipe. The District may consider other piping materials for specialized applications on a case-by-case basis.
- All new distribution mains will be sized by a hydraulic analysis.
- All new mains providing fire flow will be sized to provide the required fire flow at a minimum residual pressure of 20 psi during peak day demand conditions, while maintaining a maximum pipeline velocity of 10 fps. In general, new water mains that will carry fire flow in residential areas shall be a minimum of 8 inches in diameter and looped. New water mains in commercial, government, and school areas shall be a minimum of 12 inches in diameter and looped.
- Valve installations will satisfy the following criteria.
  - Zone valves will be located at all pressure zone boundaries to allow future pressure zone realignment without the need for additional pipe construction.
  - Isolation valves will typically be installed in the lines to allow individual pipelines to be shut down for repairing or installing services. Unless it is impractical to do so, the minimum distance between isolation valves will not exceed 1,000 feet in single-family residential areas, 500 feet in commercial, government, and school areas, and ¼ mile in transmission mains. A minimum of three valves will be provided per cross, and two valves per tee. The District may increase or decrease the number of and distance between valves for new construction based on system configuration.
  - Air/vacuum release valves will be placed at all high points, or "crowns," in all pipelines.
  - Blow-off assemblies shall be located at main dead ends where there is not a fire hydrant.
  - Individual check valves will be installed on customer service lines where conditions warrant.
- Fire hydrant installations will satisfy the following criteria.
  - Fire hydrants serving detached single-family dwellings or duplex dwellings on individual lots will be located within 600 feet in accordance with the requirements of the version of the Kitsap County Fire Code current at the time of the installation.
  - Fire hydrants serving any use other than detached single-family dwellings or duplex dwellings on individual lots will be located in accordance with the requirements of the version of the Kitsap County Fire Code current at the time of the installation.
  - A minimum of one fire hydrant shall be installed per intersection.
  - South Kitsap Fire and Rescue will review all proposed fire hydrant installations to ensure the correct number and spacing of fire hydrants for each project.

5.4.6 Supply and Booster Pump Stations

- All existing and future booster pump stations will be modified/constructed to comply with the following minimum standards.
  - All structures will be non-combustible, where practical.

  - All buildings will have adequate heating, cooling, ventilation, insulation, lighting, and work spaces necessary for on-site operation and repair.
  - Sites will be fenced to reduce vandalism and District liability.
  - Each station will be equipped with a flow meter and all necessary instrumentation to assist personnel in operating and troubleshooting the facility.
  - Emergency power capability will be provided to at least one supply or booster pump station supplying each pressure zone.
- Pumps will be operated automatically, with flexibility in pump start/stop settings.
- Stations will be operated with the provision for at least two methods of control to minimize system vulnerability.
- Manual override of stations will be provided for and located at the District office using the District's supervisory control and data acquisition (SCADA) system.
- Stations will be monitored with alarms for the following conditions.
  - Pump started automatically or manually.
  - Power phase failure.
  - Power outage/generator running.
  - Communication failure.
  - Water in structure.
  - Low suction pressure.
  - High and low discharge pressure.
  - Intrusion.
  - Smoke detector.
  - Heat detector.
  - High and low chlorine levels.
- Stations will have the following indicators:
  - Local flow indication and totalizing.
  - Flow indication and totalizing at the District office.
  - Combined supply flow recording to the system.
- Booster pump stations will be placed wherever necessary to fulfill the following criteria:
  - Provide supply redundancy to a pressure zone.
  - Improve the hydraulic characteristics of a pressure zone.
  - Maximize storage availability and transmission capacity.
  - Improve water quality (i.e., increase circulation) and quantity.

5.4.7 Pressure Reducing Stations

- All pressure reducing valves will be placed in vaults that are large enough to provide ample workspace for field inspection and valve repair.
- Vaults will drain to daylight or will be equipped with sump pumps to prevent vault flooding.
- Pressure relief valves may be provided on the low pressure side of the pressure reducing valves to prevent the system over pressurizing in case of a pressure reducing valve failure.

5.4.8 Control

- The District's control system must be capable of efficiently operating the water system's components in accordance with this WSP, and in response to reservoir levels, system pressures, and abnormal system conditions.

5.4.9 Maintenance

- Facility and equipment breakdown is given the highest maintenance priority. Emergency repairs will be made even if overtime labor is involved.
- Equipment will be scheduled for replacement when it becomes obsolete and as funding is available.
- Worn parts will be repaired, replaced, or rebuilt before they represent a high failure probability.
- Spare parts will be stocked for all equipment items whose failure will impact the ability to meet other policy standards.
- Equipment that is out of service will be returned to service as soon as possible.
- A preventive maintenance schedule will be established for all facilities, equipment, and processes.
- Tools will be obtained and maintained to repair all items whose failure will impact the ability to meet other policy standards.
- Dry, heated shop space will be available for maintenance personnel to maintain facilities.
- All maintenance personnel will be trained to efficiently perform their job descriptions.
- Maintenance will be performed by the water maintenance staff or other approved sources and supervised by the Operations Foreman.
- Written records and reports showing operation and maintenance history will be maintained at each facility and item of equipment.
- Asset management has been implemented and is discussed in Section 2.5.10.

5.4.10 Joint-Use

- All joint-use facilities (with other public water systems) must comply with District policy and design standards.
- Joint-use facilities will be pursued only in those areas that improve reliability or reduce operating costs.

5.5 Financial Policies

5.5.1 General

- The District will set rates that comply with state regulations.
- Rates and additional charges established for the District should be:
  - Cost-based rates that recover current, historical, and future costs associated with the District's water system and services;
  - Equitable charges to recover costs from customers commensurate with the benefits they receive; and
  - Adequate and stable source of funds to cover the current and future cash needs of the District.
- The existing customers of the District will pay the direct and indirect costs of operating and maintaining the facilities through water rates. In addition, the water rates will include debt service incurred to finance the capital assets of the District.
- New customers seeking to connect to the water system will be required to pay connection fees and charges for an equitable share of the historical cost of the system and for the system's capital improvement program (CIP). Connection charge revenues will be used to fund the CIP in conjunction with rate revenue.
- New and existing customers will be charged for extra services through separate ancillary charges based on the costs to provide the services. Ancillary charges can increase equitability and operating efficiency by discouraging unnecessary demand for services. The charges should be reviewed regularly and updated annually based on increases in the Consumer Price Index. Revenue from ancillary charges will be used to finance annual operations and maintenance.
- The District will maintain information systems that provide sufficient financial and statistical information to ensure conformance with rate setting policies and objectives.
- User charges must be sufficient to provide cash for the expenses of operating and maintaining the system. To ensure the fiscal and physical integrity of the utility, each year an amount should be set aside and retained for capital expenditures, which will cover some portion of the depreciation of the physical plant. The amount may be transferred from the Operations and Maintenance Fund to the Construction Fund for general purposes or specific purposes.
- A non-restricted contingency reserve amount will be maintained to cover unanticipated emergencies and fluctuations in cash flow.
- Water rates will be based on either the Base-Extra Capacity Method or the Commodity-Demand Method. Both methods strive to equitably charge customers with different service requirements based on the cost of providing the water service. Service requirements relate to the total volume of water used, peak rates of use, and other factors.

5.5.2 Connection Charges

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

- General Facilities Charge: A general facility charge will be assessed against all new connections. The basis for the General Facilities Charge is the capital cost the District has or will incur to provide service capacity in the water system.
- Local Facilities Charge: A local facilities charge provides for the reimbursement of a pro rata portion of the original cost of water system local distribution extensions.
- Front Footage Charge: The front footage charge is assessed for unusual lot sizes or configurations, or for larger non-residential development, in lieu of the Local Facilities Charge.
- Meter Installation Charge: The meter installation charge for residential meters is a uniform charge that is based on historical costs of construction time incurred and materials used in installing a water service. Water meter installations greater than 1 inch in size are charged actual time, materials, and overhead costs.

5.6 Organizational Policies

5.6.1 Staffing

- The three members of the Board of Commissioners are elected by the registered voters in the District. The Board hires a General Manager who has the day-to-day responsibilities of operating the water system. The General Manager is responsible for hiring other staff. Among them are the Operations Foreman, who is responsible for directing operation and maintenance activities, and Service Technicians, who are responsible for performing various activities in support of the operation, maintenance, repair, and construction of the water system. Each of these staff members reports to the General Manager.
- Personnel certification will meet or exceed state standards.
- The District will promote staff training.
- Staffing is discussed in Section 8.5. An organization chart is included as Figure 8-1.

Chapter 6 Water Source and Quality

6.1 Introduction

The two basic objectives of a water system are to provide a sufficient quantity of water to meet customer usage demands and to provide high quality water. Chapter 7 discusses Manchester Water District's (District) ability to supply a sufficient quantity of water and identifies future source requirements. This chapter discusses the District's existing water sources, water rights, water quality regulations, and water quality monitoring results.

6.2 Existing Water Sources and Treatments

6.2.1 Water Sources

All water supply to the District's system is provided by nine groundwater wells. Since its last Water System Plan (WSP), the District transferred the water right from Well 3 to Wells 6 and 7; therefore, Well 3 has been decommissioned and the property sold to a private owner. Well 12 is used for monitoring by the Department of Ecology, is not connected to the water system, and does not have a water right for municipal supply. Several of the District's wells are located in well fields, where they draw water from the same

aquifer as another well. Additional information on each of the District's existing sources is presented in Chapter 2 and is included in Appendix B.

6.2.2 Water Treatment

The District provides fluoridated water to its customers on a system-wide basis. Except for Well 4, fluoridation is achieved at each of the well buildings through a fluoride injection system that consists of a sodium fluoride solution holding tank and a metering pump to automatically regulate the flow of sodium fluoride in proportion to the water supplied by each well. The metering pumps maintain a target residual for fluoride of 0.7 milligrams per liter (mg/L), and the fluoridation levels are monitored at each station by District staff on a daily basis to prevent sodium fluoride overfeed to the water system. Well 4 is not equipped with a fluoridation system because of its minimal flow rate and water right restrictions.

Wells 4 and 10 are only operated in conjunction with other sources of supply so that water from the two wells is blended with fluoridated water. A filtration facility is currently being designed for Well 10 to remove elevated levels of manganese.

The District is required to provide routine disinfection and maintain a detectable level of chlorine on a system-wide basis due to past Total Coliform Violations. A detectable residual disinfection concentration is defined as at least 0.2 milligrams per liter (mg/L). In the northerly portion of the service area, chlorine is added at several wells for taste and odor control purposes. Chlorine is added to Wells 1, 2, 11 via direct injection of a 12.5-percent sodium hypochlorite (NaOCl) solution at a target free residual of 0.3 to 0.5 mg/L. This trace amount of chlorine adds a barrier of protection against bacterial growth throughout the North 277 Zone. Chlorination is achieved at Wells 4, 6, and 7 by injection of a 12.5-percent NaOCl solution to oxidize hydrogen sulfide that occurs naturally in the aquifer. Metering pumps in the respective pump houses maintain a target free residual of 0.5 mg/L.

Chlorine is added to water produced at Wells 5R and 9 to protect against coliform bacterial growth in the South 277 Zone and the South 430 Zone. Chlorination is achieved through injection of sodium hypochlorite via a metering pump at the respective well houses, with a target free residual of 0.3 to 0.5 mg/L.

6.3 Water Rights

6.3.1 Overview

A water right is a legal authorization to use a specified amount of public water for specific beneficial purposes. The water right amount is expressed in terms of instantaneous withdrawal rate and annual withdrawal volume. Washington State law requires users of public water to receive approval from the Washington State Department of Ecology (Ecology) prior to actual use of the water. This approval is granted in the form of a water right permit, which is developed into a certificate. However, a water right is not required for certain purposes (typically individual residences) that use 5,000 gallons per day (gpd) or less of groundwater from a well.

The process of obtaining a water right involves submitting a water right application to be reviewed by Ecology. If the request is approved, a water right is issued to allow for water use to commence. A water right permit provides permission to construct the necessary wells or diversions, pumps, and pipes to start using water. The water right permit remains in effect until the permit holder determines that its project is complete and they have used as much water as they will under the water right. At that time, the permit

holder files a proof of appropriation form, which attests to the rate and volume of water used under the water right. A water right certificate is issued by Ecology following a proof of examination and determination that the amount of water put to beneficial use is consistent with the amount and conditions indicated on the water right permit.

A water right permit can only be issued by Ecology if the proposed use meets the following requirements.

- Water will be put to beneficial use.
- There will be no impairment to existing or senior rights.
- Water is physically and legally available for appropriation.
- Issuance of the requested water right will not be detrimental to the public interest.

During preparation of the report of examination, Ecology considers existing basin management plans, stream closures, minimum instream flows, hydraulic continuity (surface water interconnected to groundwater), utilization of existing water sources, water conservation, and availability of alternative water supplies, among other things. The water right decision process is increasingly becoming more complex and time consuming, due to the many competing interests for water, environmental issues, and regulatory requirements.

6.3.2 Existing Water Rights

The District currently holds nine water right certificates for its sources of municipal water supply. A summary of this water rights information is presented in Table 6-1. Existing sources utilized by the District to provide water supply to the existing system include Wells 1, 2, 4, 5R, 9, 10, and 11, and the well fields for Wells 6 and 7. Wells 5 and 8 were decommissioned and replaced by Well 5R. The annual volume associated with the three most recently issued water rights (G1-25058C, G1-25331C, and G1-25591C) is supplemental, or non-additive, to the District's previously existing water rights. The annual volume authorized under these supplemental rights is not added to the District's existing rights. Thus, the cumulative annual volume of the District's water rights is 1,217.7 acre-feet per year (afy). The instantaneous rate under all the District's water rights is additive and totals 2,550 gallons per minute (gpm).

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Existing W

DOH No.[2]	Source Name	WRTS Record Number[3]	Certificate Number[4]	
S12	Wells 1 and 2	G1-*00372C & G1-*00373C	GWC 608-A	
S14	Garfield Well Field, Wells 6 and 7 Well Field	G1-*05640C	GWC 4458-A	
S13	Wells 5R[5]	G1-00529C	G1-00529C	
S04	Well 4	G1-20328C	G1-20328C	
S13	Wells 5R[5]	G1-22787C	G1-22787C	
S14	Garfield Well Field, Wells 6 and 7 Well Field	G1-23372C	G1-23372C	
S09	Well 9	G1-25058C	G1-25058C	
S10	Well 10	G1-25331C	G1-25331C	
S11	Well 11	G1-25591C	G1-25591C	

Notes:

1) Supplemental in this case means that the annual volume for this water right is non-additive (NA) to existing rights.
2) DOH No. refers to Washington State Department of Health Source Number.
3) WRTS refers to Water Right Tracking System (Department of Ecology).
4) GWC refers to Groundwater Certificate.
5) Previously Well 5 and 8 well field.

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Due to a long history of confusion surrounding the use of the term "supplemental" to describe water rights, Ecology adopted Water Resources Program Policy POL-1040, *Use of Terms That Clarify Relationships Between Water Rights*, in 2006. That policy clarified what has historically been referred to as "supplemental" water rights. In this policy, the word "supplemental" is no longer in use. Instead, the following definitions apply:

- Additive: A water right for either annual or instantaneous quantities of water that are added to an existing water right.
- Non-additive: A water right for either annual or instantaneous quantities of water that does not increase the water available in existing water rights.

Water rights G1-25058C, G1-25331C, and G1-25591C have additive instantaneous quantities and non-additive annual quantities.

The District holds eight water rights in the name of Manchester Water District and one water right in the name of Sedgwick Enterprises, Inc. All the water rights identify the purpose of use as municipal, except for G1-00529C, which identifies it as community domestic and G1-22787C, which identifies it as community. Regardless, all the water used by the District is consistent with the definition of "municipal water supply purposes" found in the Revised Code of Washington (RCW) 90.03.015(4); therefore, all the District's water rights automatically qualify as municipal water rights. One advantage of holding a water right for municipal water supply purposes is that the place of use for the District's water rights becomes the service area described in a planning or engineering document approved by the Washington State Department of Health (DOH). Thus, the place of use for these water rights will be the District's water service area, as described in Chapter 2, once this WSP is approved by DOH. A second advantage is that these water rights are not subject to relinquishment as long as they are used or needed for municipal water supply purposes. Additional water right information for each source may be found on the certificates and water rights self-assessment forms in Appendix H.

6.3.3 Water Rights Evaluation

An evaluation of the District's existing water rights was performed to determine the sufficiency of the water rights to meet both existing and future water demands. Table 6-2 compares the combined instantaneous water rights with the maximum day demand (MDD) of the system and the combined annual water rights with the average day demand (ADD) of the system. As shown in Table 6-2, the District has sufficient water rights (both instantaneous and annual) to meet the demands of the existing customers.

Table 6-2
Existing Water Rights Evaluation

Description	Instantaneous Rights/ Maximum Day Demand (gpm)	Annual Rights/ Average Day Demand	
		(afy)	(gpm)
Total Water Rights	2,550	1,217.7	754
Existing (2024) Water Demand	958	674	418
Surplus (or Deficient) Rights	1,592	543.7	336

Table 6-3 summarizes the results of the future water rights evaluation, which compares the District's water rights with the future demand projections of the system. The analysis considered future demand projections with and without additional water use reductions from planned water use efficiency (WUE) efforts. The results of the future water rights evaluation indicate that the District has sufficient water rights to meet projected demands through 2045.

Table 6-3
Future Water Rights Evaluation

Description	Instantaneous Rights/ Maximum Day Demand (gpm)	Annual Rights/ Average Day Demand	
		(afy)	(gpm)
Year 2035 Without Conservation			
Total Water Rights	2,550	1,217.7	754
Projected Water Demand	1,134	731.4	453
Surplus (or Deficient) Rights	1,416	486.3	301
Year 2038 Without Conservation			
Total Water Rights	2,550	1,217.7	754
Projected Water Demand	1,138	734.0	455
Surplus (or Deficient) Rights	1,412	483.7	299
Year 2045 Without Conservation			
Total Water Rights	2,550	1,217.7	754
Projected Water Demand	1,140	735.8	456
Surplus (or Deficient) Rights	1,410	481.9	298
Year 2035 With Conservation			
Total Water Rights	2,550	1,217.7	754
Projected Water Demand	1,084	699.6	434
Surplus (or Deficient) Rights	1,466	518.1	320
Year 2038 With Conservation			
Total Water Rights	2,550	1,217.7	754
Projected Water Demand	1,088	702.1	435
Surplus (or Deficient) Rights	1,462	515.6	319
Year 2045 With Conservation			
Total Water Rights	2,550	1,217.7	754
Projected Water Demand	1,091	703.8	436
Surplus (or Deficient) Rights	1,459	513.9	318

6.3.4 Water Rights Planning

The District has sufficient water rights to supply the water system through 2045. Most of the District's well facilities have the physical capability to provide supply to the system at their maximum instantaneous water rights and are able to fully utilize their existing water rights; however, the well fields are not able to pump up to their instantaneous water right limits. Although the water rights are sufficient, improvements could be made to the well fields to boost total pumping capacity to allow them to pump up to the water right limit for the source in the future (Appendix H).

The District should request for Ecology to conform its water rights that were issued for a use other than specifically municipal to municipal purpose, as described in Water Resources Program Policy POL-2030, *2003 Municipal Water Law Interpretive and Policy Statement*. The District can request such conformance of its water rights by sending a letter to Ecology indicating the rights it wishes to have conformed. The following rights should be conformed to explicitly identify the purpose of use as municipal water supply purposes: G1-00529C (Sedgwick Enterprises, Inc.) and G1-22787C.

The District will strive to use its existing water sources efficiently by continuing the current WUE measures and implementing proposed measures, as outlined in the District's WUE Program, which is included in Appendix E.

The District should make sure it is complying with all provisions on its water rights. Those provisions, which are water right specific, are summarized here by well.

- Wells 6 and 7 need to have access ports for measuring depth to water, flow meters installed, and well tags attached to the wells.
- Well 9 needs to have an access port for measuring depth to water and a flow meter installed.
- Wells 10 and 11 need to have the static water level measured once a month; a water meter installed, read daily, and summarized monthly; and chloride concentrations measured in April and August of each year with the results forwarded to Ecology.

6.4 Long-Term Water Supply Planning

As discussed in 6.3.4, the District has sufficient water rights through at least 2045. No additional sources are needed to supply the District with water.

The District's water system currently has no interties with other water systems. However, the District is considering constructing an intertie with the adjacent West Sound Utility District to increase reliability in both water systems. All other nearby water systems are relatively small and likely do not have sufficient source capacity to provide the District with emergency water supply.

6.5 Drinking Water Regulations

6.5.1 Overview

The quality of drinking water in the United States is regulated by the Environmental Protection Agency (EPA). Under provisions of the Safe Drinking Water Act (SDWA), the EPA is allowed to delegate primary enforcement responsibility for water quality control to each state. In the State of Washington, DOH is the agency responsible for implementing and enforcing drinking water regulations. For the State of Washington

to maintain primacy (delegated authority to implement requirements) under the SDWA, the state must adopt drinking water regulations that are at least as stringent as the federal regulations. In meeting these requirements, the state, in cooperation with the EPA, has published drinking water regulations that are contained in Chapter 246-290 Washington Administrative Code (WAC).

6.5.2 Existing Regulations

The SDWA was enacted in 1974 as a result of public concern about water quality. The SDWA sets standards for the quality of drinking water and requires water treatment if these standards are not met. The SDWA also sets water testing schedules and methods that water systems must follow. The SDWA has been amended several times since 1974 in response to increasing concern regarding the quality of drinking water. In response to the 1986 SDWA Amendments, the EPA established six rules known as the Phase I Rule, the Phase II and IIb Rules, the Phase V Rule, the Surface Water Treatment Rule (SWTR), the Total Coliform Rule, and the Lead and Copper Rule. The EPA regulates most chemical contaminants through the Phase I, II, IIb, and V Rules. Additional drinking water regulations have been published since these six rules were first established, and the EPA is continually proposing new rules for promulgation.

The EPA sets two limits for each contaminant regulated under the rules. The first limit is a health goal, referred to as the Maximum Contaminant Level Goal (MCLG). The MCLG is zero for many contaminants, especially known cancer-causing agents (carcinogens). The second limit is a legal limit, referred to as the Maximum Contaminant Level (MCL). MCLs are equal to or higher than the MCLGs. Most MCLs and MCLGs are the same, except for contaminants that are regulated as carcinogens – the health goals (MCLGs) for these are typically zero because they cause cancer and it is assumed that any amount of exposure may pose some risk of cancer.

To fully understand the discussion that follows, a brief definition of several key terms is provided.

