Water District No.49

WATER SYSTEM PLAN

FEBRUARY 2019

CHS ENGINEERS

Water District No.49

WATER SYSTEM PLAN

FEBRUARY 2019

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This plan was prepared under the direction of a Registered Professional Engineer.

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INTRODUCTION

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INTRODUCTION

This report presents the results of studies that have been used to develop the 2019 Water System Plan (WSP) for King County Water District No. 49. This plan updates the 2017 WSP in response to comments provided by the State Department of Health, Seattle Public Utilities and King County. The update also extends the 20-year planning period by two years and updates the analysis and plan for a new water storage facility. The plan outlines the projected needs for the District and recommends capital improvement and financial programs to adequately provide for all aspects of supply, storage, treatment and distribution of water to the District's customers.

The plan has been prepared for compliance with applicable requirements of the State of Washington Department of Health and King County. The plan was prepared in accordance with WAC 246-290-100, WAC 246-293-230 and RCW 43.20 and 57. This plan supersedes all previous Water System Plans adopted by the Board of Commissioners of King County Water District No. 49.

The purpose of this study is to create a Water System Plan which will identify facilities and improvements necessary to serve the District for the present and reasonably foreseeable future. Some of the principal objectives of this plan are as listed below.

- Provide a comprehensive evaluation of existing and future system needs.
- Provide details of the District's policies to customers.
- Provide information to help educate customers on District needs.
- Minimize public health risks for customers.
- Maintain reliable delivery of high quality water.
- Make efficient use of available resources.
- Help assure orderly growth of the system.
- Provide documentation for water rates, plus grant and loan requests.
- Develop strategies for complying with the Safe Drinking Water Act and other requirements.
- Develop consistency between the District's planning efforts and local land use plans.

The plan addresses the following elements:

- Basic water system planning data;
- Existing system analysis;
- Planned improvements;
- Conservation program;
- Financial program;
- Relationship and compatibility with other plans, including local growth management plans and development policies;
- Operation and maintenance program;
- Ownership and management;
- State Environmental Policy Act;

The District purchases all of its water supply from Seattle Public Utilities. Therefore, a watershed control program is not required for this system.

The following abbreviations are used in this Water System Plan:

ADD	Average Daily Demand
CIP	Capital Improvement Program
CWA	Cascade Water Alliance
CCCP	Cross Connection Control Plan
cfs	Cubic feet per second
DEM	Developer Extension Manual
ERU	Equivalent Residential Unit
FAZ	Forecast Analysis Zone
gal	Gallon(s)
gpd	Gallons per day
g/d/conn	Gallons per day per connection
gpm	Gallons per Minute
HWD	Highline Water District
ccf	Hundred Cubic Feet
WD 49	King County Water District No. 49
WD 20	King County Water District No. 20
WD 45	King County Water District No. 45
WD 85	King County Water District No. 85
WD 125	King County Water District No. 125
LID	Local Improvement District
MDD	Maximum Daily Demand
MSL	Mean Sea Level
mgd	Million Gallons per Day
ppm	Parts per million
PHD	Peak Hourly Demand
PSRC	Puget Sound Regional Council
RCW	Revised Code of Washington
SDWA	Safe Drinking Water Act
SPU	Seattle Public Utilities
SEPA	State Environmental Policy Act
ULID	Utility Local Improvement District
WAC	Washington Administrative Code
DOH	Washington State Department of Health
OFM	Washington State Office of Financial Management
WFI	Water Facilities Inventory
WSCP	Water Shortage Contingency Plan
WSDM	Water System Design Manual
WSP	Water System Plan

CHAPTER 1 – DESCRIPTION OF WATER SYSTEM

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CHAPTER 1

DESCRIPTION OF WATER SYSTEM

1.1 OWNERSHIP AND MANAGEMENT

King County Water District No. 49 (District) is a municipal Group A Water System serving an urban area in southwestern King County (see Figure 1-1). The Water District is a public system formed and operating under RCW 57, dedicated to providing reliable and safe drinking water to residential and commercial customers in its service area. The system is regulated by the Washington State Department of Health (DOH) and is formally identified as:

King County Water District No. 49
System ID No. 39800P

A copy of the current Water Facilities Inventory (WFI) is included in Appendix A.

The daily operation of the Water District is under the direction of the Superintendent who reports directly to the District's Board of Commissioners. There are three positions on the Board and each Board Member must be a resident of the District.

1.2 AUTHORIZATION

Recognizing the need for establishing a uniform process to identify present and future District needs and setting forth a means for meeting those needs in an efficient manner, the Board of Commissioners has authorized CHS Engineers, LLC to proceed with the studies required to prepare this 2019 Water System Plan.

This plan brings together information on the existing system and data from future projections into an organized document. This document will be used for planning and prioritization of improvements within the District's water service area. A general summary of changes made to the 2017 Water System Plan is included in Appendix N.

1.3 SYSTEM BACKGROUND AND CHARACTERISTICS

1.3.1 Historical Water System Development

The Lake Burien area developed in the late 1800's as a farming and logging community. In the early 1900's, travelers would arrive by steamboat at Three Tree Point and make their way to the Lake Burien area resorts. This scenic rural setting became a prime resort area for the elite families of Seattle and Tacoma.

In late 1933, the first Commissioners were chosen for a new water district in the Lake Burien area. The new district would provide adequate and constant water pressure for fire protection and replace the many small existing systems, most of which were in need of repair. By September 1936, grants and LID bonds equaling approximately $240,000 were obtained for the construction of the water system.

The District operated independently with wells and elevated storage tanks until 1958 when the District began purchasing water from the Seattle Water Department, now known as Seattle Public Utilities (SPU). Over time, the elevated tanks were no longer required and were removed.

The area and the water system grew slowly until the boom of the defense industry during World War II. During the 1940's, the area's population tripled and then doubled again during the 1950's. Slowdowns at Boeing during the 1970's resulted in a small population drop. However, growth quickly returned at around one to two percent and has continued through the end of the century.

In the early 1980's, the District investigated the possibility of development of a new well water source in response to the introduction of demand metering charges by SPU. In 1988 as part of negotiations with the SPU, the District relinquished its water rights, abandoned its plans for a well and completed construction of a 500,000 gallon storage tank and booster station.

In 2011, the District and SPU completed negotiations for a new long-range water supply contract, to replace the supply contract scheduled to expire at the end of 2011. The new contract, effective May 5, 2011 continues through January 1, 2062. Periodic review and mutual revision is allowed in 2021 and 2041. The contract provides for the District's full water requirement for the term of the contract.

1.3.2 Topography

The District's service area encompasses approximately 2,136 acres of land. The local topography is comprised of predominantly gentle slopes with elevations ranging from 85 to 425 feet above sea level. The southwestern portion of the District slopes somewhat steeply toward the Puget Sound. The general Seattle metropolitan region is surrounded by the Olympic and Cascade Mountains, protecting it from the continental cold air and ocean storms.

1.3.3 Climate

The climate in Water District No. 49 is typical of the Puget Sound region. The Pacific Ocean air masses are relatively mild, producing moderate summer and winter temperatures. Local precipitation is generally heavy in the winter, moderate in the fall and spring, and light in the summer. The average annual amount of rainfall is 38.3 inches with winter averages of about 5.25 inches per month and summer averages of about 1.10 inches per month. The average annual air temperature is about 59.3°

Fahrenheit (F) with average high and low winter temperatures of 46.3° F and 35.8° F, respectively, and average high and low summer temperatures of 73.0° F and 53.5° F, respectively.

Climatic data used in this report was obtained from the Western Regional Climate Center division of the Atmospheric Sciences Center of the Desert Research Institute. The institute maintains records from SeaTac International Airport, located just east of the District.

1.3.4 Surface Waters

The District lies close to the eastern shore of Puget Sound. The lowest District elevation is approximately 85 feet above sea level and therefore it is assumed that Puget Sound poses no potential threat of flooding the service area. Lake Burien lies within the boundaries of the District. The lake is a fresh water lake and is fed by ground water and local surface runoff. The lake poses no potential threat of flooding the service area.

1.3.5 Neighboring Purveyors

The District serves a portion of the urban area that extends from Seattle to Tacoma. The District is bounded by King County Water District No. 20 to the north, northwest and east, King County Water District No. 125 to the east and by Highline Water District to the south and southwest. In addition, the District shares a portion of its southeastern boundary with the Port of Seattle's SeaTac Airport. Figure 1-2 shows the District's Retail Service Area (service area) and the adjacent water purveyors. Except for a number of parcels which are within the corporate boundary of one district but served by the neighboring district, the corporate boundary is the same as the service boundary.

1.3.6 Ordinances

The Board of Commissioners initiates, reviews and formally adopts resolutions pertaining to the regulations and operations of the District, consistent with authority granted to Districts by RCW 57. These resolutions are on file at the District office.

1.4 INVENTORY OF EXISTING FACILITIES

The District's existing water system is shown in Chapter 3 and includes the following facilities and connections.

1.4.1 Sources

The District's initial source of supply was a combination of local wells which supplied elevated reservoirs. However, these wells have since been replaced by water supplied from the Tolt and Cedar Rivers. Water from these rivers is purchased by the District

from SPU and is obtained through five direct connections to SPU's regional distribution system.

SPU's regional distribution system in the area of the District provides water at two different hydraulic gradients. The District has connections to both of these hydraulic systems thus creating two main pressure zones within the District's service area. Further discussion with regard to the District's connections and the operation of the pressure zones is presented in Chapter 3.

1.4.2 Storage

In 1988 the District constructed a 500,000 above-grade gallon concrete storage reservoir and booster pump station facility. The reservoir is filled from the lower pressure zone during off peak hours, usually over night. Water is then pumped from the reservoir into the upper pressure zone system during periods of high demand, thus reducing the peak demands on SPU's regional supply system.

1.4.3 Distribution System

The District owns and maintains approximately 59.1 miles of water mains and 640 fire hydrants with related isolation valves, control valves and water services. The water mains and distribution piping within the District's water system is summarized in Chapter 3. Some water piping smaller than 4-inch diameter is plastic or galvanized iron pipe. Pipes 4-inches in diameter and larger are ductile iron or cast iron. The District has no asbestos cement (AC) pipe within its service area.

The District has had an established water main replacement program for many years. Elements of the updated program are shown in the Capital Improvement Program (CIP) in Chapter 8.

1.4.4 Booster Pump Station

All customers within the District's service boundary can receive water service directly from the connections to SPU's regional system with no additional pressure required. However, the District does maintain a booster station which was constructed in conjunction with the storage reservoir. This booster station is used to transfer water from the reservoir to the upper pressure zone during periods of high demand.

1.4.5 Connections

As of December 2018, there were approximately 4,209 residential, multi-family and commercial metered service connections to the water system. In most cases, multi-family connections include multiple units fed from one metered connection. As of the end of 2018, there were 391 multi-family connections which served approximately 3,540 individual units.

1.4.6 Interties

In addition to the five connections to SPU's regional supply system, the District maintains seven interties with two of the adjacent water districts. The District has five interties with King County Water District No. 20 and two interties with the Highline Water District. The location and status of these interties are summarized in Chapter 3.

1.5 RELATED PLANS

The following is a list of planning documents, with a brief summary of each, that have been reviewed and that have an impact on the development of a Comprehensive Water System Plan for King County Water District No. 49.

A. King County Water District No. 49 Comprehensive Water System Plan, February 2017

This plan is the District's prior water system plan. The document provides data for historical conditions and provides insight on District changes through the development of past plans.

B. City of Burien Comprehensive Plan, revised December 2017

The City of Burien's Comprehensive Plan provides existing and future development planning data for a large portion of the District which lies within the City's boundary. Data includes growth rates, zoning and land use.

C. City of Normandy Park Comprehensive Plan, adopted January 2016

The City of Normandy Park's Comprehensive Plan provides existing and future development planning data for the southern area of the District which is within the City's boundary. Data includes growth rates, zoning and land use.

D. City of SeaTac Comprehensive Plan, updated December 2017

The City of SeaTac's Comprehensive Plan provides existing and future development planning data for a small portion of the District located just west of the Seattle-Tacoma airport. This area will be developed by the Port of Seattle including construction of the third runway and aviation support facilities. The City of SeaTac's proposed zoning and land use confirms this type of development in this area.

E. Seattle Public Utilities 2019 Water System Plan, July 2018

Seattle Public Utilities Water System Plan provides existing and future planning data relating to the District's source of supply and water quality. As the sole

supplier of water for the District and many other regional purveyors, SPU must plan for adequate facilities to meet future demands. This document was reviewed to insure the District's future demands would be met.

F. Water District No. 20 Water System Plan, July 2012, Amended September 2018

Water District No. 20 Water System Plan provides existing and future planning data relating to the District's source of supply and water quality.

G. Water District No. 125 Water System Plan, January 2018

Water District No. 125 Water System Plan provides existing and future planning data relating to the District's source of supply and water quality.

H. Highline Water District 2016 Comprehensive Water System Plan, March 2016

Highline Water District Comprehensive Water System Plan provides existing and future planning data relating to the District's source of supply and water quality.

I. Port of Seattle, Seattle-Tacoma International Airport Comprehensive Development Plan, Environmental Assessment, 2007

The Port of Seattle manages the Sea-Tac Airport and supporting facilities within the City of SeaTac. The airport operates and maintains its own water system as a direct customer of SPU.

1.6 COMMENTS FROM AGENCIES AND ADJACENT PURVEYORS

The February 2017 Plan, adopted March 22, 2017, was sent to the agencies indicated in Table 1.1 for review and comment. Their comments are included in Appendix I. The Statements of Consistency provided by each City are included in Appendix I.

A request for updated Statements of Consistency were sent to each City in January 2019. The February 2019 Plan was sent to the same agencies for review prior to adoption by the District.

TABLE 1.1
PLAN SUBMITTALS AND REVIEW COMMENTS

Organization	Mailing Address	Comments	
		YES	NO
Washington State Department of Health	Department of Health NW Drinking Water Operations 20425 72nd Ave S, Building 2, Suite 310 Kent, WA 98032-2358	X	
Seattle Public Utilities	Seattle Public Utilities P.O. Box 34018 Seattle, WA 98124-4018	X	
King County Dept. of Health	Eastgate Environmental Health 14350 SE Eastgate Way Bellevue, WA 98007		X
King County UTRC	King County UTRC Department of Natural Resources 201 South Jackson Suite 500, KSC-NR-0512 Seattle, WA 98104-3855	X	
City of Burien Planning	City of Burien Planning Dept. 400 SW 152nd Street, Suite 300 Burien, WA 98166		X (see note 1)
City of Normandy Park Planning	City of Normandy Park Planning Dept. 801 SW 174th Street Normandy Park, WA 98166		X (see note 1)
City of SeaTac Planning	City of SeaTac Planning Dept. 4800 South 188th Street SeaTac, WA 98188		X (see note 1)
King County Water District No. 20	King County Water District 20 12606 First Avenue South Burien, WA 98168		X
King County Water District No. 125	King County Water District 125 3460 S 148th Street, Suite 110 Tukwila, WA 98168		X
Highline Water District	Highline Water District P.O. Box 3867 Kent, WA 98032		X
King County Fire District 2	King County Fire Marshal 900 SW 146th Street P.O. Box 66029 Burien, WA 98166		X

Note 1 – The City had previously provided a Statement of Consistency (2017) An updated Statement was requested in January 2019.

1.7 EXISTING SERVICE AREA CHARACTERISTICS

The District's boundary encompasses an urban area containing mostly single and multi-family housing. A small portion of the District contains light industrial and commercial areas. The District serves five schools, elementary through high school, and one hospital, Highline Medical Center. Figure 1-3 illustrates the existing retail service area (service area) and City boundaries within the District. The District lies within the boundaries of three cities: the City of Burien (82.4%), the City of Normandy Park (10.1%) and the City of SeaTac (7.5%). Chapter 2 discusses land use in more detail.

1.8 FUTURE SERVICE AREA CHARACTERISTICS

The service area for the District has been fairly well established. The District is bound on all sides by Water District No. 20, Water District No. 125, the Highline Water District and the Port of Seattle (in the SPU/ Seattle Retail Service Area) as shown in Figure 1-2.

Since nearly all area is within the corporate limit of a water purveyor, there is little opportunity to increase the District's service area by annexation.

Some minor adjustments in service area are possible through interlocal service agreements between districts to address situations where one district can serve property in another district more efficiently or cost effectively. Also, mergers of districts, in part or in whole, are possible but at the present time, no merger negotiations are underway or contemplated for the near future.

Chapter 2 discusses the land use based on the current comprehensive plans of each city.

1.9 SERVICE AREA AGREEMENTS

Currently, there are no existing service area agreements between the District and any other purveyors.

1.10 SERVICE AREA POLICIES

Policies and requirements specific to the water service area are addressed in the District's resolutions which are on file at the District office. Water service provided by King County Water District No. 49 is limited to service within the service area boundary of the District. Any individual seeking service from the District who is outside the existing service boundary would be within the service boundary of an adjoining District. However, service may be provided by the District outside the existing service boundary

under the provisions of Title 57 RCW. The following is a brief summary of key service area policies.

1.10.1 Wholesaling Water

At this time, the only instances where wholesaling of water occurs is through interties with other districts under emergency situations. Specific agreements are drafted with each district receiving water from the Water District 49.

1.10.2 Wheeling Water

The District does not transfer water to other purveyors, other than per the terms of the existing intertie agreements.

1.10.3 Annexation

All land contiguous to the current District boundary is served or planned to be served by adjacent water systems. Future annexations are therefore unlikely.

1.10.4 Direct Connection and Satellite/Remote Systems

All new development within the District's corporate limits must connect to the District's water system. Service is available to all areas within the boundary; therefore, there is no need for satellite systems. There are no known self-supplied water users within the District's boundary. Property owners desiring water service must contact the District for water meter installation or a developer extension.

1.10.5 Design and Performance Standards

The District requires all water system designs to be prepared by a licensed professional engineer and to meet all local and State guidelines. The District's performance standards along with construction materials and methods are discussed in Chapter 7. Any water system extension or modification within the District's service area will be governed by District policies.

1.10.6 UGA and Water Service Extension

The District is entirely within existing King County designated urban growth areas.

For water service extensions, the proposed developer is solely responsible for all costs associated with expanding the water system beyond the District's present locations and/or capacities. The District may participate in costs based upon its own determination.

1.10.7 Oversizing

Developers and private property owners are responsible for system piping improvements along and through their property, and in some cases for some distance from their property, as necessary to provide the fire flow and domestic service to serve their development. Such improvements must also meet or exceed the capacity (i.e. pipe size) identified in the District's capital improvement plan. The developer is solely responsible for all costs associated with upgrading or extending the distribution system to meet the water demands of the proposed development. However, in cases where the District requires oversizing (i.e. installing pipes larger than required for the development, but appropriate to implement the District's capital improvement plan), the District may participate in the cost of oversizing.

1.10.8 Latecomers Agreements

Developers extending the District's water system may be eligible for a latecomer's agreement (i.e., reimbursement agreement) as allowed by RCW 57.22.020 and as described in the District's Developer Extension Manual. The term of the agreement is seven years.

1.10.9 Cross-Connection Control Policy

The District requires State-approved backflow devices installed on all potential sources of cross-connection. The design of cross-connection systems and the equipment used must be approved by the District prior to installation. The District adopted Resolution No. 05-1196, revising the Cross-Connection Control Standards in September 2005. A copy of the Cross Connection Control Plan is included in Appendix B.

1.11 CONDITIONS OF SERVICE

1.11.1 Duty To Serve

The State Municipal Water Law (RCW 43.20.260) provides water service conditions to be followed by water utilities of the State. Under this law, a municipal water supplier has "a duty to provide retail water service within its retail service area." WD 49 will provide water service to all the properties within its retail service area, which is the same as the District's future service area.

The District is committed to providing retail water service to all property within its retail service area in a timely and reasonable manner, consistent with applicable District resolutions and policies, the Municipal Water Law, Washington State Department of Health rules and regulations and other applicable federal, state and local laws. 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 retail water service area if:

- District water service can be available in a timely and reasonable manner.
- The District has sufficient water rights and other sources of supply to provide the service;
- The District has sufficient capacity to serve the water in a safe and reliable manner as determined by DOH; and
- It is consistent with the requirements of applicable comprehensive plans or development regulations adopted under Chapter 36.70A RCW (GMA) or any other applicable comprehensive plan, land use plan, or development regulation adopted by a city, town, or county for the service area.

The District will fulfill its "duty to serve" within its retail service area. The District will provide direct water service to all properties located within its retail service area in accordance with its adopted resolutions, policies and procedures.

The District defines "timely" as the availability of retail water service consistent with the terms and conditions in this Chapter and applicable District resolutions, policies and procedures. For example, the owners of properties which may directly connect to the District's existing water system without the need for the extension of that system as addressed by Developer Extension Policy should be able to obtain water service within 120 days after the District receives an application for a water meter and the property owner requesting water service has complied with all applicable District water service policies and procedures and has paid all applicable District meter, connection and administrative rates, fees and charges to the District. The owners of property which require the extension of the District's water system to make water service available to the property should be able to obtain water service following the owner's execution of an extension agreement with the District, preparation of a design of the extension required to connect the property to the District's existing water system by the owner's or the District's engineer and the approval of the extension design by the District, the construction of the extension by the owner's contractor, the owner's payment of all applicable District developer extension, meter, connection and administrative rates, fees and charges to the District, and the transfer of the ownership of the extension to the District by the property owner, all in accordance with the terms and conditions of the extension agreement and applicable District resolutions, policies and procedures.

The District defines "reasonable" retail water service as follows:
- Water service that is consistent with applicable local land use plans and development regulations;
- The conditions of water service and associated fees, costs and charges are consistent with the conditions of service described in this Plan and applicable adopted District resolutions, policies and procedures; and
- The conditions of service and associated fees, costs and charges are consistent with the District's requirements applied to other property owners requesting water service who are similarly situated and are requesting the same type or level of water service from the District.

1.11.2 Connection to System and Developer Extension Process

Developers or persons requesting service from the District must first request a Certificate of Water Availability. During the certification process, the District will determine if an extension of the District's system is required for the provision of service, and that determination may be dependent on the local fire official's requirements for fire protection. If a developer's extension (DE) is required, the Developer must purchase a DE Manual from the District. The manual outlines the developer extension process from the submittal of the application through completion of construction and warranty period. The key points in this process are listed below.

A. Application for Connection to Water System

Prior to entering into an agreement with the District, an applicant must complete an application form with attachments and submit it to the District with the applicable review fees. Upon receipt of the application, and recommendations by the District Engineer, the District Board of Commissioners determines:

1. If the District will proceed with an agreement and if there are any special requirements.

2. The required deposit to cover the District's anticipated costs associated with the extension.

B. Completion of Developer Extension Agreement

Upon the Board's approval, the applicant is notified to complete the Developer Extension Agreement and submit it with the estimated deposit, which will be applied toward all costs to be incurred by the District for inspection, engineering, legal, financial or other services performed by or for the District relating to this project. All additional District costs above the deposit amount will be charged to the developer.

Completion of the above step leads to engineering design and review, resulting in construction plans which are approved by the District Superintendent prior to construction.

C. Construction

All construction is monitored by the District's inspector and/or District personnel. Construction of the water system is required to meet all Water System Methods and Materials Standards as well as the standards of the applicable City and State agencies. Any contractor performing Developer Extension work must be acceptable to the District, and the Developer's insurance and bonding must meet the requirements outlined in the

Manuals. All connections must meet cross-connection control standards as outlined in the Water System's Cross Connections Control Plan.

The applicant is responsible for all costs including permits, design, review, construction, inspection, testing and all connection charges.

1.11.3 Applicable Fees and Connection Charges

The process of connecting to the District's system includes various fees and charges as shown below. The fees include administration fees, engineering fees, permit fees, recording fees, inspection fees and site facilities and general facilities charges. The amounts shown for items other than District general facilities charges are current as of January 2019 and may change by action of the Board of Commissioners. The District adopted updated general facilities charges in June 2017, effective August 1, 2017. The current charges, in the general order of occurrence, are as follows:

A. Certificate of Water Availability and Developer Extension Manual

$25.00 for Certificate of Water Availability. When requests for Certificates of Water Availability require engineering analysis or field testing to determine the available fire flow rate, the associated expenses will be included in the charge for the certificate.

$50.00 for copy of Developer Extension Manual and contracts.

B. Developer Extension Application Fee

Developer Extension Manual and Contracts: $1,000

C. Administration - Design/Review Fees

An extension for the provision of domestic water service (i.e. governed by Developer Extension Manual and Contracts) required payment to the District of a non-refundable $2,000 Developer Extension Fee. Additional deposits or payments may be required to cover other aforementioned extension-related District expenses.

D. General Facilities Charge

The District's current General Facilities Charges (GFC) shall be paid to the District by the Developer prior to provision of domestic water service for each metered connection and/or prior to provision of fire protection service for each metered or non-metered fire line connection in accordance with the DE manual and current District policy. The current Potable GFC is $2,450 per ERU. The current fire GFC is $850 per ERU.

The District's current General Facilities Charge (GFC) shall be paid to the District by the property owner or developer prior to connection to the water system. The GFC includes a charge per equivalent residential unit (ERU) for potable water and a charge per ERU for fire suppression capacity. The ERU count for the domestic GFC is based on the meter size for potable service. If the service to the property includes a fire suppression line that is supplied by the metered domestic service, the fire line ERU count is based on the domestic meter size. If the fire line is separate from the potable service, the fire GFC is based on the fire line size. The total GFC for a ¾ inch potable service without a separate fire line is $3,300.

The wholesale contract with SPU has provisions to allocate and recover asset costs for projects that add supply capacity, such as conservation, using either what is defined in the contracts as "Facilities Charges" or through wholesale water rates. The Seattle Regional Water Supply System Operating Board has elected to recover these costs through "Facilities Charges" based on number of ERUs added, and each water utility may recover those costs from its customers as it chooses. SPU's contract does not require that these costs be collected by new utility customers at the time of connection to the system. The District has elected to collect the SPU Facilities Charge from new connections as a direct pass-through charge. As of January 2019, the SPU Facilities Charge is $1,081 for a service with one inch or smaller meter.

The number of ERUs per connection are assigned by the required meter size as indicated below.

TABLE 1.2
GENERAL FACILITIES CHARGES*

Meter or Fire Line Size (in)	ERUs	Potable GFC	Fire GFC
¾	1	$2,450	$850
1	2	$4,900	$1,700
1.5	5	$12,250	$4,250
2	8	$19,600	$6,800
3	22	$53,900	$18,700
4	31	$75,950	$26,350
6	66	$161,700	$56,100
8	112	$274,400	$95,200
10	169	$414,050	$143,650
12	238	$583,100	$202,300

*Reference Resolution No. 17-1274 for full District GFC requirements.

Additionally, a Developer will be charged a Meter Upsize Fee when an existing meter is replaced with a large meter. The Meter Upsize Fee is calculated based on the net additional ERU's per connection.

E. Site Facilities Charge

The Site Facilities Charge is based on meter size and time and material costs for installation. In the event costs exceed the minimum charge, additional costs will be billed at current time and material rates. The current minimum charges are as follows:

TABLE 1.3
SITE FACILITIES CHARGES

Meter Size (in)	Charge
5/8x3/4	$800
1	$1,000
1.5	$1,750
2	$2,000
3	$4,500
4	$8,000
6	$18,000
8	$32,000
Larger than 8	TBD, but not less than the 8-inch meter charge

1.12 COMPLAINTS

Currently, all complaints pertaining to the District are referred directly to the District Superintendent. The Superintendent initially investigates all complaints and advises the Board of Commissioners if applicable. The District keeps records of complaints by noting the complaint on the billing system. In addition, complaints presented to the Board of Commissioners are noted in the minutes of the Board meeting.

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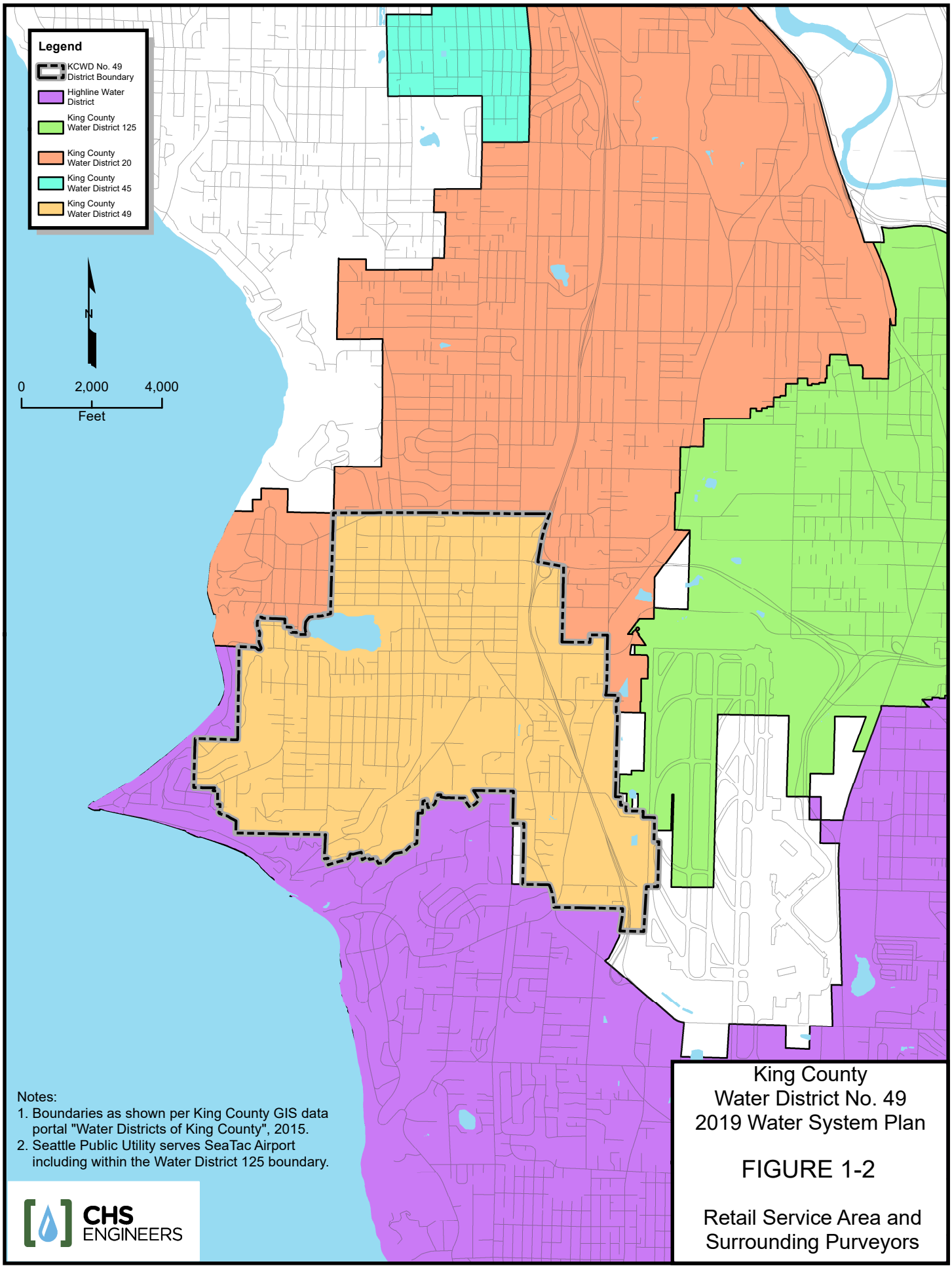
FIGURE 1-1

VICINITY MAP



Notes:
1. Boundaries as shown per King County GIS data portal "Water Districts of King County", 2015.
2. Seattle Public Utility serves SeaTac Airport including within the Water District 125 boundary.

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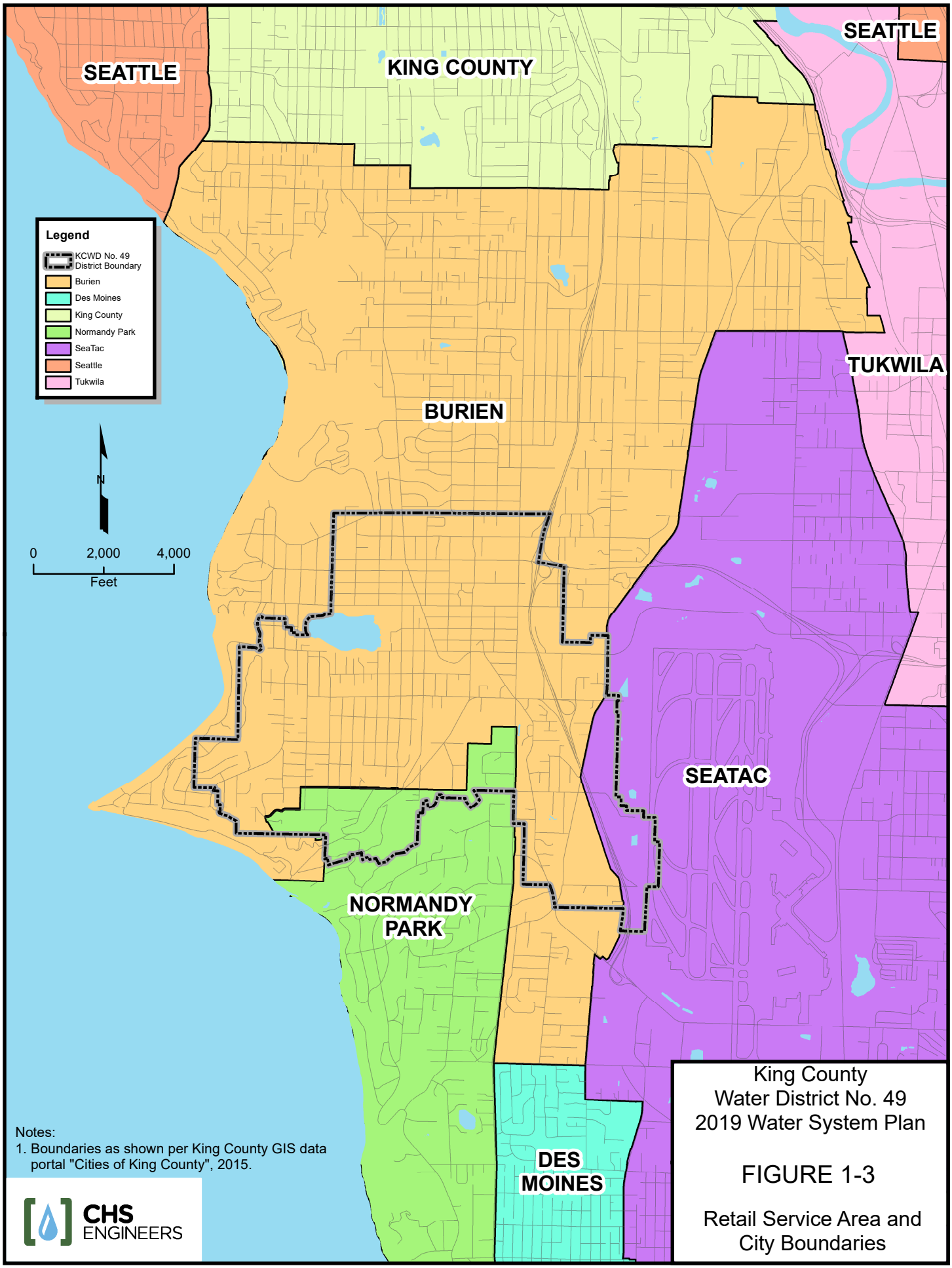
King County
Water District No. 49
2019 Water System Plan

FIGURE 1-2

Retail Service Area and Surrounding Purveyors


SEATTLE
KING COUNTY
SEATTLE
Legend
KCWD No. 49 District Boundary
Burien
Des Moines
King County
Normandy Park
SeaTac
Seattle
Tukwila
N
0
2,000
4,000
Feet
BURIEN
TUKWILA
SEATAC
NORMANDY PARK
DES MOINES
Notes:
1. Boundaries as shown per King County GIS data portal "Cities of King County", 2015.
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King County
Water District No. 49
2019 Water System Plan
FIGURE 1-3
Retail Service Area and City Boundaries

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CHAPTER 2 – BASIC PLANNING DATA

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CHAPTER 2

BASIC PLANNING DATA

This chapter presents basic planning data essential for the assessment of King County Water District No. 49's water system. In order to forecast future water demands it is necessary to evaluate the current state of the existing water system and to determine future needs based on foreseeable demographic trends over the next 20 years. This is accomplished by a study of the population trends and land use which may impact the capacity and placement of future system improvements.

The water system analysis includes the study of historical growth and water demands for the system and population projections based on current and future land use designations from the Cities of Burien, SeaTac, and Normandy Park. These projections are used to determine the potential population and ultimate development of the District's service area.

2.1 EXISTING CONDITIONS

The District covers approximately 3.32 square miles of mostly developed urban land located largely within the City of Burien with smaller portions located in the Cities of Normandy Park and SeaTac. The District's service area is primarily residential with localized commercial developments, including retail stores, shops, and restaurants. There are also some existing industrial and warehouse complexes within the service area. Figure 2-1 shows the existing land use within the District's boundary.

2.1.1 Current Residential Population

The District's service area encompasses a portion of the largely developed urban area of southwestern King County. Population projections have been prepared from source materials put forth by the United States Census Bureau, the Washington State Office of Financial Management (OFM), and the Puget Sound Regional Council (PSRC). None of the above sources identifies data that is specific to the District's service area. Therefore, an interpretation of the available data has been done to estimate the actual population served by the District.

The U.S. Census Bureau groups population information into census tracts. The District's service area covers portions of nine census tracts (274.00, 275.00, 276.00, 278.00, 279.00, 280.00, 284.02, 285.00 and 286.00). Figure 2-2 shows the census tracts within the District boundary.

The PSRC takes the census data and forecasts future population based on a specific set of criteria. The PSRC released an update to its package of long-range forecast products in April 2014. This release, Maintenance Release 1 (MR1), updates both of the future land datasets: the Land Use Baseline and the Land Use Targets. For the

purposes of this Plan, the Land Use Targets dataset was utilized, which is consistent with what the City of Burien used in their 2017 Comprehensive Plan Update. More information about forecast population can be found in Section 2.2.2.

Table 2.1 summarizes the areas and percentages of the census tracts within the District's boundary.

TABLE 2.1
PERCENTAGE OF THE CENSUS TRACTS
WITHIN DISTRICT BOUNDARY

Census Tract	Area[1], acres	Area in District, acres	% of Census Tract in District Boundary
274.00	822	11	1.4
275.00	551	51	9.2
276.00	1,027	26	2.5
278.00	907	404	44.5
279.00	868	796	91.8
280.00	518	177	34.3
284.02	2,057	58	2.8
285.00	867	390	45.0
286.00	2,065	210	10.2

[1]Information provided by Puget Sound Regional Council

The service area population was estimated by taking the percentage of the census tract within the District boundary and multiplying it by the estimated population for each census tract. Table 2.2 summarizes existing service area population for 2010.

Table 2.3 summarizes the historical population trends for the District from two different sources. Population data shown for the years 1990 and 2000 are based on population data from the US Census Bureau. Data shown for the years 2007 and 2010 are based on revised estimates put forth by the PSRC. The District's estimated population as of December 31, 2010 was 11,718 people.

TABLE 2.2
POPULATION FOR 2010

Census Tract	2010 Census Tract Population[1]	% of Census Tract in District Boundary	2010 Estimated Service Area Population
274.00	5,417	1.4	75
275.00	4,707	9.2	432
276.00	4,641	2.5	115
278.00	3,288	44.5	1,464
279.00	6,507	91.8	5,972
280.00	3,363	34.3	1,153
284.02	5,123	2.8	145
285.00	3,845	45.0	1,730
286.00	6,215	10.2	632
		Total Population	**11,718**
		Service Area, acres	**2,124**

[1]From estimates put forth by the PSRC (LUT-MR1, released April 2014)

TABLE 2.3
HISTORICAL POPULATIONS

Year	Total ERUs[1]	Total Population[2]	King County Population	County Population/ Household
1990	4,900	12,162	1,507,319	2.40
2000	6,921	12,923	1,737,044	2.39
2007	7,020	13,152	1,861,226	2.41
2010	7,055	11,718	1,931,249	2.39

[1] Equivalent Residential Units based on water use for single-family, multi-family and commercial customers.
[2] 1990 and 2000 population information from Census data

2.1.2 Total Service Connections

The District's current number of connections (December 2018) is 4,209 including residential (R), commercial (C) and irrigation (IRR and IRC). All connections are metered with meter sizes ranging from 5/8" for a typical single-family residence up to 10" for the Port of Seattle[1].

[1] The District provide potable water and fire suppression service to Port facilities/buildings situated west of the Sea-Tac Third Runway, as a direct retail service.

The District's billing system records accounts in three categories. Irrigation meters are included as subcategories of commercial account totals. For this Plan, all meters are considered to be capable of supplying full time water use. The number of service connections in each of the three categories as of December 2018 is:

Single Family Residence	3,204 (76%)
Multi-Family Residence	391 (9%)
Commercial/Industrial	614 (15%)
Total	4,209

2.1.3 Water Use Data Collection

The Washington State Department of Health's *Water Use Efficiency Guidebook* establishes data collection and reporting requirements.

Monthly reporting of quantities of water purchased from SPU is provided by SPU through monthly invoices. Individual customer service meters are read by District staff bimonthly, with approximately one half of the District meters being read each month. Readings are input into the District's billing system by office personnel who in turn generate monthly invoices.

The District has kept accurate water use records for many years and uses that information to establish consumption trends and forecast District water demands. The historical information is used in order to calculate future water system demands as required by SPU, the historical information about the water use (purchased versus sold) and the percentage of distribution system leakage or non-revenue water.

Table 2.4 shows the available historical information for WD 49 since 1993. Non-revenue water is the water that is the difference between what the District purchases and what they sell. This value is calculated each spring for the previous year. This amount includes water used for fire flows and water main testing.

Negative values for non-revenue water in the table are believed to be the result of inaccuracies of the SPU water meters. The volumes purchased in 2011 and 2012 are unusually high, resulting in high non-revenue water percentage. This purchased water data is likely erroneous due to meter issues. These meters were replaced in 2013.

TABLE 2.4
Historical Water Supply and Sales[1]

Year	WD 49 Water Purchased from SPU	WD 49 Water Purchased Wholesale[4]	WD 49 Water Sold Retail	Non-Revenue Water[2]	% Of Non-Revenue Water[3]
1993	478,733,083	-	500,257,531	(21,524,448)	(4.50)
1994	523,938,613	10,527,336	540,812,422	(6,346,473)	(1.21)
1995	532,633,221	10,833,289	543,794,157	(327,647)	(0.06)
1996	570,193,660	10,665,725	512,587,672	68,271,714	11.97
1997	515,658,425	7,027,949	515,731,735	6,954,639	1.35
1998	515,639,724	6,697,310	494,396,543	27,940,490	5.42
1999	512,690,903	5,079,273	500,044,336	17,725,840	3.46
2000	503,985,822	1,576,894	490,354,070	15,253,528	3.03
2001	461,281,777	-	458,457,881	2,823,896	0.61
2002	467,615,534	-	459,470,744	8,144,790	1.74
2003	457,797,351	[10]	482,505,509	(24,715,638)	(5.40)
2004	479,136,283	-	456,943,824	22,192,459	4.63
2005	439,473,069	-	453,259,668	(13,786,598)	(3.14)
2006	448,798,286	-	464,200,676	(15,402,391)	(3.43)
2007	476,432,823	-	450,755,190	25,677,633	5.39
2008	438,202,129	-	423,369,754	14,832,375	3.38
2009	440,687,158	-	429,299,562	11,387,596	2.58
2010	416,427,832	97,247	402,037,555	14,487,523	3.48
2011	477,451,670	-	401,314,189	76,137,481	15.95
2012	456,487,512	27,678	402,310,594	54,204,596	11.87
2013	421,033,588	36,655	401,828,849	19,241,394	4.57
2014	453,846,008		417,526,868	36,319,140	8.00
2015	467,871,725		428,339,956	39,531,769	8.45
2016	472,006,700		424,562,504	47,444,196	10.05
2017	450,857,748		423,521,340	27,336,408	6.06
2004-2017 Average % Non-Revenue Water					**5.66**
2007-2017 Average % Non-Revenue Water					**5.77**

[1]Water volumes are in gallons (gal).

[2]Non-revenue water is defined as all water not sold retail or wholesale. Discrepancies may occur with WUE information as this table includes all forms of authorized non-revenue consumption, not just system leakage.

[3]Percent Non-revenue water is a percentage of total water purchased. Averages do not include results for negative values or for years 2011 and 2012.

[4]Water purchased from and [sold to] to Highline Water District from 1993 through 2013 and Water District No. 20 from 2008 through 2013. Usage events were for planned maintenance activities where local supply was limited, and some usage is attributed to the PRV settings allowing intertie supply during local flushing conditions. The settings have since been refined.

2.1.4 Equivalent Residential Unit

An equivalent residential unit (ERU) is a unit of measure used to equate multi-family and commercial or non-residential water use to an equivalent amount of water consumed by a typical single family residence. The ERU amount changes each year based on the water usage for single family customers in a given calendar year.

Calculation of the District's historical ERU values for the period 1993 – 2017 is summarized in Appendix E. ERU values for 2002 – 2017 are shown in Table 2.5.

The District's water use data for single family residences since 2012 was evaluated. The average day demand (ADD) for single family residences was determined for each year in the period from 2002 through 2017. The average ADD per residential connection during this period is 169 gallons per ERU per day. For the ten year period 2008 through 2017, average usage was 158 gallons per ERU per day.

The value of 165 gpd/ERU was selected as the ADD for the District. The average value of 165 gpd/ERU is used because it is slightly higher than recent actual usage and it provides a small contingency for prudent forecasting. This value was then used to determine the equivalent number of residential units for multi-family and commercial customer classes. The results are shown as 2013 Adjusted data in Table 2.5 below and were used as the basis for the water usage forecast presented later in this chapter.

TABLE 2.5
ERU VALUES By Customer Type

Year, gpd/ERU, ERUs	Single Family	Multi-Family	Commercial	TOTAL
2002				
Average Use	189			
ERUs	3,143	1,757	1,761	6,661
2003				
Average Use	199			
Estimated ERUs	3,143	1,684	1,814	6,641
2004				
Average Use	190			
ERUs	3,047	1,708	1,826	6,581
2005				
Average Use	177			
ERUs	3,150	1,825	2,038	7,013
2006				
Average Use	196			
ERUs	3,201	1,667	1,622	6,490
2007				
Average Use	176			
ERUs	3,198	1,884	1,938	7,020
2008				
Average Use	161			
ERUs	3,274	2,050	1,880	7,204
2009				
Average Use	171			
ERUs	3,279	1,894	1,710	6,883
2010				
Average Use	156			
ERUs	3,263	1,999	1,793	7,055
2011				
Average Use	154			
ERUs	3,209	2,115	1,821	7,145
2012				
Average Use	157			
ERUs	3,148	2,079	1,798	7,025
2013 Adjusted (Used for Forecast)				
Average Use	165			
ERUs	3,147	1,974	1,798	6,919

2014				
Average Use	154			
ERUs	3,171	2,235	2,021	7,427
2015				
Average Use	157			
ERUs	3,166	2,179	2,128	7,473
2016				
Average Use	155			
ERUs	3,198	2,147	1,930	7,275
2017				
Average Use	165			
ERUs	3,210	1,988	2,079	7,277

Average Use and Growth Rate Data

Year Range	Single Family Average Use (gpd/ERU)	Single Family Average Growth Rate (%)	Multi-Family Average Growth Rate (%)	Commercial Average Growth Rate (%)
2015 – 2017	159	0.41%	-3.79%	1.24%
2013 - 2017	157	0.39%	-0.64%	3.22%
2008 - 2017	158	0.04%	0.76%	0.92%

The District water use records were also used to determine the maximum day demand (MDD). The District collects daily source meter data from its SPU interties. Gaps in the data were found for years prior to 2014. Therefore, the 2014 SPU daily source meter data was used to calculate actual MDD for the system. The ratio of MDD/ADD was calculated and it was 1.5 for 2014.

For the purposes of the District's demand forecast, a ratio of 2.0 was used, which is consistent with previous planning data and still conservative compared to the actual 2014 MDD/ADD ratio of 1.5.

Actual flow data for peak hour demand (PHD) for the District is not available. Therefore, DOH equation 5-1 was used to develop PHD. PHD is a function of MDD and the number of service connections for systems with more than 500 connections.

The following equation from the DOH Water System Design Manual (WSDM) was used:

$$PHD = (MDD/1440)[(1.6)(\#\ ERU's) + 225] + 18 \qquad \{WSDM\ Equation\ 5\text{-}1\}$$

The resulting ratio of PHD to MDD, with appropriate unit conversion is 1.64 through 2026 and 1.63 from 2027 through 2038.

2.1.5 Winter and Summer Seasonal Water Use

Due to a change in the billing system in Fall 2012, there is no seasonal data available for years 2008 through 2012. Because of this, the seasonal water use was not analyzed for this period. The observations for years 2002 through 2007 are included below. The seasonal water use will be evaluated during the next WSP update when sufficient data is available for updated analysis.

The water usage records for years 2002 through 2007 were examined for winter and summer seasonal usage for the single-family residential, multi-family residential and commercial customer classes. Historical monthly water billing data for each customer class from 1993-2007 is shown in Appendix E. Water volume billed each month is for water usage for the previous two months. For example, customers billed in December are actually being billed for water used in October and November.

The summer season is assumed to be the months of April through September. Usage for these months is billed in the months of June through November. The winter season is the months of October through March which are billed December through May.

Figure E-1 shows the average water usage for the summer season as compared to the winter season for the three customer classes. The graphs are the average usage for the summer and winter seasons for years 2002 through 2007.

Average yearly usage for the multi residential class shows a fairly constant uniform usage between summer and winter seasons. Maximum summer average usage is about 25% higher than the lowest winter average. This is attributed to the fact that few multi residential developments have separate irrigation systems.

Maximum yearly summer average for the commercial accounts shows approximately a 52% increase over the minimum winter usage primarily due to separate irrigation systems.

Maximum average summer usage for the single family residential class shows the greatest increase over the minimum winter average. Summer usage is approximately double that of the winter usage. This large increase is due to individual irrigation systems and increased outdoor activities at home.

2.1.6 Largest Water Users

The top twenty water users for the District in 2018 are shown in Table 2.6.

TABLE 2.6
LARGEST WATER USERS IN 2018

No.	Customer	Annual Sales Average 2018 (mcf)[1]
1	Highline Medical Center	1.511
2	Merrill/Legacy at Burien MF, LLC	0.795
3	Cambridge Square - West	0.674
4	Cambridge Square - East	0.604
5	Burien Town Square, LLC	0.462
6	Highline School District - High School	0.430
7	LA Fitness	0.411
8	Wizards Casino	0.408
9	Highline School District - Sylvester	0.382
10	Merrill Gardens at Burien	0.375
11	Seatac's Best Laundromat, LLC	0.350
12	Navos Irrigation	0.309
13	Safeway Stores, Inc. #434	0.299
14	Ring Yuba City Company	0.297
15	Courtyard Apartments	0.282
16	Burien Development Group	0.266
17	Simkus, Inc.	0.265
18	Normandy Park Assisted Living	0.243
19	Highline School District - Performing Arts	0.241
20	Highline School Dist - Sunnydale	0.241
	Total	**8.845**

[1] million cubic feet

2.2 COMMUNITY AND WATER USAGE PROJECTIONS

2.2.1 Projected Land Use

The area within the service boundary of the District is under the jurisdiction of three separate municipalities and, therefore, is subject to the comprehensive land use plans and zoning codes of the City of Burien, the City of SeaTac and the City of Normandy Park. Land use is classified as residential, multi-family, industrial, commercial, office, aviation and parks and open space and is shown in Figure 2-1.

2.2.2 Projected Population and Water Demand

As discussed in previous sections, the District's service area covers a mostly developed urban area of southwest King County. The service area lies mainly within the boundary of the City of Burien with small portions in the Cities of SeaTac and Normandy Park.

As mentioned in Section 2.1.1, the PSRC Maintenance Release 1 of the Land Use Targets dataset was utilized for the purposes of forecasting population in this Plan.

The Land Use Targets is a companion product to the Land Use Baseline that provides long-range future land use dataset based on local growth targets developed (or being developed) by each county to align with VISION 2040's regional growth strategy.

VISION 2040 is an integrated growth management, environmental, economic and transportation strategy which focuses new employment and housing in vibrant urban centers. The PSRC adopted VISION 2040 in April 2008.

Table 2.7 summarizes the estimated projected residential population served by the District for the years 2019-2038. The percent of the census tract area within the District boundary was applied to the population in each tract for each year forecast by PSRC (2025, 2030, 2031 and 2035). Populations between the years forecast by PSRC were then determined linearly and are presented in Table 2.7 below. Data for 2036-2038 was extrapolated three additional years based on growth forecast from 2031 to 2035.

TABLE 2.7
FORECAST RESIDENTIAL POPULATION

Census Tract	2019	2028	2033	2038
274	79	83	86	90
275	454	479	497	513
276	118	123	128	132
278	1,462	1,490	1,539	1588
279	7,492	8,690	8,998	9310
280	1,247	1,341	1,395	1449
284.02	163	185	200	215
285	1,922	2,100	2,183	2267
286	640	647	652	657
Total	**13,577**	**15,138**	**15,678**	**16,221**

The District has seen significant changes in the number of accounts over the past ten years but relatively small changes in water use over the same period. The annual water use by customer class for 1993-2018 is shown in Tables E.1 and E.2 based on the SPU annual wholesale customer summaries. The calculated non-revenue water is shown for each year also.

Annual water demands will vary with population and in response to climatic and economic conditions. Section 2.2.3 below discusses the growth in demand by customer class in more detail.

2.2.3 Projected Growth of Customer Class

The 2013 adjusted ERUs presented in Table 2.5 were used as the basis for the water demand forecasts presented later in this chapter.