- Organic Chemicals: Animal or plant produced substances containing carbon and other elements such as hydrogen and oxygen.
- Synthetic Organic Chemicals (SOCs): Manmade organic substances, including herbicides, pesticides, and various industrial chemicals and solvents.
- Volatile Organic Chemicals (VOCs): Chemicals, as liquid, that evaporate easily into the air.
- Inorganic Chemicals (IOCs): Chemicals of mineral origin that are naturally occurring elements. These include metals such as lead and cadmium.
- Coliform: Coliform is a group of bacteria, some of which live in the digestive tract of humans and many animals and are excreted in large numbers with feces. Coliform can be found in sewage, soils, surface waters, and vegetation. The presence of any coliform in drinking water indicates a health risk and potential waterborne disease outbreak, which may include gastroenteric infections, dysentery, hepatitis, typhoid fever, cholera, and other infectious diseases.
- Lead: Lead is a common metal found throughout the environment in lead-based paint, air, soil, household dust, food, certain types of pottery, porcelain, pewter, brass, and water. Lead can pose a significant risk to health if too much of it enters the body. Lead builds up in the body over many years and can cause damage to the brain, red blood cells, and kidneys. The greatest risk is to young children and pregnant women. Lead can slow normal mental and physical development of growing bodies.

- Copper: Copper is a common, natural, and useful metal found in our environment. It is also a trace element needed in most human diets. The primary impact of elevated copper levels in water systems is stained plumbing fixtures. At certain levels (well above the action levels), copper may cause nausea, vomiting, and diarrhea. It can also lead to serious health problems in people with Wilson's disease. Long-term exposure to elevated levels of copper in drinking water also could increase the risk of liver and kidney damage.
- Arsenic: Arsenic is a naturally occurring element that is normally present in water, soil, food, and air. Arsenic levels vary based on farming and industrial activity and natural geological processes. Health effects are dependent on the amount of exposure and the length of time exposed. Long-term exposure to small amounts of arsenic has the potential to increase the risk of certain types of cancer.
- Asbestos: Asbestos is fibrous material occurring in natural deposits and used in cement piping materials. Asbestos has the potential to cause lung disease and cancer after long-term exposure.
- Disinfection Byproducts (DBPs): DBPs are formed when free chlorine reacts with organic substances, most of which occur naturally. These organic substances (called precursors) are a complex and variable mixture of compounds, and the DBPs themselves may pose health risks.
- Total Trihalomethanes (TTHM): A group of four chemicals that are formed along with other DBPs when chlorine or other disinfectants used to control microbial contaminants in drinking water react with naturally occurring organic matter in water. The four TTHMs are chloroform, bromodichloromethane, dibromochloromethane, and bromoform. Formation of TTHMs is dependent on such factors as amount and type of chlorine used, water temperature, concentration of precursors, pH, and chlorine contact time. TTHMs have been found to cause cancer in laboratory animals and are suspected to be human carcinogens.
- Haloacetic Acids (HAA5): A group of chemicals that are formed along with other DBPs when chlorine or other disinfectants used to control microbial contaminants in drinking water react with naturally occurring organic matter in water. The regulated HAA5s are monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid. Formation of HAA5 is dependent on such factors as amount and type of chlorine used, water temperature, concentration of precursors, pH, and chlorine contact time. HAA5 have been found to cause cancer in laboratory animals and are suspected to be human carcinogens.
- Per- and polyfluoroalkyl substances (PFAS): A large family of chemicals in use since the 1950s, to make a wide variety of stain-resistant, water-resistant, and non-stick consumer products. Some examples include food packaging, outdoor clothing, and non-stick pans. PFAS also have many industrial uses because of their special properties. In Washington State, PFAS were used in certain types of firefighting foams.

Phase I Rule

The Phase I Rule, which was the EPA's first response to the 1986 Amendments, became effective on January 9, 1989. This rule provides limits for eight VOCs that may be present in drinking water. The District currently complies with all contaminant monitoring requirements under this rule.

Phase II and IIb Rules

The Phase II and IIb Rules became effective on July 30, 1992, and January 1, 1993, respectively. These rules updated and created limits for 38 contaminants (organics and inorganics), of which 27 were newly regulated. Some of the contaminants are frequently applied agricultural chemicals (e.g., nitrate), while others are more obscure industrial chemicals. The District currently complies with all contaminant monitoring requirements under this rule.

Phase V Rule

The Phase V Rule became effective on January 17, 1994. This rule set standards for 23 additional contaminants, of which 18 are organic chemicals (mostly pesticides and herbicides), and 5 are inorganic chemicals (such as cyanide). The District currently complies with all contaminant monitoring requirements under this rule.

Revised Total Coliform Rule

The Total Coliform Rule was published in the Federal Register on June 29, 1989 and became effective on December 31, 1990. The rule set both health goals (MCLGs) and legal limits (MCLs) for total coliform levels in drinking water, and the type and frequency of testing that is required for water systems. The rule requires more monitoring than prior requirements, especially for small systems. In addition, every public water system is required to develop a coliform monitoring plan, subject to approval by DOH.

On February 13, 2013, the EPA published revisions to the rule in the Federal Register, and the rule was renamed to the Revised Total Coliform Rule. This rule eliminated the coliform MCL, sets an MCL for Escherichia coli (E. coli), and specifies the frequency and timing of coliform testing based on population served, public water system type, and source water type. When total coliform is detected, this is now known as a treatment technique trigger and public notice is no longer required. Instead, the water system must conduct an assessment of its water system facilities and operations and fix any sanitary defects. For confirmed E. coli incidents, now known as an E. coli MCL violation, the water system must perform a Level 2 assessment and provide public notice within 24 hours.

Coliform is a group of bacteria, some of which live in the digestive tract of humans and many animals and are excreted in large numbers with feces. Coliform can be found in sewage, soils, surface waters, and vegetation. The presence of any coliform in drinking water indicates a potential health risk and potential waterborne disease outbreak, which may include gastroenteric infections, dysentery, hepatitis, typhoid fever, cholera, and other infectious diseases. E. coli is a member of the coliform group that is almost exclusively of fecal origin, and its presence can lead to increased health risks.

The rule established the health goal for total coliform and E. coli at zero. To comply with the legal limit, systems may not find coliform in more than 5 percent of the samples taken each month. For smaller systems, like the District, that take fewer than 20 samples per month, one sample that contains coliform would exceed the legal limit and trigger the follow-up sampling requirements. The rule also requires that every public water system develop a coliform monitoring plan, subject to approval by DOH.

A copy of the District's coliform monitoring plan is included as part of the *Water Quality Monitoring Plan* contained in Appendix I of this WSP.

Lead and Copper Rule

The Lead and Copper Rule became effective on December 7, 1992 and was further revised in 2000, 2004, and 2021. The rule identifies action levels for both lead and copper. An action level is different than an MCL, in that an MCL is a legal limit for a contaminant, and an action level is a trigger for additional prevention or removal steps. The action level for lead is greater than 0.015 mg/L, and the action level for copper is greater than 1.3 mg/L. If the 90th percentile concentration of either lead or copper from the group of samples exceeds these action levels, a corrosion control study must be undertaken to evaluate strategies and make recommendations for reducing the lead or copper concentration below the action levels. The rule requires systems that exceed the lead level to educate the affected public about reducing its lead intake. Systems that continue to exceed the lead action level after implementing corrosion control and source water treatment may be required to replace piping in the system that contains the source of lead. Corrosion control is typically accomplished by increasing the water's pH to make it less corrosive, which reduces its ability to break down water pipes and absorb lead or copper.

Additionally, beginning October 16, 2024, public water systems that exceed the Action Level for Lead, where the 90th percentile of lead tap samples exceeds 0.015 mg/L, must provide Tier 1 Public Notice to all customers within 24 hours of learning of the exceedance, and immediately notify DOH of the exceedance. EPA templates for these Tier 1 Public Notices are available for your use below.

The District provided a lead service line inventory to DOH prior to the October 16, 2024 deadline required by the 2021 Lead and Copper Rule Revision (LCRR).

The District has been required to perform monitoring under this rule and the results are summarized later in this chapter.

Radionuclides Rule

The final rule for radionuclides became effective on December 8, 2003. The rule established an MCLG of zero for the four regulated contaminants and MCLs of 5 picoCuries per liter (pCi/L) for combined radium-226 and radium-228, 15 pCi/L for gross alpha (excluding radon and uranium), 4 millirem per year (mrem/year) for beta particle and photon radioactivity, and 30 micrograms per liter (µg/L) for uranium.

The District currently complies with all contaminant monitoring requirements under this rule and the results are summarized later in this chapter.

Wellhead Protection Program

Section 1428 of the 1986 SDWA Amendments mandates that each state develop a wellhead protection program. The Washington State mandate for wellhead protection and the required elements of a wellhead protection program are contained in WAC 246-290-135, Source Protection, which became effective in July of 1994. In Washington State, DOH is the lead agency for the development and administration of the state's wellhead protection program.

A wellhead protection program is a proactive and ongoing effort of a water purveyor to protect the health of its customers by preventing contamination of the groundwater that it supplies for drinking water. All federally defined Group A public water systems that use groundwater as their source are required to develop and implement a wellhead protection program. All required elements of a local wellhead protection program must be documented and included in either the Comprehensive Water System Plan (applicable to the District) or Small Water System Management Program document (not applicable to the District).

A copy of the District's Wellhead Protection Program is contained in Appendix J of this WSP.

Consumer Confidence Report

The final rule for the Consumer Confidence Report (CCR) became effective on September 18, 1998, and minor revisions were posted in the Federal Register in May of 2000. The CCR is the centerpiece of the right to know provisions of the 1986 Amendments to the SDWA. The CCR is a report on the quality of water that was delivered to the system during the previous calendar year. The report must contain certain specific elements but may also contain other information that the purveyor deems appropriate for public education. Some, but not all, of the information that is required in the reports includes the source and type of drinking water, type of treatment, contaminants that have been detected in the water, potential health effects of the contaminants, identification of the likely source of contamination, violations of monitoring and reporting, and variances or exemptions to the drinking water regulations. The annual report must be updated and re-issued to all customers by July 1st of each year.

A copy of the District's latest CCR is contained in Appendix K.

Stage 1 Disinfectants/Disinfection Byproducts Rule

The Stage 1 Disinfectants/Disinfection Byproducts Rule (D/DBPR) became effective on February 16, 1999. The rule applies to the District and most other water systems that add a chemical disinfectant to their drinking water during any part of the treatment process. The rule reduced the MCL for TTHMs to 0.08 mg/L. The rule established MCLs and requires monitoring of three additional categories of DBPs: 1) 0.06 mg/L for HAA5; 2) 0.01 mg/L for bromate; and 3) 1.0 mg/L for chlorite. The rule also established maximum residual disinfectant levels (MRDLs) for chlorine (4.0 mg/L), chloramines (4.0 mg/L), and chlorine dioxide (0.8 mg/L). The rule requires systems using surface water or groundwater directly influenced by surface water to implement enhanced coagulation or softening to remove DBP precursors, unless alternative criteria are met.

The District currently complies with all contaminant monitoring requirements under this rule and the results are summarized later in this chapter.

Stage 2 Disinfectants/Disinfection Byproducts Rule

This rule is the second part of the D/DBPR and it became effective on March 6, 2006. Similar to the Stage 1 D/DBPR, this rule applies to most water systems that add a disinfectant to the drinking water other than ultraviolet light or those systems which deliver such water. The Stage 2 D/DBPR changes the calculation procedure requirement of the MCLs for two groups of DBPs (TTHM and HAA5) by requiring each sampling location to determine compliance with MCLs based on their individual annual average DBP levels (termed the Locational Running Annual Average), rather than utilizing a system-wide annual average. The rule also proposes new MCLGs for chloroform (0.07 mg/L), trichloroacetic acid (0.02 mg/L), and monochloroacetic acid (0.03 mg/L).

Additionally, the rule requires systems to document peak DBP levels and prepare an Initial Distribution System Evaluation (IDSE) to identify Stage 2 D/DBPR compliance monitoring sites. IDSEs require each water system to prepare a separate IDSE plan and report, with the exception of those systems who obtain a 40/30 Certification or a Very Small System (VSS) Waiver. In order to qualify for the 40/30 Certification, all samples collected during Stage 1 D/DBPR monitoring must have TTHM and HAA5 levels less than or equal to 0.040 mg/L and 0.030 mg/L, respectively.

The District currently complies with monitoring and IDSE requirements under this rule and the results are summarized later in this chapter.

Arsenic Rule

The Arsenic Rule subsequently became effective on February 22, 2002. The rule sets the MCLG of arsenic at zero and reduced the MCL from the previous standard of 0.05 mg/L to 0.01 mg/L. Arsenic's monitoring requirements are consistent with the requirements for other inorganic contaminants.

The District complies with this rule and monitoring results are summarized later in this chapter.

Groundwater Rule

The EPA promulgated the Groundwater Rule (GWR) to reduce the risk of exposure to fecal contamination that may be present in public water systems that use groundwater sources. The GWR also specifies when corrective action (which may include disinfection) is required to protect consumers who receive water from groundwater systems from bacteria and viruses. The GWR applies to public water systems that use groundwater and to any system that mixes surface and groundwater if the groundwater is added directly to the distribution system and provided to consumers without treatment equivalent to surface water treatment. The final rule became effective on January 8, 2007.

The rule targets risk through an approach that relies on the four following major components.

- Periodic sanitary surveys of groundwater systems that require the evaluation of eight critical elements and the identification of significant deficiencies (such as a well located near a leaking septic system).
- Source water monitoring to test for the presence of *E. coli*, *enterococci*, or coliphage in the sample. The two types of monitoring specified are:
    - Triggered monitoring, when a system identifies a positive coliform sample within the system and the system does not provide treatment that achieves at least 99.99 percent (4-log) removal; and
    - Assessment monitoring, at the option of the state, at any time for high-risk systems.
- Corrective actions required for any system with a significant deficiency or source water fecal contamination. The system must implement one or more of the following corrective action options: correct all significant deficiencies; eliminate the source of contamination; provide an alternate source of water; or provide treatment that reliably achieves 99.99 percent inactivation or removal of viruses.
- Compliance monitoring to ensure that the treatment technology installed to treat drinking water reliably achieves at least 99.99 percent inactivation or removal of viruses.

DOH conducted its most recent sanitary survey of the District's water system on October 25, 2022. The District complies with all requirements of the rule.

PFAS Rule

The State Board of Health (SBOH) revised the WAC 246-290 Group A Drinking Water Rules in December 2021, to require public water systems to monitor for select PFAS using specific analytical methods. The

SBOH rule established state action levels (SALs) for five PFAS contaminants. EPA published the final PFAS rule on April 26, 2024. The District has monitoring of PFAS included in their 2025 WQMS.

Other Source Water Quality Monitoring

Other water quality rules that were reviewed for applicability, but do not apply directly to the District due to the reliance on only groundwater sources and the system's size, include the Surface Water Treatment Rule, Interim Enhanced Surface Water Treatment Rule, Long Term 1 and Long Term 2 Enhanced Surface Water Treatment Rule, Filter Backwash Recycling Rule, and the Unregulated Contaminant Monitoring Regulation.

Drinking water regulations are continuously changing in an effort to provide higher quality and safer drinking water. Modifications to the existing rules described in this chapter and implementation of new rules are planned for the future. The District will stay abreast of the changing regulations and update monitoring as necessary.

6.6 Source Water Quality

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

6.6.1 Drinking Water Standards

Drinking water quality is regulated at the federal level by the EPA and at the state level by DOH. Drinking water standards have been established to maintain high-quality drinking water by limiting the levels of specific contaminants (i.e., regulated contaminants) that can adversely affect public health and are known, or are likely to occur, in public water systems. Non-regulated contaminants do not have established water quality standards and are generally monitored at the discretion of the water purveyor and in the interest of customers.

The regulated contaminants are grouped into two categories of standards – primary standards and secondary standards. Primary standards are drinking water standards for contaminants that could affect health. Water purveyors are required by law to monitor and comply with these standards and notify the public if water quality does not meet any one of the standards. Secondary standards are drinking water standards for contaminants that have aesthetic effects, such as unpleasant taste, odor, or color (staining). The national secondary standards are unenforceable federal guidelines or goals where federal law does not require water systems to comply with them. States may, however, adopt their own enforceable regulations governing these contaminants. The State of Washington has adopted regulations that require compliance with some of the secondary standards. Water purveyors are not required to notify the public if water quality does not meet the secondary standards.

6.6.2 Source Monitoring Requirements and Waivers

The District is required to perform water quality monitoring at each of the active sources for inorganic chemical and physical substances, organic chemicals, and radionuclides. The monitoring requirements the District must comply with are specified in WAC 246-290-300. A description of the source water quality monitoring requirements and procedures for each group of substances is contained in the District's *Water Quality Monitoring Plan*, which is included in Appendix I of this WSP.

A Susceptibility Assessment Survey Form is used by DOH to determine a drinking water source's potential for contamination. The results of the susceptibility assessment may provide monitoring waivers that allow reduced source water quality monitoring. Based on the results of the susceptibility assessment survey for each source, DOH assigned a low susceptibility rating to Wells 1, 4, 6, and 10; and moderate susceptibility ratings to Wells 2, 5, 7, 9, 11, Well Field (S01, S02), and Garfield Well Field. The District's sources were granted a susceptibility waiver that allowed the District to reduce monitoring of SOCs, VOCs, IOCs (except nitrate).

6.6.3 Source Monitoring Results

The quality of the District's sources has been satisfactory and meets or exceeds all drinking water standards. In accordance with DOH requirements, the District monitored each source for VOCs, including trihalomethanes. VOCs were measured twice in 2021 since DOH increased the frequency to quarterly for Wells 5 and 8. All other sources were measured at least once during each of the two past compliance periods. Monitoring of inorganic chemical and physical substances was also accomplished at least once during each of the two past compliance periods at Wells 1 and 2, the Wells 5 and 8 Well Field, and the Wells 6 and 7 Well Field; the most recent sample was taken in 2016. The District monitored for IOCs and physical substances at Wells 4, 9, 10, and 11 at least once during the last 9-year monitoring cycle, most recently in 2023, in accordance with DOH's reduced monitoring schedule for these sources. Nitrate monitoring has also been completed at each source at least once during each of the past two compliance periods. The results of IOC (including nitrate) monitoring and VOC monitoring for the District's sources indicate that all primary and secondary standards were met, except for higher than allowable levels of manganese at Wells 4.

The District recently monitored for SOCs, and all the sources were in compliance. The District routinely monitors radionuclides as directed by DOH. The results of the radionuclide monitoring indicate that all the District's sources are in compliance with the regulations. The District sampled for arsenic most recently in 2007 and found that the levels were well below the MCLs per the Arsenic Rule.

The District maintains a fluoride level of 0.71 ppm and chlorine level of 0.48 ppm throughout their distribution system, which meets standards for both compounds.

6.7 Distribution System Water Quality

6.7.1 Monitoring Requirements and Results

The District is required to perform water quality monitoring within the distribution system for coliform bacteria, disinfectant (chlorine) residual concentration, DBPs, lead and copper, and asbestos in accordance with Chapter 246-290 WAC. A description of the distribution system water quality monitoring requirements and procedures are contained in the District's *Water Quality Monitoring Plan*, which is included in Appendix I of this WSP.

The District has been in compliance with all monitoring requirements for the past several years, except for a few coliform violations that are described in the following section. A summary of the results of the distribution system water quality monitoring within the District's system is presented as follows.

Coliform Monitoring

The District is required to collect a minimum of ten coliform samples per month from different locations throughout the system, based on a population served of 9,245 in 2024.

The most recent positive coliform sample occurred over a decade ago, on May 8, 2014. This was likely due to sampling error, since all follow-up samples were negative. The District has continued to install modern sampling stations throughout the system to minimize the risk of sample contamination, as well as train staff on proper sampling procedures to minimize contamination.

Disinfectant Residual Concentration Monitoring

Disinfection requirements applicable to the District are contained in WAC 246-290-451, which states that a disinfectant residual concentration shall be detectable in all active parts of the distribution system. In 2022, the distribution free chlorine residual ranged from 0.31 mg/L to 0.68 mg/L, with an average of 0.48 mg/L.

Lead and Copper Monitoring

The Lead and Copper Rule identifies the action level for lead as being greater than 0.015 mg/L, and the action level for copper as being greater than 1.3 mg/L. The results of the tests from the 2022 monitoring periods, which included a total of 20 sample sites, indicated levels of 0.0027 mg/L for lead and of 0.17 mg/L for copper at the 90th percentile. These results have all been satisfactory, since the 90th percentile concentration of either lead or copper from each group of samples has not exceeded the action levels. The District is no longer eligible for accelerated reduced monitoring. Monitoring currently must be accomplished every 3 years.

Asbestos

Asbestos monitoring is required if the sources are vulnerable to asbestos contamination or if the distribution system contains more than 10 percent of asbestos cement (AC) pipe. Although none of the District's sources are susceptible to asbestos contamination, AC pipe composes more than 10 percent of the District's distribution system. Therefore, the District must monitor for asbestos in the distribution system. The current MCL for asbestos is 7 million fibers per liter greater than 10 microns in length. Monitoring must be accomplished during the first 3-year compliance period of each 9-year compliance cycle. The water sample must be taken at a tap that is served by an AC pipe under conditions where asbestos contamination is most likely to occur. The District's most recent sample in 2019 did not contain asbestos contamination.

Disinfectants/Disinfection Byproducts Monitoring

The District began trihalomethane monitoring, as well as other disinfection byproducts monitoring, when the Stage 1 D/DBPR became effective on in 1999. The District was required to comply with this rule in late 2003. Subsequent testing indicates that TTHM and HAA5 have been well below the MCL, including the most recent results in 2022.

Fluoride Concentration Monitoring

The District adds fluoride to its drinking water to assist in the prevention of tooth decay. The District is required to monitor the concentration of this fluoride addition in accordance with WAC 246-290-460. The Environmental Protection Agency's (EPA) target is to maintain a fluoride concentration of 0.7 mg/L throughout the distribution system. The District collects a daily sample downstream of each fluoride injection point and analyzes the sample to confirm that the fluoride concentration is within the target range.

The results of fluoride monitoring performed by the District in 2023 indicate that the average fluoride levels were successfully maintained within the target range. Fluoride concentrations ranged from 0.46 to 1.1 mg/L, and averaged 0.71 mg/L.

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Chapter 7 Water System Analysis

7.1 Introduction

This chapter presents the analysis of the existing Manchester Water District (District) water system. Individual water system components were analyzed to determine their ability to meet policies and design criteria under both existing and future water demand conditions. The policies and design criteria are presented in Chapter 5 and the water demands are presented in Chapter 4. A description of the water system facilities and current operation is presented in Chapter 2. The last section of this chapter presents the existing and projected system capacity analyses that were performed to determine the maximum number of equivalent residential units (ERUs) that can be served by the District's water system.

7.2 Pressure Zones

Table 7-1 lists each of the District's seven pressure zones, the highest and lowest elevation served in each zone and the minimum and maximum distribution system pressures within each zone, based on maximum static water conditions (full reservoirs and zero demands). The upper portion of the table illustrates the minimum and maximum pressures of the existing system and the lower portion of the table illustrates pressures after proposed pressure zone improvements are implemented. While this table presents the results of the evaluation of pressures based on the adequacy of the pressure zones (under static conditions), the hydraulic analysis section later in this chapter presents the results of the evaluation of pressures based on the adequacy of the water mains (under dynamic conditions).

The District is currently providing water at pressures of at least 40 psi in the 215 and 242 Zone, as shown in the upper portion of the table. The low pressures in the North 277 Zone, the North 430 Zone and the South 430 Zone occur in the higher elevations near the Cedar, California and Sedgwick reservoirs, respectively. The area of low pressure in the South 277 Zone is located downstream of the Harper Hill PRV in the area of higher elevation west of Harper Hill Road. These low pressure areas will be eliminated in the future when proposed pressure zone improvements, described in Chapter 9, are implemented. The low pressures in the 223 Zone occur in the area immediately downstream of the Alki View PRV. Although the low pressures in the District's system do not fall within the ideal pressure range due to system constraints in the areas, with the exception of the low pressure area in the South 277 Zone, they adequately meet the DOH minimum pressure requirement of 30 psi, as described in the Distribution and Transmission System analysis section later in this chapter. The pressures in all of the zones after completion of the pressure zone improvements are shown in the lower portion of Table 7-1. The North and South 277 Zones will be permanently operated as one pressure zone in the future.

Table 7-1
Minimum and Maximum Distribution System Static Pressures

Pressure Zone	Highest Elevation Served		Lowest Elevation Served	
	Elevation (feet)	Static Pressure (psi)	Elevation (feet)	Static Pressure (psi)
Existing System – Before Proposed Zone Modifications				
215 Zone	120	41	0	93
223 Zone	134	39	127	42
242 Zone	132	48	70	75
North 277 Zone	207	30	0	120
South 277 Zone	220	25	0	120
North 430 Zone	347	36	117	136
South 430 Zone	361	30	149	122
Future System – After Proposed Zone Modifications				
223 Zone	134	39	127	42
242 Zone	132	48	70	75
255 Zone	160	41	0	110
277 Zone	197	35	0	120
North 430 Zone	336	41	117	136
South 430 Zone	331	43	149	122
Proposed 480 Zone	347	58	273	90
Proposed 500 Zone	361	70	325	76

Most of the District's pressure zones have areas of pressure in excess of 80 psi. The highest pressures in the 215 Zone occur along Beach Drive E. In the 242 Zone, the highest pressures exist along the easterly extents of the zone. The highest pressures in the North 277 Zone and the South 277 Zone occur along the waterfront areas, where the elevations are at or nearly sea level. The highest pressures in the North 430 Zone are located near the eastern boundary of the zone. The northerly portions of the South 430 Zone along Arvick Road SE and Harper Hill Road SE are the highest pressure areas of the zone.

Individual services that have pressures greater than 80 psi are required to install customer-owned pressure regulators to reduce the pressures to acceptable levels per the plumbing code. In the table above, the listed pressures are calculated in the water main and the actual service pressure is lower due to the required pressure regulators. The District has accepted the high pressures in most parts of the system due to the pressure regulator requirement and the good condition of the water main in these areas. Pressure zone improvements will not be necessary in these areas. Where pressure zone improvements recommended in Chapter 9 increase pressures to above 80 psi, pressure regulators will be required on the services, if none currently exist.

7.3 Source Capacity Evaluation

This section evaluates the combined capability of the District's existing sources to determine if they have sufficient capacity to meet the overall demands of the system, based on existing and future water demands. The section that follows will address the evaluation of the individual facilities to determine if they have sufficient capacity to meet the existing and future demands of the individual zone, or zones, that they supply.

7.3.1 Analysis Criteria

Supply facilities must be capable of adequately and reliably supplying high quality water to the system. In addition, supply facilities must provide a sufficient quantity of water at pressures that meet the requirements of WAC 246-290-230. The evaluation of the combined capacity of the sources in this section is based on the criteria that they provide supply to the system at a rate that is equal to or greater than the peak day demand of the system.

7.3.2 Source Capacity Analysis Results

The combined capability of the District's active sources to meet both existing and future demand requirements, based on existing pumping capacities of the individual supply facilities, is presented in Table 7-2.

The demands used in the evaluation are future demand projections without reductions from WUE efforts, as shown in Chapter 4. Therefore, if additional reductions in water use are achieved in the future through WUE efforts, the total source capacity required in the future will be less than that shown in the table. Since Well 5R cannot be operated simultaneously with Well 9, the total available source capacity includes only the greater of the two source capacities. The total available source capacity was also adjusted to account for the restriction on Well 4 that limits its operation to eight hours in any 24-hour period.

Table 7-2
Water Source Capacity Evaluation

Description	Existing		Future Projections	
	2022	2033	2035	2043
Required Source Capacity (gpm)				
Peak Day Demand	955	1,004	1,006	1,016
Available Source Capacity (gpm)				
Well 1	250	250	250	250
Well 2[1]	150	150	150	150
Well 4[2]	17	17	17	17
Well 5R[3]	0	0	0	0
Wells 6 and 7 Well Field	650	650	650	650
Well 9[3]	650	650	650	650
Well 10	280	280	280	280
Well 11	70	70	70	70
Totals	2,067	2,067	2,067	2,067
Surplus or Deficient Source Capacity (gpm)				
Surplus or Deficient Amount	1,112	1,063	1,061	1,051

Notes:
1) When Wells 1 and 2 are operated simultaneously, the production of the two wells decreases to a combined capacity of 400 gpm.
2) Well 4 is limited to operating 8 hours per day at 50 gpm within each 24-hour period. Capacity reflects average day flow rate.
3) Well 5R's source capacity is 250 gpm; however, if cannot be operated simultaneously with Well 9. Total source capacity reflects larger of the two capacities.

The results of the analysis indicate that the District has approximately 1,112 gpm of surplus source capacity to meet existing demands. The District's existing sources are sufficient to meet the projected demands of the system until beyond 2043, as discussed in Chapter 4.

7.4 Water Supply Facilities Evaluation

This section evaluates the existing supply facilities to determine if they have sufficient capacity to provide water supply at a rate that meets the existing and future demands of the one or more zones they supply. This section also identifies facility deficiencies that are not related to the capacity of the supply facilities.

7.4.1 Analysis Criteria

The evaluation of supply facilities to determine if they have adequate capacity is based on one of two criteria, as follows. If the pressure zone that the facility provides supply into has water storage, then the amount of supply required is equal to the peak day demand of the zone. If the pressure zone that the facility provides supply into does not have water storage, then the amount of supply required is equal to the

peak hour demand of the zone. The higher supply requirement of the latter criteria is due to the lack of equalizing storage that is typically utilized to provide short-term supply during times of peak system demands.

North 430 Zone Facilities

Water supply is provided to the North 430 Zone from Wells 4, 10 and 11 and the Well 6 and 7 Well Field. These sources also provide supply to the 215, 223 and 242 Zones indirectly through several pressure reducing stations. Although the Cedar Avenue Booster Pump Station can provide additional supply to the North 430 Zone from lower zones, its supply capacity was not included in this analysis since the booster pump station is currently operated manually. Table 7-3 summarizes the current and future supply requirements of the North 430 Zone, based on existing and projected water demands for the North 430 Zone and the transfer amount necessary to meet the existing and future demands of the 215, 223 and 242 Zones. Table 7-3 also summarizes the current amount of water supply available to the North 430 Zone based on current pumping rates of the supply facilities. The results of the analysis, as shown in Table 7-3, indicate that the existing configuration and capacities of the North 430 Zone supply facilities are sufficient to meet both the existing and future demands beyond 2043.

Table 7-3
North 430 Zone Supply Evaluation

Description	Existing 2022	Future Projections		
		2033	2035	2043
Required Supply (gpm)				
North 430/Other Zone Peak Day Demand	470	494	495	500
Total Required Supply	470	494	495	500
Available Supply (gpm)				
Well 4[1]	17	17	17	17
Wells 6 and 7 Well Field	650	650	650	650
Well 10	280	280	280	280
Well 11	70	70	70	70
Totals	1,017	1,017	1,017	1,017
Surplus or Deficient Supply (gpm)				
Surplus or Deficient Amount	547	523	522	517

Note:
1) Well 4 is limited to operating eight hours per day at 50 gpm within each 24-hour period. Capacity reflects average day flow rate.

South 430 Zone, North 277 and South 277 Zone Facilities

Wells 1, 2, 9, and 5R currently provide all water supply to the South 430, North 277 and South 277 Zone supply area. Water supply is transferred between the three pressure zones through several pressure reducing stations, the Banner Road Booster Pump Station and a normally open zone valve located between the North and South 277 Zones. Table 7-4 summarizes the current and future supply

requirements of the supply area, based on existing and projected water demands for the South 430, North 277 and South 277 Zones. Table 7-4 also summarizes the current amount of water supply available to the supply area based on the current pumping rate of the wells. The results of the analysis indicate that the existing configuration and capacities of supply facilities are sufficient to meet both the existing and future demands beyond 2043.

Table 7-4
South 430 Zone, North 277 and South 277 Zone Supply Evaluation

Description	Existing 2022	Future Projections		
		2033	2035	2043
Required Supply (gpm)				
South 430 Zone Peak Day Demand	80	84	84	85
North/South 277 Zones Peak Day Demand	396	417	417	421
Total Required Supply	476	501	502	506
Available Supply (gpm)				
Well 1	250	250	250	250
Well 2[1]	150	150	150	150
Well 5R[1]	0	0	0	0
Well 9[2]	650	650	650	650
Totals	1,050	1,050	1,050	1,050
Surplus or Deficient Supply (gpm)				
Surplus or Deficient Amount	574	549	548	544

Notes:
1) When Wells 1 and 2 are operated simultaneously, the production of the two wells decreases to a combined capacity of 400 gpm.
2) Well 5R's source capacity is 250 gpm; however, it cannot be operated simultaneously with Well 9. Total source capacity reflects larger of the two capacities (Well 9 only).

Facility Deficiencies

Wells 1 and 2 are the District's oldest supply facilities and are in need of overall rehabilitation. Well 1 is housed in a small wood structure that lacks proper accessibility to the equipment. The well's fluoridation system is located in an adjacent building that utilizes the double access doors to provide any necessary ventilation. The well's mechanical equipment needs to be upgraded. Well 2's pump house and equipment is aging and corroded. Site improvements are needed to reroute the well building's drain away from the foundation. Well 2's fluoridation building and equipment is in good condition.

Wells 4, 5 and 9 are in good condition but Well 4 lacks standby power or a power receptacle to enable connection of a portable generator.

Wells 6 and 7 are in good condition with the exception of Well 6's wellhead, which is aging and corroded. The District recently constructed an enclosure to protect the wellhead from further corrosion; however, improvements are needed to restore the integrity of the wellhead piping.

Wells 10 and 11 are located on the same site and while the two wells are in hydraulic connection, they do not operate within the same well field. The District currently restricts the operation of Well 10 because the well produces water with higher than allowable levels of manganese. To utilize the well's full capacity, improvements are needed to reduce the amount of manganese that enters the distribution system from the well. Additionally, the Wells 10 and 11 site lacks proper fencing to enclose and secure the facilities as well as standby power or a power receptacle to enable connection of a portable generator.

The Cedar Avenue Booster Pump Station requires a booster pump replacement due to the existing pump being undersized and unable to meet the peak day demand of the North 430 Zone. Associated switchgear and a power receptacle should also be installed to enable connection of a portable generator in the event of a power outage.

The Banner Road Booster Pump Station is in good condition but lacks standby power or a power receptacle to enable connection of a portable generator.

Proposed improvements to resolve these supply facility deficiencies are identified in Chapter 9.

7.5 Storage Facilities

This section evaluates the District's existing water storage tanks to determine if they have sufficient capacity to meet the existing and future storage requirements of the system. This section also identifies facility deficiencies that are not related to the capacity of the storage tanks.

7.5.1 Analysis Criteria

Water storage is typically made up of the following components: operational storage; equalizing storage; standby storage; fire flow storage; and dead storage. Each storage component serves a different purpose and will vary from system to system. A definition of each storage component and the criteria used to evaluate the capacity of the District's storage tanks is provided below.

Operational Storage: Volume of the storage tank used to supply the water system under normal conditions when the source or sources of supply are not delivering water to the system (i.e., sources are in the off-mode). Operational storage is essentially the average amount of draw down in the tank during normal operating conditions, which represents a volume of storage that will most likely not be available for equalizing storage, fire flow storage or standby storage. The operational storage in the District's tanks is the amount of storage between the fill, or well pump starting setpoint level, and the overflow elevation of the tank.

Equalizing Storage: Volume of the storage tank used to supply the water system under peak demand conditions when the system demand exceeds the total rate of supply of the sources. The Department of Health (DOH) requires that equalizing storage be stored above an elevation that will provide a minimum pressure of 30 psi at all service connections throughout the system under peak hour demand conditions. Because the District's supply sources primarily operate on a "call on demand" basis to fill the storage tanks,

the equalizing storage requirements are determined using the standard DOH formula that considers the difference between the system peak hour demand and the combined capacity of the supply sources.

Standby Storage: Volume of the storage tank used to supply the water system under emergency conditions when supply facilities are out of service due to equipment failures, power outages, loss of supply, transmission main breaks and any other situation that disrupts the supply source. DOH requires that standby storage be stored above an elevation that will provide a minimum pressure of 20 psi at all service connections throughout the system. The criteria for determining the standby storage requirements for the District's system is based on the standard DOH standby storage volume of 200 gallons per ERU.

Fire Flow Storage: Volume of the storage tank used to supply water to the system at the maximum rate and duration required to extinguish a fire at the building with the highest fire flow requirement. The magnitude of the fire flow storage is the product of the fire flow rate and duration of the system's maximum fire flow requirement established by the local fire authority, the Kitsap County Fire Marshal. DOH requires that fire flow storage be stored above an elevation that will provide a minimum pressure of 20 psi at all points throughout the distribution system under peak day demand conditions. The fire flow storage requirements shown in the analyses that follow are based on the target fire flow for non-residential structures of 1,500 gpm for a two-hour duration.

Dead Storage: Volume of the storage tank that can not be used because it is stored at an elevation that does not provide system pressures that meet the minimum pressure requirements established by DOH without pumping. This unusable storage occupies the lower portion of most ground level reservoirs. Water that is stored below an elevation that cannot provide a minimum pressure of 20 psi is considered dead storage for the analyses that follow.

7.5.2 Storage Analysis Results

The storage analyses are based on an evaluation of the existing storage facilities providing water to two operating areas; one being the North 430 Zone which also serves the 215, 223 and 242 Zones, and the other being the operating area that serves all other pressure zones, which include the South 430 Zone and the North and South 277 Zones.

Existing Storage Analysis

As shown in Table 7-5, the maximum combined storage capacity of the District's tanks is 3.3 MG. However, the total amount of usable storage for operational, equalizing, standby, and fire flow purposes is reduced more than 50 percent to 1.46 MG. The dead storage is due to the water services that are located at the higher elevations near a storage tank. The dead storage caused by normally low pressures in these areas is the result of being served by a pressure zone that is not suited to provide adequate pressures at these higher elevations. For example, the services in the higher elevations of the South 277 Zone near Harper Hill Road should be served by the South 430 Zone. A portion of the dead storage will be converted to usable storage in the future, upon completion of proposed pressure zone improvements that are described in Chapter 9.

Table 7-5
Existing Storage Evaluation

Description	Operating Area		Totals
	North 430 Zone	Other Zones	
Available/Usable Storage (MG)			
Maximum Storage Capacity	2.35	0.95	3.30
Dead (Non-usable Storage)	-1.34	-0.44	-1.78
Total Available Storage	1.01	0.51	1.52
Required Storage (MG)			
Operational Storage	0.21	0.12	0.33
Equalizing Storage	0.00	0.00	0.00
Standby Storage	0.36	0.37	0.73
Fire Flow Storage	0.18	0.18	0.36
Totals	0.76	0.67	1.42
Surplus or Deficient Storage (MG)			
Surplus of (Deficient) Amount	0.25	-0.16	0.09

The results of the existing storage evaluation, as shown in

Table 7-5, indicate the District has adequate storage in the North 430 Zone operating area, but has a storage deficiency of approximately 0.16 MG in the operating area that serves all other pressure zones. This storage deficiency is primarily due to the significant amount of dead storage that currently cannot be utilized. The storage surplus in the North 430 Zone, however, is also available to the lower North and South 277 Zones through pressure reducing stations. The amount of dead storage will be reduced following the completion of planned improvements described in Chapter 9.

7.5.3 Future Storage Analysis

Future storage requirements of the system were computed for the future planning periods based on year 2033, 2035 and 2043 demand projections, as shown in Table 7-6. The analyses were performed to determine the adequacy of the District's existing tanks to meet future storage requirements without additional sources of supply. The analyses are based on the completion of proposed pressure zone improvements that will eliminate a portion of the system's existing dead storage. These improvements are discussed in more detail in Chapter 9.

Table 7-6
Future Storage Projections

Description	2033 Operating Area			2035 Operating Area			2043
	North 430 Zone	Other Zones	Totals	North 430 Zone	Other Zones	Totals	North 430 Zone
Available/Usable Storage (MG)							
Maximum Storage Capacity	2.35	0.95	3.30	2.35	0.95	3.30	2.35
Dead (Non-usable Storage)	-1.34	-0.34	-1.69	-1.34	-0.13	-1.47	-1.05
Total Available Storage	1.01	0.61	1.61	1.01	0.82	1.83	1.30
Required Storage (MG)							
Operational Storage	0.21	0.12	0.33	0.21	0.12	0.33	0.21
Equalizing Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Standby Storage	0.38	0.39	0.766	0.38	0.39	0.76	0.38
Fire Flow Storage	0.18	0.18	0.36	0.18	0.18	0.36	0.18
Totals	0.77	0.68	1.45	0.77	0.68	1.45	0.77
Surplus or Deficient Storage (MG)							
Surplus or (Deficient) Amount	0.24	-0.08	0.16	0.24	0.14	0.38	0.53

The results of the analyses shown in Table 7-6 indicate that adequate storage is available in all operating areas through the 20-year planning period with the completion of proposed pressure zone improvements. Approximately 0.61 MG of additional storage will be available to the system when the dead storage is transferred to usable storage with these improvements.

7.5.4 Facility Deficiencies

Most of the District's storage facilities are in good condition and do not have any noticeable deficiencies. The interior and exterior of the Cedar Avenue Tank was repainted in 2007, but the exterior of both Cedar Avenue Tank and the Sedgwick Road Tank need to be pressure washed for general cleaning purposes on a regular cycle. A qualified coating inspector is recommended to inspect the integrity of the reservoir coatings on a five-year time schedule, or more frequently, if visible signs of coating deterioration appear. Proposed improvements to repaint the tanks as needed are identified in Chapter 9.

7.6 Distribution and Transmission System

This section evaluates the District's existing distribution and transmission system (i.e., water mains) to determine if they are sized and looped adequately to provide the necessary flow rates and pressures to meet the existing and future requirements of the system. This section also identifies deficiencies that are not related to the capacity of the water mains.

7.6.1 Analysis Criteria

Distribution and transmission water mains must be capable of adequately and reliably conveying water throughout the system at acceptable flow rates and pressures. The criteria used to evaluate the District's distribution and transmission system is the state mandated requirements for Group A water systems contained in WAC 246-290-230 Distribution Systems. The pressure analysis criteria states that the distribution system."…shall be designed with the capacity to deliver the design peak hour demand quantity of water at 30 psi under peak hour demand flow conditions measured at all existing and proposed service water meters." It also states that if fire flow is to be provided."… the distribution system shall also provide maximum day demand (MDD) plus the required fire flow at a pressure of at least 20 psi at all points throughout the distribution system.

Hydraulic analyses of the existing system were performed under existing peak hour demand conditions to evaluate its current pressure capabilities and to identify existing system deficiencies. The existing system was also analyzed under existing peak day demand conditions to evaluate the current fire flow capabilities and to identify additional existing system deficiencies. Additional hydraulic analyses were then performed with the same hydraulic model, but under future peak day demand conditions and with proposed improvements to demonstrate that the identified improvements will eliminate the deficiencies and meet the requirements far into the future. Following is a description of the hydraulic model and the operational conditions and facility settings used in the analyses.

7.6.2 Hydraulic Model

Description

A computer-based hydraulic model of the existing water system was created using the WaterCAD program, during the development of the District's 2007 WSP. All water mains in the District's water system, including dead-end mains, were included in the model and were based on AutoCAD water system maps and as-built information provided by the District. The junction node elevation data was generated from LiDAR data

published by the Puget Sound Regional Consortium and United States Geographical Survey (USGS). A hydraulic model node diagram that provides a graphical representation of the model of the water system is contained in Appendix L. All hydraulic modeling was performed by RH2 Engineering, Inc.

Demand Data

Updated future water demand projections for 2023 through 2043 are similar to those originally prepared for this Water System Plan in 2016, and the water system analyses, and modeling based on those projections will continue to be relied upon. The hydraulic model of the existing system contains 2015 average day demand data. Supply data from the 2015 average day demand, which is 3.6% less than the 2023 average day demand, was distributed throughout the junction nodes of the model, based on allocation levels that reflect the proportionate share of total supply to each supply area. The peaking factors shown in Chapter 4 were used to analyze the system under peak hour and peak day demand conditions.

The hydraulic model of the proposed system contains 10-year and 20-year demand levels shown in Chapter 4. The distribution of demands is based on estimated future demand levels in each pressure zone.

Facilities

The hydraulic model of the existing system for the pressure analysis contains all active existing system facilities with settings that correspond to peak hour demand events. All sources of supply that are currently available to the system during a peak period, which include Wells 1, 2, 9 and 11 and the Well 6 and 7 Well Field, were operating at their normal summertime pumping rates. The booster pump stations were not operating. The storage tank levels were modeled to reflect full utilization of operational and equalizing storage. All active pressure reducing stations were modeled as being in service and at their normal set points.

Separate fire flow analyses were performed on the system to size distribution system improvements and to calculate fire flow availability. The hydraulic model of the existing system for the fire flow analyses contains all active existing system facilities with settings that correspond to peak day demand events. All sources of supply that are currently available to the system during a peak period, which include Wells 1, 2, 9 and 11 and the Well 6 and 7 Well Field, were operating at their normal pumping rates. The booster pump stations were not operating. The storage tank levels were modeled to reflect full utilization of operational, equalizing and fire flow storage, based on the target fire flow for non-residential structures of 1,500 gpm for two hours, or 180,000 gallons. However, for the fire flow analyses in the single family areas of the system, the tanks were only drawn down through the fire flow storage required for single family residences of 500 gpm for 30 minutes, or 15,000 gallons. Fire flow storage for the 215, 223, 242 and North 430 Zones was provided by the California Avenue Tanks, while fire flow storage for the South 430 Zone was provided by the Sedgwick Road Tank. Fire flow storage for the North and South 277 Zones was provided by the Cedar Avenue Tank and the Banner Road Tank. All active pressure reducing stations were modeled as being in service and at their normal set points.