The forecast residential population within the District boundary, based on the PSRC Land Use Targets dataset, is expected to increase from 11,718 to 16,331 people from 2010 to 2036. This is equivalent to an increase of 1.285% annually through 2036. This percentage increase was applied to the single-family ERUs for 2014-2036. The same rate of growth was used to extrapolate ERU growth from 2036 through 2038.

The multi-family growth rate for the years 2016 through 2018 is based on a large increase in living units planned or now under construction as the Merrill Gardens at Burien and the Burien Town Square Apartments developments. Approximately 353 additional units are expected over the next few years corresponding to an annual growth rate of 3.5%.

Census tract 279.00 encompasses a large portion of the City of Burien's Urban Center Boundary, where there is a heightened focus on future commercial and multi-family residential growth in the next 20 years. The forecast annual increase in residential population within census tract 279.00 is 1.75% annually through 2036. This percentage increase was applied to the multi-family ERUs for 2014-2015 and 2019-2038.

The forecast annual increase in employment within the City of Burien is 1.9% in their most current Comprehensive Plan update. The increase in employment directly corresponds to the growth in commercial ERUs and therefore this 1.9% increase was applied to the commercial ERUs for 2014-2038.

Table 2.8 is a summary of projected growth rates by customer class.

TABLE 2.8
PROJECTED GROWTH RATE BY CUSTOMER CLASS

Customer Type	Projected Annual Growth Rate (percent)
Single Family Residential	1.285%
Multi-Family Residential	
2016-2018	3.5%
2014-2015, 2019-2038	1.75%
Commercial	1.9%

2.2.4 Projected Non-Revenue Water and Wholesale Water Sales

Monthly billing statements are provided by SPU for total volumes registered through its meters. The District calculates non-revenue water volumes as the difference between the quantity sold to customers and quantity purchased from SPU. Included in the non-revenue water is water used for fire hydrant flushing, fire demands, leaks and other losses and water main testing. These volumes of water were first estimated by the District for 2007 and will continue into the future.

The amount of non-revenue water, as calculated by the above method, has generally been less than 6% since 1993 except in 1996, 2011 and 2012. This amount is considered very low and represents a well-managed District in terms of controlling distribution system leakage. In addition, the District's ongoing capital improvement program results in the replacement of aging water mains which may experience leaks.

Based on the above information, the District's percentage of non-revenue water usage is projected to remain relatively constant throughout the planning period. For purposes of this Plan, non-revenue water will be estimated at a constant 6% of the total District average day demand.

The District does not normally buy or sell water to any adjacent purveyor. Water exchange between districts is on an emergency basis only. For purposes of this Plan, no wholesale water is forecast to be bought or sold by the District, except for purchases from SPU.

2.2.5 Water Rates and Rate Impacts on Water Demand

The District's current rate structure is included in Chapter 9. The District bills approximately one half of the accounts each month resulting in a bimonthly billing cycle for each customer. The customer's bill reports the previous meter reading and the current reading along with the difference shown as the current usage amount.

The total amount due includes the total water charge (including both base charge and the usage charge) and the charge for street lighting. The District performs various administration duties related to street lighting including answering customer questions and verifying outages. Seattle City Light charges the District for each street light which is paid for by the money collected by the District.

In 2007, the District completed a rate study. The results of the study were updated in 2008 to reflect the impact of newly-announced SPU rate increases. New rates were adopted to cover the SPU rate increases and the increasing costs for District expenses and projects. The block rate structure was added to encourage water conservation by charging more for larger users. Rates have been reviewed periodically since then and adjusted when determined to be appropriate by the District Board of Commissioners.

A detailed rate study was completed in 2017 following adoption of the 2017 Water System Plan. The study recommended a series of additional rate increases. The Board adopted the rate increases effective January 2017 and January 2018. Future increases will be considered following completion of this 2019 Water System Plan.

The 2018 water rate structure includes the base rate which is billed by meter size for each customer class and a water usage rate. For single family customers, the usage rate is a three-tiered structure. For 0 to 10 ccf, the rate is $3.58 per ccf, for 11 to 16 ccf it is $4.41 and for 17 ccf and more, the rate is $6.06. Usage rate for multi-family and commercial accounts is constant at $4.13 per ccf. Discount accounts are billed at a rate of $3.58 per ccf, irrigation accounts at a rate of $6.06 per ccf and unmetered water is billed at a rate of $5.24 per ccf.

2.2.6 Water Demand Forecasting

Factors affecting the District's water demand forecast have been discussed in this chapter. Table 2.5 shows a summary of historical demands by customer type from 2002 through 2018. Tables 2.9 and 2.10 below summarize the demand projections through the year 2038 utilizing the projected average usage per ERU. Table 2.9 uses a constant average daily demand of 165 gallons per day per ERU. Table 2.10 assumes a 0.75% per year reduction in demand through 2018 (reduced to 159 gpd/ERU), and then a 0.25% per year reduction in demand through 2022 (reduced to 157.4 gpd/ERU). The average daily use is then calculated by multiplying the number of ERUs by the daily demand. Non-revenue water is estimated at a constant 6% of the total District demand. MDD is calculated using a MDD/ADD ratio of 2.0. PHD is calculated using the DOH WSDM Equation 5.1. The complete projected water demand forecasts, without and with conservation benefit, can be found in Appendix E, Tables E-4 and E-5.

As noted in Section 2.1.2, the count of single family connections (also ERUs) at the end of 2018 was 3,204. Table E.4 indicates the forecast count of single family ERUs, as developed for the 2017 Water System Plan, is 3,354. This indicates that the forecast prepared for the 2017 Plan is somewhat conservative, or that growth early in the planning period is lagging behind the forecast by over four percent, at this point in time.

TABLE 2.9
PROJECTED WATER DEMAND 2019 – 2038
Average Day, Maximum Day, Peak Hour
(Without Additional Projected Savings)

Type	2019	2020	2021	2022	2023	2024
Single-Family Residential	560,505	567,765	575,025	582,450	589,875	597,465
Multi-Family Residential	380,655	387,255	394,020	400,950	408,045	415,140
Commercial	332,145	338,415	344,850	351,450	358,050	364,815
Dist. System Leakage	76,398	77,606	78,834	80,091	81,358	82,645
ADD (mgd)	**1.35**	**1.37**	**1.39**	**1.41**	**1.44**	**1.46**
MDD (mgd)	**2.62**	**2.66**	**2.71**	**2.75**	**2.79**	**2.84**
PHD (gpm)	**2,986**	**3,032**	**3,078**	**3,126**	**3,175**	**3,224**

Type	2025	2026	2027	2028	2033	2038
Single-Family Residential	605,220	612,975	620,895	628,815	670,395	714,615
Multi-Family Residential	422,400	429,825	437,415	445,005	485,430	529,155
Commercial	371,745	378,840	386,100	393,360	432,135	475,035
Dist. System Leakage	83,962	85,298	86,665	88,031	95,278	103,128
ADD (mgd)	**1.48**	**1.51**	**1.53**	**1.56**	**1.68**	**1.82**
MDD (mgd)	**2.88**	**2.93**	**2.98**	**3.02**	**3.27**	**3.54**
PHD (gpm)	**3,274**	**3,325**	**3,377**	**3,429**	**3,706**	**4,005**

Notes:

1. Flow in gallons per day for each customer class/category

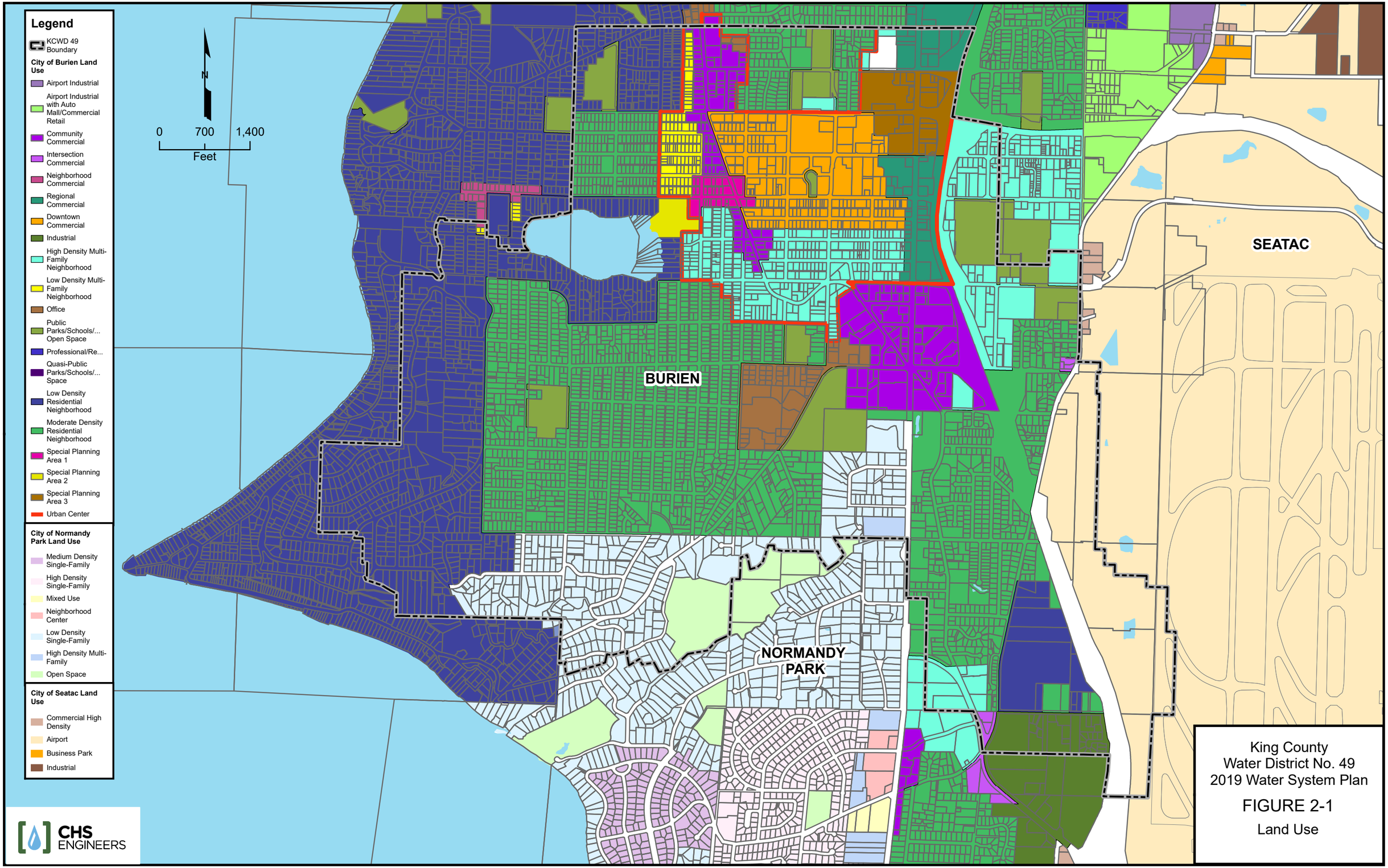
TABLE 2.10
PROJECTED WATER DEMAND 2019 – 2038
Average Day, Maximum Day, Peak Hour
(With Additional Projected Savings)

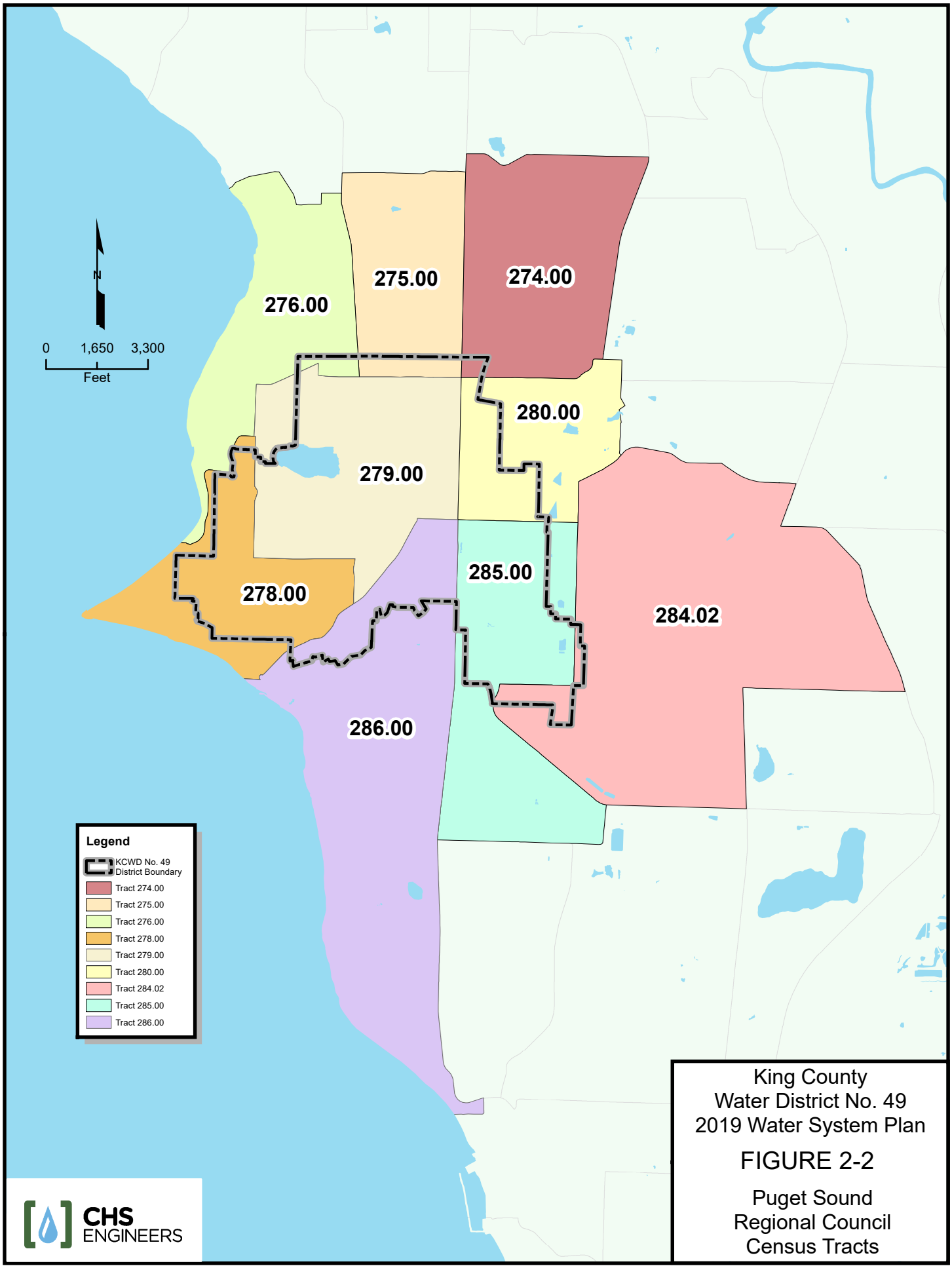
Type	2019	2020	2021	2022	2023	2024
Single-Family Residential	538,764	544,366	549,933	555,622	562,705	569,945
Multi-Family Residential	365,890	371,295	376,826	382,482	389,250	396,018
Commercial	319,262	324,468	329,802	335,262	341,558	348,011
Dist. System Leakage	73,435	74,408	75,394	76,402	77,611	78,839
ADD (mgd)	**1.30**	**1.31**	**1.33**	**1.35**	**1.37**	**1.39**
MDD (mgd)	**2.52**	**2.55**	**2.59**	**2.62**	**2.66**	**2.71**
PHD (gpm)	**2,870**	**2,907**	**2,945**	**2,983**	**3,029**	**3,076**

Type	2025	2026	2027	2028	2033	2038
Single-Family Residential	577,343	584,741	592,296	599,851	639,516	681,699
Multi-Family Residential	402,944	410,027	417,267	424,508	463,071	504,782
Commercial	354,622	361,390	368,316	375,242	412,231	453,155
Dist. System Leakage	80,095	81,370	82,673	83,976	90,889	98,378
ADD (mgd)	**1.42**	**1.44**	**1.46**	**1.48**	**1.61**	**1.74**
MDD (mgd)	**2.75**	**2.79**	**2.84**	**2.88**	**3.12**	**3.38**
PHD (gpm)	**3,124**	**3,173**	**3,222**	**3,272**	**3,536**	**3,822**

Notes:

1. Flow in gallons per day for each customer class/category


Legend
KCWD 49 Boundary
City of Burien Land Use
Airport Industrial
Airport Industrial with Auto Mall/Commercial Retail
Community Commercial
Intersection Commercial
Neighborhood Commercial
Regional Commercial
Downtown Commercial
Industrial
High Density Multi-Family Neighborhood
Low Density Multi-Family Neighborhood
Office
Public Parks/Schools/... Open Space
Professional/Re...
Quasi-Public Parks/Schools/... Space
Low Density Residential Neighborhood
Moderate Density Residential Neighborhood
Special Planning Area 1
Special Planning Area 2
Special Planning Area 3
Urban Center
City of Normandy Park Land Use
Medium Density Single-Family
High Density Single-Family
Mixed Use
Neighborhood Center
Low Density Single-Family
High Density Multi-Family
Open Space
City of Seatac Land Use
Commercial High Density
Airport
Business Park
Industrial
N
0
700
1,400
Feet
BURIEN
NORMANDY PARK
SEATAC
CHS ENGINEERS
King County
Water District No. 49
2019 Water System Plan
FIGURE 2-1
Land Use


N
0
1,650
3,300
Feet
276.00
275.00
274.00
280.00
279.00
278.00
285.00
284.02
286.00
Legend
KCWD No. 49 District Boundary
Tract 274.00
Tract 275.00
Tract 276.00
Tract 278.00
Tract 279.00
Tract 280.00
Tract 284.02
Tract 285.00
Tract 286.00
CHS ENGINEERS
King County
Water District No. 49
2019 Water System Plan
FIGURE 2-2
Puget Sound
Regional Council
Census Tracts

CHAPTER 3 – SYSTEM ANALYSIS

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CHAPTER 3

SYSTEM ANALYSIS

The objective of this chapter is to determine if the existing system facilities can supply enough quality and quantity of water to meet existing and projected demands in the District's water service area. In this section, five primary planning elements will be reviewed in detail:

- system design standards
- water quality analysis
- system description and analysis
- summary of system deficiencies
- selection and justification of proposed improvements

The design standards identify the design criteria that apply to District water system facilities. The design and water quality standards for Group A public water systems are summarized in Chapter 246-290 WAC. These standards provide a set of minimum design and performance criteria for new water utilities and for all existing utilities planning to install capital facilities for expansion purposes.

System description and analysis includes a description of the system configuration and general condition, hydraulic analysis and study, and determination of the deficiencies of the components of the District's water system. The discussion is summarized with identification of the improvements proposed to eliminate existing and anticipated deficiencies.

3.1 System Design Standards

This chapter establishes the criteria to be used in the planning, analysis and construction of facilities that will be required by the District to meet future customer demand. The criteria include consideration of adequate water quality and supply and the sizing of storage and distribution facilities. The design criteria are based on historical District records, design standards recommended by the DOH and other accepted standards normally used in the design and construction of water facilities.

The DOH *Water System Design Manual* (WSDM), dated December 2009, was utilized for this system analysis. The primary design criteria included maintaining 30 psi in the distribution system under peak hourly demand flow conditions and 20 psi under maximum day demands and fire flow conditions.

3.1.1 Abbreviations

In this report, a number of common technical terms and expressions have been abbreviated. These terms and their abbreviations are presented in the introduction.

3.1.2 Reference Datum

The planning of facilities in this study is based on the National Geodetic Vertical Datum (NGVD) of Mean Sea Level at elevation zero.

3.1.3 Period of Design

In the planning of water facilities, it is necessary to design facilities that can provide for projected system demands for a specific period of time. This window of time is known as the *period of design*, and for this plan the period spans from the date of this plan to the year 2038.

In planning facilities with capacities adequate for the design period, it should be noted that these requirements do not need to be fulfilled immediately. A more realistic approach to the development and improvement of water system facilities is a plan which reflects the phasing of improvements.

3.1.4 Water System Design Standards

DOH relies on various publications, agencies and the utility itself to develop and establish design criteria. Chapter 246-290-200 WAC, Design Standards, lists the various criteria allowed by DOH. It provides that:

> (1) Purveyors shall ensure that good engineering criteria and practices are used in the design and construction of all public water systems, such as those set out in:
>
> (a) Department guidance on design for Group A public water systems;
> (b) The most recent published edition of the *International Building Code (IBC), the Uniform Plumbing Code* (UPC), and other national model codes adopted in Washington state;
> (c) The most recent published edition of *Recommended Standards for Water Works, A Committee Report of the Great Lakes - Upper Mississippi River Board of State Public Health and Environmental Managers*;
> (d) Standard specifications of the American Public Works Association (APWA), the American Society of Civil Engineers (ASCE), the American Water Works Association (AWWA), or the American Society for Testing and Materials (ASTM);
> (e) Design criteria, such as contained in current college texts and professional journal articles, acceptable to the department;
> (f) Chapter 173-160 WAC *Minimum Standards for Construction and Maintenance of Water Wells*;
> (g) The latest edition of the PNWS-AWWA *Cross-Connection Control Manual*, or the University of Southern California (USC) *Manual of Cross-Connection Control*.

(2) In addition, purveyors of new or expanding public water systems shall consider and use, as appropriate, the following design factors:

(a) Historical water use;
(b) Community versus recreational uses of water;
(c) Local conditions and/or regulations;
(d) Community expectations;
(e) Public Water System Coordination Act considerations where appropriate;
(f) Provisions for systems and component reliability in accordance with WAC 246-290-420;
(g) Wind pressures, seismic risk, snow loads, and flooding;
(h) Other risks from potential disasters, as feasible; and
(i) Other information as required by the department.

3.1.5 Average Day, Maximum Day and Peak Hour Demands

The Average Day and Maximum Day Demands (ADD and MDD, respectively) are discussed in Chapter 2, Sections 2.1.4 and 2.2.6. The water demand for the District's system is forecast through the year 2038 based on historical water use patterns by customer class and projected growth within each customer class, both with and without estimated impact of future water conservation efforts.

Actual flow data for PHD for the District is not available. Therefore, DOH equation 5-1 was used to develop PHD. PHD is a function of MDD and the number of service connections for systems with more than 500 connections.

The following equation from the DOH WSDM was used:

PHD = (MDD/1440)[(1.6)(# ERU's) + 225] + 18 {WSDM Equation 5-1}

For the District, the resulting ratio of PHD to MDD is 1.64 through 2026 and 1.63 from 2027 through 2038.

The detailed projections are presented in Tables 2.9 through 2.12, but the key numbers are summarized in Table 3.1 for reference.

TABLE 3.1
SUMMARY OF FORECAST ADD, MDD AND PHD
2019-2038

Type	2019	2020	2021	2022	2023	2024
Without Additional Projected Savings						
ADD (mgd)	1.35	1.37	1.39	1.41	1.44	1.46
MDD (mgd)	2.62	2.66	2.71	2.75	2.79	2.84
PHD (gpm)	2,986	3,032	3,078	3,126	3,175	3,224
With Additional Projected Savings						
ADD (mgd)	1.30	1.31	1.33	1.35	1.37	1.39
MDD (mgd)	2.52	2.55	2.59	2.62	2.66	2.71
PHD (gpm)	2,870	2,907	2,945	2,983	3,029	3,076

Type	2025	2026	2027	2028	2033	2038
Without Additional Projected Savings						
ADD (mgd)	1.48	1.51	1.53	1.56	1.68	1.82
MDD (mgd)	2.88	2.93	2.98	3.02	3.27	3.54
PHD (gpm)	3,274	3,325	3,377	3,429	3,706	4,005
With Additional Projected Savings						
ADD (mgd)	1.42	1.44	1.46	1.48	1.61	1.74
MDD (mgd)	2.75	2.79	2.84	2.88	3.12	3.38
PHD (gpm)	3,124	3,173	3,222	3,272	3,536	3,822

3.1.6 Storage Requirements

There are five components of storage that must be considered when designing a water system: operational, equalizing, standby, fire suppression and dead storage. Chapter 9 of the DOH WSDM provides recommendations and equations for determining the quantities of each component. Each of the five components is explained below with the respective equation or criteria for determining the required value.

A. Operational Storage

Operational storage (OS) is the volume of a reservoir reserved for supplying system demands during times that the supply system, usually pumps, is not delivering water.

B. Equalizing Storage

Equalizing storage (ES) provides water during periods of heavy consumption when the source of supply cannot meet the PHD. It allows

the use of smaller, more economical pumps and places less demand on the water source. Supply transmission mains can also be designed smaller because they do not have to supply peak demands.

The volume of storage required for equalizing purposes depends upon the peak hour demand, diurnal variations in demand and the rate of supply from the source(s). The DOH manual sets forth a procedure for determining the required equalizing storage utilizing the typical variables historically found in most systems. Under continuous source of supply, a mass analysis must be prepared to determine the minimum volume of ES.

Under an "on-call" demand scenario, DOH Equation 9-1 relates supply (pumping) capacity with PHD to determine an applicable ES volume.

Equation 9-1:

ES = (PHD - Qs)(150 min), where:

PHD = Peak Hourly Demand (gpm)
Qs = sum of all installed and active sources of supply (gpm)

C. Standby Storage

Standby storage (SB) is defined as the storage necessary to augment the available supply in the event that the system's largest source is out of service for a period of time. With five connections to SPU's two transmission mains, and each SPU main served from a different part of the SPU system, the District's system can be considered a multiple source system. Therefore, standby storage is determined by DOH Equation 9-3 for multiple sources which assumes the loss of the supply from the source with largest capacity.

Equation 9-3:

$SB = (2 \text{ days})(ADD)(N) - t_m (Q_S – Q_L)$, where:

ADD = Average day demand for design year (gpd/ERU)
N = Number of ERUs
Q_S = Sum of all installed and continuously available sources (gpm)
Q_L = The largest capacity source (gpm)
t_m = time remaining sources are pumped (min., usually 1440 min.)

In any event, DOH recommends that SB volume be no less than 200 gallons per ERU.

According to WAC 246-290-235, standby and fire suppression storage volumes may be nested with the larger of the two volumes being the minimum available, provided the local fire protection authority does not require them to be additive.

D. Fire Suppression Storage

The fourth component of required storage is the amount needed for fire suppression storage (FSS). Fire flow rates for the District are set forth by the local fire official. Fire flow rates are determined based on a variety of factors including land use, construction materials, building use(s), size, access and related risk-based considerations. The maximum flow for the highest risk structure in an area determines the fire flow rate requirement for that area. For commercial land uses, this determination is largely based on the requirements of the *International Fire Code*, as adopted by the local land use jurisdiction (see Appendix G).

The determination of the fire suppression storage volume is determined by DOH Equation 9-4 which multiplies the required rate by the required duration.

Equation 9-4:

$FSS = (FF)(t_m)$, where :

FF = required fire flow rate (gpm)
t_m = required duration (min.)