The hydraulic model of the 10-year planning horizon contains all active existing system facilities and proposed system improvements for the 10-year planning period that are identified in Chapter 9. All existing and proposed sources of supply that are planned to be available to the system during a peak period in the 10-year planning horizon, which include Wells 1, 2, 9 and 11 and the Well 6 and 7 Well Field, were operating at their normal pumping rates. The booster pump stations were not operating. The storage tank levels were modeled to reflect full utilization of operational and equalizing storage during the pressure analysis. During the fire flow analyses, existing tanks were modeled to reflect full utilization of operational,

equalizing and fire flow storage, based on the target fire flow for non-residential structures of 1,500 gpm for two hours, or 180,000 gallons. However, for the fire flow analyses in the single family areas of the system, the tanks were only drawn down through the fire flow storage required for single family residences of 500 gpm for 30 minutes, or 15,000 gallons. Fire flow storage for the 215, 223, 242 and North 430 Zones was provided by the California Avenue Tanks, while fire flow storage for the South 430 Zone was provided by the Sedgwick Road Tank. Fire flow storage for the North and South 277 Zones was provided by the Cedar Avenue Tank and the Banner Road Tank. All existing and proposed pressure reducing stations were modeled as being in service and at their normal set points.

The hydraulic model of the proposed system in the 20-year planning horizon contains all active existing system facilities and proposed system improvements for the 20-year planning period that are identified in Chapter 9. All existing and proposed sources of supply that are planned to be available to the system during a peak period in the 20-year planning horizon which include Wells 1, 2, 9, 10 and 11 and the Well 6 and 7 Well Field, were operating at their normal pumping rates. The booster pump stations were not operating. The storage tank levels were modeled to reflect full utilization of operational and equalizing storage during the pressure analysis. During the fire flow analyses, existing tanks were modeled to reflect full utilization of operational, equalizing and fire flow storage, based on the target fire flow for non-residential structures of 1,500 gpm for two hours, or 180,000 gallons. However, for the fire flow analyses in the single family areas of the system, the tanks were only drawn down through the fire flow storage required for single family residences of 500 gpm for 30 minutes, or 15,000 gallons. Fire flow storage for the 215, 223, 242 and North 430 Zones was provided by the California Avenue Tanks, while fire flow storage for the South 430 Zone was provided by the Sedgwick Road Tank. Fire flow storage for the North and South 277 Zones was provided by the Cedar Street Tank, and the Banner Road Tank. All existing and proposed pressure reducing stations were modeled as being in service and at their normal set points.

Calibration

Hydraulic model calibration is the process of adjusting hydraulic model data so the model closely reflects actual system pressures and flows under similar demand and operating conditions. Initial Darcy-Weisbach roughness coefficients were entered into the model based on computed estimates of the coefficients from available pipe age and material data. For example, older water mains were assigned higher roughness coefficients than new water mains; thereby assuming that the internal surface of water pipes become rougher as it gets older. Additional calibration of the model was achieved using field fire flow and pressure data, which was collected throughout the system for this purpose. Hydraulic model calibration was achieved during the development of the 2007 WSP by adjusting the roughness coefficients of the water mains and elevations of the junction nodes in the model until the model results reflected an average accuracy within ninety-five percent of the actual field data that was collected. The system has not experienced significant changes since the model was last calibrated; therefore the current model calibration was determined to be adequate for the purposes of these analyses.

7.6.3 Hydraulic Analysis Results

Several hydraulic analyses were performed to determine the capability of the system to meet the pressure and flow requirements identified in Chapter 5 and contained in WAC 246-290-230. The first analysis was performed to determine the pressures throughout the system under existing peak hour demand conditions. The results of this analysis were used to identify locations of low and high pressures. To satisfy the minimum pressure requirements, the pressure at all water service locations must be at least 30 psi during these demand conditions. In addition, the system should not have widespread areas with high pressures, generally considered to be more than 100 psi. A summary of the pressure deficiencies identified from the

results of this analysis is contained in Table 7-7 and shown in Figure 7-1 in Appendix R. As shown in the table, all low pressure deficiencies will be resolved by 2035, following the completion of proposed improvements described in Chapter 9 scheduled to be completed within the 10-year planning period. Although there are areas with pressures greater than 100 psi, the District has required pressure regulators on all services in these areas and is confident in the integrity of the water mains. Thus, pressure zone improvements were not proposed for these areas.

Table 7-7
Pressure Analysis Summary

Description	Approximate Location	Existing Pressure Zone	Pressure (PSI)		
			Existing System	Future with Improvements	
				2035	2043
Low Pressure Areas					
Single Family Area	E Crestwoods Ct and Timber Trail Rd E	North 430	33	32	58
Single Family Area	3286 Harper Hill Rd SE	South 277	27	83	87
Single Family Area	SE Sedgwick Rd and Banner Rd SE	South 430	27	61	61
Single Family Area	SE Sedgwick Rd and SE Eastway Dr	South 430	28	61	61
High Pressure Areas					
Commercial Area	Manchester Village	North 277	111	111	111
Single Family Area	E Alder St and Valley Ave E	North 430	120	118	120
Single Family Area	Alaska Ave E, North of Washington St	North 430	126	125	125
Single Family Area	Colchester Dr SE, North of Blakeview Dr	North 430	131	127	127
Single Family Area	Woods Rd E, North of E Kansas St	North 430	145	145	101
Single Family Area	E Alki View Court	North 430	122	121	121
Single Family Area	Puget Dr E and Puget Heights Ln SE	North 430	118	116	116
Single Family Area	Garfield Ave SE, West of Wells 6 and 7	North 430	111	106	106
Single Family Area	SE Southworth Dr (SR 160)	South 277	119	114	116
Commercial Area	Rocky Rd SE	South 277	110	107	107
Single Family Area	Banner Rd SE and SE Martin Ln	South 430	113	113	113
Single Family Area	Arvick Rd SE and SE Fern Brook Ln	South 430	119	118	55

The second set of analyses was performed to determine the capability of the existing water system to provide fire flow throughout the existing water system under peak day demand conditions. A separate fire flow analysis was performed for each node in the model to determine the available fire flow at a minimum residual pressure of 20 psi. More than 700 fire flow analyses were performed to comprehensively evaluate the water system. For each node analyzed, the resulting fire flow was compared to its general planning level fire flow requirement, which was assigned according to the land use classification that it is located within. A summary of the results of the analyses for representative system nodes is presented in Figure 7-2 included in Appendix R.

Table 4-10 in the Water Demands chapter lists the general fire flow requirements for each land use classification. Since the fire flow requirement varies for buildings within each land use classification, the land use based fire flow requirements are only used as a general target for the primary purpose of the system-wide analyses that were performed for this plan. Additional improvements may be needed in areas where actual fire flow requirements exceed the planning level targets or the available flows and shall be the responsibility of the developer. The results of the fire flow analyses were used to identify undersized water mains and proposed water main improvements. A summary of the fire flow deficiencies from these analyses is contained near the end of this section.

Areas with insufficient flow to meet the fire flow requirements may be allowed with additional improvements such as sprinklers if approved by the Fire Marshal.

Once all deficiencies were identified, proposed water main improvements were included in the model and pressure and fire flow analyses were performed throughout the system to demonstrate that the improvements will eliminate the deficiencies and meet the flow and pressure requirements. These analyses were modeled under the projected 10-year planning horizon and 20-year planning horizon peak day demand conditions to ensure that the improvements are sized sufficiently to meet the needs of the future system. A summary of the results of these analyses is shown in Table 7-8 for the same areas that were summarized from the existing water system analyses. The results of the pressure analyses under the 20-year planning horizon demand conditions with the proposed improvements is shown in Figure 7-3 included in Appendix R. The results of the fire flow analyses indicate that all fire flow deficiencies are resolved with the proposed 20-year improvements as shown in Figure 7-4 included in Appendix R. A description of these improvements and a figure that shows their locations are presented in Chapter 9.

Other Deficiencies

Some areas of the system have water mains that are more than 50 years old, which is beyond the average life expectancy of water mains. Most of the older water mains are located along Colchester Drive E.

Approximately 45 percent of the District's water main is asbestos cement (AC) water main, while six percent of the District's water main is constructed of steel. The AC and steel pipe is the oldest pipe in the system and requires replacement. The District is planning to replace these in the future; however, since the steel water main in the system has a high occurrence of leaks or breaks, the District has committed to replacing all steel main within the 20-year planning period. Although it is not feasible to replace all AC main in the system within the 20-year planning period because it consists of over half of the water system, the District will endeavor to replace as much AC main as possible as funding is available. All new water main installations are required to use ductile iron water main in accordance with the District's Water System Standards, a copy of which is included in Appendix G.

7.7 Pressure Reducing Stations

This section evaluates the District's existing pressure reducing stations to identify deficiencies related to their current condition and operational capability.

7.7.1 Evaluation and Deficiencies

The District has a total of ten operational pressure reducing stations. The Beach PRV is undersized to provide adequate flow to the 215 Zone in the event that the Montana PRV is out of service for maintenance or emergency purposes. The Sedgwick PRV does not have adequate drainage and is in need of overall

rehabilitation. The Alki View and Montana Extension PRVs do not have pressure relief valves to protect the lower zones from high pressures in the event of a wide-open control valve failure. Proposed improvements for pressure-reducing stations are addressed in Chapter 9.

7.8 Telemetry and Supervisory Control System

This section evaluates the District's existing telemetry and supervisory control system to identify deficiencies related to its condition and current operational capability.

7.8.1 Evaluation and Deficiencies

Server and software improvements to the District's telemetry and supervisory control system were installed in 2024 and the system is in good operating condition.

7.9 System Capacity

This section evaluates the capacity of the District's existing and future water system components (supply, storage, transmission and water rights) to determine the maximum number of equivalent residential units (ERUs) it can serve. Once determined, system capacity becomes useful in determining how much capacity is available in the water system to support new customers that apply for water service through the building permit process. The system capacity information, together with the projected growth of the system expressed in ERUs, as shown in Figure 4-5 of Chapter 4, also provides the District with a schedule of when additional system capacity is needed.

7.9.1 Analysis Criteria

The capacity of the District's system was determined from the limiting capacity of the water rights, supply and storage facilities. A transmission main capacity analysis was not completed since the sources of supply are connected directly to the District's distribution system, rather than through long transmission mains. The supply capacity analysis was based on the limiting capacity of the supply facilities and the system's peak day demand per ERU.

The storage capacity analysis was based on the storage capacity for equalizing and standby storage and the computed storage requirement per ERU. Operational and fire flow storage capacity were excluded from the storage analysis because these components are not directly determined by water demand or ERUs. For the analyses, a reserve amount equivalent to the existing operational and fire flow storage requirements was deducted from the total available storage capacity to determine the storage capacity available for equalizing and standby storage. The storage capacity available for equalizing and standby storage was divided by the existing number of ERUs presented in Chapter 4 to determine the storage requirement per ERU. The ERU-based demand data was derived from the average day demand of the system and peaking factors from Chapter 4.

The annual water rights capacity evaluation was based on the existing annual water rights, as summarized in Chapter 6, and the system's average day demand per ERU. The instantaneous water rights capacity evaluation was based on the existing instantaneous water rights, as summarized in Chapter 6, and the system's peak day demand per ERU.

7.9.2 Existing Capacity Analysis Results

A summary of the results of the existing system capacity analysis is shown in Table 7-8.

Table 7-8
Existing System Capacity Analysis

Description	Capacity
Demands per ERU Basis	
Average Day Demand per ERU (gal/day)	171
Maximum Day Demand per ERU (gal/day)	379
Peak Hour Demand per ERU (gal/day)	636
Supply	
Limiting Supply Rate – Source Capacity (gal/day)	2,976,480
Maximum Day Demand per ERU (gal/day)	379
Maximum Supply Capacity (ERUs)	7,845
Storage Capacity	
Maximum Equalizing and Standby Storage Capacity (gal)	827,065
Equalizing and Standby Storage Requirement per ERU (gal)	200
Maximum Storage Capacity (ERUs)	4,135
Annual Water Rights Capacity	
Annual Water Right Capacity (gal/day)	1,085,760
Average Day Demand per ERU (gal/day)	171
Maximum Annual Water Right Capacity (ERUs)	6,349
Instantaneous Water Rights Capacity	
Instantaneous Water Right Capacity (gal/day)	3,672,000
Maximum Day Demand per ERU (gal/day)	379
Maximum Instantaneous Capacity (ERUs)	9,689
Maximum System Capacity	
Based on Limiting Facility – Storage	4,135
Unused Available System Capacity	
Maximum System Capacity (ERUs)	4,135
Existing ERUs	3,671
Surplus Capacity (ERUs)	464

The results of the system capacity analysis indicate that the limiting capacity of the system is storage, which can support up to a maximum of approximately 4,135 ERUs. As shown near the bottom of Table 7-8, the existing water system has a surplus capacity of approximately 464 ERUs.

7.9.3 Future Capacity Analysis Results

A summary of the results of the 10-year projected system capacity analysis is shown in Table 7-9. The reduced storage requirement per ERU shown in the table reflects water system improvements planned for completion within the ten-year planning period that will increase the total useable storage volume of the District's tanks. The completion of these improvements, presented in Chapter 9, will result in more storage capacity for future ERUs.

The results of the 2033 system capacity analysis indicate that the limiting capacity of the system is storage, which can support up to a maximum of approximately 5,702 ERUs. As shown near the bottom of Table 7-9, the 3,809 ERUs of the 2033 system is less than the future system capacity. Thus, the water demand projections are not expected to exceed the system capacity within this time period.

Table 7-9
Future System Capacity Analysis

Description	Capacity
Demands per ERU Basis	
Average Day Demand per ERU (gal/day)	171
Maximum Day Demand per ERU (gal/day)	379
Peak Hour Demand per ERU (gal/day)	636
Supply	
Limiting Supply Rate – Source Capacity (gal/day)	2,976,480
Maximum Day Demand per ERU (gal/day)	379
Maximum Supply Capacity (ERUs)	7,845
Storage Capacity	
Maximum Equalizing and Standby Storage Capacity (gal)	1,140,397
Equalizing and Standby Storage Requirement per ERU (gal)	200
Maximum Storage Capacity (ERUs)	5,702
Annual Water Rights Capacity	
Annual Water Right Capacity (gal/day)	1,085,760
Average Day Demand per ERU (gal/day)	171
Maximum Annual Water Right Capacity (ERUs)	6,349
Instantaneous Water Rights Capacity	
Instantaneous Water Right Capacity (gal/day)	3,672,000
Maximum Day Demand per ERU (gal/day)	379
Maximum Instantaneous Capacity (ERUs)	9,678
Maximum System Capacity	
Based on Limiting Facility – Storage	5,702
Unused Available System Capacity	
Maximum System Capacity (ERUs)	5,702
Existing ERUs	3,809
Surplus Capacity (ERUs)	1,893

Chapter 8 Operations and Maintenance

8.1 Introduction

Manchester Water District's (District) operations and maintenance program consists of the following four elements.

1. Normal Operations.
2. Emergency Operations.
3. Preventive Maintenance.
4. Cross-connection Control.

8.2 Normal Operations

8.2.1 District Personnel

The District functions under the direction of the General Manager, who is appointed by the Board of Commissioners. The Operations Foreperson and Accounting Specialist report to the General Manager. The Customer Service Representative reports directly to the Accounting Specialist, and all field service personnel report to the Operations Foreperson. The relationship and organization of the District is graphically illustrated in Figure 8-1.

The General Manager is responsible for supervising, organizing, and directing activities related to the general operation of the water system.

The Operations Foreperson supervises daily operations of the water system. The District's operations and maintenance staff consists of several maintenance personnel that function under the Operations Foreperson, as shown in Figure 8-1. The tasks that are performed by the operations and maintenance staff include inspecting, testing, installing, and repairing system facilities, routine operation and preventive maintenance, water quality sampling, regulatory compliance monitoring, and corrective or breakdown maintenance required in response to emergencies.

The Accounting Specialist is responsible for all accounting related activities, financial reporting, and general supervision of the Customer Service Representative. The Accounting Specialist also prepares timekeeping and payroll documents for the Kitsap County Treasurer's office, manages employee benefits programs through the Washington State Public Employees' Benefits Board, and is influential in determining customer billing and rate structure policies.

The Customer Service Representative is the primary contact for customer service inquiries, coordinates service requests with field service personnel, receives payments, and maintains the District's website. Cash receipt generation and general clerical work are also performed by the Customer Service Representative.

Various engineers provide services to the District. The District Attorney is Mr. Ken Bagwell.

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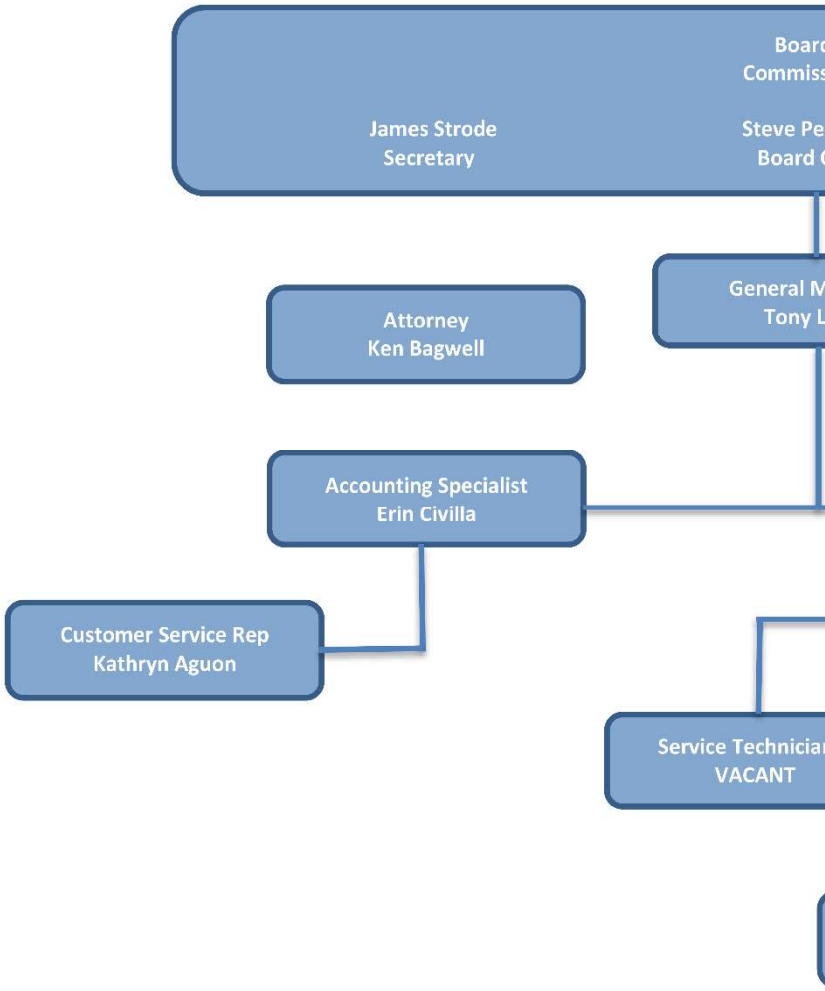

Figure 8-1 Org

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Washington State Law (Chapter 246-292 Washington Administrative Code) requires that the District's water system is operated by one or more certified operators. In addition, specialty certification is required for backflow device testing and cross-connection control program activities and management. Table 8-1 shows the current certifications of the District's water operations and maintenance (O&M) staff. It is District policy to maintain a well-qualified, technically trained staff. The District annually allocates funds for personnel training, certification, and membership in professional organizations, such as the American Water Works Association (AWWA). The District believes that the time and money invested in training, certification, and professional organizations are repaid many times in improved safety, skills, and confidence.

Table 8-1
Personnel Certification

Name	Position	Certificate Number	Certification
Tony Lang	General Manager	13001	WDM 3, WTPO1, CCS
Cody Hodge	Operations Foreperson	14940	WDM 3, WTPO1-OIT, CCS
Beau Watson	Lead Service Technician	14903	WDM 2, CCS
Vacant	Service Technician II		
Sean Steele	Service Technician	16147	WDM 1
Allison Townsend	Service Technician	17076	WDM 1

8.2.2 Personnel Responsibilities

The key responsibilities of District staff are summarized below.

General Manager: Supervises, organizes, directs, and performs activities related to the general operation of the District; prepares and administers the annual budget; administers personnel; recommends policy to the Board of Commissioners; and implements approved policy.

Accounting Specialist: Responsible for performing general accounting and financial functions, including, but not limited to, preparing the general ledger, processing accounts payable and payroll, performing general accounting duties, auditing procedures, operating computer systems, controlling inventory, and overseeing customer service and utility billing functions.

Customer Service Representative: Initial point of contact for District customers. Gathers, analyzes, researches, inputs, and updates data for water billings, meter readings, billing adjustments, connections/disconnections, fees, and credits, and produces associated reports. Responsible for researching and resolving customer questions, problems, and concerns.

Operations Foreperson: Responsible for directing the operation and maintenance of District water production, and the transmission and distribution system, including the installation and repair of the system in a timely and cost-effective manner. Directs field customer service activities. Makes recommendations regarding the hiring, discipline, and discharge of employees. Ensures water system functions operate within budget and completes the necessary documentation, job cost forms, and timesheets. Works with internal and external customers to meet team and organizational priorities and project a professional image of the

District to customers. Serves as a role model to team members in the use of effective communications and professional conduct.

Lead Service Technician: Senior level position that performs various manual labor activities, equipment operation, and routine and scheduled activities in support of the operation, maintenance, repair, and construction of the water system and related facilities. Position also assists with the training of lower level technicians.

Service Technician II: Experienced level position that performs various manual labor activities, equipment operation, and routine and scheduled activities in support of the operation, maintenance, repair, and construction of the public water system and related facilities. Position may also assist with the training of lower level technicians.

Service Technician I: Entry level position that performs various manual labor activities, equipment operation, and routine and scheduled activities in support of the operation, maintenance, repair, and construction of the public water system and related facilities.

Service Technician's Apprentice: Performs functions related to the operation, maintenance, and construction of the public water utility as a trainee under supervision of the Service Technicians. Duties include performing routine and scheduled system construction activities, maintenance, and repair of District facilities, and water supply and distribution systems. The position requires operating equipment and performing other functions, including, but not limited to, customer service, meter reading, pipefitting, and maintaining tools and equipment.