The source of supply should be adequate to replenish the fire suppression storage within 72 hours while concurrently supplying the system MDD.

E. Dead Storage

Dead storage (DS) is the volume of water not available for the system such as the lower volume in a standpipe or the upper volume in a reservoir too high to be filled by the system's source of booster pumps.

3.1.7 Distribution System

The water distribution system is required to provide dependable service. This is accomplished through interconnection and proper pipeline sizing which results in adequate water pressure and fire protection for the community. It is recommended that water pressure be maintained between 30 and 80 psi through the use of pressure reducing valves, booster pump stations, and water storage reservoirs.

All water mains shall be designed in accordance with good engineering practice by a professional engineer to suit actual conditions at the project location. All pipelines shall be constructed in accordance with the requirements of the District's methods and standards which are referenced in Chapter 7 of this plan. All water mains maintained by the District shall be owned and operated by the District. Under special circumstances the District does serve privately owned and maintained systems through master meters. This is the case with areas owned by the Port of Seattle.

In general, all water mains should be looped where feasible thus minimizing dead-end lines. The minimum size for water mains constructed within the District is 8 inches in diameter.

All decisions about required fire flow, fire hydrant quantity, spacing and location are subject to the approval of the local fire official. Hydrant spacing within the District is a maximum of 500 feet for residential areas and as close as 200 feet for commercial/industrial areas with high fire flow requirements (see *International Fire Code*, as adopted by local land use jurisdiction, Appendix G). Any hydrant branch exceeding 50 feet in length shall be 8 inches in diameter. Where the rate of fire flow for a specific building is greater than 1,000 gpm, more than one point of supply from the system is required, with a maximum of 1,000 gpm per fire hydrant. For example, if a commercial building requires 2,500 gpm fire flow, two hydrants and an additional fire service line, or a minimum of three fire hydrants, would be required to deliver that flow.

3.1.8 Fire Flow Standards and Performance

Fire protection is of primary importance in nearly all communities. In most circumstances, water flows for fighting fires produce the highest demand on the water system. The 2015 IFC was adopted by the City of Burien effective June 2016. Appendix B & C of the 2015 IFC are in Appendix G of this Plan for reference.

Under these standards the current fire flow requirements are a minimum of 1,000 gpm for a period of one hour for all single family residences under 3,600 square feet. All commercial buildings and residences larger than 3,600 SF are governed by size and type of structure. These standards are presented in Table B105.1 of the 2015 IFC.

In addition to IFC requirements, the City of Burien code requires automatic sprinkler systems to be installed in all buildings over 5,000 square feet and all residences over 3,600 square feet. The City of Normandy Park requires all residences to be sprinklered. The installation of sprinkler systems reduces the fire flow requirements for the structure to 50% of the required flow or 1,000 gpm, whichever is larger.

Single family dwellings under 3,600 square feet, which are located in areas that cannot provide the 1,000 gpm minimum fire flow, can also have sprinkler systems installed to reduce fire flow requirements. If sprinklers are installed, the required fire flow is lowered to 500 gpm for a period of half an hour. Very large (e.g. 6,200 to 11,300 sf) residences will require up to 1,375 gpm fire flow, with sprinkler protection.

The highest commercial building fire flow requirement, with sprinkler protection, is 4,000 gpm for four hours.

3.1.9 System Pressure

According to WAC 246-290-230 and Chapter 8 of the WSDM, water systems shall be designed to maintain a minimum residual pressure of 30 pounds per square inch (psi) at the meter, under PHD conditions, excluding fire demand. A residual pressure of 20 psi shall be provided throughout the system under combined fire flow and MDD conditions.

As stated in the District's *Developer Extension Manual* (DEM), the size of a new water line shall be as necessary to meet the WAC 246-290-230 and WSDM requirements stated above, with a maximum velocity of eight feet per second (fps). The District goal is to provide a minimum pressure of 40 psi throughout the system under PHD conditions. The maximum pressure at the point of customer connection should be 80 psi. (Some portions of the existing distribution system are subject to pressures in excess of 80 psi, due to pressure zone and local topography variations.)

Booster pump stations should be designed with multiple pumps of such capacity that the MDD of the service area could be provided, at 30-psi minimum, with the largest pump out of service. The station should be designed to provide a minimum of 20 psi at the pump suction manifold under fire flow plus MDD conditions. The station should include an automatic shutdown feature should the suction pressure drop below 10 psi.

3.1.10 Minimum Pipe Sizes/Looping

Water line extensions shall be continued through or along the property being developed for potential future connection or extension.

Water mains shall be a minimum of 8-inch diameter if providing fire flow, or larger in accordance with this plan. Mains not providing fire flow may be smaller under certain conditions. Details are presented in the District DEM. Engineering analysis should be completed for each extension considering the specific fire flow requirements and hydraulic conditions for the development.

Velocities in the pipe system should not exceed eight fps under PHD conditions, but all pipes should ideally be capable of being flushed at 2.5 fps under ADD conditions.

The water mains shall be "looped" where feasible within the proposed development and/or designed with multiple connections to the existing water distribution system in accordance with this plan or as required by the District to provide the required adequate flow and pressure and reliable supply to the most remote hydrant and service in the proposed water extension.

3.1.11 Telemetry and Control Systems

Telemetry and control systems shall be included with each reservoir and pump station. These systems shall be designed for local or remotely controlled automatic operation. Telemetry communication shall be via the existing radio system, where feasible and authorized by the FCC or by phone depending on local topography. Critical levels, flow, pressure, function, etc. shall be continuously monitored and unusual conditions shall be annunciated locally, to the water headquarter office or via the auto-dialer to the "on-call" operator.

3.1.12 Standby Power Requirements

The main objective of standby power requirements is to assure that the system is pressurized at all times to minimize cross-connection contamination concerns and maintain minimum service pressures. Each booster pumping station should contain no less than two pumps with capacities such that peak demand can be satisfied with the largest pump out of service. Standby power shall be provided from at least two independent sources or a standby or an auxiliary source should be provided.

The District's water system can continue regular service during power outages because of multiple taps to SPU's transmission system. There are no provisions at the pump station to allow connection of a portable generator for electrical power supply during extended power outages.

District staff recommends consideration of a natural-gas powered standby power generator at the existing reservoir booster pump station. This consideration should be made in the context of additional storage capacity and related pump facilities.

3.1.13 Valve and Hydrant Spacing

Fire hydrants shall be installed along all water mains in the distribution system and shall be placed within 250 feet of any structure. Maximum spacing of fire hydrants shall be 500 feet in single family residential areas and can be as close as 200 feet for commercial/industrial areas with high fire flow requirements or as required by the local fire district requirements, if more stringent.

Valves shall be installed at all branches of tee and cross pipeline intersections unless otherwise approved by the District. Valves shall be installed at intersections, at intervals not to exceed 800 feet in the distribution system and 1/4 mile in transmission mains. Mainline valves shall be installed at fire hydrant locations so that only one fire hydrant is out of service at any one time. Auxiliary valves shall be installed on each hydrant branch.

Details regarding hydrant materials and installation are included in the District DEM (referenced per Chapter 7).

3.1.14 Summary of System Design Standards

The system design standards described in the previous sections, in addition to other standards, have been summarized in Table 3.2 below.

TABLE 3.2
SYSTEM DESIGN STANDARDS

Parameter	Minimum Standard
Water Quality	Federal Safe Drinking Water Act and State Statutes (DOH) for Maximum Contaminant Levels (WAC 246-290-310)
Maximum Day Demand	2 x ADD
Peak Hour Demand	Per DOH Equation 5-1
Storage	Per DOH WSDM Chapter 9
Fire Flow	1,000 gpm for 60 minutes for single family residence under 3,600 sq. ft. Commercial and larger residences per adopted IFC (Maximum anticipated: 4,000 gpm for four hours)
Minimum System Pressure	30 psi during PHD conditions 20 psi under MDD plus fire flow conditions
Minimum Pipe Size (for additions to system)	8 inch
Valve Spacing	At all tees or crosses and 800 ft. max. on pipe runs
Hydrant Spacing	Per local fire official Generally 500' maximum in single family residential areas and as close as 200' for commercial/industrial areas with high fire flow requirements
Construction Standards	See Developer Extension Manual
Cross-Connection Control	Per WAC 246-290-490 and most current *Cross-Connection Control Manual* by the Pacific Northwest Section of the American Waterworks Association Cross-Connection Control Committee

The performance and design criteria address the size and reliability requirements for source, storage, and distribution to meet the domestic and fire flow water demands of the system. Construction standards set forth the actual materials and construction standards that contractors, developers and the District must follow when constructing water system facility improvements.

The design standards include the DOH standards as presented in the December 2009 WSDM and the District 49 DEM, latest edition. In case of conflict between these standards, the most stringent standards shall apply.

3.2 Water Quality Analysis

Public water systems are obligated to supply their customers with healthful, palatable water. Group A public water systems must comply with the provisions of the Safe Drinking Water Act (SDWA). DOH enforces the SDWA and regulates bacteriological contaminates, inorganic chemicals (IOC's), inorganic physical parameters, volatile organic chemicals (VOC's), synthetic organic chemicals (SOC's), lead and copper, radionuclides, trihalomethanes, arsenic and asbestos.

WAC 246-290-200, Design Standards, lists various criteria allowed by DOH. These water quality parameters include maximum contaminant levels (MCL's) for a variety of potential organic, inorganic and radioactive constituents in the water supply. The water supply must be free from pathogenic bacteria and carry a residual of chlorine for disinfection throughout the water system.

There are also secondary MCLs for constituents which may not result in health problems, but may lead to taste, odor and other aesthetic objections from water system customers. Additionally, the water must be periodically tested for asbestos, lead and copper, to determine the interaction of the water with the distribution piping and private service/plumbing piping used for delivery of water to the customer's tap.

Additional drinking water regulations will become effective in the next several years. These regulations will impose new regulatory requirements for sulfate, radionuclides, additional IOCs and SOCs, and additional disinfection by-products and bacteriological contaminants.

DOH is the primary agency responsible for ensuring state drinking water laws are implemented and enforced. Washington State must adopt laws at least as stringent as the federal regulations. When a federal drinking water law has yet to be included in state drinking water codes, drinking water purveyors are responsible for meeting federal regulatory requirements as put forth by the USEPA.

SPU is responsible for monitoring the water sources and water quality directly after treatment. Since the District does not own or operate any drinking water source, the District is responsible solely for monitoring and maintaining compliance with drinking water regulations that apply to distribution system water quality. The appropriate water quality regulations and the status of the District with respect to each regulation is included in Table 3.3.

TABLE 3.3
SUMMARY OF APPLICABLE REGULATIONS AND COMPLIANCE STATUS

Regulation	Requirements	District Status	Compliance?
Phase I (VOCs) and Phase II and Phase V (IOCs and SOCs)	Written Plan/ Monitoring	SPU monitors after treatment prior to SPU's distribution system	Yes
Surface Water Treatment Rule/ Interim Enhanced Surface Water Treatment Rule	Written Plan/ Monitoring	SPU monitors	Yes
Total Coliform Rule	Written Plan/ Monitoring	SPU collects routine TCR samples and District Staff collects repeat TCR samples within the distribution system	Yes
Chlorine Residual	Written Report/ Monitoring	District collects samples	Yes
Lead and Copper Rule	Monitoring/ Treatment for corrosion control	District Monitors, Meets MCLs	Yes
Stage 2 D/DBP Rule	Monitoring	District samples and SPU monitors D/DBPs throughout distribution system, meets MCLs	Yes
Radionuclides Rule	Monitoring	SPU monitors, meets MCLs	Yes
CCR and Public Notification Rules	Annual Reports / Reporting as needed	District Publishes Confidence Reports annually	Yes

Table 3.4 provides a summary of water quality monitoring requirements for the District, including the parameters to be monitored, sampling location, and frequency. The District is in compliance with monitoring requirements.

The District has developed a Coliform Monitoring Plan and a Stage 2 Disinfection By-Products Rule (DBPR) Monitoring Plan which guide monitoring for these particular parameters. The State of Washington identifies rules and guidelines for other monitoring requirements.

The yearly sampling requirements for the Stage 2 DBPR and the final Individual Distribution System Evaluation (IDSE) report have been completed and submitted to United States EPA. The USEPA has approved the standard monitoring report and a

copy of the approval letter is included in Appendix C. Stage 2 DBPR compliance monitoring began in 2012.

TABLE 3.4
SUMMARY OF EXISTING MONITORING REQUIREMENTS

Parameter	Regulatory Requirement	Location	Frequency
Inorganic Compounds	Primary Drinking Water Regulation	Point of entry into SPU's distribution system	Once every 9 years under a waiver from the Washington DOH. Nitrate once/year.
Organic Compounds	Phase I, II and IV	Point of entry into SPU's distribution system	SPU collects once every 3 to 9 years, depending on the parameter
Secondary Inorganic Compounds	Secondary Drinking Water Regulations	Point of entry into SPU's distribution system	Once every 9 years under a waiver from the Washington DOH
Bacteriological	Total Coliform Rule	Throughout the District's distribution system	15 samples/month
Chlorine Residual	Surface Water Treatment Rule	Throughout the District's distribution system	Daily
Lead and Copper	Lead and Copper Rule	Customer taps	Once/ three years
TTHM & HAA5	Stage II DBPR Compliance Monitoring	Throughout the District's distribution system	4 sampling sites at high TTHM & HAA5 locations, 4 times per year
Radionuclides	Radionuclides	Point of entry into SPU's distribution system	Once/four years

The District utilizes the following state certified laboratories to perform water quality testing. The contact information is listed below:

Seattle Public Utilities – Water Quality Laboratory
800 S. Stacey Street
Seattle, WA 98134
206-684-7834

Pace Analytical Services, Inc.
940 S. Harney Street
Seattle, WA 98108
206-767-5060

The District presently purchases all of its water from SPU. WD 49 has no district-owned sources of water and does not foresee any plans in the near future for developing its own water source.

The SPU system currently has two major sources of water supply: the Cedar River System located southeast of Seattle which provides approximately 70% of SPU's total water supply and the Tolt River system located east of Duvall which provides approximately 30% of Seattle's total water supply. Since SPU provides the water to the District, SPU is responsible for source water quality.

At times of peak demand, SPU can supplement its existing water supply system by utilizing three on-line production wells (two wells at the Riverton well field and one well at the Boulevard Park well field) located near the Riverton Heights Reservoir. The wells are located north of SeaTac airport and have a total capacity of 10 MGD. The wells are operated under a temporary water rights permit. A portion of WD 49 is situated within the Boulevard Park well field recharge area.

In accordance with the SDWA, the District informs all of its water customers about the quality of the water provided to them with an annual Water Quality Report. This report is prepared each year and furnishes the results of the water quality analysis covering the previous calendar year. SPU is responsible for the water quality delivered to the District and provides the analysis results for District notification. There have been no reported violations in the inorganic water quality contaminants.

Copies of the District's 2015, 2016 and 2017 Annual Water Quality Reports are included in Appendix F.

3.3 SYSTEM DESCRIPTION AND ANALYSIS

3.3.1 Source

In 2011, the District signed a new water supply contract with SPU for the purchase of water through the year 2062. A copy of the signed contract is included in Appendix D.

Under normal operating conditions the water supplied to the District is generally supplied from the Cedar River Watershed, with water from the Tolt River Watershed never reaching the District. However, SPU's system is configured to deliver water from either source.

The *2019 SPU Water System Plan* indicates their source of supply system has an estimated firm yield of 172 mgd. The revised forecast shows total demand increasing

gradually to 137 mgd by 2039 and then declining to stay relatively flat at about 133 mgd through 2060.

The portions of SPU's regional supply system which are directly related to the operation of the Water District No. 49 system consist of a 24-inch line which runs along SW 146th Street and a 24-inch line that runs along Des Moines Way. The line running along SW 146th Street, which is referred to by the District as the north line or the "pumped" water line, originates at the Burien Pump Station at South 146th Street and 8th Avenue South. This line is also interconnected to the West Seattle Reservoir by a 12-inch and a 20-inch line.

The line running along Des Moines Way, known by the District as the east line or the "gravity" water line, is also supplied by the Riverton Heights Reservoir. However, this line is not connected to the booster station.

WD 49 purchases all of its water from SPU. As stated above, the water supplied by SPU reaches the District at two different hydraulic gradient levels creating two separate major pressure zones within the District. The District has five master meter connections to SPU's regional transmission system. The District manages the supply of water in each zone and can transfer water from zone to zone if required.

The District has two master meters on the "pumped" water system. The water is pumped from SPU's Riverton Heights reservoir to a hydraulic gradient of at least 575 feet by the Burien Pump Station. This system supplies water to the District's 575 pressure zone. This zone makes up the majority of the District's service area.

The District has three master meters on SPU's "gravity" system which has a hydraulic gradient of at least 430 feet. These meters supply water to the District's minor pressure zones and to the reservoir.

System demands are generally evenly spread across the District. The main pressure zone, which is fed by the "pumped" water line, covers approximately 56% of the District. The second largest pressure zone, which is fed by the "gravity" water main, covers approximately 37% of the District. The minor pressure zones, which are fed by these two larger pressure zones, cover the remainder of the District.

The District's connections to the regional distribution system and the transmission mains operated by SPU are reportedly in good condition. The combined delivery capacity of the District's five connections to the regional system, in gallons per minute, is much greater than the projected MDD of the District.

The most recent SPU contract included more detail about SPU's responsibility for water supply, through the five interties with the District. These are indicated in Exhibit II to the water supply contract (see Appendix D). Three interties are designated for primary use and two are designated for backup supply purposes. However, all are readily available for service. SPU is obligated to deliver up to 1,500 gpm (2.16 mgd) through the two

interties serving the District's 575 pressure zone, at minimum hydraulic gradients of 550 feet and 540 feet. SPU is obligated to deliver up to 1,000 gpm (1.44 mgd) at a minimum hydraulic gradient of 430 feet to the District's 425 pressure zone. The two backup sources are connected to the 425 pressure zone, with minimum supply hydraulic gradients of 420 and 395 feet.

The total commitment from SPU is for 2,500 gpm or 3.6 mgd. This is intended to cover fully the maximum day supply requirements for the foreseeable future and is 1.6 percent higher than the year 2038 MDD forecast of 3.54 mgd (see Table 3.1).

Generally, an additional quantity of water is available from the SPU interties, but SPU is not obligated to meet delivery rates higher than indicated in the contract, subject to the needs of their direct customers, other purveyors in the region or operations, maintenance or construction activities in the SPU delivery system. SPU addressed this in a clarifications letter in late 2014 (see Appendix D).

The District is not aware of any circumstances that would limit the ability of SPU from providing the necessary quantity and quality of water to meet the projected needs of the District. Therefore, the source capacity of the District is not foreseen to be a limiting factor in the growth of the District. Further information regarding the Cedar River and Tolt River sources can be found in the Seattle Public Utilities *2019 Water System Plan.*

Major elements of the District's system are shown on Figure 3-1.

3.3.2 Seattle Master Meters

Water is purchased from SPU at five points of delivery through master meters owned, operated and maintained by SPU. One master meter (Station 143) is used exclusively as an emergency supply to provide fire flows to a large apartment complex and the south end of the District.

Water is supplied directly into the District's distribution system. Station 139 and 142 each have a pressure reducing station and flow control installed on the primary feed and a pressure reducing station installed on the secondary parallel feed. Station 143 only has a primary feed and has one pressure reducing station installed. The supply points at Stations 25 and 140 do not have pressure reducing valves installed; therefore the hydraulic gradient provided by the SPU system also establishes the District's pressure zones gradients at these stations. All of the pressure reducing stations noted above belong to the District and are downstream of the SPU supply meters.

Location and size of the master meters are shown in Table 3.5. The minimum hydraulic gradient (head) that SPU provides at each location is also shown.

TABLE 3.5
SPU MASTER METERS

METER Location	SPU Number	Size of Meter (In)	Meter No.	Min. Head Ft.	Elevation	PSI
575 (Main) Pressure Zone						
SW 149th St.& 10th Ave SW	139	10	70025553	540	369	74
SW 146th St. & 8th Ave SW	142	8	70069777	550	385	72
425 Pressure Zone						
S. 168th St. & Des Moines	25	8	70081077	420	241	78
S. 160th St. & Des Moines	140	12	14482003	430	271	69
Ambaum Bl. & Des Moines	143	10	5149253	395	253	62

Seattle Public Utilities Demand Charges

By the early 1970's the City of Seattle Water Department, now Seattle Public Utilities (SPU), realized that its regional system was near capacity during the summer months of June, July and August. In an effort to reduce this peaking of the regional system, SPU established a demand charge to be levied against purveyors that draw peak demand water from the regional system. The demand charge was based on the peak usage of the 10 maximum consumption days during the months of June, July and August. The intent of the demand charge was to encourage purveyors to construct and operate storage facilities to limit peak demands on SPU's transmission mains and facilities.

The construction of the District's reservoir, which is further detailed in Section 3.3.4, resulted from an agreement between the District and SPU to help prevent the District from receiving demand charges.

SPU has not imposed a demand charge on the District for many years. However, the current water supply contract retains SPU's right to calculate and impose a demand charge where excessive peak flow withdrawals are occurring. This provision encourages local purveyors to construct and maintain adequate storage facilities.

3.3.3 Water Treatment

SPU is responsible for treatment of the water supply.

Seattle has two large regional watersheds, the Cedar and Tolt, which supply Seattle and surrounding communities with drinking water. The Cedar River Watershed is located southeast of Seattle. This watershed provides about 70% of the drinking water to people in the greater Seattle area. Melting snow and rain are gathered and stored in the Chester Morse Lake and the Masonry Pool reservoirs created by the Masonry Dam. The dam diverts the water into two large penstocks which drop water 620 feet to the

hydroelectric power plant at Cedar Falls, the birthplace of Seattle City Light. The water is released back in to the river and continues flowing to the Landsburg diversion dam. At Landsburg, a portion of the water is diverted from the river into two large pipelines which run to Lake Youngs in Renton. From Lake Youngs, water is pumped a short distance to the Cedar Water Treatment Facility. The Tolt River Watershed is in the foothills of the Cascades in east King County. It supplies about 30% of the drinking water for the people in the greater Seattle area. The Tolt Reservoir captures water and snow from the Tolt watershed. Most of this water is released from the dam directly to the South Fork Tolt River. A portion of the water is drawn through penstocks to a small hydroelectric facility. There it enters a small body of water called the regulating basin. The water then continues its journey, all by gravity, to the Tolt Water Treatment Facility. While the source water is good to start with, the Tolt and Cedar Water Treatment Facilities improve on that source quality in order to meet health standards and SPU's taste and odor requirements. The Tolt facility uses a variety of compounds to achieve optimal water quality and includes filtration, ozonation, chlorination, fluoridation and the addition of minerals for corrosion control. The Cedar facility uses ozonation, UV disinfection and chlorination for treatment. From the treatment facilities, the drinking water enters one of several large pipelines which run the 20 miles or more to Seattle and surrounding communities. Transmission mains branch off into smaller pipes, to water storage tanks and reservoirs, sometimes to water pumping stations, and to adjacent cities and water districts.

Additional information about the SPU water source and testing is available in the SPU water quality annual report available online at:

http://www.seattle.gov/util/MyServices/Water/Water_Quality/WaterQualityAnnualReport/index.htm

The District does not provide treatment of water within its distribution system.

SPU collects water samples monthly at eight sampling stations located throughout the District's distribution system, for routine analysis for coliform, temperature and chlorine. SPU will contact the District if a routine coliform sample is positive so that District staff can collect the required repeat coliform samples within the distribution system within 24 hours, per the WAC. The District collects samples quarterly at four additional locations for disinfection byproduct sampling. If other water quality problems exist in the distribution system (i.e. contamination), it is the responsibility of the District staff to be aware of it and take appropriate action. The District recently completed installation of an automated continuous chlorine analyzer to facilitate daily monitoring of chlorine residual in the distribution system.

3.3.4 Storage

A. General Description and Condition

In 1984, the District investigated storage alternatives to avoid SPU demand charges. A deep well and pump system located at 4th Avenue SW and SW 146th Street was determined to be potentially more cost effective than construction of a reservoir.

An aquifer test of an exploratory well, drilled in the spring of 1985, concluded that a potential interference existed between the District's proposed well and SPU's wells and that a District well would impact SPU's deep well program.

The District and SPU negotiated to find a mutually acceptable solution to lowering the District's demand charges. As a result, the District agreed to sell its water rights to SPU, and in exchange, SPU would contribute funding toward the construction of a reservoir.

In the summer of 1988, the District completed construction of a reservoir located at SW 158th Street and 4th Avenue SW. The reservoir is a partially buried, above-grade circular concrete reservoir with pump station which was constructed to transfer water from the 425 pressure zone to the 575 pressure zone during periods of high demand. Water in the reservoir is supplied to and drawn from the bottom through separate piping. Under typical demand conditions, water within the reservoir is replaced approximately every day.

The District's reservoir structure is approximately 57 feet in diameter and 25 feet in height. Water volume is about 500,000 gallons of storage capacity; however, the purpose of the reservoir is to reduce or eliminate the demand charges from SPU. The following section analyzes the District's required level of storage capacity.

The interior of the reservoir was cleaned and inspected in 2013.

A booster pump station was constructed as an integral part of the reservoir structure. The station has three pumps with all related controls, valves, electrical and mechanical systems and telemetry. There are two pumps of 400 gpm capacity with 60 horsepower motors and one pump of 800 gpm capacity with a 125 horsepower motor.

The reservoir receives water from the SPU "gravity" water supply system in Des Moines Drive through the District's 425 pressure zone distribution system.

The reservoir is filled at a constant rate over each 24-hour period. The water is pumped from the reservoir into the 575 pressure zone during high demands periods, thus reducing the peak demands on SPU's regional system.

Table 3.6 presents the general description of the reservoir.

TABLE 3.6
EXISTING RESERVOIR

Ownership – WD 49	100%
Type of reservoir	Surface Partially buried
Material type	Concrete
Total capacity Size of Facility	0.5 mg 57’ diam, 25’ high
Pressure Zone Served (With Pump Station)	575 pressure zone
Age/future life expectancy	27 yrs/50 yrs
Pumps – 2 units 1 unit	400 gpm/60HP 800 gpm/125HP
Painting –Interior (PS) - Exterior	2000 N.A.
Last inspection/ Cleaning	2013
Isolation valves	Yes
Sample tap	Yes
High & low level alarms	Yes
Low level indication	Yes
Drain facilities	Yes
Overflow pipe	Yes
Air Gap on overflow/drain	Yes
Tank atmospheric vents w/ non-corroding insect screen	Yes
Locks/fences to prevent unauthorized entry	Yes
Water tight, insect proof access hatches, vents	Yes
Access ways and ladders for maintenance access	Yes
Removable silt-stop on the outlet pipe	No
Slope of Reservoir roof	Minimal
Piping material below reservoir & extending 10’	Ductile Iron
Separate inlet and outlet pipes	Yes
Seismic Restraint	No

B. Storage Capacity Analysis

Prior to 1988, the District operated with no storage facilities. The District continues to function primarily as a distributor with limited storage capacity.