8.2.3 Available Equipment

The District has several types of equipment available for daily routine operation and maintenance of the water system. The equipment is stored in the maintenance yard at the District's Field Operations Complex. If additional equipment is required for specific projects, the District will rent or contract with a local contractor for the services needed. A stock of supplies in sufficient quantities for normal system operation and maintenance and short-term emergencies is stored in the maintenance yard at the District office. A list of major equipment used in the normal operation of the water system is shown in Table 8-2.

The District utilizes several different types of communications equipment to ensure a reliable and redundant means of communication between staff. All O&M staff are equipped with smart phones that have email and texting capabilities.

In addition to the equipment listed in Table 8-2, the District uses computers and software to conduct routine operations and data tracking. The inventory of computer hardware and software used by the District is listed in Table 8-3.

Table 8-2
Equipment List

Quantity	Year	Manufacturer	Item
1	1990	International	S7100 Dump Truck
1	2014	John Deere	310SK Backhoe
1	2002	Atlas Copco	185 cfm Towable Air Compressor
1	2002	Atlas Copco	90 lb. Jackhammer
1	2022	Vermeer	CV573SGT Vactor Trailer
1	2018	Chevrolet	Silverado 3500 Flatbed
1	2017	Chevrolet	Colorado Pickup Truck
1	2019	Toyota	Tacoma Pickup Truck
1	2009	Wacker Neuson	150 kW Trailer-mounted Generator
1	2011	Ford	F – 550 Heavy Duty Service Truck
1	2022	Dodge	Ram 2500 Service Truck
1	2024	Ford	Maverick Pickup Truck
1		Briggs & Stratton	4-inch Trash Pump
1		DBI/Sala	Fall Protection Tripod
1		DBI/Sala	Safety Block and Tackle
1		Honda	EU 2000 Portable Inverter
1	2020	Hustler	Riding Lawn Mower
1		Honeywell	GasAlert XT-II Portable Air Monitor
1		Sensidine	BDX 530CF/CFT Air Flow Ventilator
4		Speed Shore	1.5 x 2846 Shoring Rams
2		Speed Shore	3.5 x 2846H Shoring Rams
3		Stihl	FS 80 Weedeater
1		Stihl	Model 034 Chainsaw
1		Milwaukee	MXF315 Demo Saw
1		Vermeer	Pneumatic Boring Tool
1		Wacker Neuson	2.5-inch Trash Pump
1		Milwaukee	MFX270 Rammer

Notes:
1) kW = kilowatt.
2) Cfm = cubic feet per minute.

Table 8-3
Computers and Software

Quantity	Item
Hardware	
1	Admin Office Dell PowerEdge T550 Server
8	Dell Computer Tower Workstations
1	HP XW 4600 Server
1	Sharp Admin Office Printer/Scanner
1	Lexmark Field Office Printer
1	Canon ImagePro IPF770 Mapping Printer
1	Field Operations Portable SCADA Tablet
1	Dell PowerEdge T550 SCADA Server
Software	
1	Springbrook Utility Billing Software
8	Windows 10 Pro Operating System

Table 8-4 lists vendors that typically provide supplies and chemicals to the District.

Table 8-4
Water District Suppliers

Name	Address	Phone	Products
H.D. Fowler	6420 SW Birt Drive Port Orchard, WA 98367	360-377-4507	Water system construction and repair materials.
Ferguson	11650 Clear Creek Road Silverdale, WA 98383	360-895-4446	Water system construction and repair materials.
Orca Pacific	2403 S 200th Street Seattle, WA 98198	206-878-8366	Sodium hypochlorite (12.5% Solution).
Univar Kent	8201 S 212th Street Kent, WA 98032	253-872-5000	Sodium Fluoride (50 pound bags).
USA Bluebook	PO Box 9006 Gurnee, IL 60031	800-548-1234	Water system specialty products.

Routine Operations

Routine operations involve the analysis, formulation, and implementation of procedures to ensure that the facilities are functioning efficiently and meeting the pressure and water quality requirements and other demands of the system. The District's maintenance procedures are good, with repairs being made promptly so customers receive high-quality water service.

The District strives to maximize the operating efficiency and life of its production and distribution system components through a prescribed preventive maintenance program. Daily monitoring of all wells, pumping equipment, and storage facilities ensures that mechanical systems are functioning properly and facilities are secure. Daily monitoring of water quality through sampling and testing ensures that the supply and treatment equipment is functioning properly and the water is safe to consume.

The District performs annual unidirectional flushing of the distribution system, with targeted areas such as dead-end mains completed semi-annually. The District also conducts preventive hydrant and valve maintenance as part of the prescribed preventive maintenance program.

Distribution system reservoirs are inspected externally on a daily basis. Defects of appurtenances such as ladders, hatches, vents, and level indicators are repaired as needed. Draining, cleaning, and inspecting of interior coating systems are completed every 5 to 7 years on a rotating basis.

The District has initiated a program of production well inspection and redevelopment utilizing historical and current production data. Each well is removed from service a minimum of once every 12 months for maintenance and replacement of equipment as needed.

The District also has staff on call at all times to respond to production and distribution system failures and customer inquiries.

8.2.4 Continuity of Service

The District has the structure, stability, authority, and responsibility to ensure that water service will be continuous. For example, changes in the Board of Commissioners or staff are not expected to have an adverse impact on the District's customers or quality of service.

8.2.5 Routine Water Quality Sampling

The Washington State Department of Health (DOH) has adopted federal regulations that specify minimum monitoring requirements for water systems. The sampling requirements depend on the population served, source type and treatment provided. The specific requirements are contained in Washington Administrative Code (WAC) 246-290-300, and the minimum monthly routine coliform sampling requirements are summarized in Table 2 of the WAC. The District currently performs all routine coliform sampling throughout the distribution system. A total of ten samples are taken each month. A further discussion of the water quality monitoring program is contained in Chapter 6 and Appendix I of this Water System Plan (WSP).

8.2.6 Cross-Connection Control

The District drafted a cross-connection control program beginning in 1994 to comply with WAC 246-290-490 pertaining to contamination of potable water due to cross-connections.

Currently, the District works closely with Kitsap County's Building Department to agree on cross-connection control requirements. Backflow prevention devices are required at service connections where a potential for contamination exists. The Cross-connection Control Plan was updated with the previous WSP and is included in Appendix F. The District's certified Cross-Connection Control Specialists are listed in Table 8-1.

8.2.7 Recordkeeping and Reporting

DOH has enacted regulations for recordkeeping and reporting that may be found in WAC 246-290-480. Additional public notification requirements may also be found in WAC 246-290-71001 through 71007. The regulations identify recordkeeping and reporting procedures for operations and water quality testing, as well as public notification procedures.

Recordkeeping

Records shall be kept for chlorine residual and other information as specified by DOH. DOH requires retention of critical records dealing with facilities and water quality issues as summarized below.

- Bacteriological analysis results: 5 years.
- Chemical analysis results: For as long as the system is in operation.
- Daily source meter readings: 10 years.
- Other records of operation and analyses as may be required by DOH: 3 years.
- Documentation of actions to correct violations of primary drinking water standards: 3 years after last corrective action.
- Records of sanitary surveys: 10 years.
- Project reports, construction documents and drawings, inspection reports, and approvals: Life of the facility.
- Where applicable, daily records of chlorine residual, fluoride level, water treatment plant performance, and turbidity: 3 years.

The District's recordkeeping procedure is as follows.

1. Data is recorded daily at all sites and monthly logs are kept digitally at the District office.
2. Service information is entered into a customer records database.

Reporting

The District must report the following:

- Within 48 hours: A failure to comply with the primary standards or treatment technique requirements specified in Chapter 246-290 WAC.
- Within 48 hours: A failure to comply with the monitoring requirements specified in Chapter 246-290 WAC.
- Within 48 hours: A violation of a primary maximum contaminant level (MCL).
- Within 1 business day: A backflow incident, per WAC 246-290-490(8)f.
- As soon as possible, but no later than 24 hours after the violation is known: National Primary Drinking Water Regulation (NPDWR) violations and situations with significant potential to have serious adverse effect on human health as a result of short-term exposure that require Tier 1 public notice per 40 Code of Federal Regulations (CFR) 141.202.

The District must submit to DOH all applicable reports required by Chapter 246-290 WAC. Monthly reports are due by the tenth day of the following month, unless otherwise specified.

Daily source meter readings must be made available to DOH on request.

Records regarding the status of monitoring waivers must be submitted during each monitoring cycle.

Total annual water production records for each source must be made available to DOH on request.

A water facilities inventory and report form (WFI) must be submitted to DOH within 30 days of any change in name, category, ownership, or responsibility of management of the water system.
The District must notify DOH of the presence of:

- Coliform in a sample within 10 days of notification by the testing laboratory; and
- Fecal coliform or *E. coli* in a sample by the end of the business day in which the District is notified by the testing laboratory.

When a coliform MCL violation is determined, the District must:

- Notify DOH within 24 hours of determining acute coliform MCL violations;
- Notify DOH before the end of the next business day when a non-acute coliform MCL is determined; and
- Notify water customers in accordance with WAC 246-290-71001 through 71007 and the U.S. Environmental Protection Agency's (EPA) Public Notification Rule.

If volatile organic compound (VOC) monitoring is required, a copy of the results of the monitoring and any public notice must be sent to DOH within 30 days of receipt of the test results.

Public Notice

The District must notify water system customers and issue a public notice for the following.

- NPDWR violations.
- Failure to comply with an applicable MCL or maximum residual disinfectant level.
- Failure to comply with a prescribed treatment technique.
- Failure to perform water quality monitoring, as required by the drinking water regulations.
- Failure to comply with testing procedures as prescribed by drinking water regulations.
- Operation under a variance or an exemption.
- Failure to comply with the requirements of any schedule that has been set under a variance or exemption.
- Occurrence of a waterborne disease outbreak or other waterborne emergency.
- Exceedance of the secondary maximum contaminant level (SMCL) for fluoride.
- Availability of unregulated contaminant monitoring data.
- Issuance of a departmental order.
- Failure to comply with a departmental order.
- Issuance of a category red operating permit by DOH.

Public notice requirements for each type of violation or situation are organized into three tiers per 40 CFR 141.201 through 208 and are based on the seriousness of the violation and the potential for adverse health effects. Tier 1 public notices are required for NPDWR violations and situations with significant potential to have serious adverse effects on human health as a result of short-term exposure. Public notices in this tier must be provided as soon as possible, but no later than 24 hours after the violation is known. DOH must also be notified within this timeframe and may require repeat or additional notices.

Tier 2 public notices are required for all other NPDWR violations and situations not covered in Tier 1 with the potential to have serious adverse effects on human health. Public notices under Tier 2 requirements, with the exception of turbidity violations, must be provided as soon as possible, but no later than 30 days after the violation is known. Turbidity violations must be reported to DOH as soon as possible, but no later than 24 hours after the violation is known, to determine whether a Tier 1 public notice will be necessary. Repeat notices must be issued for as long as the violation persists.

All other NPDWR violations and situations not included in Tier 1 and Tier 2 are grouped within Tier 3. Tier 3 public notices must be provided within 1 year of the District learning of the violation or beginning operations under a variance or exemption. The notice must be repeated annually for as long as the violation, variance, exemption, or other situation persists.

Other Reports

Several other reports are required for state agencies, including the Department of Revenue, the Department of Labor and Industries, the Department of Social and Health Services, the Department of Ecology, and the Employment Security Department. The District completes these reports according to their instructions.

8.2.8 Operations and Maintenance Records

Facilities Operations and Maintenance Manuals

O&M manuals are available for staff members' reference. These manuals are kept on file at the District office. The District intends to maintain its policy of requiring complete O&M manuals for all new equipment and facilities.

Mapping and As-built Drawing Records

Maintenance of drawings is essential to District staff, developers, and anyone else needing to know how the water system is laid out throughout the District. Drawing records are stored at the District office in paper and electronic media. Updates are maintained by the District.

Operations and Maintenance Records

Records are stored at the District office for the following items.

- Backflow and cross-connections.
- Confined spaces.
- Hydrant repairs.
- Hydrant meter forms.
- Hydrant databases.

- Pump motor tests.
- Well sounding and static water levels.
- Precipitation.
- Water usage.
- Water used for construction.
- Water consumable inventory.
- Water maintenance.
- Water main notes.
- Water worksheets.
- Water main flushing.
- Bacteriological tests.
- Inorganic chemical tests.
- VOC tests.
- Synthetic organic compound tests.
- Water samples from new developments.
- Lead and copper tests.
- Chlorination levels.
- Customer complaints.
- Vandalism forms.

8.2.9 Safety Procedures and Equipment

Safety is the concern and responsibility of all water O&M staff. To maintain the highest level of safety, the District has taken steps toward educating its staff and providing resources to ensure a safe working environment. The District will strive to improve its safety program on an on-going basis. The AWWA publishes a manual entitled *Safety Practices for Water Utilities (M3)* that describes safety programs, provides guidelines for safe work practices, and provides techniques for a variety of water utility work situations.

The following identifies procedures to be followed for O&M tasks that involve the most common potential work place hazards in the District's water system.

Material Safety Data Sheets (MSDS) are maintained at chemical locations as required, with a master copy at the District office.

Use of Chlorine and Chlorine Products

Standard Procedure – Handle with care, provide adequate ventilation, and wear safety glasses and rubber gloves.

Sodium Hydroxide

Standard Procedure – Handle with care, provide adequate ventilation, and wear safety goggles, an apron, and rubber gloves. Keep container tightly closed and store in a dry, corrosion-proof area. Protect from unintentional contact with water. Never return contaminated material to its original container. Immediately contact the chemical supplier/manufacturer for handling instructions if drums of caustic appear to be swollen.

Working in Confined Spaces

Standard Procedure – Follow state requirements for confined space entry.

Working around Heavy Equipment

Standard Procedure – Obtain proper training and follow all safety procedures. Use noise protection equipment.

Working in Traffic Areas

Standard Procedure – Wear proper clothing and provide adequate signage and flagging for work area.

Working on or around Water Tanks

Standard Procedure – Follow proper safety harness procedures for working on tall structures.

Working in or around Pump Stations

Standard Procedure – Obtain proper training and follow all safety procedures for working on pumps and electrical equipment. Use noise protection equipment.

Working on Asbestos Cement Water Main

Standard Procedure – Obtain proper training and follow all safety procedures for working with asbestos materials.

District personnel are required to take training courses regarding the following topics: asbestos cement pipe handling; confined spaces; hazardous waste; fall protection; hearing protection; competent persons; electrical hazards; heavy equipment operation; CPR and first aid; traffic flagging; lockout-tagout; and blood-borne pathogens.

The District's facilities are equipped with confined space entry equipment, oxygen gas meters, and lockout-tagout equipment. Each District vehicle is equipped with first aid and blood-borne handling kits. The District also owns flagging signs and equipment for safe handling of traffic.

The District follows all appropriate Washington Industrial Safety and Health Act (WISHA) regulations in its day-to-day operations and complies with the following state requirements.

- WAC 296-62-145 to 14529 Part M – Entry into confined spaces.
- WAC 296-155-650 to 66411 Part N – Shoring of open ditches.
- WAC 296-155-429 – Lockout-tagout for work on energized or de-energized equipment or circuits.
- WAC 296-155 Part C1 – Fall restraint for access to the top of the District's water tanks.
- Manual on Uniform Traffic Control Devices – Traffic control for work in the public right-of-way.

8.3 Emergency Operations

8.3.1 Capabilities

The District is equipped to accommodate short-term system failures and abnormalities. Its capabilities are as follows.

Multiple Supply Capability

The District could lose the operation of one of its groundwater wells without adversely impacting its ability to meet normal customer demands. The District currently has nine operational wells that are well distributed throughout the system and could be used to provide customers with water in an emergency.

Multiple Tanks

Water storage is provided by five active tanks that are located at four different sites. The larger tanks are in the highest pressure zone, which allows for service to the lower zones through the use of pressure reducing valves. Two booster pump stations provide the capability to distribute water to the higher pressure zones when the larger tanks are out of service.

Distribution System

The District has attempted to loop water mains wherever possible to improve water circulation (i.e., water quality) and minimize impacts to the system in the event that a portion of the distribution system must be taken temporarily out of service for maintenance or repairs.

Emergency Equipment

The District is equipped with the necessary tools to deal with common emergencies. If a more serious emergency should develop, the District will hire a local contractor who has a stock of spare parts necessary to make repairs to alleviate the emergency condition. The District also has a mutual aid agreement with the nearby West Sound Utility District.

Emergency Telephone

The District has a published phone number that allows for emergency after-hours contact. Emergency contact information, including cell phone, pager, and home phone numbers, is provided to each District employee.

On-call Personnel

The "on-call" person is equipped with a service vehicle and required to respond to a call within 45 minutes, but can often respond to a call within 15 minutes. A list of emergency telephone numbers is provided to each "on-call" employee. New employees are not placed "on-call" until they are familiar with the water system and maintenance procedures and are properly certified by the State of Washington as may be required.

Material Readiness

Some critical repair parts, tools, and equipment are on-hand and kept in fully operational condition. As repair parts are used, they are re-ordered. Inventories are kept current and adequate for most common emergencies that reasonably can be anticipated. The District has ready access to an inventory of repair parts, including parts required for repair of each type and size of pipe within the service area. Additionally,

the District has been provided with after-hours emergency contact phone numbers for key material suppliers, which gives the District 24-hour access to parts and supplies not kept in inventory.

8.3.2 Emergency Response Plan

A detailed Emergency Response Plan (ERP) complying with EPA and the Department of Homeland Security guidelines was developed and adopted by the District in 2021. The ERP is on file at the District and available for regulatory review on a "need-to-know" basis as determined by the General Manager. The ERP contains confidential information and is exempt from public disclosure under the provisions of Revised Code of Washington (RCW) 42.17.310(1)(ww).

8.3.3 Public Notification

The federal Safe Drinking Water Act (SDWA), WAC 246-290-495, and the EPA's Public Notification Rule require purveyors to notify their customers if any of the following conditions occur.

- Failure to comply with a primary MCL described under WAC 246-290-310.
- Failure to comply with a surface water treatment technique.
- Failure to comply with monitoring requirements under Chapter 246-290 WAC.
- Failure to comply with testing requirements.
- Failure to comply with a DOH order.
- Failure to comply with a variance or exemption schedule from DOH.
- If a system is identified as a source of waterborne disease outbreak.
- If DOH issues the system a category red operating permit.
- If DOH issues an order.
- If the system is operating under a variance or exemption.

Specific notice content, distribution channels, and time limit requirements, as specified in WAC 246-290-495 and the EPA's Public Notification Rule, must be in compliance when notification is required.

8.3.4 Washington Water/Wastewater Agency Response Network (WAWARN)

The District is part of the Southwest Region of Washington Water/Wastewater Agency Response Network (WAWARN). The mission of WAWARN is to support and promote statewide emergency preparedness, disaster response, and mutual aid assistance for Washington's public and private water related utilities in the case of natural or man-made disasters.

8.4 Preventive Maintenance

Maintenance schedules that meet or exceed manufacturer's recommendations have been established for all critical components in the water system. The following schedule is used as a minimum for preventive maintenance and manufacturers' recommendations should be followed where conflict exists.

8.4.1 Storage Facilities

Daily	Visually check security and inspect facilities for proper operation.
Annually	Check condition, vents, hatches, etc., on tanks.
As Needed	Clean and/or repaint interior and exterior as needed on tanks (approximate 5- to 7-year frequency).

8.4.2 Distribution System

Water Mains	
Annually or As Needed	Leak survey.
Annually	Flush.
Wells	
Daily	Log and record volume delivered and current supply rate; inspect visually; check packing; check security; check for excessive heat, vibration, and noise from pump motors.
Annually	Check all valves and screens; check control valve settings; re-grease.
As Needed	Maintain electrical and mechanical equipment; paint structures and piping; calibrate equipment; replace O-rings and diaphragms in equipment.
Booster Pump Stations	
Daily	Inspect visually and audibly; check security; check pump motors for excessive heat, vibration, or noise.
Weekly	Observe and record motor current draw (three phases); log and record volume delivered and pump motor hours; check motor oil level; measure and record discharge pressure; check motor noise, temperature, and vibration.
Annually	Change motor oil.
Annually	Take inventory of parts, pumps, and motors.
As Needed	Calibrate flow meter; maintain electrical and mechanical equipment; paint structures and piping; perform routine maintenance of equipment.
Engine Generator Sets	
Monthly	Operate to achieve normal operating temperatures; observe output.
Semi-annually	Routine maintenance in accordance with manufacturers' recommendations.
As Needed	Replace fluids and filters in accordance with manufacturers' recommendations (or more frequently depending on amount of use).
As Needed	Perform tune-up; replace parts as necessary.
Pressure Reducing Stations	
Annually	Flush and check all valves and screens; check pressure settings; rebuild and paint every 5 years, or as necessary.

Isolation Valves	
Annually	Operate fully open/closed; uncover where buried; clean out valve boxes and repair as necessary. Repair and/or install valve marker posts as necessary.
Hydrants	
Annually	Check for leakage and visual damage. Operate and flush; check drain rate; lubricate as necessary; measure pressure; paint as necessary. Check nozzle and cap threads; clean and lubricate per manufacturer's recommendations. Replace lost and damaged gaskets. Check and operate auxiliary valve in accordance with the valve maintenance schedule. Leave in open position. Inspect drain system to ensure proper drainage and protection from freezing weather.
Meters	
2- to 20-year Intervals	Time and measure volume of meter-delivered flow; dismantle, clean, and inspect all parts; replace worn or defective parts; retest meter for accuracy. Frequency varies based on meter size. Customer meters shall be replaced when reading problems are encountered.
Air and Vacuum Release Valve Assemblies	
Annually	Flush and inspect; repair as needed.
Blowoff Assemblies	
Annually	Flush and inspect; repair as needed.
Telemetry and Control System	
Daily	Backup program and data.
Daily	Review alarms and reports; ensure problems are corrected.
Monthly	Visually inspect cabinets and panels for damage, dust, and debris.
Semi-annually	Inspect inside of cabinets and panels for damage, dust, and debris.
Semi-annually	Vacuum clean all modules.
Semi-annually	Test alarm indicator units.
Semi-annually	Clean and flush all pressure sensitive devices.
Semi-annually	Visually inspect all meters to coordinate remote stations.
Annually	Check master and remote telemetry units for proper operation; repair as necessary.

8.4.3 Tools and Equipment

Rolling Stock	
Weekly	Check all fluid levels and brakes. Fluid levels and brakes are checked each time the equipment is used if less than weekly.
As Needed	Replace fluids and filters in accordance with manufacturers' recommendations (or more frequently depending on type of use); perform preventive maintenance per manufacturers' recommendation.

Tools	
As Needed	Clean after each use; lubricate and maintain as necessary; inspect for damage and wear before each use; perform preventive maintenance per manufacturers' recommendation.

8.5 Staffing

The preventive maintenance procedures, as well as the normal and emergency operations of the utility, are described in the previous sections. The hours of labor and supervisory activity required to effectively perform the work of these on-going maintenance and operations schedules form the basis for determining adequate staffing levels.

8.5.1 Current Staff

The current staff includes management personnel, maintenance workers, and office personnel engaged in operating and maintaining the water system. There are currently four field crew and one manager for field operations, and two administrative staff, all under the direction of the General Manager.

8.5.2 Staffing Requirements

The estimated hours of work required to provide the desired levels of operation and maintenance of the water system (excluding time required for clerical tasks) is shown in Table 8-5. The upper section of the table identifies the staffing time requirements for preventive maintenance tasks, and the lower section identifies the staffing time requirements for operations tasks.

Table 8-5
Staffing Requirements

Description	Total Units in System	Frequency (Times/Year)	Time/Unit (Hours)	Time/Year (Hours
Preventive Maintenance				
Hydrants	286	1	0.5	143
Isolation Valves, Hydrant Valves	759	1	0.25	190
Air and Vacuum Release Valves	0	1	0.5	0
Blowoff Assemblies	49	1	0.25	12
Meters	3,473	0.1	2	593
Leak Survey of Water Mains	47.3	1	0.5	24
Flushing Water Mains	47.3	1	5	237
Booster Pump Station	2	1	40	80
Pressure Reducing Stations	10	1	6	60
Sources	11	12	4	528
Tanks	5	1	30	150
Telemetry and Control System	2	12	5	120
Operations				
Monitor System	1	360	1	360
False Alarm Response	1	12	2	24
Meter Reading	3,473	6	0.1	2,004
Groundskeeping	16	12	6	1,152
Inventory	1	2	40	80
Meter Repair/Replace	100	1	4	400
Main Breaks	12	4	8	384
System Failures	6	4	8	192
Hydrant Repairs	10	1	8	80
Service Connections	30	1	8	240
Main Connections	10	1	24	240
Water Quality Sampling	10	12	1	120
Satellite System Management (SMA) Contract Labor – Port of Manchester	2 1	12 12	1 8	24 96
Administration	1	200	8	1,600
Total Requirements				
Total Hours Required				9,132
Total Full Time Staff Required (based on 1,540 hours per year per person)				**6.0**

Description	Total Units in System	Frequency (Times/Year)	Time/Unit (Hours)	Time/Year (Hours
Time Available Per Year Per Person				
Beginning Hours Available				2,080
Less average vacation of 3 weeks per year				-120
Less average sick leave of 2 weeks per year				-80
Less holidays of 11 days per year				-88
Less average training of 40 hours per year				-40
Less average small tasks other than above of 1 hour per day				-219
Net Total Available Hours Per Year Per Person				**1,533**

To achieve the level of operations and maintenance shown in Table 8-5, six full-time personnel are required for the water system. The District's current staff is slightly deficient in meeting the calculated personnel level for the desired program. At the current staffing level, the District is capable of adequately operating the water system and complying with the minimum requirements of DOH. As the water system continues to expand, the need for additional staff will increase. The District will evaluate the need for additional staff on an ongoing basis to optimize preventive maintenance and meet the additional requirements from system expansion, as the budget allows.

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Chapter 9 Water System Improvements

9.1 Introduction

This chapter presents proposed improvements to the Manchester Water District's (District) water system that are necessary to resolve existing system deficiencies and accommodate the projected growth of water customers. The water system improvements were identified from an evaluation of the results of the water system analyses presented in Chapter 7. The water system improvements were sized to meet both existing and future demand conditions of the system.

A Capital Improvement Program number, herein referred to as a CIP number, has been assigned to each improvement and is shown in Figure 9-1. The improvements are also illustrated in the hydraulic profile of the future water system that is shown in Figure 9-2. The improvements are organized and presented in this chapter according to the following categories.

- Water System Improvements Since Last Water System Plan.
- Water Main Improvements.
- Pressure Reducing Station Improvements.
- Pressure Zone Improvements.
- Facility Improvements.
- Miscellaneous Improvements.
- Developer-Funded Improvements.

The remainder of this chapter presents a brief description of each group of improvements, the criteria for prioritizing, the basis for the cost estimates, and the schedule for implementation.

9.2 Description of Improvements

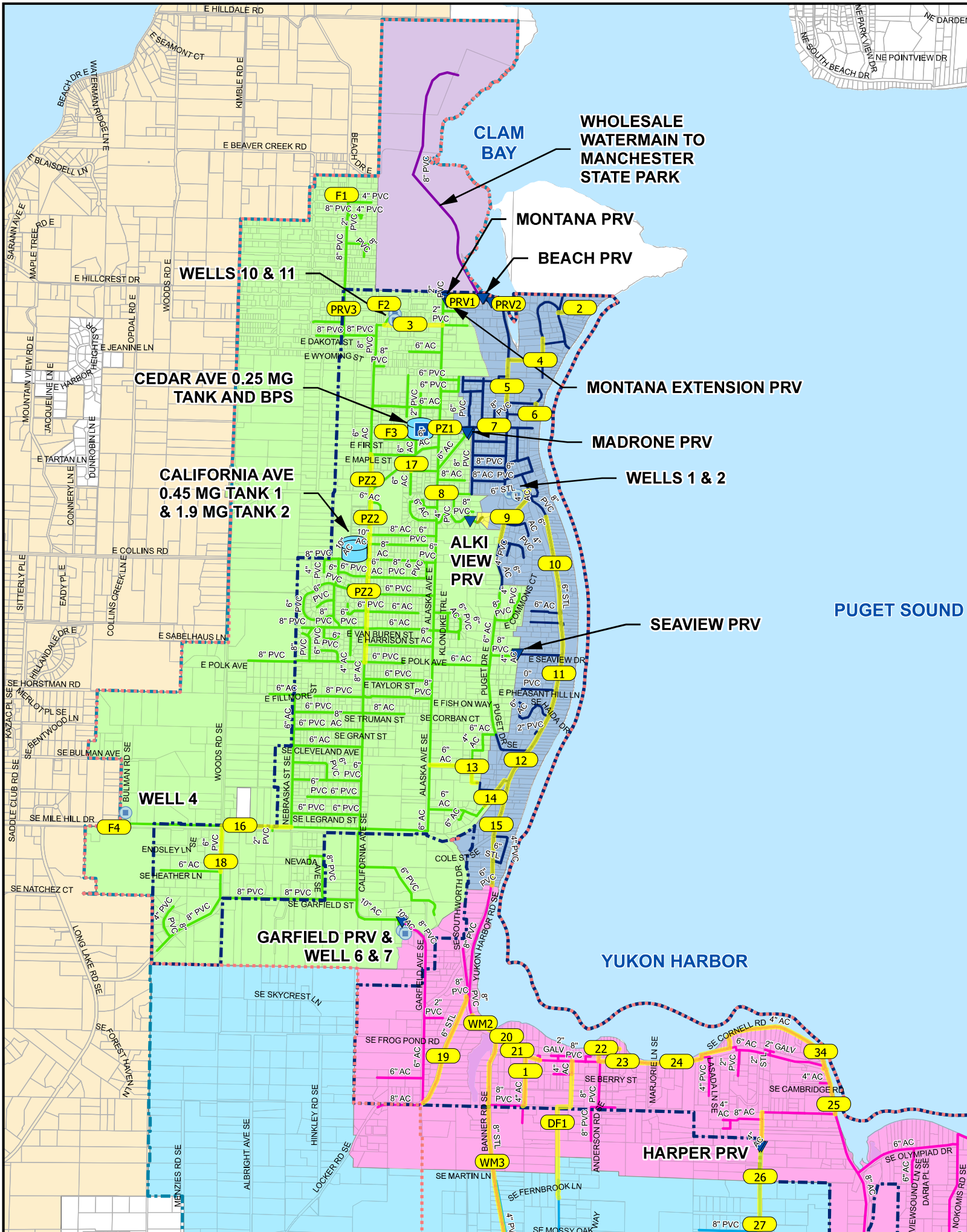
This section provides a general description of each group of improvements and an overview of the deficiencies they will resolve. Most of the improvements are necessary to resolve existing system deficiencies. However, improvements have also been identified for some undeveloped areas to illustrate the major facilities that will be required when development occurs in those areas. Additional developer-funded projects include localized on-site water main improvements that are not associated with overall water distribution but are necessary when the property served by the water main is redeveloped or expanded. The costs associated with these improvements shall be borne by the developers, rather than the existing water customers. The locations of improvements in the undeveloped areas are shown schematically in Figure 9-1 and will most likely be altered to fit the layout of the future developments. The CIP numbers for these improvements have a "DF" prefix (example: DF1).

9.2.1 Water System Improvements Since Last Water System Plan

The water system has undergone several changes since the District last updated its Water System Plan (WSP). The District has implemented a number of the recommended projects from the previous CIP, including a reservoir project, a new supervisory control and data acquisition (SCADA) system, a pressure reducing valve (PRV) replacement, a new automated meter reading system, and a number of water main projects. Table 9-1 lists the CIP projects that have been completed, along with additional non-CIP projects that have been completed since the District's last WSP.

Table 9-1
Improvements Completed Since Last Water System Plan

Project Description
Banner Road Tank Replacement
Wells 1 and 2 Chlorination
Wells 1 and 2 Reconditioning
Madrone PRV Replacement
Automated Meter Reading System
SCADA Telemetry and Systems Control
Mile Hill Drive Water Main
Yukon Harbor Drive Water Main
Southworth Drive Water Main
South Street Water Main
Nevada Street Water Main
Garfield Road Water Main
Sedgwick PRV Replacement
Well 5 Rehabilitation


CLAM BAY
WHOLESALE WATERMAIN TO MANCHESTER STATE PARK
MONTANA PRV
BEACH PRV
WELLS 10 & 11
CEDAR AVE 0.25 MG TANK AND BPS
MONTANA EXTENSION PRV
MADRONE PRV
WELLS 1 & 2
CALIFORNIA AVE 0.45 MG TANK 1 & 1.9 MG TANK 2
ALKI VIEW PRV
SEAVIEW PRV
PUGET SOUND
WELL 4
GARFIELD PRV & WELL 6 & 7
YUKON HARBOR
HARPER PRV
E HILLDALE RD
E SEAMONT CT
BEACH DR E
WATERMAN RIDGE LN E
KIMBLE RD E
E BEAVER CREEK RD
E BLAISDELL LN
SARANN AVE E
MAPLE TREE RD E
E HILLCREST DR
WOODS RD E
OPDAL RD E
E JEANINE LN
E HARBOR HEIGHTS CT
MOUNTAIN VIEW RD E
JACQUELINE LN E
DUNROBIN LN E
CONNERY LN E
E TARTAN LN
E COLLINS RD
COLLINS CREEK LN E
SITTERLY PL E
EADY PL E
HILLANDALE DR E
E SABELHAUS LN
E POLK AVE
SE HORSTMAN RD
KAZAC PL SE
MERLOT PL SE
SE BENTWOOD LN
SE BULMAN AVE
BULMAN RD SE
SADDLE CLUB RD SE
SE MILE HILL DR
ENDSLEY LN SE
SE HEATHER LN
SE NATCHEZ CT
LONG LAKE RD SE
WOODS RD SE
NEBRASKA ST SE
NEVADA
SE GARFIELD ST
SE LEGRAND ST
SE CLEVELAND AVE
SE GRANT ST
SE TRUMAN ST
E FILLMORE ST
E TAYLOR ST
E VAN BUREN ST
E HARRISON ST
E FISH ON WAY
SE CORBAN CT
E MAPLE ST
E FIR ST
E DAKOTA ST
E WYOMING ST
ALASKA AVE E
KLONDIKE TRL E
E COMMONS CT
PUGET DR E
PUGET DR SE
E SEAVIEW DR
E PHEASANT HILL LN
SE LAIDA DR
COLE ST SE
SE SOUTHWORTH DR
YUKON HARBOR RD SE
CALIFORNIA AVE SE
ALASKA AVE SE
GARFIELD AVE SE
SE SKYCREST LN
SE FOREST HAVEN LN
MENZIES RD SE
ALBRIGHT AVE SE
HINKLEY RD SE
LOCKER RD SE
SE FROG POND RD
BANNER RD SE
ANDERSON RD SE
MARJORIE LN SE
LASALLE LN SE
SE BERRY ST
SE CORNELL RD
SE CAMBRIDGE RD
SE OLYMPIAD DR
SE MARTIN LN
SE FERNBROOK LN
SE MOSSY OAK WAY
VIEWSOUND LN SE
DARIA PL SE
NOKOMIS RD SE
NE SOUTH BEACH DR
NE PARK VIEW DR
NE POINTVIEW DR
NE DARDEN
F1
F2
F3
F4
PRV1
PRV2
PRV3
PZ1
PZ2
WM2
WM3
DF1
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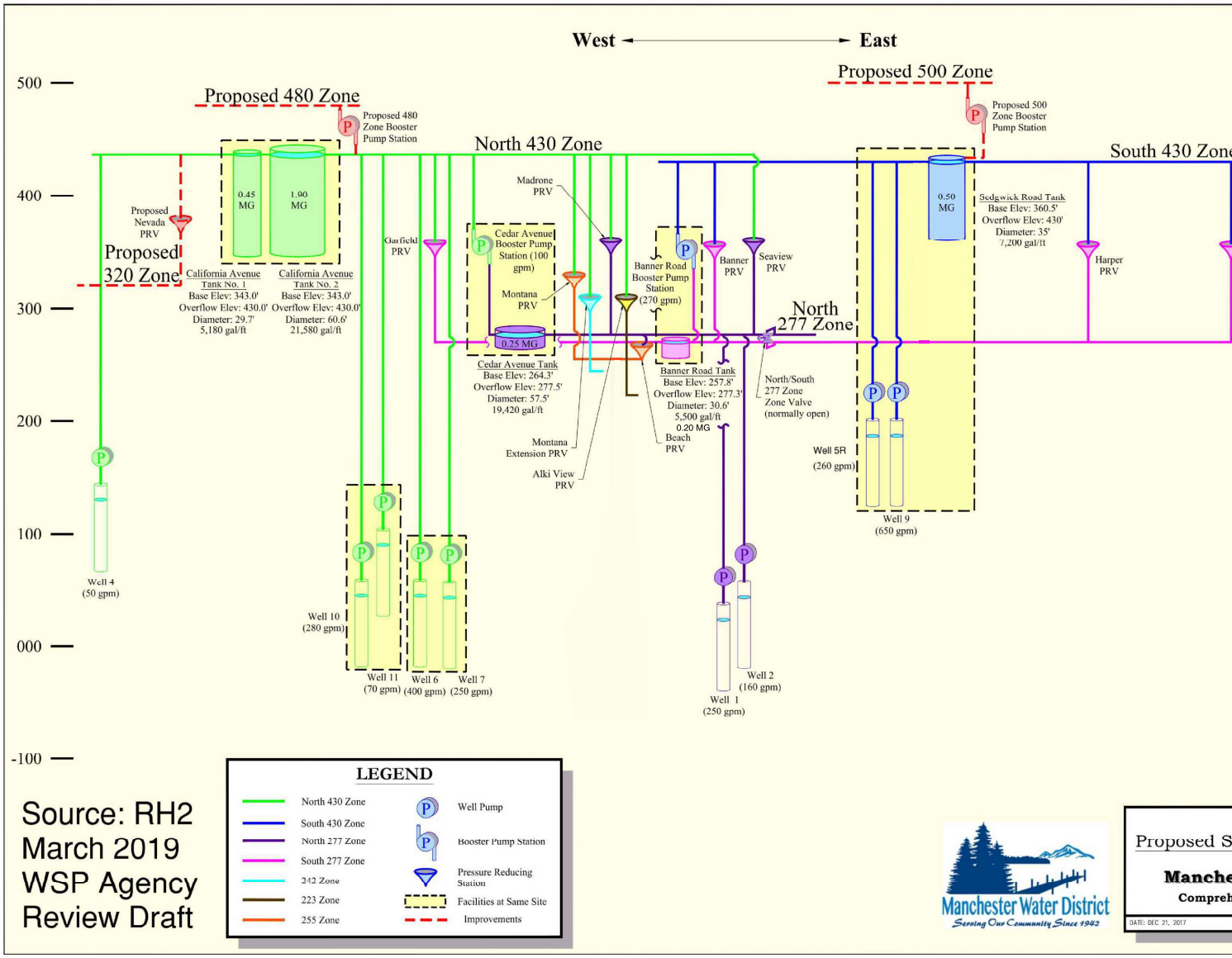

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Manchester WATER DISTRICT

Proposed Syste
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Manchester Water Sys
October 2025

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9.2.2 Water Main Improvements

The following water main improvements were identified from the results of the distribution and transmission system analyses discussed in Chapter 7. Most of the water main improvements are replacements of existing distribution water mains and are grouped in the Annual Water Main Replacement Program (CIP WM1). The individual water main improvement projects within this group are numbered 1 through 34 as shown on Figure 9-1. The other water main improvements are mostly larger diameter water mains that function more like transmission mains than distribution mains and are identified as individual projects (CIP WM2 through CIP WM4).

CIP WM1: Annual Water Main Replacement Program

Deficiency: Most of the water main improvements shown in Figure 9-1 are required to resolve existing system fire flow deficiencies caused primarily by undersized water mains. Many areas also contain non-standard water main materials.

Improvement: Replace existing water main with new ductile iron water main in accordance with the District's construction standards. The individual water main improvements grouped under this project are numbered 1, 2, 3, etc., as shown in Figure 9-1. The selection of specific projects will be accomplished annually during the District's budget development process and guided by the prioritization presented later in this chapter. This provides the District with the flexibility to coordinate these projects with other projects that may occur within the same area. An allowance of $200,000 per year has been established for the annual replacement of water mains.

CIP WM2: Southworth Drive Water Main

Deficiency: The existing transmission main is constructed of aging 6-inch asbestos cement (AC) pipe and undersized to meet existing system needs.

Improvement: Replace the existing water main in SE Southworth Drive with 400 lf of new 8-inch ductile iron water main from Banner Road to the 12-inch ductile iron water main/gate valve on the westside of the Curley Creek Bridge. The crossing on Curley Creek Bridge was upgraded to 12-inch ductile iron pipe as part of a Kitsap County project in 2012.

CIP WM3: Banner Road Tank Transmission Main

Deficiency: The existing transmission main is constructed of aging 8-inch steel pipe and is undersized to meet existing system needs.

Improvement: Replace the existing transmission main along Banner Road SE from the Banner Road Tank to SE South Street with 4,430 lf of new 12-inch ductile iron transmission main. Replace the existing water main along Banner Road SE from SE South Street to SE Southworth Drive with 440 lf of new 8-inch ductile iron water main.

CIP WM4: Sedgwick Road Tank Transmission Main

Deficiency: Supply to the southeastern portion of the South 277 Zone is supplied primarily by the South 430 Zone via a transmission main along SE Sedgwick Road that conveys water from the Sedgwick Road Tank site. The existing transmission main is constructed of aging asbestos cement pipe and undersized to meet existing system needs. When the District completes CIP PZ4, a portion of this main will be replaced. The remaining section of the transmission main will need to be replaced to meet existing system needs.

Improvement: Replace the existing transmission main along SE Sedgwick Road from SE Eastway Drive to Harper Hill Road SE with 2,920 lf of new 12-inch ductile iron transmission main.

Future Water Main Extensions and Replacements

All new water main extensions and replacements shall be installed in accordance with the District's Water System Construction Standards, which are included in Appendix G. All new water mains shall be ductile iron pipe and sized by a hydraulic analysis to ensure that all pressure, flow, and velocity requirements, as stated in Chapter 5, are met. In general, new water mains that will carry fire flow in residential areas shall be a minimum of 8 inches in diameter. New water mains in commercial and school areas shall be a minimum of 12 inches in diameter and looped.

9.2.3 Pressure Reducing Station Improvements

The following pressure reducing station improvements were identified to resolve existing system deficiencies.

CIP PRV1: Montana Extension and Alki View Pressure Relief

Deficiency: The existing 223 and 242 Zones do not have pressure relief facilities to prevent over pressurization in the event that a pressure reducing station control valve fails in the open position.

Improvement: Install new pressure relief stations or modify the existing Montana Extension and Alki View PRVs to include a pressure relief valve.

CIP PRV2: Beach PRV Replacement

Deficiency: The existing Beach PRV is undersized to provide adequate flow to the 215 Zone in the event that the Montana PRV is out of service for maintenance or emergency purposes. The hydraulic grade of the 215 Zone limits the available fire flow to the zone such that it does not meet existing system needs.

Improvement: Adjust the setpoint of the existing Montana PRV to maintain a downstream hydraulic grade of 255 feet. Replace the existing pressure reducing station near the intersection of Beach Drive E and E Montana Street. The large pressure reducing valve shall be a 6-inch valve, and the small valve shall be a 2-inch valve. The station should also include a pressure relief valve to relieve pressures in the new 255 Zone in the event of a pressure surge in the zone. Other alternatives to this improvement that will resolve the deficiency will be evaluated during the preliminary design phase of this project.

CIP PRV3: Nevada Avenue PRV

Deficiency: Residential development that is occurring in the Manchester Heights area north of Minnesota Street experiences extremely high pressures being served directly by the North 430 Zone.

Improvement: Install a PRV in Nevada Avenue between Michigan Street and Minnesota Street to reduce pressures from the North 430 Zone. The PRV will serve the new 320 Zone, and its setting will be determined during the design phase of the project. The large pressure reducing valve shall be a 6-inch valve, and the small valve shall be a 2-inch valve. The station should also include a pressure relief valve to relieve pressures in the new 320 Zone in the event that a pressure reducing station control valve fails in the open position.

9.2.4 Pressure Zone Improvements

The following pressure zone improvements will improve various low pressure problem areas throughout the water system. A brief description of the existing deficiency that the improvement will resolve and a description of the improvement itself is provided below.

CIP PZ1: North 277 Zone to North 430 Zone Conversion

Deficiency: A portion of the North 277 Zone, in the higher elevations along the Cedar Avenue Tank transmission main, has low pressures that do not meet the minimum pressure requirements.

Improvement: Install approximately 280 linear feet of 8-inch-diameter water main in E Main Street from the existing 8-inch North 430 Zone water main in Alaska Avenue E east towards 3rd Avenue E. Connect the existing hydrant near the intersection of E Main Street and Alaska Avenue E to the new water main. Convert the services along the new alignment to the North 430 Zone by connecting them to the new water main. Other alternatives to this improvement that will resolve the deficiency will be evaluated during the preliminary design phase of this project.