As discussed in Section 3.3.1, the District relies on two pipelines from SPU’s regional system. The “pumped” north line and “gravity” east line both provide water to the

District and pass through the District to supply water to other districts as well. To analyze possible storage needs, the hypothetical loss of one of these pipelines or an individual supply meter has been considered.

The loss of service from the gravity east supply line is one potential challenge. South of South 156th Street, SPU's 24" main is a dead end pipe. Problems with the SPU pipe between South 156th Street and South 160th Street would cut off the District's supply to the 425 pressure zone. However, with the SPU north line still operating under this scenario, the District's two connections to the north line could provide water to the entire District including the 425 pressure zone through PRV interconnections from the major to the minor zones.

Complete loss of service from SPU's pumped north line is also possible but unlikely. Because of valve arrangement and spacing, geometry of SPU's pumped water system and the flexibility in operation that is possible in the SPU system regarding pumping and supply from their various reservoirs, it is highly unlikely that their entire pumped water system would be off at one time. However, a short section of the SPU main or an individual master meter (meter 139 or 142) could be shut off individually.

Loss of water supply from an individual SPU master meter also occurs during SPU's shutdown of the meter during its yearly routine maintenance and testing program.

As described in Section 3.3.6 and Chapter 4, the District has five interties with King County Water District No. 20 (WD20), and two with Highline Water District (HWD). The WD20 interties are all between the WD20 575 pressure zone and the District's 575 pressure zone, both of which are supplied by multiple connections to the SPU "pumped" water supply system. Two of these interties are set up for automatic delivery from one system to the other, on a drop in local system pressure. The other three are manually operated. Depending on local conditions, each intertie can supply upwards of 1,500 gpm to the system in need. WD20 has five interties to its 575 pressure zone and, in addition, can pump water to this zone from its six million gallon reservoir, supplied directly by an additional SPU service. WD20 shares the volume of that reservoir with King County Water District Nos. 45 and 125.

The interties with Highline (one each for supply typically in each direction) are intended for service for local emergency or planned maintenance situations and do not appreciably impact the total supply for the District.

Calculations of the various components and minimum recommended total storage volumes have been determined as outlined in Section 3.1.6 of this report and are based on the DOH WSDM Chapter 9. Specific storage results for the recent conditions (2018) and the future conditions (2038) are summarized below.

The District is concurrently preparing a Project Report in anticipation of completing design and construction of a second storage reservoir. The geometry of the second

reservoir indicated below is based on preliminary analysis. Details will be presented in the Project Report.

Operational storage (OS) is necessary to meet system demands when water is not being supplied by the source. The District relies on a continuous supply from the SPU regional supply system. Even though the risk of loss of this continuous source is very low, it is prudent to plan for a small amount of OS. The OS of the existing gallon reservoir is 4.0 feet (or 0.08 MG) and should be accounted for in the current and future OS volume. Preliminary analysis for a second reservoir suggests an allowance of 0.5 feet (or 0.05 MG) from overflow to normal low water level for OS volume. The two combined results in an OS of 0.13 MG for year 2018 and 2038.

Equalizing storage (ES) provides water during periods of the day when system demands are higher than source capacity. Under normal operating conditions, the capacity of the District's connections to the regional system is much greater than the projected demands of the District. However, the contract supply rate from SPU is less than the PHD throughout the planning period.

A mass demand analysis was developed to evaluate ES. A diurnal curve was developed based on a summer holiday weekend demand pattern, adjusted to achieve the planning level ratio of Q_{peak} to Q_{avg} and then escalated for the MDD in 2018 and 2038. Once these curves were developed, the volume above the SPU supply rate of 2,500 gpm was calculated to determine ES. ES required for year 2018 is 0.05 MG and for year 2038 ES is 0.40 MG.

Standby Storage (SB) for a multiple-source system assumes the loss of the largest capacity source to the system. Because of the number and size of the connections to SPU supply mains and the District's well–looped, hydraulically-efficient distribution system downstream of the supply points, total supply capacity is at least 9,000 gpm, but this rate is not guaranteed and is limited to 2,500 gpm by contract.

Though highly unlikely, the loss of the largest SPU source of supply (1,000 gpm) was considered. It was also assumed, for this analysis, that the WD20 emergency interties would not provide supplemental supply. Using DOH WSDM Equation 9-3, the resulting SB storage for 2018 is 1.16 MG and for 2038 is 2.2 MG.

DOH recommends that regardless of the amount calculated by Equation 9-3, standby storage should not be less than 200 gallons per ERU. Standby storage calculated by this method was greater than the value for 2018 but slightly less than the value for 2038, as calculated using Equation 9-3. The minimum recommended SB storage for 2018 is 1.52 MG and for 2038 is 2.20 MG.

Fire suppression storage (FSS) is based on a flow rate of 4,000 gpm for a duration of four hours. Therefore, required FSS for both year 2018 and 2038 is 0.96 MG.

Dead storage (DS) is the unusable water in the bottom of a reservoir. The DS in the existing reservoir is controlled by minimum water elevation for the booster pumps and amounts to 0.06 MG. Preliminary analysis for a second reservoir suggests an allowance of approximately 1.25' (about 0.11 MG) of DS for the new facility, based on control levels for low water level. The total DS volume for both year 2018 and 2038 is 0.18 MG.

According to the DOH WSDM Chapter 9, water systems can exclude the smaller of the standby or fire suppression storage (nesting), as long as this practice is not prohibited by local ordinance or the local fire official. In this case, the local fire official recommends, but does not require, that SB and FSS not be nested. Because of the high reliability of the SPU continuous supply, it would be reasonable to nest SB and FSS and use the larger of the standby and fire suppression storage to calculate the total storage volume for the District, even though this approach is not recommended by the local fire official.

Table 3.7 summarizes the minimum recommended storage volumes for 2018 and 2038.

TABLE 3.7
STORAGE ANALYSIS

Storage Component	Year 2018	Year 2038
Operational Storage	0.13	0.13
Equalizing Storage	0.05	0.40
Standby Storage	1.52	2.20
Fire Suppression Storage	0.96	0.96
Dead Storage	0.18	0.18
Total Required	2.84	3.86
Available	0.48	0.48
Surplus/(Deficit)	(2.36)	(3.38)

(Volumes in million gallons)

It is recommended that the District construct a new reservoir with a total volume of 3.4 MG, which assumes the continued use of the existing 0.48 MG reservoir. Pre-design work in support of this project has concluded that the new facility should have a nominal capacity of 3.7 MG.

3.3.5 Pipe Distribution System

The District's distribution system is made up of two major pressure zones, which are both connected to SPU's regional distribution system. Each zone operates independently of the other; however, water can be transferred between zones if required. Several minor pressure zones receive water from the larger, major zones through pressure reducing valve stations.

A hydraulic profile of the District is included as Figure 3-3.

The 575 pressure zone, which encompasses most of the District, is fed through a 24-inch line from SPU's Burien Pump Station. The pump station boosts water from the Riverton Heights Reservoir to a hydraulic gradient of at least 575 feet. The 425 pressure zone is supplied by the same reservoir through a separate 24-inch line. Its hydraulic gradient is at least 430 feet.

The District's transmission and distribution system is a well-looped, hydraulically efficient system covering generally all of the service area. Large 10-inch and 12-inch mains convey water from the areas of the regional system connections to outlying areas. Distribution mains are primarily 8-inch in diameter; however, about 53,600 feet of 6-inch and smaller cast iron mains still remain in use. An ongoing main replacement program schedules the replacement of these smaller cast iron mains with 8-inch ductile iron. Most of the system has been installed or replaced since 1960.

The lowest pressures in the District are in the higher elevation areas along the west side of the airport in the south portion of the District. Service pressures in these areas are in the range of 40-50 psi.

In some places the system pressures exceed 80 psi. These areas are in the lowest elevation areas of the pressure zones. Residents in these areas have been advised of these pressures and are instructed to maintain pressure reducing valves on their water service to regulate their individual system pressure.

As mentioned above, the system is generally well looped; however, there are numerous short dead end lines located within the service area. A complete inventory of the District's distribution system is included in Table 3.8 and a map of the water system, including appurtenances, is included as Figure 3-2.

Evidence from District maintenance records and routine inspections suggests that the overall system is in acceptable condition with isolated locations highlighted as trouble spots. The majority of system repairs are made on the aging cast iron mains and the related galvanized service connections. In these areas, leaks are commonly caused by the deterioration of the galvanized service line between the water main and the service meter.

All water system “as-built” records are kept by computer mapping and include the locations of all facilities, pipe sizes and hydrant and valve locations. Dates of installation for pipelines are also noted for all new pipelines.

Fire hydrants generally have adequate spacing and coverage per the requirements of the local fire official. Locations of isolation valves are generally good with limited areas having greater than desired valve spacing. The addition of valves and fire hydrants where identified are included in main replacement projects and developer extensions.

The District’s water system includes approximately 640 fire hydrants and 60 miles of ductile iron and cast iron pipe. There are no asbestos cement (AC) mains or large diameter steel water mains remaining in service. There are minor amounts of plastic and galvanized steel water main below 4” diameter, primarily 2” diameter.

Installation of a water system improvement or extension can be by District capital improvement project, a Developer Extension or by a utility local improvement district (ULID) process. The District’s system inventory is shown in Table 3.8.

TABLE 3.8
SYSTEM INVENTORY

Water Main Size and Material	**Linear Feet**
Unknown diameter and material	1,711
Less than 4” Galvanized and Plastic	2,085
4” Ductile Iron and Cast Iron	11,832
6” Ductile Iron and Cast Iron	39,928
8” Ductile Iron and Cast Iron	218,160
10” Ductile Iron and Cast Iron	21,400
12” Ductile Iron and Cast Iron	22,114
(Total Length = 317,230 Linear Feet or Approximately 60.1 Miles)	
Fire Hydrants	**Quantity**
2 and 3 Port Hydrants	677
Valves	1,231

In 2016 the Governor issued Directive 16-06 which, part, directed Group A water systems to identify all lead service lines and lead components in their systems, and plan to remove them within 15 years. The present District Superintendent has worked for the District for approximately 25 years, in roles of increasing responsibility. He reports that he has never observed or seen record of lead service lines or lead components in the existing system and therefore believes they are none in the system. The District has completed numerous water main replacement projects over his years of service and all those projects include replacement of the main and service lines. While there are galvanized lines in some areas he has not observed lead goosenecks in the system.

3.3.6 Interties with Adjacent Purveyors

As described above, in addition to the five connections to SPU's regional supply system, the District maintains seven interties with two of the adjacent water districts. Status of these interties is shown in Table 3.9.

TABLE 3.9
INTERTIES WITH ADJACENT PURVEYORS

Location	District	Open/Closed	Metered
SW 144th & Ambaum Blvd	WD 20	Closed	No
S. 152nd St. & 4th Ave. S.	WD 20	Closed	No
SW 154th & 21st Ave. SW	WD 20	Open	Yes
SW 152nd & 16th Ave. SW	WD 20	Open	Yes
1st Ave. S. & SW 144th	WD 20	Closed	No
SW 170th & 27th Ave. SW	Highline WD	Open	Yes
S. 177th St. & 10th Ave. S	Highline WD	Open	Yes

All of these interties are normally inactive and are maintained as emergency interties between the districts. The three closed interties are isolation valves which are normally closed and which must be opened manually to transfer water to either district. The remainder are metered interties with automatic control valves.

3.3.7 Pressure Zones

Along the north side of the District, SPU maintains a "pumped water" system which provides a minimum hydraulic gradient of 550 feet. This system supplies water to the District's 575 pressure zone at master meter stations 139 and 142.

Along the east side of the District, SPU operates a "gravity water" system that provides a minimum hydraulic gradient of 430 feet. This system supplies water to the District's 425 pressure zone at master meter stations 25, 140 and 143.

Because of low ground elevations along the west and south sides of the District, the District maintains four minor pressure zones which receive water from the two major zones through pressure reducing valve stations.

These minor zones are the 497, 483, 380 and 336 pressure zones.

Figure 3-1 shows a map of the hydraulic pressure zones. Figure 3-3 shows the District's hydraulic profile. The pressure zones are summarized as follows:

A. 575 Pressure Zone (1)

As can be seen from Figure 3-1, the 575 pressure zone covers the majority of the District encompassing approximately 1,217 acres or 56.0% of the total area within the District. This pressure zone serves the bulk of the District lying above 300-foot elevation mean sea level.

The 575 pressure zone is supplied water from the SPU "pumped water" transmission main through Master Meters 139 and 142. This pressure zone is also supplied water from the "gravity water" system through the District's 425 pressure zone, reservoir and pump station.

B. 425 Pressure Zone (2)

The 425 pressure zone is the other major pressure zone covering about 806 acres or 37.1% of the District. Ground elevations are primarily between 175 and 330 feet mean sea level.

This pressure zone receives water from SPU's "gravity" water system in Des Moines Drive through master meters 25, 140 and 143. The pressure zone can also receive water from the 575 pressure zone through pressure reducing valve stations.

C. 497 Pressure Zone (5)

The 497 pressure zone is a very small zone of about 5 acres (0.2%) in the south end of the District. Ground elevations generally lie between 190 and 250 feet above mean sea level.

This pressure zone is supplied water from the 575 pressure zone through a pressure reducing valve station.

D. 483 Pressure Zone (6)

The 483 pressure zone is a small zone of about 57 acres (2.6%) along the west side of the District. The ground level elevations within this area generally lie between 125 and 325 feet above mean sea level.

This pressure zone receives its water supply from the 575 pressure zone through pressure reducing valve stations.

E. 380 Pressure Zone (3)

The 380 pressure zone is a small zone of 48 acres (2.2%) located in the southerly portion of the District. The ground level elevations within this area generally lie between 140 and 210 feet above mean sea level.

This pressure zone obtains its water through a pressure reducing valve station from the 575 pressure zone.

F. 336 Pressure Zone (4)

The 336 pressure zone is another small zone located in the extreme southerly portion of the District. The zone is approximately 41 acres (1.9%) with ground elevations primarily between 110 and 190 feet above mean sea level.

This pressure zone receives its water through pressure reducing valve stations from the 380 pressure zone.

3.3.8 Pressure Reducing Valve Stations

The District operates and maintains nine pressure reducing valve stations that supply water from a zone with a high pressure gradient to a zone at lower elevations requiring a lower pressure gradient.

The majority of these stations supply water from the major pressure zones (the 575 and 425 pressure zones) to the minor pressure zones (the 497, 483, 380 and 336 pressure zones). However, several stations can supply water from the 575 pressure zone to the 425 pressure zone. This provides a reliable, flexible supply system to each zone.

Most of the PRV stations consist of a small (2” or 3”) valve for low flows and a larger (6”, 8” or 10”) valve for higher flow rates.

Table 3.10 shows the current information, location, size and pressure settings of each station.

TABLE 3.10
PRESSURE REDUCING VALVE STATIONS

PRV No.	Location	Zone Served	Size of Valves (in)	Valve Elevation (ft)	Outlet Setting (psi)	Outlet Hydraulic Gradient (ft)
1	SW 157th St / 23rd Ave SW	483	2, 6	318	60, 55	456, 445
2	Sylvester / 6th Ave SW (Highline Community Hospital)	425	8	240	80	425
3	SW 167th St / 31st Ave SW	483	2, 6	322	65, 60	472, 460
4	Sylvester / 12th Place SW	336	2, 6	190	70, 65	352, 340
5	Sylvester / 11th Place SW	336	2, 4	163	61, 56	303, 292
6	SW 158th St / 4th Ave SW	425	3, 8	288	60, 50	426, 403
7	SW 170th St / 12th Ave SW	497	2, 6	243	65, 60	393, 381
8	Sylvester / 8th Place SW	380	6	200	75, 70	373, 361
9*	SW 155th St / 1st Ave S	425	3, 10	260	92, 74	472, 431

**PRV-9 has a pressure relief valve in addition to a pressure reducing valve*

3.3.9 Telemetry

The District's existing telemetry system was upgraded in 1998. The system is run by a sole computer station located in the District office. Only a portion of the District's facilities (SPU stations 139, 140, 142 and the booster pump station) are connected to the telemetry system.

Flow monitoring can be observed for Stations 139, 140 and 142. Station 143 is for emergency supply only and is not connected to the system. Station 25 was constructed in 2001 and is not connected to the system.

The system can monitor and report on incoming flow rates and pressures from the SPU master meter stations, water level in the reservoir and outgoing flow rate from the pumps at the District's booster station. Reservoir filling and pumping functions can be, and are, performed from the computer station. The reservoir is filled at a constant rate

over each 24 hour period and the pumps are programmed to operate for a two to four hour period during the peak demand times of the day. Length of the pumping cycle each day depends on weather and time of the year.

Expansion of the system to monitor all five connection points to the regional system has not been completed and is not planned. Upgrades to the existing system are proposed in connection with the addition of a second reservoir.

3.3.10 Hydraulic Capacity Analysis

A computer model simulating the existing primary elements of the distribution system has been developed. The computer model can be used to determine the adequacy of the distribution system under normal demand and fire flow conditions.

As an aid in identification of present and future demands and recommended improvements, the District's water system was modeled utilizing the WATERGEMS software program developed by Bentley.

King County Water District 49's computer model has been developed as one large network which covers the entire District. Incorporated in the model are the individual pressure zones, supply points, pipes, junction nodes and pressure reducing valves. The computer model is regularly updated upon completion of a construction project.

The model uses the minimum pressures that SPU is obligated to provide at the supply points. Normally, SPU provides more than the minimum pressure, but the model uses the minimums that SPU must provide under the terms of the water supply contract.

The model uses the existing current pipe network; however, the demands used at each node are "future" demands.

The computer model is used to analyze the conditions in the water system under various conditions. Various input conditions such as supply pressure and residential or fire flow demands can be input and easily changed. The computer calculates the various output conditions such as node pressures, flows and velocities in each pipe, incoming flow rates from the various supply points, etc.

The District's system was analyzed under three demand conditions. These were the MDD condition, the MDD with fire demand condition and the PHD condition. All three cases used the flows as detailed above, for years 2016 and 2036.[1]

Since the fire demand condition typically presents the greatest challenge for the hydraulics of the system, analysis of the results of the fire demand situation revealed

[1] The hydraulic analysis presented in the February 2017 Water System Plan was not updated for the 2019 Plan. The prior analysis did not reveal distribution system needs other than fire flow through 2036. The Plan and hydraulic model will be updated well before 2036, so the additional modeling effort at this time was deemed to be of minimal value.

the system deficiencies. This was used to develop the elements of the Capital Improvement Program detailed in Chapter 8 of this WSP.

The fire flow criterion for single family residential areas is 1,000 gpm. Nodes for residential areas were considered deficient if the available fire flow was less than 1,000 gpm.

The maximum anticipated fire flow in the District is 4,000 gpm, and this is considered as potentially required for all non-residential (i.e., non-single family) areas served by the District.

A minimum system-wide residual pressure of 20 psi was used for the MDD plus fire demand condition and 30 psi was used for the MDD and PHD demand conditions.

Summary of System Deficiencies

The 2016 total MDD in the District was forecast as 1,722 gpm. With the PRV and master meter hydraulic gradients as shown in Table 3.5, water normally enters the District at the South 160th Street, the South 168th Street, the SW 146th Street and the SW 149th Street master meters. Minimum pressure in the District is 46 psi and the maximum pressure is 154 psi. Pressures are over 120 psi at 12 nodes in the District. These are at the lower elevation areas of the pressure zones, but in general, pressures are not considered excessive throughout the District. Maximum velocity is 2.2 ft/sec in the 10" supply pipes at the SW 146th Street master meter. Flow velocities throughout the District are not excessive.

The 2016 total PHD in the District was forecast as 2,823 gpm. Minimum pressure in the District is 46 psi and the maximum pressure is 154 psi. Maximum velocity is 3.3 ft/sec at in the 12" supply pipes at the SW 149th Street master meter. Flow velocities throughout the District are not excessive.

Under the 2016 MDD with fire flow condition criteria, a total of 35 nodes did not satisfy the 1,000 gpm (residential) or 4,000 gpm (multi-family residential, commercial or industrial) flow criterion.

The District is planning to replace existing 4" and 6" water mains, typically cast iron, over time. The replacement piping is planned to be a minimum of 8" diameter. This replacement program constitutes a majority of the projects identified in the Capital Improvement Program (CIP) presented in Chapter 8.

The 2036 total MDD in the District is 2,382 gpm. Minimum pressure in the District is 46 psi and the maximum pressure is 154 psi. Pressures are over 120 psi at 12 nodes in the District. These are at the lower elevation areas of the pressure zones, but in general, pressures are not considered excessive throughout the District. Maximum velocity is 2.8 ft/sec in the 10" supply pipes at the SW 146th Street master meter. Flow velocities throughout the District are not excessive.

The 2036 total PHD in the District is 3,883 gpm. Minimum pressure in the District is 45 psi and the maximum pressure is 154 psi. Maximum velocity is 4.5 ft/sec at in the 12" supply pipes at the SW 149th Street master meter. Flow velocities throughout the District are not excessive.

Under the 2036 MDD with fire flow condition criteria, a total of 36 nodes did not satisfy the 1,000 gpm (residential) or 4,000 gpm (multi-family residential, commercial or industrial) flow criterion. With the planned CIP improvements, 16 of these nodes satisfy the fire flow criterion. The remaining nodes have been reviewed individually and are in existing previously developed and served areas. Future redevelopment in those areas may require higher fire flows, which may lead to need for system improvements. Such analysis and action would be addressed at time of redevelopment.

Potentially deficient nodes are shown in Figure 3-4. Table 3.11 compares the available fire flow at the deficient nodes before and after implementation of the water main replacement projects in the CIP.

TABLE 3.11 - POTENTIAL FIRE FLOW DEFICIENT NODES

Node	Fire Flow Need (gpm)	Before CIP (2016 MDD w/FF, gpm)	After CIP (2036 MDD w FF, gpm)	Comment (Notes below)
J30	1,000	895	1,000+	1
J121	4,000	2,229	3,668	3, 4
J122	4,000	1,550	2,852	3, 4
J123	4,000	1,271	2,437	3, 4
J124	4,000	1,244	2,407	3, 4
J125	4,000	728	2,203	3, 4
J153	4,000	1,411	4,000+	1
J172	4,000	3,621	4,000+	1
J173	4,000	3,501	4,000+	1
J184	4,000	2,492	4,000+	1
J191	4,000	3,731	3,740	3, 4
J199	4,000	3,327	3,527	3, 4
J241	1,000	795	1,000+	1
J259	4,000	4,000	3,988	3, 4
J263	4,000	1,319	2,307	3, 4
J264	4,000	3,824	3,851	3, 4
J287	4,000	3,277	4,000+	1
J290	4,000	2,557	2,618	3, 4
J324	4,000	3,567	3,577	3, 4
J325	4,000	3,079	3,086	3, 4
J326	4,000	2,869	2,875	3, 4
J328	4,000	2,705	2,710	3, 4
J329	4,000	2,678	2,683	3, 4
J363	1,000	701	1,000+	1
J382	1,000	980	980	2
J426	1,000	610	1,000+	1
J462	4,000	3,932	4,000+	1
J467	4,000	2,590	4,000+	1
J468	4,000	2,810	4,000+	1
J473	4,000	2,671	3,345	3, 4
J475	4,000	2,579	3,097	3, 4
J476	4,000	2,537	2,987	3, 4
J522	4,000	2,532	4,000+	3, 4
J531	4,000	2,536	2,987	3, 4
J532	4,000	3,779	3,792	3, 4
J622	4,000	3,516	3,597	3, 4

1. CIP planned.
2. N/A Local node not intended to provide fire flow.
3. Existing system in developed neighborhood.
4. Action TBD upon development – no action recommended until need demonstrated.

3.4 SYSTEM DEFICIENCIES / PROPOSED SOLUTIONS

The following system deficiencies have been identified from the preceding system analysis.

3.4.1 Source of Supply

The existing sources are projected to be adequate to serve the system through the design period. The District's current contract with SPU expires in 2062. No deficiencies are expected for the source of supply.

3.4.2 Water Treatment

All water treatment is provided by SPU. The treatment capacity projections from SPU do not indicate the need for addition treatment facilities for the design period. No deficiencies are expected for the water treatment.

3.4.3 Storage

Under the current conditions, the existing reservoir is functioning as it was intended as an equalizing storage reservoir. However, because of the small volume available, there is a deficiency of storage volume of 2.36 MG presently and 3.38 MG for the future conditions. Pre-design work in support of this project has concluded that the new facility should have a nominal capacity of 3.7 MG.

The recommended action is construction of a new reservoir with sufficient additional volume for present and future deficiencies. The most desirable location for a new structure would be at a high elevation and near the existing SPU regional supply mains. Because the District's service area is nearly fully developed, existing vacant parcels suitable for a reservoir are very limited. Considering purchase of existing property, and installation of transmission mains and potentially construction of a new master meter tap to SPU's regional supply system, this action will be a significant element of the District's near-term capital improvement plan.

In 2016 the District initiated a study to determine the minimum property size needed for a new storage facility, preferred material for the new facility and preferred location in the system considering hydraulic conditions, geotechnical and critical area conditions, proximity to existing supply connections and land use constraints. The study concluded that at least one acre of land was necessary and four general areas were identified for further evaluation. The preferred facility material was determined to be prestressed concrete. A property for sale in the 575 pressure zone was identified as a preferred site based on its size, immediate proximity to an SPU meter location, with commercial zoning. The District completed a due-diligence evaluation including geotechnical and environmental assessments. Ultimately the District purchased the property in 2017. The property is on the south side of SW 146th St., between 8th Ave. SW and 9th Ave.

SW. The reservoir will be situated at ground level and fill from the 575 pressure zone distribution system. The site is immediately adjacent to SPU meter 142. A booster pump station will be necessary for transferring stored water from the reservoir back into the 575 pressure zone. Water will be circulated through the reservoir on a more or less ongoing basis to maintain good water quality. Preliminary evaluation of the station's necessary capacity suggests a total capacity of 5,500 to 6,000 gpm. This is based on the SPU source available at the contract amount (2,500 gpm), with SPU pumped source out of service (less 1,500 gpm), less the District's year 2038 MDD (less 3.54 mgd or 2,459 gpm), less 4,000 gpm fire flow demand, for a forecast need of 5,459 gpm. A station configured with three large pumps operating together is proposed to provide approximately 6,000 gpm total. Two smaller pumps at 650 gpm each can be utilized as a primary and backup pump for water quality circulation. All pumps will have variable frequency drives to support operation in response to specific system needs.

3.4.4 Distribution System/Hydraulics

Telemetry As noted in Section 3.3.9, the District's telemetry system has not been connected to all of the District's facilities. SPU supply meter stations 25 and 143 are not controlled or monitored at this time. Possible improvements to the telemetry system would include the addition of these stations to the system in order to have a fully controlled system. The system will be upgraded to include the proposed new storage facility and booster pump station.

Water Main Replacement The Capital Improvement Program described in Chapter 8 of this WSP lists the projects that are recommended to resolve or eliminate the existing and anticipated system deficiencies. The projects are listed in order with the highest priority projects listed first but actual scheduling may depend on availability of District resources and proposed projects by other governmental agencies such as roadway improvements by the cities.