CIP PZ2: North 430 Zone to 480 Zone Conversion

Deficiency: A portion of the North 430 Zone, in the higher elevations near the California Avenue Tanks, has marginally low pressures and creates a large amount of dead storage in the tanks. By converting this area to a higher pressure zone, the volume of available storage within the District's system will increase by nearly 300,000 gallons.

Improvement: Convert the area near the California Avenue Tanks to the new 480 Zone by disconnecting all water main serving areas east of California Avenue E from the existing 8-inch water main in California Avenue E from E Maple Street to E Polk Avenue. The existing 8-inch water main will serve the new 480 Zone. Construct a parallel water main in California Avenue E from E Maple Street to E Polk Avenue. Connect the new water main to all existing North 430 Zone water main serving areas east of California Avenue E. The new 430 Zone water main from E Maple Street to E Harrison Avenue shall be 12-inch ductile iron, while the new 430 Zone water main from E Harrison Avenue to E Polk Avenue shall be 8-inch ductile iron. Disconnect the California Avenue Tanks inlet/outlet pipe from the existing 8-inch water main in California Avenue and connect it to the new 12-inch ductile iron water main. Install check valves at the following locations so that water can be supplied to the 480 Zone from the North 430 Zone in the event that pressures are excessively suppressed in the upper zone, such as a fire flow: California Avenue Tanks site; California Avenue E and E Chester Road; and California Avenue E and E Polk Avenue.

Construct a 480 Zone booster pump station with all necessary mechanical and electrical equipment at the California Avenue Tanks site to supply water from the tanks to the new zone via the existing 8-inch water main in California Avenue. The booster pump station shall have a maximum capacity to satisfy the future peak hour demand of the zone, estimated at approximately 300 gallons per minute (gpm). Fire flow supply to the zone will be provided through the new check valves. The actual capacity and configuration of the pump station will be determined during the preliminary design phase of the project. Install an engine generator set for providing standby power in the event of a power outage.

CIP PZ3: South 430 Zone to 500 Zone Conversion

Deficiency: A portion of the South 430 Zone in the higher elevations near the Sedgwick Road Tank contains low pressures that do not meet minimum pressure requirements.

Improvement: Convert the area near the Sedgwick Road Tank to the new 500 Zone by installing normally closed zone valves in the following locations to isolate the zone.

- In Banner Road SE, just north of the hydrant located approximately 600 feet north of SE Sedgwick Road.
- In SE Sedgwick Road, just west of the tee located at the intersection of SE Sedgwick Road and Banner Road SE.
- In Arvick Road SE, just south of the hydrant located approximately 510 feet north of SE Sedgwick Road.
- In SE Westway Drive, just south of the hydrant located approximately 110 feet south of SE Northway Place.
- In SE Eastway Drive, just south of the hydrant located approximately 110 feet south of SE Northway Place.
- In SE Sedgwick Road, just east of the tee located at the intersection of SE Sedgwick Road and SE Eastway Drive.

Construct a 500 Zone booster pump station with all necessary mechanical and electrical equipment at the Sedgwick Road Tank site to supply water from the tank to the new zone. The booster pump station shall have a maximum capacity to satisfy the peak hour demand plus the maximum fire flow requirement of the zone, estimated at approximately 1,550 gpm. The actual capacity and configuration of the pump station will be determined during the preliminary design phase of the project. Install an engine generator set for providing standby power in the event of a power outage. Install a check valve at the Sedgwick Road Tank site so that water can be supplied to the 500 Zone from the South 430 Zone in the event that pressures are excessively suppressed in the upper zone.

Install new South 430 Zone 12-inch water main in SE Sedgwick Road from the west side of the new zone valve near Banner Road SE to the east side of the new zone valve near SE Eastway Drive. Extend new South 430 Zone 12-inch water main in Banner Road SE from the new 12-inch water main in SE Sedgwick Road to the north side of the new zone valve in Banner Road SE. Replace the water main from the Sedgwick Tank to SE Sedgwick Road with new 12-inch ductile iron main and connect it to the new South 430 Zone water main in SE Sedgwick Road. Install new South 430 Zone 8-inch ductile iron water main from the new 12-inch water main in SE Sedgwick Road to the north side of the new zone valves in Arvick Road SE, SE Westway Drive, and SE Eastway Drive.

9.2.5 Facility Improvements

The following water system facility improvements were identified from the results of the water system analyses that are discussed in Chapter 7. The improvements are primarily necessary to resolve existing system deficiencies but also have been sized to accommodate projected growth.

CIP F1: West Sound Utility District Nevada Street Intertie

Deficiency: An intertie is needed between the District and the West Sound Utility District (WSUD) to increase reliability within the two water systems.

Improvement: Following the completion of CIP PRV3, construct an intertie facility at Nevada Avenue E and Delaware Court E to transfer water between the District and WSUD's water systems. The actual capacity and configuration of the intertie will be determined through negotiations with WSUD and during the preliminary design phase of the project. Since this project will benefit both the District and WSUD, it is anticipated that it will be partially funded by both utilities.

CIP F2: Well 10 Treatment Facility

Deficiency: Well 10 cannot be utilized to its full capacity because it produces water with high levels of manganese. High levels of manganese cause black staining of fixtures and laundry.

Improvement: Install water treatment facilities at the Well 10 and 11 site to reduce the level of manganese in the water produced by Well 10. The new facility will consist of a new structure located adjacent to the existing well building. The new structure will house filtration equipment, backwash recycle and waste system, monitoring and control equipment, and a small laboratory for water quality monitoring. Install a backwash storage tank for storage and settling of the backwash water prior to recycling, and a power receptacle to enable connection of a portable generator. Construct on-site improvements to concentrate and dispose of the waste stream. Install a fence to enclose and secure the Wells 10 and 11 facilities.

CIP F3: Cedar Avenue Booster Pump Station Replacement

Deficiency: Recent improvements to the Cedar Avenue Booster Pump Station include a new concrete masonry unit (CMU) and wood-framed building that houses the electrical gear and SCADA panel. The underground booster pump is undersized and needs to be replaced.

Improvement: Replace the underground booster pump and associated switchgear to increase pump capacity. For planning purposes, the cost estimate assumes the booster pump station will be sized to meet the peak day demand of the North 430 Zone, as well as the other zones it serves, estimated at approximately 900 gpm. The facility shall include a power receptacle to enable connection of a portable generator in the event of a power outage.

CIP F4: West Sound Utility District Mile Hill Drive Intertie

Deficiency: An intertie is needed between the District and West Sound Utility District to increase reliability within the two water systems.

Improvement: Extend 8-inch water main along SE Mile Hill Drive to WSUD's water system. Construct an intertie facility near the intersection of Bulman Road SE and Mile Hill Drive to transfer water between the two systems. The actual capacity and configuration of the intertie will be determined through negotiations with WSUD and during the preliminary design phase of the project. Since this project will benefit both the District and WSUD, it is anticipated that it will be partially funded by both utilities.

CIP F5: South End Reservoir

Deficiency: The south end of the District only has 700,000 gallons of storage. More storage is necessary to mitigate a potential extended loss of source supply from one of the wells.

Improvement: Prepare an engineering report to determine the storage volume needed in the south end, and to identify a site for the upgrades. Construct a new reservoir to provide additional storage volume. For the purposes of developing an OPPC, a 1 MG tank is assumed.

9.2.6 Miscellaneous Improvements

The following miscellaneous improvements are planning efforts and program elements that are required to comply with various state water regulations. In addition, general operational improvements are identified as miscellaneous improvements.

CIP M1: Storage Tank Cleaning and Inspection

Deficiency: The District's existing storage tanks require periodic inspections and cleaning to maintain the integrity of the structures.

Improvement: Inspect the interior and exterior of each storage tank and determine where cleaning or other improvements are required. Retain a qualified coating inspector to inspect the integrity of the coating on a 5-year time schedule, or more frequently, if visible signs of coating deterioration appear. Clean, recoat, and improve the tanks as necessary. This program is not funded through the District's CIP; therefore, it is not included in the CIP schedule.

CIP M2: Water System Plan Update

Deficiency: WAC 246-290-100 requires that the District's Water System Plan be updated every 10 years and submitted to the Washington State Department of Health for review and approval.

Improvement: The District will update and submit its Water System Plan every 10 years to comply with state requirements.

CIP M3: Water Use Efficiency Program

Deficiency: Several water use efficiency measures must be carried out on an ongoing basis to comply with state requirements.

Improvement: The District will continue its water main replacement program to reduce the amount of older and potentially leaking water mains. The District will perform ongoing water use efficiency measures, including public education programs, as outlined in the Water Use Efficiency Program included in Appendix E. This program is not funded through the District's CIP; therefore, it is not included in the CIP schedule.

CIP M4: Cross-Connection Control Program

Deficiency: The District's Cross-Connection Control Program is an ongoing program that needs additional development to continue to protect the water system from backflow contamination.

Improvement: The District will carry out the Cross-Connection Control Program requirements as outlined in Appendix F. This program is not funded through the District's CIP; therefore, it is not included in the CIP schedule.

CIP M5: Wellhead Protection Program

Deficiency: The Wellhead Protection Program requires periodic updates.

Improvement: The District will carry out wellhead protection program requirements as outlined in the Wellhead Protection Program included in Appendix J. This program is not funded through the District's CIP; therefore, it is not included in the CIP schedule.

9.2.7 Developer-Funded Improvements

The following water system facility improvement costs shall be borne by the developers, rather than the existing water customers, unless over-sizing of the improvements provides benefit to the existing customers. Improvements have been identified for the undeveloped areas of the District's existing service area to illustrate the major facilities that will be required to properly serve these areas. Additional developer-funded projects include localized on-site water main improvements that are not associated with overall water distribution but would be necessary if the property served by the water main is redeveloped or expanded. The locations of the facilities are shown schematically in Figure 9-1.

CIP DF1: Arvick Water Main Extension and PRV

Deficiency: Development that occurs along Arvick Road SE between SE Berry Street and approximately SE Fern Brook Lane will be required to extend water main from the existing system to supply the new development. A pressure reducing station will be needed to eliminate a 277 Zone dead-end and reduce pressures to acceptable levels in the development area.

Improvement: Install a pressure reducing station in Arvick Road SE near SE Fern Brook Lane. The PRV will serve the 277 Zone, and its setting will be determined during the design phase of the project. The large pressure reducing valve shall be a 6-inch valve, and the small valve shall be a 2-inch valve. Extend 8-inch ductile iron water main from the north end of the existing 8-inch water main in Arvick Road approximately 450 feet north of SE Fern Brook Lane to SE Berry Street. Replace the existing 4-inch water main in Arvick Road SE from SE Southworth Drive to SE Berry Street with 8-inch ductile iron water main.

CIP DF2: Wilson Creek Water Main Extension and PRV

Deficiency: Development that occurs along Wilson Creek Road SE between SE Grand View Street and approximately 1,000 feet south of SE Southworth Drive will be required to extend water main from the existing system to supply the new development. A pressure reducing station will be needed to eliminate a South 430 Zone dead-end and to reduce pressures to acceptable levels in the development area.

Improvement: Extend 8-inch ductile iron water main along Wilson Creek Road SE from SE Grand View Street to the south end of the existing 8-inch water main located approximately 1,000 feet south of SE Southworth Drive. Install a pressure reducing station in Wilson Creek Road SE, approximately 790 feet north of SE Grand View Street. The PRV will serve the 277 Zone, and its setting will be determined during the design phase of the project. The large pressure reducing valve shall be a 6-inch valve, and the small valve shall be a 2-inch valve.

9.3 Estimating Costs of Improvements

Project costs for the proposed improvements were estimated based on costs of similar, recently constructed projects in Manchester and around the Puget Sound area and are presented in 2025 dollars. The cost estimates include the estimated construction cost of the improvement and indirect costs estimated at 30 percent of the construction cost for engineering preliminary design, final design, and construction management services, permitting, legal, and administrative services. The construction cost estimates also include a 35 percent contingency and sales tax. Cost estimate breakdowns are included as Appendix U.

9.4 Prioritizing Improvements

The water system improvements were prioritized from established criteria to formulate a schedule that identifies projects with the most deficiencies and greatest need for improvement to be completed prior to projects with fewer deficiencies. A description of the criteria and method for prioritizing each category of improvements is provided below.

9.4.1 Water Main Improvements

Table 9-2 lists criteria that were established for prioritizing the water main improvements. The criteria are based on the underlying deficiencies of the existing water main that will be replaced by the proposed water main improvements. The criteria are arranged in four different categories, with a weight factor assigned to each category. The criteria given the most weight is the "Existing Water Main Fire Flow Capability.

Table 9-2
Water Main Improvements Priority Ranking Criteria

Points	Category	Weight Factor	Weighted Points
Existing Water Main Fire Flow Capability			
3	Available Fire Flow is 69% or Less of Required Fire Flow	4	12
2	Available Fire Flow is 70-89% of Required Fire Flow	4	8
1	Available Fire Flow is 90-100% or More of Required Fire Flow	4	4
Existing Water Main Year of Installation			
3	Before 1960	3	9
2	1960 – 1980	3	6
1	After 1980	3	3
Existing Water Main Material			
3	Steel	3	9
2	Asbestos Cement	3	6
1	Ductile Iron or PVC	3	3
Existing Water Main Benefit Area			
3	Large Benefit Area (i.e., transmission main)	2	6
2	Medium Benefit Area	2	4
1	Small Benefit Area (i.e. localized area)	2	2

The "Existing Water Main Fire Flow Capability" category ranks the water main improvements based on the ability of the existing water mains to provide the required fire flow, as determined from the results of the hydraulic analyses addressed in Chapter 7. The "Existing Water Main Year of Installation" category ranks the water main improvements based on the age of the existing water mains. The "Existing Water Main Material" category ranks the water main improvements based on the material of the existing water main. Steel was given the highest ranking in this category because of its extensive history of leaks and breaks

within the system. The "Existing Water Main Benefit Area" category ranks the water main improvements based on the size of the area that will benefit from the water main replacement.

The water main priority ranking criteria was applied to the annual water main replacement projects, which are grouped under CIP WM1. Project identification numbers were then assigned to each water main project based on their location. These projects, CIP 1 through 34, are shown in Figure 9-1 and organized in Table 9-3 by their priority ranking.

9.4.2 Other Improvements

The additional water main, pressure zone, pressure reducing station, and facility improvements were prioritized based on existing deficiencies, safety concerns, maintenance requirements, and capacity requirements. Improvements to resolve pressure deficiencies identified in Chapter 7 were given the highest priority and scheduled for completion within the 10-year planning period. The miscellaneous improvements were prioritized based on regulatory requirements and an assessment of other water system needs. The priority order of these improvements is reflected in the schedule of improvements, which is presented in the next section.

9.5 Schedule of Improvements

The results of prioritizing the improvements were used to assist in establishing an implementation schedule that can be used by the District when preparing its 10-year CIP and annual budget. The implementation schedule for the proposed improvements is shown in Table 9-4. An allowance of $200,000 per year has been established for the annual replacement of water mains. The District will identify and schedule the replacement of these smaller water mains during the annual budget process. This provides the District with the flexibility to coordinate these projects with road or other projects within the same area. The developer-funded improvement projects and their associated cost estimates are shown near the bottom of the table. However, the implementation dates for these improvements are not shown, due to the uncertainty of the timing of the future developments that will be responsible for these improvements.

9.5.1 Future Project Cost Adjustments

All cost estimates shown in Table 9-3 and Table 9-4 are presented in 2025 dollars. Therefore, it is recommended that future costs be adjusted to account for the effects of inflation and changing construction market conditions at the actual time of project implementation. Future costs can be estimated for planning level purposes using the Engineering News Record Construction Cost Index for the Seattle area or by applying an estimated rate of inflation that reflects the current and anticipated future market conditions.

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Table 9-3
Prioritized Annual Water Main Replacement Projects

No.	Size		Description			Estimated Cost
	Length (ft)	Diameter (in)	In	From	To	
1	1,000	8	Harvey St SE	SE South St	SE Southworth Dr	$ 720,00
2	510	8	Easement	Caraway Rd E	E. end of ex. 4" main	$ 420,00
3	1,130	8	E Washington St	Wells 10 & 11	Alaska Ave E	$ 800,00
4	1,140	8	E Caraway Rd	Beach Dr E	Ex. 4" x 4" tee	$ 810,00
5	850	8	Beach Dr E	E Caraway Rd	2nd St	$ 630,00
6	240	8	E Daniels Loop	Daniel St	2nd St	$ 260,00
7	120	8	1st Ave E	Main St	North to Ex. Hydrant	$ 190,00
8	330	8	E Alder St	Alaska Ave E	Salal St E	$ 310,00
9	1,290	8	Puget Dr E	Colchester Dr	Aguilar Ct	$ 910,00
10	2,130	8	Colchester Dr	Miracle Mile Dr	~600 ft N of Seaview	$ 1,450,00
11	1,820	8	Colchester Dr	~600 ft north of Seaview	SE Haida Dr	$ 1,250,00
12	1,490	8	Colchester Dr	SE Haida Dr	Yukon Harbor Rd SE	$ 1,020,00
13	830	8	SE Monte Bella Pl	Alaska Ave SE	Ex. 6" x 4" tee	$ 900,00
	440	8	Private Driveway	SE Monte Bella Pl	South to Ex. Hydrant	
14	700	8	Colchester Dr SE	Yukon Harbor Rd SE	S. to Ex. 6" AC main	$ 550,00
15	2,100	8	Yukon Harbor Rd SE	Colchester Dr SE	~500 ft S of Cole Lp	$ 1,430,00
16	1,350	8	SE Mile Hill Dr	Woods Rd SE	Nebraska St SE	$ 950,00
17	240	8	Cedar Avenue	E Chester Rd	Madrone Ave	$ 260,00
18	890	8	SE Woods Rd	SE Mile Hill Dr	SE Heather Ln	$ 650,00
19	2,260	8	Locker Rd SE	SE Southworth Dr	Garfield Ave SE	$ 1,520,00
20	500	8	SE Bay St	SE Southworth Dr	E end of ex. 4" main	$ 400,00

No.	Size		Description			Estimated Cost
	Length (ft)	Diameter (in)	In	From	To	
21	950	8	SE Southworth Dr	Banner Rd SE	~300 ft East of Harvey	$ 690,00
22	240	8	Anderson St SE	SE Southworth Dr	SE John St	$ 520,00
	400	8	SE John St	Anderson St SE	East end of John	
23	930	8	SE Southworth Dr	Anderson St SE	Marjorie Ln SE	$ 680,00
24	1,710	8	SE Southworth Dr	Marjorie Ln SE	SE Cornell Rd	$ 1,160,00
25	970	8	SE Southworth Dr	SE Cornell Rd	Harper Hill Rd SE	$ 700,00
26	1,830	8	Harper Hill Rd SE	Private Driveway	SE Alder St	$ 1,250,00
27	1,270	8	Harper Hill Rd SE	SE Alder St	Private Driveway	$ 900,00
28	2,070	8	Harper Hill Rd SE	Private Driveway	SE Sedgwick Rd	$ 1,410,00
29	1,140	8	SE Rocky Rd	SE Vesper Pl	North to Ex. Hydrant	$ 810,00
30	2,250	8	SE Southworth Dr	Nokomis Rd SE	SE Sebring Dr	$ 1,520,00
31	210	8	Unnamed Road	SE Southworth Dr	Ex. 6" AC main	$ 240,00
32	1,970	12	SE Sedgwick Rd	Harper Hill Rd SE	~650 ft W of Wilson Cr Rd	$ 1,330,00
33	50	8	SE Sedgwick Rd	Siana Pl SE	North to Ex. Hydrant	$ 150,00
34	2,950	8	SE Cornell Rd	Lasada Ln SE	SE Sedgwick Dr (East End)	$ 1,940,00
					Total	**$ 28,730,00**

Tabl
Proposed Improvements

No.	Description	OPPC (2025 Dollars)	20-		
			2025	2026	
					Water Main Ir
WM1	Annual Water Main Replacement	$ 28,730K	$ 200K	$ 200K	$
WM2	Southworth Drive Water Main	$ 540K			
WM3	Banner Road Tank Transmission Main	$ 3,810K			
WM4	Sedgwick Road Tank Transmission Main	$ 2,160K			
					Pressure Reducing Station
PRV1	Montana Ext. and Alki View Press. Relief	$ 105K			
PRV2	Beach PRV Replacement	$ 408K			
PRV3	Nevada Avenue PRV	$ 408K			
					Pressure Zone
PZ1	North 277 Zone to North 430 Zone Conv.	$ 310K		$ 310K	
PZ2	North 430 Zone to 480 Zone Conv.	$ 7,320K			
PZ3	South 430 Zone to 500 Zone Conv.	$ 8,750K			
					Facility Imp
F1	WSUD Nevada Street Intertie	$ 480K			
F2	Well 10 and 11 Treatment Facility	$ 800K	$ 400K	$ 400K	
F3	Cedar Avenue BPS Replacement	$ 1,420K			
F4	WSUD Mile Hill Drive Intertie	$ 1,020K			
F5	South End Reservoir	$ 4,930K			
					Miscellaneous
M1	Storage Tank Cleaning and Inspection	O&M Funded			
M2	Water System Plan Update	$ 450K	$ 90K		
M3	Water Use Efficiency Program	O&M Funded			
M4	Cross-Connection Control Program	O&M Funded			
M5	Wellhead Protection Program	O&M Funded			
Total OPPC of District Funded Improvements		**$ 60,951K**	**$ 690K**	**$ 910K**	**$**
					Developer-Funde
DF1	Arvick Water Main Extension and PRV	$ 2,338K			
DF2	Wilson Creek Water Main Extension and PRV	$ 1,198K			
Total OPPC of Developer-Funded Improvements		**$ 3,536K**			

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Chapter 10 Financial Analysis

10.1 Introduction

The financial analysis assesses the District's financial viability during the planning period, considering its recent historical performance and anticipated future needs. It also evaluates the affordability of the District's rates, at existing levels and with any rate increases needed to support the capital program.

10.2 Financial History

Table 10-1 summarizes the District's financial performance for the 2019 – 2024 period as documented in the District's Income & Expense Reports. Key findings from Table 10-1 include:

- Water sales increased from $1.47 million in 2019 to $1.85 million in 2024, corresponding to an average increase of 4.6 percent per year during that period. PSRC population estimates shown in Table 3-1 suggest that the population has grown by an average of about 1.1 percent per year over this period, with the remainder of the observed revenue increase being attributable to water rate increases that the District has imposed. Most recently, the District increased its base monthly base charge by $1.00 and its volume charges by 7.0 percent each year in 2023 and in 2024.
- Meter sales include revenues from Meter Installation Fees, General Facilities Charges (GFCs), and Local Facilities Charges (LFCs) that the District collects from new or expanded service connections. From 2019 – 2024, the District collected an average of roughly $200,000 per year (varying from a low of $68,000 in 2024 to a high of $419,000 in 2023) from these charges.
- Streetlight Revenue: Through a partnership with Puget Sound Energy (PSE), the District provides administrative and billing services for various small streetlighting districts within its service area. The District bills certain customers an additional streetlight fee and uses the revenue to pay PSE for the electrical and other operating costs.
- Cash operating expenses increased by 26 percent from 2019 – 2024, including an annual increase of 21 percent from 2022 to 2023 that was driven by a cost-of-living salary adjustment of 8.9 percent and other human resource initiatives proposed by District staff.

- The operating ratio provides a means of evaluating the District's self-sufficiency as an enterprise, measuring the ability of annual operating revenues to cover annual operating costs. A ratio of 1.0 indicates that the District is collecting exactly enough revenue to pay for its operating costs; the District's operating ratio has varied from 1.06 to 1.25 over the past six years. Table 10-1 indicates that the District was able to cover cash operating expenses for the entire six-year period.
- Days of cash on hand is a measure of financial security, quantifying how long the District would be able to fund daily operations if it received no additional revenue. While there is no firm minimum standard for this metric, bond rating agencies have recently expressed a preference for a minimum of 180 days of cash on hand for utilities seeking the highest bond ratings. The District has been able to maintain 208 – 301 days of cash on hand over the past six years.

Table 10-1
Historical Financial Performance (2019 – 2024) ($000s)

	2019	2020	2021	2022	2023	2024
Operating Revenues						
Water Sales	$ 1,475	$ 1,507	$ 1,627	$ 1,613	$ 1,773	$ 1,851
Penalties & Fees	25	6	0	17	21	27
Streetlight Revenue	28	28	28	27	28	28
Satellite Systems	2	2	1	2	2	2
Port of Manchester	18	10	14	16	20	18
Rental Revenue	40	69	63	51	54	54
Meter Installation Fee	32	23	60	50	82	14
Developer Extension Income	1	-	-	-	-	-
Miscellaneous Revenue	15	2	-	9	16	31
Investment Interest	3	1	0	1	4	5
OPERATING REVENUES	**$ 1,639**	**$ 1,648**	**$ 1,794**	**$ 1,787**	**$ 2,000**	**$ 2,030**
General Facilities Charge	90	63	156	139	280	44
Local Facilities Charge	20	16	39	33	57	10
TOTAL REVENUES	**$ 1,748**	**$ 1,726**	**$ 1,989**	**$ 1,960**	**$ 2,337**	**$ 2,084**
Operating Expenses						
Human Resources	$ 766	$ 828	$ 822	$ 852	$ 1,048	$ 1,043
Professional Services	24	16	22	17	27	23
AWWA Conference	-	-	-	-	-	6
Election Costs	-	-	13	-	6	-
Administrative	230	221	244	264	319	306
Operations & Maintenance	221	352	270	330	382	360
Streetlights	22	21	23	23	19	23
Satellite Systems	0	1	0	0	0	0
Port of Manchester	19	12	14	4	7	5
Rental Expense	3	0	-	-	-	-
Developer Extension Payback	1	-	-	-	-	-
Fleet & Equip. / Capital Outlay	146	33	28	69	73	40
OPERATING EXPENSE	**$ 1,433**	**$ 1,483**	**$ 1,435**	**$ 1,560**	**$ 1,882**	**$ 1,805**
Capital Expenditures	390	89	137	360	289	237
TOTAL EXPENSE	**$ 1,823**	**$ 1,571**	**$ 1,572**	**$ 1,920**	**$ 2,171**	**$ 2,042**
Income Before Debt Service	**$ (75)**	**$ 155**	**$ 417**	**$ 40**	**$ 166**	**$ 42**
Debt Service	102	101	100	99	98	97
Net Income	**$ (176)**	**$ 54**	**$ 317**	**$ (59)**	**$ 68**	**$ (55)**
Operating Ratio	**1.14**	**1.11**	**1.25**	**1.15**	**1.06**	**1.12**
Ending Fund Balance	**$ 814**	**$ 875**	**$ 1,183**	**$ 1,130**	**$ 1,203**	**$ 1,155**
Days of Cash on Hand	**208**	**215**	**301**	**264**	**233**	**234**

10.3 Capital Funding Resources

Other than cash financing, the District may fund the capital improvement plan (CIP) from a variety of sources, described in further detail below.

10.3.1 Government Programs

Federal and state grant programs were historically available to local utilities for capital funding assistance including recent programs tied to the American Rescue Plan Act of 2021 (ARPA) and the Infrastructure and Investment Jobs Act of 2023. However, these assistance programs have either ended or have been substantially reduced in scope and amount, or replaced by loan programs. Remaining grant programs are generally lightly funded and heavily subscribed. Nonetheless, even the benefit of low-interest loans makes the effort of applying worthwhile. Appendix S provides a summary of these programs prepared by the Washington State Department of Commerce.

10.3.2 Debt Financing

Revenue Bonds

Revenue bonds provide a means of funding capital improvements that exceed a utility's financial resources. They are secured only by utility revenues, while other bonds (e.g. general obligation bonds) can have additional security in the form of a pledge of tax revenues or other resources. With this limited commitment, revenue bonds normally bear higher interest rates than other types of debt and also require additional security conditions intended to protect bondholders from default risk. These conditions may include the maintenance of dedicated reserves and minimum standards of financial performance (e.g. bond debt service coverage).

Revenue bonds can be issued in Washington State without a public vote. While there is no explicit statutory bonding limit, the conditions that come with revenue bonds often impose practical limits on a utility's level of indebtedness. An excessive debt burden may reduce a utility's flexibility to phase in rate increases, also resulting in a higher overall cost of capital investment given the related interest payments. It is worth noting that bond rating agencies also consider a utility's debt service coverage when assigning a rating – higher levels of indebtedness make it more difficult for a utility to meet the coverage ratios that the rating agencies require for the highest ratings (and the lowest interest rates).

Connection Charges

The District imposes a general facilities charge (GFC) and a local facilities charge (LFC) on new development as a condition of connecting to its water system. For a typical new service connection with a 3/4" meter, the GFC is $6,910, and the LFC is $1,725 (based on typical lot size and front footage). These charges are "connection charges" authorized by RCW 57.08.005 (11) as a means of recovering an equitable share of the cost of utility infrastructure from growth. The GFC and LFC promote equity between new and existing customers, also providing a source of cash funding for the District's capital needs and related debt repayment.

10.4 Current Revenue

The primary goal of the financial analysis is to develop a multi-year rate strategy that generates enough revenue to cover the District's operating and capital costs. This study focuses on defining the amount of revenue needed to meet the system's financial obligations including:

- Operation and maintenance costs
- Administrative and overhead costs
- Policy-based needs (e.g. reserve funding)
- Capital costs
- Existing/new debt service obligations

As the District operates as an enterprise, it relies on revenue from its water rates (as opposed to taxes or other external resources) to cover the expenses outlined above. The financial analysis examines the District's ability to fund its CIP and other financial needs while maintaining affordable water rates. It is a comprehensive analysis that includes both operating and capital elements:

- The revenue requirement analysis determines the amount of revenue necessary to fund the ongoing operation, maintenance, and administration of the utility on an annual basis, focusing specifically on the needs funded from operating revenues. It includes a framework of fiscal policies intended to promote long-term financial stability and viability.
- The capital funding plan develops a funding strategy for the CIP that considers rate revenues, existing reserves, connection charges, debt financing, and any other anticipated resources (e.g. grants, developer contributions, etc.). The plan can impact the revenue requirement analysis through the use of debt financing (resulting in annual debt service) and capital funding embedded in rates.

10.4.1 Financial Policies

The ensuing discussion summarizes the key financial policies used in this analysis.

Utility Reserves

Reserves are a key component of any utility financial strategy, as they provide the flexibility to manage variations in costs and revenues that could otherwise have an adverse impact on ratepayers. For the purpose of this analysis, resources are separated into the following reserves:

- Operating Reserve: This reserve provides an unrestricted fund balance to accommodate the short-term cycles of revenues and expenses and is intended to address variations in revenues and expenses, whether anticipated (e.g. billing/receipt cycles, payroll cycles) or unanticipated (e.g. weather, economic conditions). This analysis assumes a minimum balance for this reserve equal to 60 days of operating expenses, which is approximately $313,000 given the 2025 Budget.
- Capital Reserve: This reserve provides a source of cash for unanticipated capital expenditures such as emergency asset replacements or capital project overruns. In the context of the financial analysis, it also enforces an appropriate segregation of resources that are restricted (or otherwise designated) for capital purposes including ongoing infrastructure renewal and replacement. This analysis assumes a minimum balance equal to 1 percent of the original cost of system assets, which is approximately $104,000 in 2025.
- Debt Reserve: The District currently does not have any outstanding debt that requires a debt reserve. However, if the District were to issue bonds in the future, the bond covenants could establish reserve requirements as a means of protecting bondholders against the risk of nonpayment. These reserves are typically funded at the time of borrowing as part of the debt principal.

Financial Performance Standards

The revenue requirement analysis uses a pair of sufficiency tests to establish the amount of revenue needed to meet the District's financial obligations on an annual basis.

- Cash Flow Test: To satisfy this test, operating revenues must be adequate to fund all known cash requirements including O&M expenses, debt service, the Fleet and Equipment Replacement Program (and other rate-funded capital outlays), and reserve funding.
- Coverage Test: Intended to ensure compliance with the District's bond covenants, which would typically require that the District's net revenue is greater than or equal to 1.25 times annual parity debt service. The District does not currently have, nor is it projected to have any debt service requiring coverage.

The annual revenue requirement is broadly defined as the amount of revenue needed to satisfy both these tests. Short-term cash flow deficits may occur as part of a strategy to phase rate increases in, as long as the utility has sufficient reserves on hand to absorb them. The financial analysis assumes that the debt service coverage requirement must always be met.

Capital Funding Plan

As shown below in Table 10-2, the ten-year CIP includes $15.8 million in expenditures from 2025 through 2035 (2025 dollars). Adjusting for inflation at a rate of 4.0 percent per year, the total projected 2025 – 2035 capital expenditures increase to $21.2 million.

Table 10-2 indicates that the District's cash resources (including existing cash balances, interest earnings, capital funding contributions funded by rates, and GFC and LFC revenues) will not be adequate to cover the projected capital costs. The ten-year capital funding strategy includes $10.8 million in PWTF loan funding – $816,000 for the Well 10 Filtration Project spread across 2025 and 2026, $10.0 million for the South 430 Zone to 500 Zone Conversion Project spread across 2032 to 2034, and a $3.3 million loan for the Sedgewick Road Transmission Main spread over 2035 and 2036. This strategy anticipates cash-funding 41 percent of the ten-year CIP.

Table 10-2
Capital Improvement Plan ($000s)

Year	Projected Capital Costs			Projected Capital Funding		
	Base Estimate (2025 $)	Adjustment for Inflation	Projected Costs	Cash	Loan Proceeds	Total
2025	$ 552	$ -	$ 552	$ 152	$ 400	$ 552
2026	800	32	832	416	416	832
2027	510	42	552	552	-	552
2028	200	25	225	225	-	225
2029	200	34	234	234	-	234
2030	608	132	740	740	-	740
2031	713	189	902	902	-	902
2032	1,658	524	2,182	263	1,919	2,182
2033	3,846	1,418	5,264	274	4,990	5,264
2034	4,220	1,786	6,006	2,915	3,091	6,006
2035	2,506	1,203	3,709	2,110	1,599	3,709
Total	**$ 15,813**	**$ 5,385**	**$ 21,198**	**$ 8,783**	**$ 12,415**	**$ 21,198**

10.4.2 Revenue Requirement

The revenue requirement analysis evaluates the District's ability to cover its projected costs under its currently adopted rates. In the event of any projected deficiencies, this analysis will serve as the basis for a strategy of recommended rate adjustments.

Projected Financial Performance

The revenue requirement analysis is developed from the District's 2025 Budget along with other assumptions. Some of the key assumptions include:

- The rate revenue forecast is based on 2024 actuals provided by the District, adjusted for customer growth at a rate of approximately 0.26 percent (10 equivalent residential units) per year based on input from District staff.
- The operating forecast generally holds most of the District's non-rate revenues at the budgeted 2025 levels moving forward, with the following exceptions:
  - Interest earnings are calculated on the District's projected fund balances, assuming an interest earnings rate of 3.0 percent.
  - Meter installation fee revenues are estimated based on the projected growth in equivalent residential units and the District's prevailing meter installation charge.
- The forecast of operating expenses adjusts the budgeted 2025 expenses for inflation as follows:
  - General Cost Inflation: 3.5 percent per year
  - Construction Cost Inflation: 4.0 percent per year

  - Salaries/Wages: 3.5 percent per year
  - Employee Benefits: 4.5 percent per year
- These escalators are based on input received from District staff, considering historical escalation of the Consumer Price Index, the Washington Economic and Revenue Forecast Council's March 2025 Economic Forecast Summary, the Engineering News Record (ENR) Construction Cost Index, and the Employment Cost Index.
- Taxes are calculated based on the projected revenues and prevailing rates:
  - State Excise Tax (Water Distribution): 5.029 percent.
  - Business & Occupation (B&O) Tax: 1.5 percent (the District is projected to have less than $1 million per year of revenue subject to the B&O tax, so the workforce education surcharge of 0.25 percent does not apply).
- The District's debt schedules indicate a total payment of about $96,000 in 2025; the annual payments for the 2005 and 2011 PWTF loans decrease over time as the District pays off its outstanding debt.

Table 10-3 summarizes the District's projected financial performance and rate revenue requirements based upon the above assumptions. It indicates that the District's existing rates are inadequate to cover operating expenses and debt repayment obligations for the 2025 – 2035 planning period, and rate increases will be needed for the following reasons:

- ***Fund capital projects.*** Table 10-2 shows the District funding about $8.8 million of capital improvement projects through cash resources over the ten-year forecast period, $7.4 million of which will need to come from rates between 2026 and 2035. This equates to an average of approximately $738,000 per year of capital funding needed from rates, which after adjusting for additional taxes will require a cumulative rate increase of about 42 percent by 2035.
- ***Covering new debt service.*** As noted above, the forecast assumes that the District will receive PWTF loans for three projects during the 2025 – 2035 planning period (Well 10 Filtration Project, South 430 Zone to 500 Zone Conversion, Sedgwick Road Tank Transmission Main). Based on the projected draws of proceeds from these loans, the District's annual debt service payments are projected to be around $822,000 by 2035 and are expected to reach $1 million by 2037. Adjusting for additional taxes, this new debt will require a cumulative rate increase of 41 percent by 2035.
- ***Keeping up with increasing operating costs.*** Based on the assumed inflation rates noted above, the District's operating expenses are projected to increase by 3.5 – 4.5 percent per year while rate revenue (at existing rates) increases by only 0.26 percent per year. By 2035, expenses will have grown by about 37 percent while sales revenue will only have grown by 3 percent without rate increases. Accounting for additional taxes on the revenue raised through the projected rate increases, this difference requires a cumulative rate increase of 38 percent by 2035.

Table 10-3
Projected Financial Performance & Revenue Requirements ($000s)

	2025	2026	2027	2028	2029	2030	2031	2032	203
Revenue									
Rate Revenue @ Existing Rates	$ 1,855	$ 1,860	$ 1,864	$ 1,869	$ 1,874	$ 1,879	$ 1,884	$ 1,889	$ 1,8
Non-Rate Revenues	155	155	159	156	160	161	161	162	
Total Revenue	**$ 2,010**	**$ 2,014**	**$ 2,024**	**$ 2,025**	**$ 2,034**	**$ 2,040**	**$ 2,045**	**$ 2,051**	**$ 2,0**
Expenses									
Cash Operating Expenses	$ 1,903	$ 1,931	$ 2,013	$ 2,073	$ 2,150	$ 2,214	$ 2,289	$ 2,366	$ 2,4
Existing Debt Service	96	44	43	42	41	41	40	-	
New Debt Service	-	16	59	59	58	57	56	93	3
Fleet & Equipment / Capital Outlay	178	62	-	157	70	61	63	66	
Total Expenses	**$ 2,177**	**$ 2,053**	**$ 2,115**	**$ 2,331**	**$ 2,319**	**$ 2,373**	**$ 2,448**	**$ 2,525**	**$ 2,8**
Net Cash Flow @ Existing Rates	**($ 167)**	**($ 39)**	**($ 92)**	**($ 306)**	**($ 284)**	**($ 333)**	**($ 403)**	**($ 474)**	**($ 7**
Annual Rate Adjustment	**0.0%**	**10.5%**	**10.5%**	**10.0%**	**9.0%**	**9.0%**	**9.0%**	**9.0%**	**9.**
Cumulative Rate Adjustment	**0.0%**	**10.5%**	**22.1%**	**34.3%**	**46.4%**	**59.6%**	**73.9%**	**89.6%**	**106.**
After Rate Increases:									
Rate Revenues	$ 1,855	$ 2,055	$ 2,277	$2,511	$2,744	$2,999	$3,277	$3,581	$ 3,9
Net Cash Flow	($ 167)	$ 147	$ 300	$ 303	$ 542	$ 730	$ 920	$1,133	$ 1,1
Ending Operating Fund Balance	$ 333	$ 476	$ 356	$ 511	$ 530	$ 546	$ 564	$ 583	$ 6
Ending Capital Fund Balance	473	161	121	133	513	589	693	1,650	2,6
Total Ending Balance	$ 806	$ 637	$ 477	$ 644	$ 1,043	$ 1,135	$ 1,257	$ 2,233	$ 3,2
Combined Minimum Balance	$ 417	$ 430	$ 449	$ 461	$ 476	$ 494	$ 515	$ 549	$ 6
Surplus (Deficit)	$ 389	$ 207	$ 28	$ 183	$ 567	$ 641	$ 742	$ 1,684	$ 2,6

Under the phasing strategy shown in Table 10-3, the District is projected to draw its Operating Fund balance down to a minimum of approximately $333,000 (64 days of operating expenses) in 2025. The forecast shows the District remaining above 60 days of operating expenses from 2026 through 2035. The forecast shows that higher rate increases are needed in 2026 and 2027 to meet the minimum reserve target at the end of 2027. The longer-term forecast shows that with a strategy of 9.0 percent annual rate increases, the District will end 2035 with only about $50,000 more than the combined reserve target.

It is important to note that these financial projections are based upon current assumptions and the current capital program. Circumstances might change over time, causing the actual rate adjustments needed to be higher or lower than projected once actual costs are known. It would be prudent for the District to monitor its financial status regularly, revisiting the analysis periodically or in the event of significant changes to the assumptions outlined above.

10.4.3 Current and Projected Rates

The District's current water rate structure consists of a bimonthly fixed charge and an inclining-block volume rate for all customers. This structure is consistent with the Washington State Department of Health's recommendations in Section 9.6.2 of the Water System Planning Guidebook – supporting water use efficiency (conservation rates). Table 10-4 presents a forecast of the District's water rates, applying the rate adjustments shown in Table 10-3 uniformly to the District's existing charges.

Table 10-4
Bimonthly Rate Forecast

	Annual Rate Increase	Base Charge per Account	Consumption Charge per Hundred Cubic Feet (HCF)			
			0 – 8 HCF	8 – 30 HCF	30 – 60 HCF	> 60 HCF
2025		$45.50	$2.75	$3.45	$4.89	$5.98
2026	10.5%	$50.28	$3.04	$3.81	$5.40	$6.61
2027	10.5%	$55.56	$3.36	$4.21	$5.97	$7.30
2028	10.0%	$61.12	$3.70	$4.63	$6.57	$8.03
2029	9.0%	$66.62	$4.03	$5.05	$7.16	$8.75
2030	9.0%	$72.62	$4.39	$5.50	$7.80	$9.54
2031	9.0%	$79.16	$4.79	$6.00	$8.50	$10.40
2032	9.0%	$86.28	$5.22	$6.54	$9.27	$11.34
2033	9.0%	$94.05	$5.69	$7.13	$10.10	$12.36
2034	9.0%	$102.51	$6.20	$7.77	$11.01	$13.47
2035	9.0%	$111.74	$6.76	$8.47	$12.00	$14.68

Affordability

The Washington State Department of Health and the Public Works Board have historically used an affordability index to prioritize low-cost loan awards. The typical threshold looks at whether a system's rates exceed 2.5 percent of median household income (MHI) for the demographic area – if monthly bills are below this level, they are generally considered affordable. U.S. Census Bureau data indicates that the MHI

in the Manchester Census Designated Place (CDP) was $108,242 in 2023 dollars. Table 10-5 summarizes the affordability evaluation of the District's rates for the ten-year planning period, using the 2023 estimate of MHI escalated by annual inflation of 3.5 percent.

Table 10-5
Affordability Assessment

Year	Inflation	Median HH Income[1]	Projected Bimonthly Bill[2]	Percent of Median HH Income
2025	3.50%	$116,000	$88.20	0.46%
2026	3.50%	$120,000	$97.46	0.49%
2027	3.50%	$124,000	$107.70	0.52%
2028	3.50%	$129,000	$118.50	0.55%
2029	3.50%	$133,000	$129.16	0.58%
2030	3.50%	$138,000	$140.74	0.61%
2031	3.50%	$143,000	$153.48	0.65%
2032	3.50%	$148,000	$167.28	0.68%
2033	3.50%	$153,000	$182.35	0.72%
2034	3.50%	$158,000	$198.73	0.75%
2035	3.50%	$164,000	$216.62	0.79%

Notes:
1) Median Income Data: US Census Bureau, 2023 ACS 5-year estimate.
2) Assumes 14 HCF of bimonthly usage.

Table 10-5 suggests that the District's rates are and will remain within the affordability index threshold of 2.5 percent of median household income during that period. In addition, the District's customer assistance program currently includes the following elements:

- Working with customers on payment arrangements if bills cannot be paid on time. Though the District does not offer formal payment plans, customers can avoid additional fees and charges by maintaining communication with the District.
- The District's website links to information on "helpful tips and tricks" for customers to conserve water and lower the consumption portion of their water bills.
- Customers that purchase and install water-efficient washing machines, dishwashers, or toilets can request a rebate from the District.
- Customers who see a significant increase in their water bill due to a leak may apply once every three years for an adjustment to their water bill. They must apply within 60 days of discovering the leak and affirm that they have fixed the leak.

Conclusion

The revenue requirement analysis indicates that the District needs to increase its water rates to keep up with operating costs, cover projected debt service payments, and generate cash funding for capital investment. The recommended rate strategy envisions annual rate increases of 10.5 percent in 2026 and 2027, followed by an annual rate increase of 10.0 percent in 2028, and annual rate increases of 9.0 percent from 2029 – 2035. Even with these increases, the average residential bill is expected to remain well within the affordability index threshold of 2.5 percent of median household income. It would be prudent for the District to regularly monitor its financial position, revisiting the key underlying assumptions to ensure that the utility's revenues remain sufficient to meet its financial obligations.

APPENDICES