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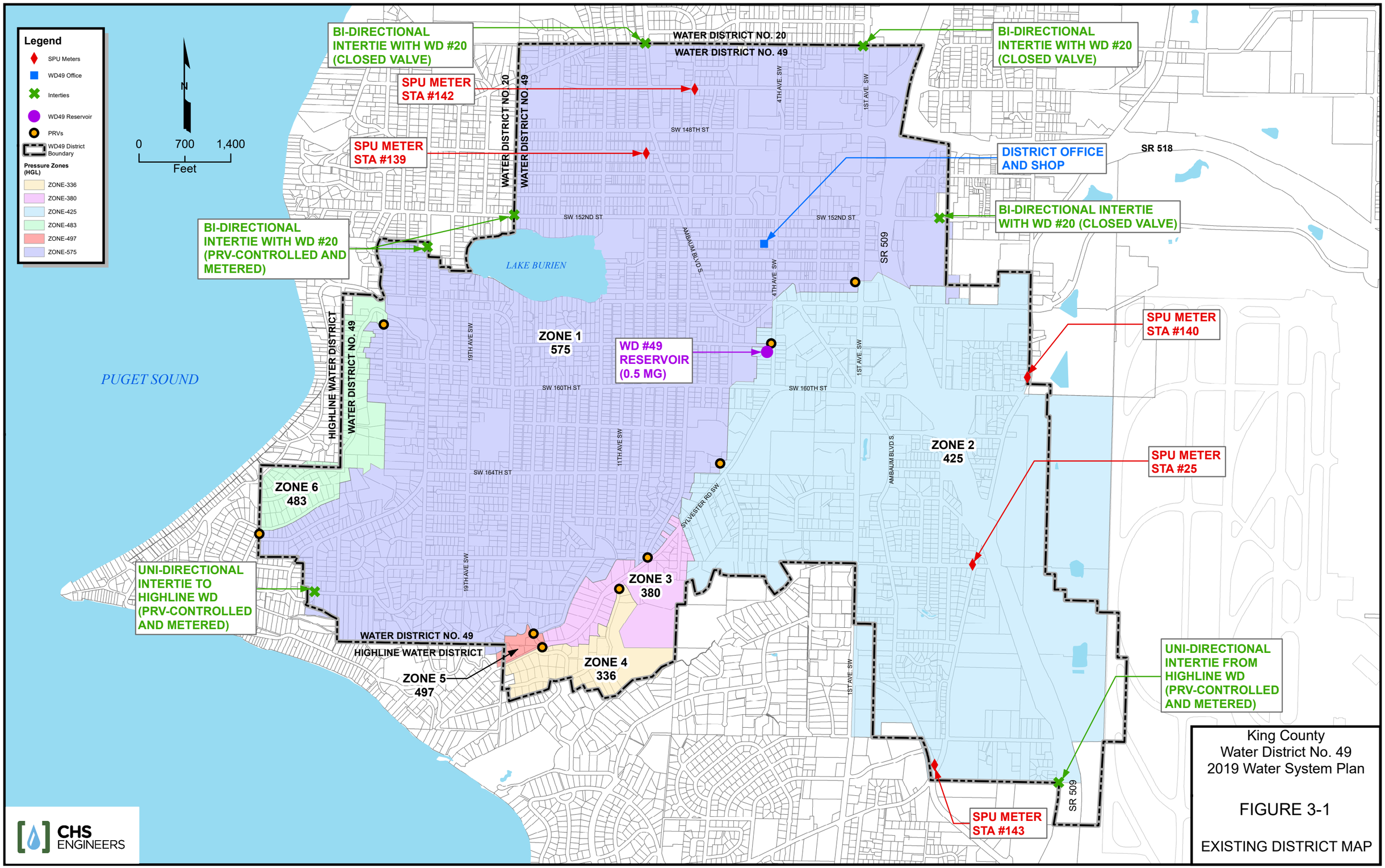
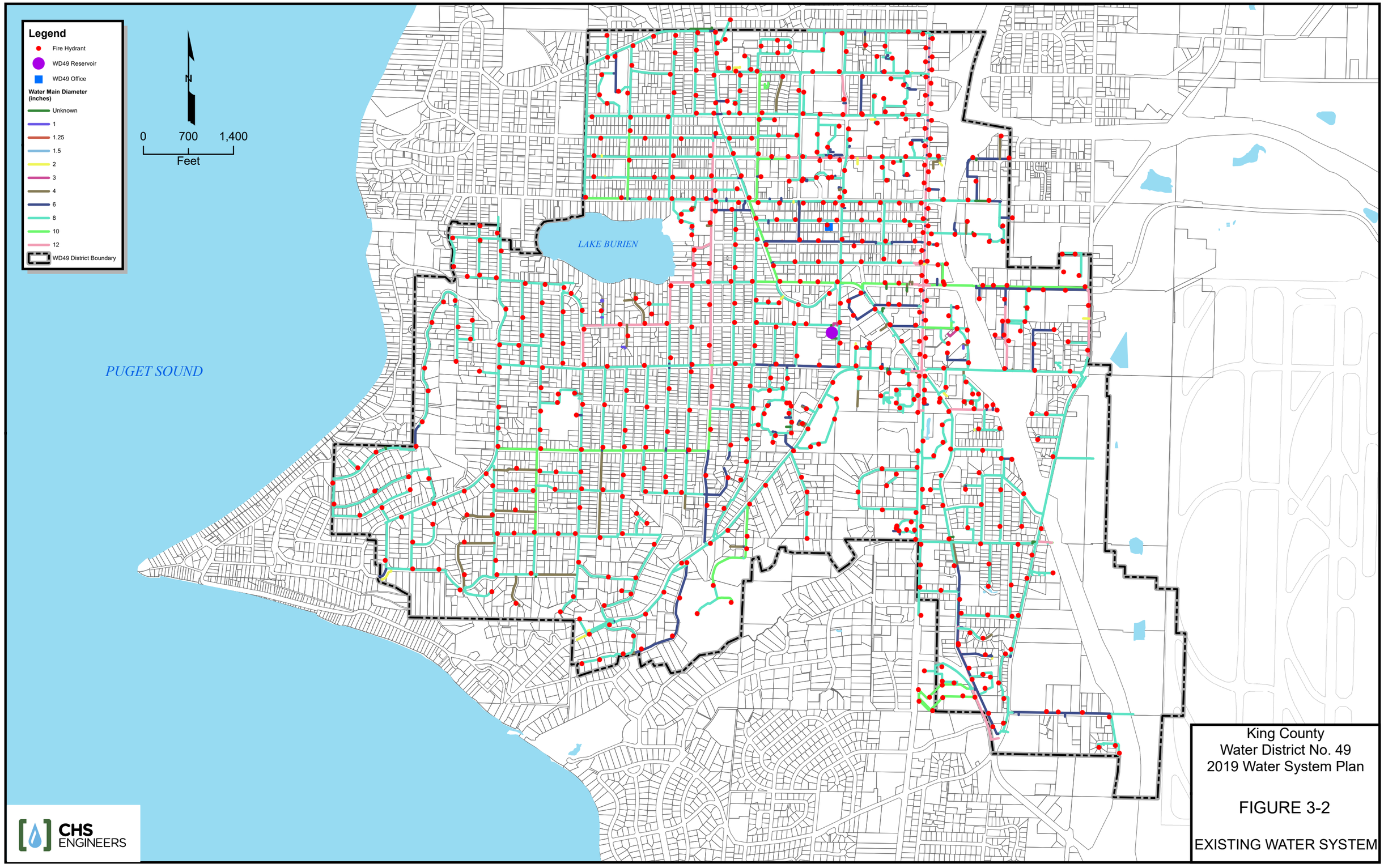
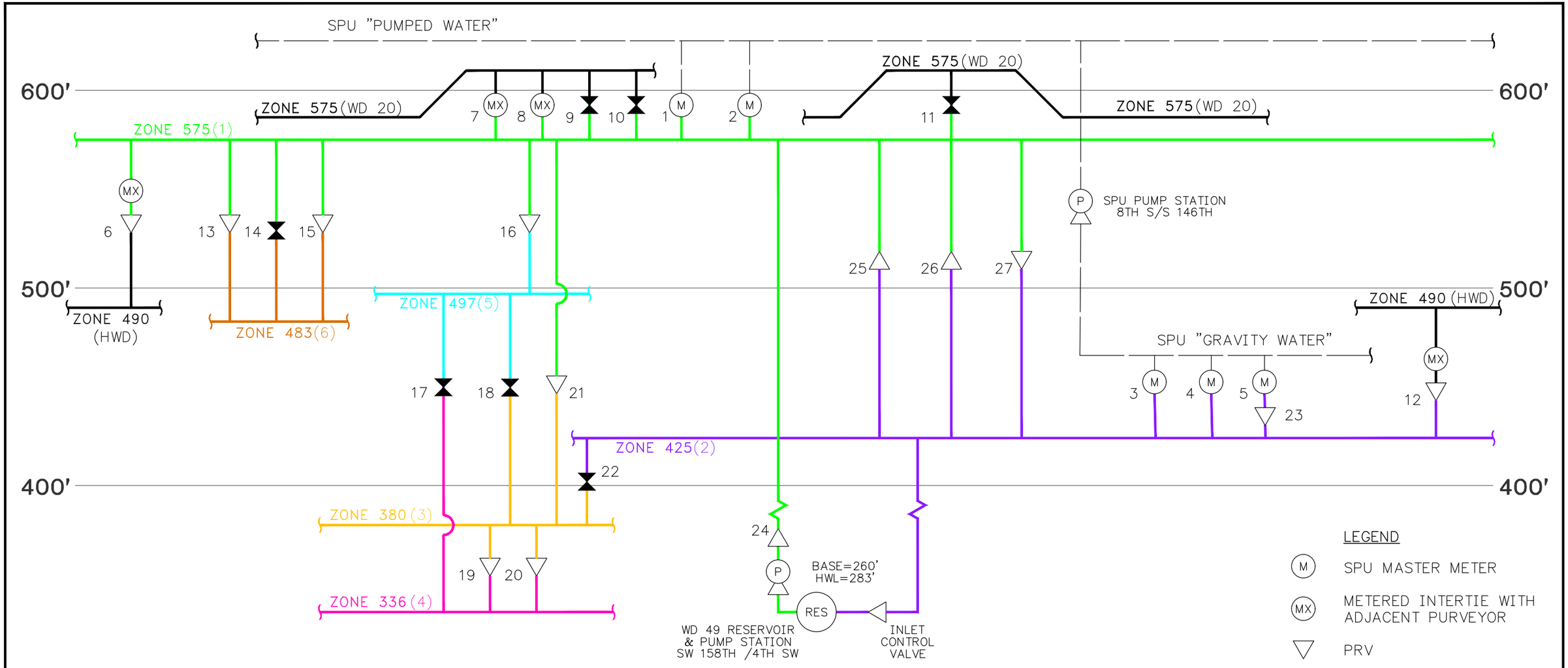

Legend
SPU Meters
WD49 Office
Interties
WD49 Reservoir
PRVs
WD49 District Boundary
Pressure Zones (HGL)
ZONE-336
ZONE-380
ZONE-425
ZONE-483
ZONE-497
ZONE-575
N
0
700
1,400
Feet
BI-DIRECTIONAL INTERTIE WITH WD #20 (CLOSED VALVE)
WATER DISTRICT NO. 20
WATER DISTRICT NO. 49
BI-DIRECTIONAL INTERTIE WITH WD #20 (CLOSED VALVE)
SPU METER STA #142
SPU METER STA #139
DISTRICT OFFICE AND SHOP
SR 518
BI-DIRECTIONAL INTERTIE WITH WD #20 (PRV-CONTROLLED AND METERED)
BI-DIRECTIONAL INTERTIE WITH WD #20 (CLOSED VALVE)
LAKE BURIEN
PUGET SOUND
ZONE 1
575
WD #49 RESERVOIR (0.5 MG)
SPU METER STA #140
ZONE 2
425
SPU METER STA #25
ZONE 6
483
UNI-DIRECTIONAL INTERTIE TO HIGHLINE WD (PRV-CONTROLLED AND METERED)
ZONE 3
380
WATER DISTRICT NO. 49
HIGHLINE WATER DISTRICT
ZONE 4
336
ZONE 5
497
UNI-DIRECTIONAL INTERTIE FROM HIGHLINE WD (PRV-CONTROLLED AND METERED)
SPU METER STA #143
SW 148TH ST
SW 152ND ST
SW 160TH ST
SW 164TH ST
4TH AVE. SW
1ST AVE. SW
19TH AVE SW
11TH AVE SW
AMBAUM BLVD S.
SYLVESTER RD SW
SR 509
King County
Water District No. 49
2019 Water System Plan
FIGURE 3-1
EXISTING DISTRICT MAP
CHS ENGINEERS


Legend
Fire Hydrant
WD49 Reservoir
WD49 Office
Water Main Diameter (inches)
Unknown
1
1.25
1.5
2
3
4
6
8
10
12
WD49 District Boundary
N
0
700
1,400
Feet
LAKE BURIEN
PUGET SOUND
CHS ENGINEERS
King County
Water District No. 49
2019 Water System Plan
FIGURE 3-2
EXISTING WATER SYSTEM



LEGEND

- M — SPU MASTER METER
- MX — METERED INTERTIE WITH ADJACENT PURVEYOR
- ▽ — PRV
- ⋈ — CLOSED ZONE OR INTERTIE VALVE
- P / RES — RESERVOIR & PUMP STATION

SPU SUPPLY METERS

1	STATION 139	SW 149TH/10TH SW
2	STATION 142	SW 146TH/8TH SW
3	STATION 140	DES MOINES/S 160TH
4	STATION 25	DES MOINES/S 168TH
5	STATION 143	DES MOINES/S 176TH

INTERTIES

6	HIGHLINE WD	SW 170TH/27TH SW	PRV/METER
7	KCWD 20	21ST SW/SW 154TH	PRV/METER
8	KCWD 20	16TH SW/SW 152ND	PRV/METER
9	KCWD 20	SW 144TH/AMBAUM	CLOSED VALVE
10	KCWD 20	1ST SW/SW 144TH	CLOSED VALVE
11	KCWD 20	S 152ND/4TH S	CLOSED VALVE
12	HIGHLINE WD	10TH S/S 177TH	PRV/METER

PRVs AND CLOSED ZONE VALVES

13	PRV-3	SW 167TH/31ST SW
14	ZONE VALVE	SW 167TH/26TH SW
15	PRV-1	SW 157TH/23RD SW
16	PRV-7	SW 170TH/12TH SW
17	ZONE VALVE	SYLVESTER/SW 172ND
18	ZONE VALVE	SYLVESTER/12TH SW
19	PRV-4	SYLVESTER/12TH SW
20	PRV-5	SYLVESTER/11TH SW
21	PRV-8	SYLVESTER/8TH SW
22	ZONE VALVE	SYLVESTER/8TH SW
23	PRV-143	DES MOINES/176TH
24	PRV (PS)	SW 158TH/4TH SW
25	PRV-2	SYLVESTER/6TH SW
26	PRV-6	SW 158TH/4TH SW
27	PRV-9	SW 155/1ST S

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King County Water District No. 49
2019 Comprehensive Water System Plan

FIGURE 3-3

HYDRAULIC PROFILE

Legend

- Node with Deficient Fire Flow
- FIRE HYDRANT
- WD49 Reservoir
- WD49 OFFICE

Water Main Diameter (inches)

- Unknown
- 1
- 1.25
- 1.5
- 2
- 3
- 4
- 6
- 8
- 10
- 12
- KCWD No.49

N

0 700 1,400

Feet

PUGET SOUND

LAKE BURIEN

BURIEN

NORMANDY PARK

SEATAC

J-30
J-125
J-122
J-124
J-123
J-121
J-153
J-191
J-241
J-172
J-287
J-184
J-259
J-173
J-199
J-290
J-263
J-264
J-324
J-532
J-325
J-326
J-328
J-329
J-622
J-363
J-382
J-426
J-462
J-468
J-473
J-522
J-467
J-475
J-476
J-531

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King County
Water District No. 49
2019 Water System Plan

FIGURE 3-4

FIRE FLOW
DEFICIENT NODES

CHAPTER 4 – WATER USE EFFICIENCY PROGRAM, WATER RIGHT ANALYSIS, SYSTEM RELIABILITY AND INTERTIES

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CHAPTER 4

WATER USE EFFICIENCY PROGRAM, WATER RIGHT ANALYSIS, SYSTEM RELIABILITY AND INTERTIES

This section of the Water System Plan (WSP) addresses a number of related topics. Section 4.1 describes WD 49's water use efficiency (WUE) program. Section 4.2 provides an analysis of the potential new sources of supply. Section 4.3 summarizes water rights held by WD 49. Section 4.4 provides an overview of system reliability. Lastly, Section 4.5 identifies interties that link WD 49 to SPU's and other purveyor's water systems.

4.1 WATER USE EFFICIENCY PROGRAM DEVELOPMENT AND IMPLEMENTATION

A WUE program should include components of long-term conservation measures and peak use management. Short-term emergency response plans, which are associated with drought and other emergency conditions of water shortage, are not considered WUE measures.

The Washington State Legislature adopted the Municipal Water Law (RCW 43.20.260) in 2003. This law amends and clarifies sections of the RCW pertaining to public water systems, including requirements for specific water conservation efforts. WAC 246-290 was amended effective January 22, 2007 to include the final rules developed from the Municipal Water Law. The new rules require development of a WUE program, including WUE planning requirements, WUE goal setting and performance reporting, and distribution system leakage monitoring and correction as required. More specific direction is presented in DOH Publication # 331-375, *Water Use Efficiency Guidebook*. The District's original WUE Program was adopted on December 12, 2007 and was updated in September 2008 to include 2007 data. An update of the 2008 WUE Plan was presented in the 2017 WSP. An update of that plan is presented in this Plan.

Since the early 1990s, the District has been active in a conservation program. Because of its primarily residential (single and multi-family) customer base, the District's conservation programs have been targeted mostly at both these customer classes. However, the District, thru SPU, has worked with commercial customers to promote and encourage WUE.

4.1.1 Current WUE Program

In 2000, SPU, the District and several other water utilities formed the Saving Water Partnership (SWP). The SWP consists of the SPU wholesale water customers, excluding municipalities and special purposes districts that belong to Cascade Water Alliance. Detailed information is presented at www.savingwater.org. The District contributes funding to the SWP as part of its rates for the development and implementation of the regional program.

The District's water conservation program began in the early 1990s. Table 4.1 identifies the conservation measures that have been implemented by the District in the past several years.

TABLE 4.1
EXISTING WUE PROGRAM MEASURES

	Classes			Years Implemented								
Conservation Measures	SF	MF	COM	2008	2009	2010	2011	2012	2013	2014	2015-2018	Local or Regional
Indoor Program (Hardware)												
Clothes Washer Rebates	X	X	X	X	X	X	X					Regional
Toilet Rebates	X	X	X	X	X	X	X	X	X	X	X	Regional
Showerhead and Faucet Aerators		X	X	X	X	X	X					Regional
Outdoor Program (Hardware)												
ET Controller Rebate	X	X	X	X	X	X	X	X	X	X	X	Regional
Rain Sensor Rebates	X	X	X	X	X	X	X	X	X	X		Regional
Irrigation System Audits			X	X	X	X	X	X	X	X	X	Regional
Behavior Changes												
Leak Detection & Repair	X	X	X	X	X	X	X	X	X	X		Local & Regional
Education												
Consumer Confidence Report	X	X	X	X	X	X	X	X	X	X	X	Local
Water Conservation Messages on Billing Notes	X	X	X	X	X	X	X	X	X	X	X	Local
Youth Education	X	X		X	X	X	X	X	X	X	X	Regional
Fairs	X	X		X	X	X	X	X	X	X	X	Regional
Supply Side Activities												
Conservation Rates	X	X	X	X	X	X	X	X	X	X	X	Local

WD 49 is an active participant in the Saving Water Partnership's regional water conservation program. The program offers a comprehensive set of services that helps residents and businesses use water wisely. The services include education, technical assistance, and financial incentives, as show below:

Customer financial incentives:

- Toilet rebates for single family, multifamily and commercial customers

- Irrigation system rebates for single family, multifamily and commercial customers
- Urinal rebates for commercial customers
- Dishwasher rebates for commercial customers
- Ice machine rebates for commercial customers
- Food steamer rebates for commercial customers
- Coin-operated clotheswasher rebates for multifamily and commercial customers
- Cooling tower improvement rebates for commercial customers
- Water Smart Technology program for commercial customers that provides rebates up to 50% of installed cost for water related equipment

Customer education and technical assistance:

- Classroom presentations for K-12 grade students
- Community festivals and events
- Water efficient gardening classes for residents
- Garden hotline to answer questions about water-efficient gardening and other topics
- Landscape professionals training
- Gardening brochures and fact sheets
- Technical assistance to residential and commercial customers on irrigation efficiency issues
- Technical assistance to commercial customers on indoor efficiency issues
- Regional website full of comprehensive information, tips, rebate information, etc (www.savingwater.org)
- Regional conservation hotline 206-684-SAVE

Clothes Washer Rebates

The District offered clothes washer rebates for the single family sector from 1997 through 2011 as part of the SWP. The rebates were intended to encourage customers to replace older, less efficient clothes washers with more efficient models.

Toilet Rebates

The District has offered toilet rebates since 2000 as part of the SWP. Toilets that flush at greater than 3.5 gallons/flush are eligible.

Showerhead and Faucet Aerators

The District made low-flow showerhead and faucet aerators available to customers for many years as part of the regional program.

ET Controller Rebates

As part of the regional program, the District provides rebates for Evapotranspiration (ET) based, WaterSense-labeled controllers which automatically adjust irrigation systems to real time weather data. Rebates are given to customers regardless of customer class.

Rain Sensor Rebates
As part of the regional program, the District provides rebates for rain sensors which turn off automatic irrigation systems when it is raining. Rebates were given to all customers with in-ground irrigation systems, regardless of customer class.

Irrigation System Audits
As part of the regional program, the District offers free irrigation audits to customers with more than one acre of irrigated area and high outdoor water usage to improve the efficiency of their irrigation system.

Leak Detection & Repair
The District's staff monitors customer water use for irregularities. The billing software notifies the office staff when a customer's usage is above average during any single billing period. At this point the field staff is sent out to reread the meter to ensure that an erroneous reading did not occur. Once usage is confirmed both written and verbal contact with the customer is attempted to discuss the abnormal water use.

While the office staff will attempt to help the customer with suggested possible sources of high usage, it occasionally requires members of the field crew to meet with the customer to discuss possible problems. Field personnel do not conduct repairs on private property but offer suggestions as what to look for or who to contact to perform on-site inspections of the customer's system. The District does allow for some reduction in customer billing for leaks under certain conditions. The District feels that customers are more encouraged to correct their leaks under this policy.

Consumer Confidence Report
The District publishes a semi-annual newsletter, informing customers of new projects, current water supply status, possible system maintenance, and ongoing water conservation measures. These are distributed biannually in conjunction with the required lead information letter, which goes out in the fall, and the Consumer Confidence Report which goes out in June of each year.

Water Conservation Messages on Billing Notes
The District also provides customers with their consumption history on each water bill. Consumption for the previous 12 months is shown on the bill to inform the customer of his usage over the past year. Messages are included on the bills to encourage water conservation.

Youth Education
As part of the regional program, the District provides in-classroom education programs and a range of youth-oriented educational materials aimed at conservation.

Fairs
As part of the regional program, the District sponsors a wide variety of events that residents of the District have an opportunity to participate in.

Conservation Rates
Rates can be used to encourage conservation action by customers. The District's stepped rate structure went into effect in October 2007. The rate structure includes a fixed or base rate which is applied regardless of the amount of water consumed and a variable rate charge which is applied based on the volume of water consumed. The increasing block rate is considered conservation pricing in that it will encourage customers to reduce usage.

4.1.2 Water Use Efficiency Goals

The regional WUE goal for the SWP is to reduce per capita water demand from current levels so that the total average annual retail water use of the SWP members is less than 105 million gallons per day from 2013 through 2018, despite forecasted population growth. The goal was met in 2013, with a total use of 93.1 mgd and again in 2014, with a total use of 93.8 mgd. The goal was met in 2015, 2016, and 2017 with 96.9, 94.4 and 96.6 mgd, respectively. A copy of the SWP strategies and action report and recent SWP annual reports are included in Appendix L.

The District plans to concurrently adopt the Saving Water Partnership regional WUE goal and participate in the next regional program, which will cover 2019-2028[1]. The SWP WUE goal for that period is to "Keep the total average annual retail water use of SWP members under 110 mgd through 2028, despite forecasted population growth, by reducing per capita water use."

Additionally, the District renews its goal to maintain distribution system loss at less than 10 percent for its system.

With the public hearing and adoption process for this updated WSP, the District adopts both the SWP 2019-2028 and system loss goals as its WUE goals.

4.1.3 Water Use Efficiency Measure Evaluation

SWP completes an annual report including general evaluation of the regional program (see reports for the last few years in Appendix L).

4.1.4 Water Use Efficiency Measure Implementation Schedule

The District program for 2019-2028 will be largely a continuation of existing measures. The measures managed by the SWP are part of the District's program to achieve

[1] Details are presented in the SWP *2019-2028 Water Conservation Program Planning Document*, December 2018.

additional savings. Table 4.2 identifies the program the District will be following during the next several years in order to meet the two goals identified above.

TABLE 4.2
2019-2028 WUE PROGRAM

	Classes			Local or Regional
Measures	SF	MF	COM	
Indoor Program – Hardware				
Toilet Rebates	X	X		Regional
Outdoor Program (Hardware)				
ET Controller Rebates	X			Regional
Irrigation System Audits			X	Regional
Behavior Changes				
Leak Detection & Repair	X	X	X	Local
Education				
Youth Education	X	X		Regional*
Website/Videos/Hotline	X	X	X	Regional
Conservation Giveaways	X	X	X	Regional
Customer newsletter	X	X	X	Local
Water conservation messages on billing notes	X	X	X	Local
Fairs	X	X		Regional*
Supply Side Activities				
Conservation Rates	X	X	X	Local

*Regional programs may sponsor youth education, fairs or regional events on a limited basis.

4.1.5 Customer Education

The District participates in school outreach, speakers' bureaus and program promotion. The District receives information from SPU, including conservation ideas and literature, then distributes it with customer billing and newsletters. In addition, the information is also available in the office for walk-in customers.

4.1.6 Projected Water Savings

The conservation goals discussed in this chapter were reflected in the water use forecast by assuming a 0.75% reduction in water use from 2016-2018 (effectively reducing ADD/ERU from 165 to 159), and a 0.25% reduction thereafter through 2022 (effectively reducing ADD/ERU from 159 to 157.4). The 0.74% reduction inversely generally corresponds to the anticipated population growth rate of 0.70%.

These conservation efforts are forecast to result in cumulative estimated savings of 0.65 MG of ADD and 1.16 MG of MDD from 2019 through 2028.

4.1.7 Water Use Efficiency Effectiveness Evaluation

SWP periodically evaluates the impact of regional programs and surveys customers on conservation attitudes and behaviors to ensure the message (from SPU and WD 49) are on track.

4.1.8 Distribution System Leakage Evaluation

The District has continued to maintain water leakage of less than 10 percent over the past 10 years, assuming potential source meter errors for 2011 and 2012. Fire hydrant flows and flushing volumes were estimated throughout the year beginning in 2007. By keeping track of these two activities, water loss volumes should be reduced.

4.1.9 Water Rate Structure Evaluation

The District completed a rate study in 2017 based on the February 2017 version of this Plan. The study did not modify the rate structure as established in 2008. The existing rate structure includes a block rate to encourage WUE. The block rate includes consumption charges in the following blocks: 0-10 ccf, 11-16 ccf, and 17+ ccf. As a result of the 2017 rate study, the District adopted five percent increases to all elements of the water rate structure effective August 1, 2017. An additional increase of five percent was adopted effective January 1, 2018. The District anticipates the needs for additional rate increases in the following years to support funding and implementation of the capital improvement plan presented in this Plan.

4.1.10 Reclaimed Water Opportunities Evaluation

The local wastewater management agency is Southwest Suburban Sewer District (SWSSD). At this time, SWSSD does not produce reclaimed water at either of its treatment plants. The SWSSD's 2014 *Comprehensive Sewer Plan* states that the costs to establish the required tertiary treatment, pumping systems, distribution systems and operation and management facilities are prohibitive. None of the District's top 20 customers (see Table 2.6) can reduce water use substantially by receiving reclaimed water. The complete King County Water Reclamation Evaluation form is included in Appendix L.

4.1.11 Water Supply Characteristics

The District purchases and receives surface water from SPU. The majority of the water is from the Cedar River watershed. The water is conveyed to the District principally through two interties with SPU, which are owned and operated by SPU. Lesser quantities of water enter the District's system through three other SPU interties. Seven interties exist between the District and WD 20 and Highline Water Districts. The District and SPU entered into a new long-term supply contract effective May 2011, through January 1, 2062. The contract includes commitment to deliver up to 2,500 gpm, as a

wholesale supply to the District. The contract, a letter clarifying some terms of the contract, and revisions to Exhibit I of the contract are included in Appendix D. The SPU commitment exceeds the MDD forecast for year 2038 (see Table 2.12).

4.2 SOURCE OF SUPPLY ANALYSIS

The Department of Ecology requires water purveyors to demonstrate consideration of opportunities to optimize or obtain the use of existing sources already developed. An evaluation of other innovative methods to meet water needs should also be included. The source of supply should include analysis of the feasibility and cost effectiveness of implementing the alternatives in lieu of new source development. These alternatives are discussed below.

4.2.1 Enhanced WUE Measures

As discussed in Section 4.1, the District has implemented multiple water use efficiency measures with the goals of reducing regional water use and having less than 10% water loss for the entire system.

4.2.2 Water Right Changes

The District purchases the water it distributes from SPU and has no water rights to any local aquifers or surface waters. SPU holds the water rights for the District's source of supply and is under contract to provide the District's water supply.

A water rights self-assessment form (see Table 4.3 at the end of this chapter) has been completed using the District's existing contract, recent actual water use (2017) and projected water use (2028 and 2038).

4.2.3 Interties

The District currently has five interties with Water District No. 20 and two interties with the Highline Water District. These connections are only used for emergency transfer of water. No normal daily water supplies pass through these interties.

4.2.4 Artificial Recharge

Artificial recharge is the injection or infiltration of available surface water, typically from winter flow or other available water into an aquifer and its subsequent withdrawal. This potential supply method is not used by the District.

4.2.5 Use of Reclaimed Water, Reuse and other Non-Potable Sources

Southwest Suburban Sewer District, which manages the closest treatment plant to the District, is not currently set up to distribute reclaimed water to the District. Detailed planning efforts regarding this operation have not been completed because of the initial

estimates of the cost of treatment and identification of potential users. Installation of a reclaimed water distribution system is a major cost and thus far, has exceeded the estimated benefit from the use of reclaimed water. None of the Districts top 20 customers (see Table 2.6) can reduce water use appreciably by receiving reclaimed water.

4.2.6 Treatment

The type and level of treatment will need to be determined by SPU at such times as additional sources are identified.

4.3 WATER RIGHT EVALUATION

The District's water is supplied from sources under the control of SPU. SPU owns the water rights and manages the watersheds and transmission system. Pursuant to the 2011 Full Requirements Contract with the District, SPU is obligated to deliver water to the District derived from their rights, permits and claims.

Review of SPU's *2019 Water System Plan Update* indicates SPU has adequate water rights to supply the needs of the District. Applications for additional water rights are on file with the Department of Ecology.

4.4 WATER SYSTEM RELIABILITY ANALYSIS

A water system reliability analysis is necessary and prudent to understand the issues that threaten the District's ability to provide an adequate quantity of high quality water to its customers at all times.

4.4.1 Summary of System Reliability Efforts

Source Reliability

The District purchases all of its water from SPU. The supply projections provided in SPU's current WSP indicate that SPU has adequate supply to meet the needs of the District. This amount of supply is adequate to meet the District's demand forecasts, with conservation benefits, for at least the next twenty years. See Chapters 2 and 3 for more information regarding source of supply.

As with source capacity, SPU maintains the water quality of the water distributed by the District. Per SPU's current WSP the reliability of SPU's water treatment facilities is considered extremely high, with multiple sources and means for wholesale supply.

Water Rights Adequacy

The District has no water rights.

Facility Reliability

Elements of Chapter 3 discuss each system component and the related reliability.

4.4.2 Water Shortage Response Planning

The District's emergency response plan is summarized in Section 6.4 of this Plan, and the water shortage response plan is summarized in Section 6.5.

4.4.3 Monitoring Water Levels

The District does not have any monitoring wells in its service area.

4.5 INTERTIES

4.5.1 Existing Interties

The District currently has five interties with Water District No. 20 and two interties with the Highline Water District in addition to the five connections with SPU's regional supply system. The connections to SPU's regional supply system provide water for all of the District's service area.

The interties with Water District No. 20 and Highline Water District are for emergency use only. Water is not normally bought, sold or transferred between districts through the emergency interties but are used only in the event of an emergency, fire demand, or planned and coordinated maintenance actions.

Three of the interties with Water District No. 20 consist of normally closed isolation valves. These are at SW 144th Street at Ambaum Blvd., at South 152nd Street at 4th Avenue South, and at SW 144th and 1st Ave South. The valves are always closed and must be opened manually to transfer water between Districts. Because the hydraulic gradient is the same in both Districts, water may flow both ways.

Two of the interties with Water District No. 20 consist of vaults with flow meters and control valves. These are at SW 153rd Street at 21st Avenue SW and at SW 152nd Street at 16th Avenue SW. The interties are normally open but the control valves are set low enough so that water is only transferred in the event of an emergency or locally high demand (e.g. fire flow situation). Operation is automatic and because the hydraulic gradients are the same in both Districts, flow may go either way through the intertie.

The two interties with the Highline Water District consist of vaults with flow meters and control valves. These interties are normally open but the control valves are set low enough so that water is transferred only in the event of a high demand or emergency. Because each District maintains a zone with a different hydraulic gradient at these two locations, flow through these interties is typically only one way. The intertie at South 177th Street and 10th Avenue South supplies water to Water District No. 49 from

Highline Water District. The intertie at SW 170th Street and 27th Avenue SW supplies water to Highline Water District from Water District No. 49. If the valves are manually adjusted, limited supply could be provided in the opposite direction at each site.

4.5.2 New Intertie Proposals

At this time there are no potential interties that the District is pursuing.

4.5.3 Intertie and Franchise Agreements

Existing intertie and franchise agreements are on file at the District's office and copies are included in Appendix D of this plan.

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Table 4.3 - Water Right Self-Assessment

Mouse-over any link for more information. Click on any link for more detailed instructions.

Water Right Permit, Certificate, or Claim # *If water right is interruptible, identify limitation in yellow section below	WFI Source # If a source has multiple water rights, list each water right on separate line	Existing Water Rights Qi= Instantaneous Flow Rate Allowed (GPM or CFS) Qa= Annual Volume Allowed (Acre-Feet/Year) This includes wholesale water sold				Current Source Production – Most Recent Calendar Year Qi = Max Instantaneous Flow Rate Withdrawn (GPM or CFS) Qa = Annual Volume Withdrawn (Acre-Feet/Year) This includes wholesale water sold				10-Year Forecasted Source Production (determined from WSP) This includes wholesale water sold				20-Year Forecasted Source Production (determined from WSP) This includes wholesale water sold			
		Primary Qi Maximum Rate Allowed	Non-Additive Qi Maximum Rate Allowed	Primary Qa Maximum Volume Allowed	Non-Additive Qa Maximum Volume Allowed	Total Qi Maximum Instantaneous Flow Rate Withdrawn	Current Excess or (Deficiency) Qi	Total Qa Maximum Annual Volume Withdrawn	Current Excess or (Deficiency) Qa	Total Qi Maximum Instantaneous Flow Rate in 10 Years	10-Year Forecasted Excess or (Deficiency) Qi	Total Qa Maximum Annual Volume in 10 Years	10-Year Forecasted Excess or (Deficiency) Qa	Total Qi Maximum Instantaneous Flow Rate in 20 Years	20-Year Forecasted Excess or (Deficiency) Qi	Total Qa Maximum Annual Volume in 20 Years	20-Year Forecasted Excess or (Deficiency) Qa
1																	
2																	
	TOTALS =																
Column Identifiers for Calculations:		A		B		C	=A-C	D	=B-D	E	= A-E	F	=B-F	G	=A-G	H	=B-H

PENDING WATER RIGHT APPLICATIONS: Identify any water right applications that have been submitted to Ecology.

Application Number	New or Change Application?	Date Submitted	Quantities Requested			
			Primary Qi	Non-Additive Qi	Primary Qa	Non-Additive Qa

INTERTIES: Systems receiving wholesale water complete this section. Wholesaling systems must include water sold through intertie in the current and forecasted source production columns above.

Name of Wholesaling System Providing Water	Quantities Allowed In Contract		Expiration Date of Contract	Currently Purchased Current quantity purchased through intertie				10-Year Forecasted Purchase Forecasted quantity purchased through intertie				20-Year Forecasted Purchase Forecasted quantity purchased through intertie			
	Maximum Qi Instantaneous Flow Rate	Maximum Qa Annual Volume		Maximum Qi Instantaneous Flow Rate	Current Excess or (Deficiency) Qi	Maximum Qa Annual Volume	Current Excess or (Deficiency) Qa	Maximum Qi 10-Year Forecast	Future Excess or (Deficiency) Qi	Maximum Qa 10-Year Forecast	Future Excess or (Deficiency) Qa	Maximum Qi 20-Year Forecast	Future Excess or (Deficiency) Qi	Maximum Qa 20-Year Forecast	Future Excess or (Deficiency) Qa
1 Seattle Public Utilities	2,500 GPM	n/a	Jan. 1, 2062	1756 GPM	744 GPM	1,384 AF/YR	n/a	2,2,099 GPM	401 GPM	1,742 AF/YR	n/a	2,459 GPM	41 GPM	2,041 AF/YR	n/a
2 King County WD No. 20		n/a	Indefinite		n/a	0 AF/YR	n/a	0 GPM	n/a	0 AF/YR	n/a	0 GPM	n/a	0 AF/YR	n/a
3 Highline WD		n/a	Indefinite		n/a	0 AF/YR	n/a	0 GPM	n/a	0 AF/YR	n/a	0 GPM	n/a	0 AF/YR	n/a
TOTALS =	2,500 GPM	n/a		1756 GPM	744 GPM	1,384 AF/YR	n/a	2,099 GPM	401 GPM	1,742 AF/YR	n/a	2,459 GPM	41 GPM	2,041 AF/YR	n/a
Column Identifiers for Calculations:	A	B		C	=A-C	D	=B-D	E	=A-E	F	=B-F	G	=A-G	H	=B-H

INTERRUPTIBLE WATER RIGHTS: Identify limitations on any water rights listed above that are interruptible.

Water Right #	Conditions of Interruption	Time Period of Interruption
1		
2		
3		

ADDITIONAL COMMENTS:

1 – Interties with King County Water District No. 20 and Highline Water District are for infrequent needs such as local system maintenance or emergency supply to or from the District system. The term of the WD 20 intertie agreement is indefinite but subject to a five year notice of termination requirement. The Highline intertie agreements are for five year terms that renew automatically in the absence of thirty-days notice of termination prior to each anniversary date. The two Highline interties (one each way) are each subject to a 2,000 GPM limit.

2 – "Currently Purchased" data is for 2017. 10-year forecast is for 2028 and 20-year forecast is for 2038.

3 – The Seattle water supply contract is written as a Full Requirements Contract, under which SPU has agreed to supply all of the water needed by the District to meet the needs of its present and future water customers within its service area as shown in the District's Water System Plan.

CHAPTER 5 – SOURCE WATER PROTECTION

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CHAPTER 5

SOURCE WATER PROTECTION

5.1 GENERAL

As identified in Chapters 1 through 4, the water distributed by King County Water District No. 49 is purchased from the SPU. SPU owns and operates the watersheds, the water treatment plants and the transmission system leading from the watersheds to the District's connection points.

Authority for development and implementation of source protection lies with SPU and other holders of water rights within the watershed areas. The District does not have its own Source Water Protection Program.

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CHAPTER 6 – OPERATION AND MAINTENANCE PROGRAM

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CHAPTER 6

OPERATION AND MAINTENANCE PROGRAM

The following sections summarize the operation and maintenance procedures which assure satisfactory management of the water system operations in accordance with WAC 246-290. Ideally, operation and maintenance programs should be documented in standalone documents that clearly outline the day-to-day functions involved in keeping the water system running smoothly and within guidelines. This section is intended to summarize these stand-alone documents when available and provide direction when they are not.

6.1 DISTRICT MANAGEMENT AND PERSONNEL

King County Water District No. 49 is a special purpose district per RCW 57 which operates under the direction of a Board of Commissioners which has been elected by the voters in the District. There are three positions on the Board and each member is required to live within the boundary of the District. By resolutions, the Board makes and establishes policies that govern the operation of the District.

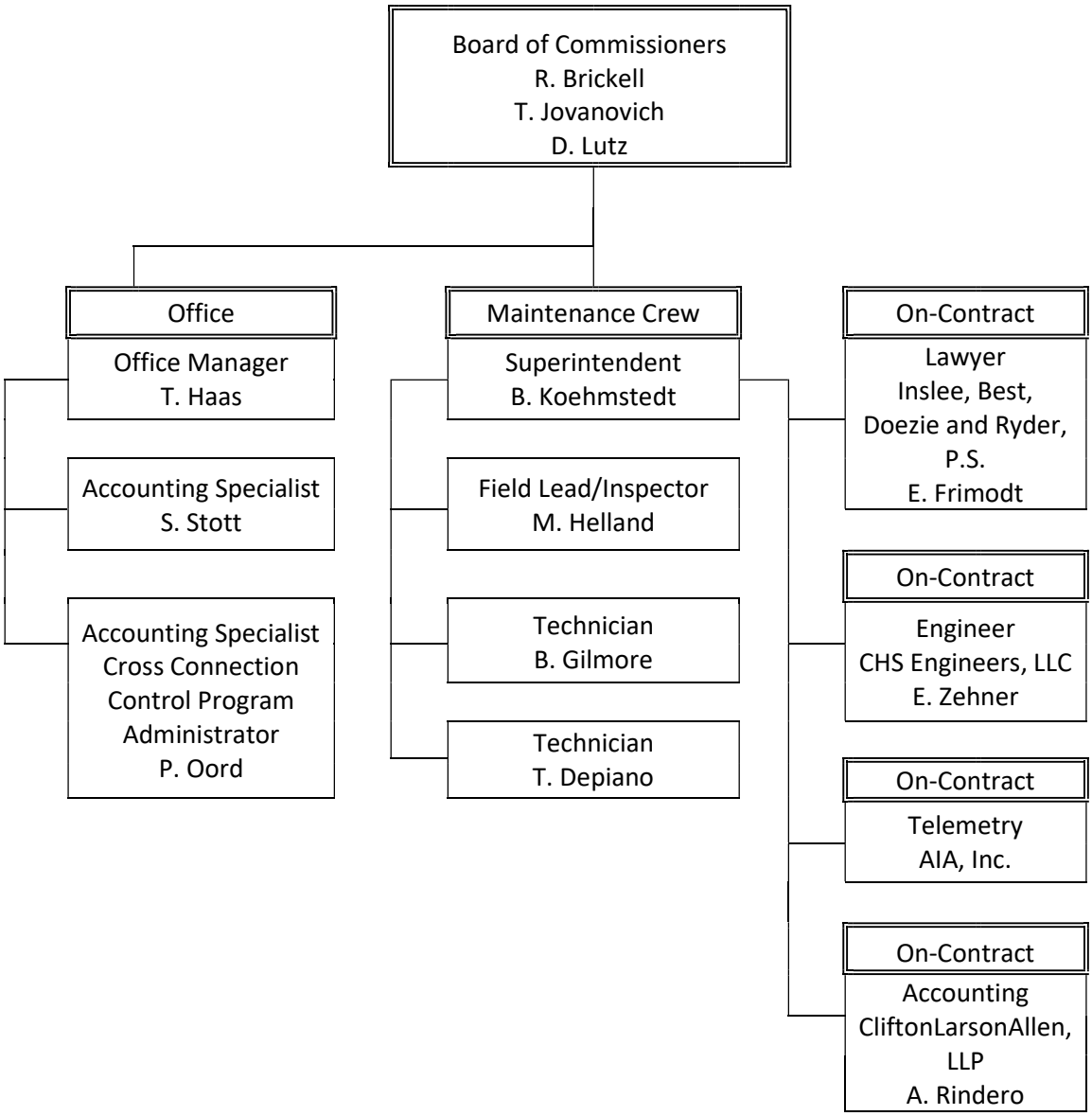
The District holds its regular public meetings on the second and fourth Wednesdays of each month. The District's business address and general information is presented below.

District Address and Phone Number:	King County Water District No. 49 415 SW 153rd Street Burien, WA 98166 206-242-8535
District Contact Person:	Bryan Koehmstedt, Superintendent
Dept. of Health Identification Number:	39800P
Dept. of Health Contact Person:	Richard Rodriguez, Regional Planner Brietta Carter, P.E., Regional Engineer Northwest Drinking Water Operations 20425 72nd Ave S, Building 2, Suite 310 Kent, WA 98032

The current Water District Superintendent is Mr. Bryan Koehmstedt who is responsible for the day to day operations of the District. The current Water Office Manger is Mrs. Tammy Haas who is responsible for District finances and related tasks. Both report directly to the Board of Commissioners. There are five additional full time employees at the District; two work in the office and three work in the field. The Superintendent manages and delegates specific tasks to the three full time maintenance employees

and the Office Manager manages and delegates specific task to the two full time office employees (see Figure 6-1).

FIGURE 6-1
ORGANIZATIONAL CHART



Engineering, technical, financial and legal counsel for the District is provided by outside consultants approved by the Board of Commissioners. These consultants report to and coordinate with the District Superintendent and other staff as directed or required.

Administrative duties are divided between the three office employees who take care of customer relations, account information, billing and other general administrative duties.

Budgets are reviewed by the Board of Commissioners on an annual basis.

The duties of the field crew include, but are not limited to, the following:

- Inspection of major facilities including the reservoir and pump station.
- Investigation of complaints and reported problems.
- Locating water facilities as requested.
- Response to emergency situations in the appropriate manner.
- Repair of leaks and line breaks. Installation of new service connections, including road restoration.
- Reading of water service meters on a bi-monthly cycle.
- Lock and unlock meters.
- Investigating and resolving reported cross-connection problems.
- Inspection of construction projects which may affect the water system in any way.
- Traffic control in support of District activities.
- Maintenance of parts inventory required for repairs.
- Maintenance and repair of fire hydrants including painting and clearing around hydrants.
- Operation and repair of equipment including backhoe and dump truck.
- Flushing of dead end mains.
- Working with other utilities and agencies for coordinated efforts on construction projects or to provide mutual aid to other districts.
- Water sampling and testing
- Meter replacement.

6.2 PERSONNEL CERTIFICATION

The District encourages state certification of operations personnel and sponsors attendance of personnel at safety and technical seminars. Table 6.1 provides a listing of current certifications held by District staff members. District staff rotates “on call” duty to ensure that a qualified staff member is available for District needs 24 hours per day.

TABLE 6.1
CURRENT EMPLOYEE CERTIFICATIONS

Employee	Job Title	Certification Level
Bryan Koehmstedt	Superintendent	Water Distribution Manager 3 Water Distribution Specialist Cross Connection Control Specialist
Mike Helland	Field Lead/Inspector	Water Distribution Manager 3 Water Distribution Specialist Cross Connection Control Specialist
Brian Gilmore	Maintenance Technician	Water Distribution Specialist Cross Connection Control Specialist
Tony Depiano	Maintenance Technician	Water Distribution Manager 3 Water Distribution Specialist Cross Connection Control Specialist

6.3 WATER QUALITY MONITORING

Water quality sampling and monitoring for the District is performed by SPU and submitted to DOH on behalf of the District. SPU collects water samples at eight sampling stations located within the boundaries of the District. In the event a positive bacteriological sample is discovered, the District is notified by SPU to take repeat samples at the predetermined locations as determined by the District's Coliform Monitoring Plan and SPUs 2011 Comprehensive Drinking Water Quality Monitoring Plan. The District's Coliform Monitoring Plan was adopted concurrent with the 2008 WSP and an updated version is included in Appendix J. All water sampling is performed in accordance with Chapter 246-290-300 WAC. The District recently completed installation of an automated continuous chlorine analyzer to facilitate daily monitoring of chlorine residual in the distribution system.

Water supplied by SPU to the District comes almost exclusively from the Cedar River watershed. Because the water from the Cedar River is unfiltered, SPU follows disinfection and monitoring requirements under WAC 246-290-692 and 246-290-694, sampling somewhere in the SPU distribution system at least once per day throughout the year.

In accordance with the requirements of the United States Environmental Protection Agency (USEPA), the District has developed and implemented a Disinfection Byproducts Rule Plan (DBP) to monitor the levels of the byproducts of the water disinfection process. Two water samples are taken by District staff at eight locations once every two months. The samples were analyzed to determine the levels of total trihalomethanes (TTHM) and five haloacetic acids (HAA5) in the distribution system. The final Individual Distribution System Evaluation report has been submitted to and

approved by the USEPA. IDSE Monitoring Plan approval letter and IDSE Standard Monitoring Report approval letter from the USEPA are included in Appendix C. Stage 2 DBP monitoring is ongoing. The District collects samples at four locations each quarter and SPU completes the analysis and reporting on behalf of the District.

6.4 EMERGENCY RESPONSE PROGRAM

The District's Emergency Response Plan (ERP) identifies the notification procedures in the event of an emergency. In response to the events of 9/11/01, the Federal government has enacted the Public Health Security and Bio-Terrorism Preparedness and Response Act (HR 3448) requiring preparation of vulnerability assessments and preparation or update of ERP's for public water systems serving populations greater than 3,300 people. The District prepared a vulnerability analysis and emergency response plan which were submitted to the EPA in 2004. The District's ERP was updated in July 2008 and adopted by Resolution 08-1218. A copy of the District's Emergency Management Plan is included in Appendix K.

The District is a member of WAWARN, a statewide municipal mutual aid organization.

The District maintains a detailed list of contacts for all District personnel and commissioners. That list is updated periodically and distributed to all staff. Key contacts are included in the ERP and are summarized in Table 6.2.

TABLE 6.2
EMERGENCY CONTACTS

Contact	Telephone No.
Emergency	911
Water District No. 49	206-242-8535 (answering service after hours)
Bryan Koehmstedt, Superintendent/Field Lead	206-735-0842
SPU	206-386-1818
Department of Health (Kent)	253-395-6750 or 877-481-4901
T.V. Stations KIRO KOMO KING	 206-728-7777 888-477-5666 206-448-5555
Radio Station (KVI)	206-404-4000
Radio Station (KOMO)	206-404-5666
Radio Station (KIRO)	206-426-7000
Radio Station (KMPS)	206-805-0941
King County Emergency Mgmt.	206-296-3830
King County Fire District No. 2	206-242-2040

During Office Hours	Contact the Superintendent or office personnel **Phone: 206-242-8535**
After Office Hours	Calls to the District office are taken by an answering service who contacts the "on-call" person. Based on the severity of the problem, this person notifies the Field Lead who will notify the District Superintendent as necessary. **Phone: 206-242-8535**

6.5 WATER SHORTAGE RESPONSE PLAN

The District updated its Water Shortage Response Plan in 2008. The Plan aims to reduce customer demands in response to a water supply emergency or in a drought event. The plan is designed to be used in highly unusual or infrequent events. It is divided into four stages to be implemented immediately for severe restrictions (in the event of a water main break or failure) or to progressively implement more severe demand reductions as part of a regional effort. The stages are:

- Advisory
- Voluntary
- Mandatory
- Rationing

The District's Water Shortage Response Plan has been updated to capture general changes since adoption in 2008. The update was adopted concurrent with the 2017 WSP and is included in Appendix M.

The District's 2017 Water Shortage Response Plan should be reviewed for consistency with the SPU 2018 Water Shortage Contingency Plan, then updated appropriately.

6.6 CROSS-CONNECTION CONTROL PROGRAM

Washington State regulations place the primary responsibility for control of cross-connections with the water purveyor. In 2005, the District adopted Resolution 05-1196 as the Policy relating to cross-connection control and backflow prevention. This set of policies establishes cross-connection control requirements in accordance with Chapter 246-290-490 WAC. All District field operations staff are certified as cross-connection control specialists. A copy of the Cross Connection Control Plan is included as Appendix B. Concurrent with adoption of this Plan, the District will adopt an update to the Program to replace Exhibit D, Backflow Incident Report Form with DOH Publication 331-457 for incident reporting.

As of 2018, the system included 34 "Table 9" hazards. All have an approved backflow prevention assembly, and all have been tested in the last year.

6.7 SYSTEM OPERATION AND CONTROL

District personnel perform routine inspections and repairs to the system based on individual policies and District Standards which are further outlined in Chapter 7. Preventative maintenance programs are limited to field maintenance activities which take place at regular intervals.

The following is a description of the major system components including basic operation and maintenance procedures.

6.7.1 System Components

The major system components of King County Water District No. 49 are shown in Figures 3-1 and 3-2.

6.7.2 Routine System Operation and Maintenance

Seattle Public Utilities Connection Points

Each of the five stations includes a master meter and are inspected monthly to verify security and proper operations of the facility. Confirmation of operation is verified by visual inspection of connection point and checking of electrical controls where applicable.

Intertie Connection Points

Each intertie with adjacent purveyors is inspected monthly to verify security and proper operations of the facility. Confirmation of open/closed status is verified by visual inspection of the applicable valves. Interties with flow meters are inspected every month to record the usage through the connection for billing purposes.

Concrete Reservoir

District personnel conduct a visual inspection of the reservoir on a weekly basis. The integrity of the reservoir vent, hatch and screens is confirmed by inspection annually, at a minimum. The reservoir is observed for signs of leakage or corrosion. The interior of the concrete reservoir is visually inspected and cleaned on a three year cycle. The hatch and interior ladder is secured.

Reservoir Distribution Pump Station

The pump station is checked weekly to verify site conditions, security and the proper operation of all equipment and controls. Landscape is maintained at least once or twice per month.

Distribution System

The District maintains an inventory of pipe, miscellaneous fittings, repair couplings, hydrants, hydrant repair kits and other system related components. District staff perform all emergency pipeline repairs and system work including service taps up to 2-inch. The inventory of items is done each quarter and restocked as needed.

Dead-end mains are flushed once a year to provide necessary cleaning of these potential water quality problem areas. Additional flushing occurs in response to customer complaints or pipeline repairs that necessitate the flushing of lines.

Isolation Valves

The water system's isolation valves are exercised annually. Valve covers are inspected for damage and replaced as necessary.

Service Meters

District personnel install all service meters. Service meters are replaced on a twenty year cycle. Meters that are not operating or not operating satisfactorily are identified by the meter readers and replaced as necessary. Meter usage data is analyzed in an effort to determine faulty meters. Records for each meter including location, meter number and installation date are kept in a database at the District. The District has installed some remote read meters in areas that are of safety and/or traffic concern to meter reading personal.

Fire Hydrants

Fire hydrants are inspected and painted as required on an annual basis by the District. Proper operation of the main valve is checked and the valve is exercised. Hose and pumper threads are checked for damage as well as conformity to local fire department requirements. Caps are checked for damage and ease of removal. Cap gaskets are checked and replaced as necessary. Fire hydrant access is cleared of obstructions. Any identified hydrant deficiencies are addressed as soon as possible.

Telemetry System

Operation of the telemetry system is checked daily. If problems with the system occur or if the system requires modifications or upgrading, the District engages an information technician subconsultant.

6.7.3 Preventative Maintenance Program

Preventative maintenance actions are either performed by District personnel or contracted out to certified professionals. The preventative maintenance actions which are routinely performed are presented below including the frequency of occurrence.

- Maintenance of pressure reducing valve stations
  - Valve cleaning every year
  - Valve rebuilding every five years

- Cleaning of reservoir
  - Interior cleaning every three to five years

- Exercising of system valves
  - Inspection and exercising every year

6.7.4 Equipment and Supplies

As stated in the previous section, the District maintains an inventory of repair parts and couplings for pipe sizes ranging from ¾-inch to 12-inch. Parts needed for repairs or minor improvements are replenished each quarter during the inventory check. The District maintains an inventory of ¾ through 4-inch service meters as well as meter setters.

6.8 SAFETY PROCEDURES

District personnel are frequently involved in water main repair and replacement projects that expose them to heavy construction activities, excavations and in many cases vehicle traffic. Safety procedures that are followed for each potential work place hazard are routinely discussed at monthly safety meetings. In addition to conducting the monthly meetings, the safety officer maintains all safety procedures and records which are on file at the District.

6.9 CUSTOMER COMPLAINTS RESPONSE PROGRAM

The District maintains a record of complaints by making notations on the computerized billing system. In addition, complaints which are filed by customers who attend board meetings are logged in the minutes of the meeting.

Complaints are responded to appropriately by District staff who determines if the issue can easily be resolved or if the creation of a service order is necessary. If a service order is issued it lists the nature of the complaint. The service order is closed out upon satisfactory completion of any required work and the recording of the corrective action taken.

Multiple complaints which arise from maintenance activities (such as dirty water complaints which often come after water is flushed through hydrants) are not individually documented.

6.10 RECORDS AND REPORTS

The District's administrative staff shares in the responsibility of maintaining all records pertaining to water use, billings, receipts and water utility financial records. In addition, the staff also maintains records regarding the system facilities, utility locate requests, repairs, and water quality monitoring and reporting.

Construction Completion Reports for all distribution main replacements and extensions are completed and filed with the respective project file.

6.11 OPERATIONS AND MAINTENANCE IMPROVEMENTS

The following is a summary of the recommended improvements related to operations and maintenance.

- In response to updates to the DOH guidance publication for preparation of a Coliform Monitoring Plan, WAC 246-290-300 and recent correspondence from DOH, the number of sample stations should be increased from four to eight. The additional stations were installed early in 2016. The additional locations are:
    - 313 S. 150th St.
    - 15402 22nd Ave. SW
    - 2640 SW 164th Pl.
    - 843 S. 177th Pl.
- In response to recent water quality and sampling situations in the region, the District should consider upgrades to allow repeat sampling at specific sample station facilities rather than hose bibs at customer residences. With a future total of eight primary sample sites, a total of 16 meter setter style sample facilities would be needed.
- In response to recent water quality and sampling situations in the region, DOH recommends review and update of sample collection standard operating procedures.
- As documented in the March 2015 Routine Sanitary Survey report by DOH, the number of monthly samples taken in the District will be increased to the number required by WAC 246-290-300 immediately. This has been implemented by SPU.
- DOH recommends completion of an E. coli response plan and consideration of means to quickly boost disinfection at the SPU supply stations or District reservoir, in an emergency water quality situation.
- DOH recommends regular monitoring and documentation of chlorine residual, pH, conductivity and heterotrophic plate counts (HPC) as background baseline data, for reference and indication of distribution system water quality. The District has already begun weekly collection of chlorine residual data and SPU provides HPC if analyzed.
- District staff recommends consideration of addition of variable frequency drives and a natural-gas powered standby power generator at the existing reservoir

booster pump station. These considerations should be made in the context of additional storage capacity and related pump facilities.

- The District's 2017 Water Shortage Response Plan should be reviewed for consistency with the SPU 2018 Water Shortage Contingency Plan, then updated appropriately.
- Existing D of the Cross Connection Control Program (Appendix B) should be replaced with DOH Form 331-457 for incident reporting. That form is included in Appendix B and that change will be adopted concurrent with approval of this Plan.
- DOH conducted a sanitary survey in March 2015. In response to that survey a tap has been added at the outlet of the existing reservoir for collection of a water sample for coliform bacteria testing. A continuous chlorine analyzer was added at the outlet of the existing reservoir for automated residual monitoring. DOH indicated that appurtenances to provide additional disinfection to the system in an emergency are recommended, at a minimum. The District intents to utilize the existing and planned reservoir for such purposes.

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CHAPTER 7 – DISTRIBUTION FACILITIES DESIGN AND CONSTRUCTION STANDARDS

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CHAPTER 7

DISTRIBUTION FACILITIES
DESIGN AND CONSTRUCTION STANDARDS

The following chapter highlights the design and construction standards of King County Water District No. 49. Water service is currently available to all areas within the boundaries of the District. Therefore, no large extensions to the system are expected. Extensions to the system will generally consist of redevelopment of existing lots and extensions to increase fire flow capacities. The following shall represent the District's standards for the construction and replacement of all distribution and distribution related facilities.

7.1 PROJECT REVIEW PROCEDURES

The District requires all construction activities related to the District's water system to be coordinated directly through the District. All developer extensions shall be reviewed by the District's engineer through the developer extension process. All projects proposed by cities, counties, special purpose districts and all other jurisdictions must also be reviewed by the District when they have a possibility of affecting District facilities. Procedures relating to the developer extension process can be found in the District's current version of the Developer Extension Manual which is incorporated into this WSP by reference.

7.2 DESIGN STANDARDS

This section outlines the general performance and design criteria used in evaluating the acceptability of system performance and construction of replacement and new facilities. The District's detailed design standards and construction specifications contained in the District's Developer Extension Manual are based on meeting or exceeding the latest version of the following standards, which are hereby incorporated by reference:

1. Water System Design Manual, Washington State Department of Health
2. Standard Specifications for Road, Bridge and Municipal Construction (WSDOT/APWA) including APWA Supplement, latest edition.
3. Standards of the American Water Works Association.
4. IAPMO Uniform Plumbing Code and Installation Standards, latest edition.
5. ICBO International Building Code, latest edition.

<u>Ownership</u>

All water lines and appurtenances located in public rights-of-way and easements where applicable shall become and remain the exclusive property of the District for future operation, maintenance and service responsibilities. For service connections, the point of District ownership and responsibility shall end at the back side of the meter. District ownership for non-potable water service lines shall end at the downstream end of the

gate valve at the point where the service line is connected to the water main (on easements on private property) or at the property line (on public rights-of-way).

Design Responsibility

Water system plans and specifications shall be prepared under the supervision of and signed by a professional engineer registered in the State of Washington and shall comply with the design standards of the District. The designer shall obtain all local requirements and criteria from the applicable city or county and the District. A copy of the final design with the District Superintendent's signature of acceptance shall be obtained prior to commencement of work. A mylar copy of the final record drawings shall be delivered to the District upon completion of work.

Pressure

A minimum of 40 psi will be provided at customer meters during normal conditions not including a fire or emergency. During peak hour conditions, the system will provide a minimum pressure of 30 psi at any customer meter. Systems will be designed to minimize pressure fluctuations between normal and peak hourly design conditions.

At service connections where static pressure exceeds 80 psi, the installation of a pressure-reducing valve behind the meter is recommended. The cost, installation and maintenance of the pressure reducing valves shall be the responsibility of the customer.

During fire flow conditions, the pressure at any major risk location and in the remainder of the system will be no less than 20 psi.

Velocities

Under normal demand conditions, the velocity of water in a transmission main should be less than four feet per second (fps). Under emergency conditions such as fire, the velocity of water in a transmission main should be less than eight fps.

Pipe Layout

All water pipe shall be designed to lie in public road right-of-way or, if not available, on a dedicated, recorded utility easement. Permanent easements shall be a minimum of 15 feet in width. Pipe will be designed for maximum trench depth of 48 inches and a minimum depth to top of pipe of 36 inches. All pipe shall maintain a positive or negative slope between respective high and low points in the water line; high points will be fitted with air-vacuum release assemblies and low points will be fitted with flushing assemblies as determined necessary by the District. Extensions to the District's system will not be allowed to connect to the system prior to completion of pressure testing, flushing and passing of bacteriological testing.

Domestic Water Services

Water mains constructed in platted areas will include the installation of water service lines to common or individual lot corners installed concurrently with the water main. Water service installation will include all materials shown on the District's current standard details. The cost of service lines installed as part of a water main extension will be borne by the Developer.

7.3 CONSTRUCTION STANDARDS

Construction standards for materials and methods and standard details for water system appurtenances and construction are included in the District's Developer Extension Manual. The Developer Extension Manual is updated regularly to incorporate new or updated District policies and standards.

7.4 CONSTRUCTION CERTIFICATION AND FOLLOW-UP PROCEDURES

All construction activity related to the District's water system must be coordinated through the District. The District will inspect the construction of water related facilities up to the property line, or end of easement if applicable, and will perform all water quality testing prior to authorizing connection to a potable water main. Testing may include soils compaction, pressure and water purity, as applicable. All costs related to inspection and testing shall be paid by the Developer.

Backflow prevention devices shall meet the standards of the District's Cross-Connection Control Program and must be on the Washington State Department of Health's approved list of backflow prevention devices. Assemblies must be initially tested and certified by a Backflow Assembly Tester and approved by the District's Cross Connection Control Specialist prior to being placed into service. Backflow prevention devices must be tested and certified annually and a copy of the certification provided to the District. The property owner shall own and be responsible for the cost of maintaining and certifying the assemblies. Backflow prevention devices shall be accessible for District inspection via easement or real property license.

7.5 IMPROVEMENTS

The District's design and construction standards have been in place for many years. The Developer Extension Manual is routinely updated to include any changes in District standards or policies. The developer extension process has been refined over the past years to improve communications between developers and the District. Therefore, at this time, there are no recommended improvements for the items presented in this section.

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CHAPTER 8 – CAPITAL IMPROVEMENT PROGRAM

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CHAPTER 8

CAPITAL IMPROVEMENT PROGRAM

8.1 OVERVIEW

King County Water District No. 49 has maintained a repair and water main replacement program for many years. Historically, the District has funded capital improvement projects with the excess revenues from rate collection, from State funded low interest loans and from the sale of revenue bonds.

Chapter 3 presents a hydraulic analysis of the District's system and develops a program of recommended capital improvements to be undertaken to correct the deficiencies and improve the system, in response to current and forecast demands.

Table 8.1 lists the recommended improvements and their estimated project costs. Figure 8-1 shows the project locations. Most of the projects involve the replacement of undersized mains.

Table 8.2 shows the ten-year capital improvement plan.

The projects have been prioritized and scheduled based on current information. Priority has been given to those areas that have recently experienced more than an average number of leaks or areas which will provide the greatest immediate improvement to the flows and hydraulic efficiency of the system.

Even though a tentative schedule has been developed, circumstances may require that projects be moved ahead or deferred.

8.2 CAPITAL IMPROVEMENT PROJECT FUNDING

As detailed in Chapter 9 of this report, it is expected that all capital improvement projects scheduled for the next six to ten years will be funded through a combination of cash-on-hand, connection charges, a Public Works Trust Fund loan and sale of revenue bonds.

It is not possible to accurately predict the actual amount of connection charge revenue or successful loan applications that will be available in any given year. It is also difficult to predict the extent of increases in construction costs that may occur. Completion of elements of the Capital Improvement Program will depend on actual availability of District resources at the time.

Table 8.1
CAPITAL PROJECTS

ID	Capital Improvement	Project Description	Estimated Project Cost (2019 $)	Recommended Year of Completion
		I. SUPPLY		
		(no supply deficiencies or projects)		
		Subtotal for Supply Projects	**$0**	
		II. STORAGE		
ST-1	Additional Storage	Construct 3.7 million gallons of additional storage capacity in 575 Pressure Zone - partially below ground level, at 8th Ave SW and SW 146th St. Include 6,000 gpm booster pump station with onsite standby power system. Estimate only includes work for 2019 through completion. Property purchased and predesign complete. Design in progress.	$5,088,000 $6,794,000 $11,882,000	2019 2020 -
		Subtotal for Storage Projects	**$11,882,000**	
		III. DISTRIBUTION		
D-1	Replace PRV-4	*Completed 2018*		
D-2	VFD for Ex. Booster Pump Station	Convert power supply for existing booster pump station to variable frequency drive for power use savings during routine cycling operations.	$136,000	2021
		Water Main Replacement Projects:		
D-3	Des Moines Memorial Drive - Phase 3	*Completed 2017*		
D-4	SW 169th St & SW 170th St	Along SW 169th St & 22nd Ave SW, west of 19th Ave SW, SW 170th St between 16th Ave SW and 19th Ave SW, and along private drive south of SW 170th St at 1900 block - 2,352 LF 8" main	$818,000	2020-2021
D-5	13th Ave SW & 14th Ave SW	Along 13th Ave SW north of SW 158th St, perpendicular to said line, along 14th Ave SW south of SW 158th St and along 25th Ave SW north of 164th St - 1,359 LF 8" main	$473,000	2022
D-6	9th Ave SW & 10th Ave SW	Along 10th Ave SW from SW 164th St to SW 168th St and along 9th Ave SW from the intersection of SW 164th St and 9th Ave SW to the intersection of SW 166th St and 10th Ave SW - 2,324 LF 8" main	$808,000	2023
D-7	SW 165th St & SW 167th St	Along SW 165th St and SW 167th St from 21st Ave SW to 19th Ave SW, along SW 167th St west of 21st Ave SW and along SW 170th St west of 27th Ave SW - 1,965 LF 8" main	$683,000	2024
D-8a	15th Ave SW	Along 15th Ave SW from SW 164th St to SW 168th St - 1,328 LF 8" main	$461,562	2019
D-8b	11th Ave SW	Along 11th Ave SW south of SW 166th St - 200 LF 8" main	$69,512	2023
D-9	Ambaum Blvd - Phase 1	Along Ambaum Blvd from S 168th St to S 173rd St and along S 173rd St east of Ambaum Blvd - 1,302 LF 8" main. Includes abandonment of existing 1,100 LF 6" main paralled by existing 8" and 12" DI	$498,000	2025
D-10	7th Ave SW & 3rd Ave SW	Along 7th Ave SW and 3rd Ave SW between SW 146th St and SW 148th St and along 3rd Ave SW south of SW 144th St - 1,543 LF 8" main. Between 2nd & 3rd Ave SW from north of 146th St to south of 144th St - 82 LF 2" copper	$547,000	2026
D-11	4th Ave S, S 150th St and Easement	Along 4th Ave S north of S 150th St, along S 150th St east and west of 4th Ave S, and along easement from S 150th St to S 152nd St - 1,766 LF 8" main	$614,000	2027

D-12	S 152nd St	Along S 152nd St from east of 4th Ave S to District Boundary, along 4th Ave S north of S 156th St and along easement south of Highline Highschool Performing Arts Center - 975 LF 8" main	$339,000	2028
D-13	Ambaum Blvd - Phase 2	Along Ambaum Blvd from S 173rd St to 660 south of 17424 Ambaum Blvd - 660 LF 8" main. Includes abandonment of existing 700 LF 6" main paralled by existing 12" DI	$253,000	2029
D-14	S 156th St	Along S 156th St from east of SR 509 to Des Moines Memorial Drive - 1,750 LF 8" main	$609,000	2030
D-15	Seahurst Elementary	Along a line west of 14th Ave SW south of 144th Pl, perpendicular to said line at the southern end, along a line north of SW 148th St east of Ambaum Blvd, along SW 144th St west of Ambaum Blvd, crossing Ambaum Blvd SW at SW 148th St, and alley south of SW 152nd St between 10th Ave SW and Ambaum Blvd - 1,658 LF 8" main	$577,000	2031
D-16	4th Ave S, 5th Pl S and S 158th St	Along a line east of SR 509 south of S 156th St, along 5th Pl S and S 158th St from S 160th St to S 158th St and along a line east of 1st Ave S south of S 160th St - 1,130 LF 8" main. Along 4th Ave S south of S156th St - 300 LF 12" main	$540,000	2032
D-17	SW 154th St	Along SW 154th St from Ambaum Blvd to 1st Ave S - 2,435 LF 8" main	$847,000	2033-2034
D-18	11 Pl SW	Along 11 Pl SW from Sylvester Rd to the intersection of 13th Ave SW and SW 174th St - 1,832 LF 8" main	$637,000	2035
D-19	SW 160th St & SW 158th St	Along SW 160th St from 8th Ave SW to 4th Ave SW, along SW 158th St from Ambaum Blvd to 1st Ave S and along a line west of SR 509 from east of 1st Ave S to FH #700- 1,510 LF 8" main	$559,000	2036
D-20	SW 157th	Along a loop of SW 156th St to and from Ambaum Blvd and along SW 157th St from Ambaum Blvd to 1st Ave S - 1,605 LF 8" main	$558,000	2037
D-21	4th Ave SW, 6th Ave SW & SW 151st St	Along 4th Ave SW south of SW 148th St, along SW 151st St east of 8th Ave SW and along 6th Ave SW between S 152nd St and S 154th St - 1,335 LF 8" main. Along SW 150th St midblock of 8th Ave SW and 6th Ave SW - 50 LF 12" main	$484,000	2038
D-22	S 176th St	Along S 176th St east of Des Moines Memorial Drive - 1,590 LF 8" main	$553,000	2038
		Subtotal for Distribution Projects	**$11,064,074**	
		IV. OTHER		
O-1	SCADA Update	Upgrade remote sites	$130,000	2021
O-2	District Office/shop	Purchase property and complete replacement office and shop facility (further evaluation, beginning with a needs assessment, will be necessary to confirm scope and cost)	$4,000,000	2025
O-3	Water System Plan Update	Update Water System Plan	$125,000	2028
V-1	Light Duty Vehicle	Replace existing light duty vehicle	$40,000	2019
V-2	Pick Up Truck #1	Replace existing service truck	$55,000	2023
V-3	Pick Up Truck #3	Replace existing service truck	$55,000	2024
V-4	Dump Truck	Replace existing dump truck	$125,000	2027
		Subtotal for Other Projects	**$4,530,000**	
		Grand Total	**$27,476,074**	

ENR Index, Seattle, December 2018 = 11,537.66

Table 8.2
10-YEAR CAPITAL IMPROVEMENT PLAN

ID	Capital Improvement	Project Description (See Table 8.1 for detailed description)	Page Where Need Identified	Funding Source*	Estimated Project Cost (2019 $)	Estimated Year of Completion
		I. SUPPLY				
	(no supply deficiencies or projects)		n/a	n/a	n/a	n/a
				Subtotal for Supply Projects	**$0**	
		II. STORAGE				
ST-1	Additional Storage	3.7 million gallons of additional storage and booster pump station with onsite standby power	3.4.3	GFC and Rates	$11,882,000	2019-2020
				Subtotal for Storage Projects	**$11,882,000**	
		III. DISTRIBUTION				
D-2	VFD for Ex. Booster Pump Station	Variable frequency drive power for existing pumps	Staff Recommend	Rates	$136,000	2021
		Water Main Replacement Projects:				
D-4	SW 169th St & SW 170th St	2352 LF 8 inch main	3.4.4	GFC and Rates	$818,000	2020-2021
D-5	13th Ave SW & 14th Ave SW	1359 LF 8 inch main	3.4.4	GFC and Rates	$473,000	2022
D-6	9th Ave SW & 10th Ave SW	2324 LF 8 inch main	3.4.4	GFC and Rates	$808,000	2023
D-7	SW 165th St & SW 167th St	1965 LF 8 inch main	3.4.4	GFC and Rates	$683,000	2024
D-8a	15th Ave SW	1328 LF 8 inch main	3.4.4	GFC and Rates	$461,562	2023
D-8b	11th Ave SW	200 LF 8 inch main	3.4.4	GFC and Rates	$69,512	2023
D-9	Ambaum Blvd - Phase 1	1302 LF 8 inch main	3.4.4	GFC and Rates	$498,000	2025
D-10	7th Ave SW & 3rd Ave SW	1625 LF 8 inch main	3.4.4	GFC and Rates	$547,000	2026
D-11	4th Ave S, S 150th St and Easement	1766 LF 8 inch main	3.4.4	GFC and Rates	$614,000	2027
D-12	S 152nd St	975 LF 8 inch main	3.4.4	GFC and Rates	$339,000	2028
				Subtotal for Distribution Projects	**$5,447,074**	
		IV. OTHER				
O-1	SCADA Update	Upgrade remote sites	Staff Recommend	Rates	$130,000	2021
O-2	District Office/shop	Purchase Property and Complete Replacement and Shop Facility	Staff Recommend	Rates	$4,000,000	2025
O-3	Water System Plan Update	Update Water System Plan	DOH	Rates	$125,000	2028
V-1	Light Duty Vehicle	Replace existing light duty vehicle	Staff Recommend	Rates	$40,000	2019
V-2	Pick Up Truck #1	Replace existing service truck	Staff Recommend	Rates	$55,000	2023
V-3	Pick Up Truck #3	Replace existing service truck	Staff Recommend	Rates	$55,000	2024
V-4	Dump Truck	Replace existing dump truck	Staff Recommend	Rates	$125,000	2027
				Subtotal for Other Projects	**$4,530,000**	
				Grand Total	**$21,859,074**	

ENR Index, Seattle, December 2018 = 11,537.66
* GFC=General Facilities Charges, Rates=Service Charges

$27,476,074

Legend

- Capital Improvement Projects
- KCWD No.49
- FIRE HYDRANT
- WD49 Reservoir
- WD49 OFFICE

Water Main Diameter (inches)

- Unknown
- 1
- 1.25
- 1.5
- 2
- 3
- 4
- 6
- 8
- 10
- 12

N

0 700 1,400

Feet

LAKE BURIEN

PUGET SOUND

D-15 D-10 D-10 ST-1 D-10 D-15 D-10 D-15 D-21 D-21 D-21 D-11 D-11 D-12 D-12 D-15 D-21 D-1 D-12 D-17 D-14 D-20 D-20 D-16 D-16 D-5 D-19 D-16 D-5 D-2 D-19 D-19 D-19 D-16 D-5 D-7 D-6 D-7 D-7 D-8 D-8 D-6 D-4 D-4 D-9 D-7 D-4 D-1 D-18 D-9 D-3 D-13 D-22 D-13 D-3 D-3

CHS ENGINEERS

King County
Water District No. 49
2019 Water System Plan

FIGURE 8-1

CAPITAL IMPROVEMENT PLAN

CHAPTER 9 – FINANCIAL PROGRAM

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CHAPTER 9

FINANCIAL PROGRAM

King County Water District No. 49 is a special purpose district, formed in the State of Washington under the laws governing municipal entities. The District has its funds invested in the King County Government Pool which is responsible for the District's investment and accounting functions.

9.1 PAST AND PRESENT FINANCIAL STATUS

Table 9.1 presents a summary of operating performance for 2013 through 2017. The District has historically maintained and currently maintains a strong financial base. The 2017 year-end total funds balance was approximately $10,355,000.

The District currently has two outstanding Public Works Trust Fund (PWTF) loans, which will be paid off in 2020 and 2025 respectively. The District has recently secured a third PWTF loan, for preconstruction funding of the 575 Zone Reservoir and Booster Pump Station project. The District sold Revenue Bonds in December 2007 for system capital improvements. The 2007 revenue bond covenant requires a bond debt coverage ratio of 1.25 and is backed by net operating revenue and connection charges. The District sold additional Revenue Bonds in 2017 for capital improvements identified in the 2017 Water System Plan and this update. The 2017 bond proceeds were used to refinance nearly all the outstanding 2007 bond debt and to provide a significant share of the funds needed for the reservoir project. The refinance action yielded significant savings for the District. The 2017 bond covenant requires a bond debt coverage ratio of 1.25 and is also backed by net operating revenue and connection charges.

Table 9.2 presents forecasted budgets through 2028. The District anticipates that funding for projects listed in this plan will be obtained first from its funds on hand, rate increases, and new customer revenues. The budget forecast includes capital improvement expenditures per Table 8.1. As anticipated in the District's 2017 Rate Study, additional funding will be necessary in 2019. With the addition of a significant project for office and shop facilities in 2025, additional funding is anticipated to be necessary by 2024. This forecast is general in nature. A more detailed forecast will be presented in a Rate Study being completed concurrently with completion of this 2019 Plan.

9.2 ALLOCATION OF REVENUE SOURCES

In preparation for the 2017 bond sale, the District reviewed and updated its financial management policies. The 2017 policy update include goals to maintain a capital contingency reserve fund of at least $350,000, a bond reserve fund as required by bond covenants, an unrestricted cash reserve of five months of operating expenses (including the capital contingency reserve fund), and a parity debt service coverage ratio of 1.75 or greater. The 2017 rate study recommended rates and general facilities/connection

charge increases in support of these goals, for continued operations and implementation of the capital improvement plan per Chapter 8. The District implemented rate increases effective January 1, 2017 and January 1, 2018. The 2017 rate study is being updated concurrently with completion of this 2019 WSP. Adoption of increased rates and charges are anticipated in the first half of 2019, and likely annually thereafter.

TABLE 9.1
FIVE YEAR HISTORICAL EXPENSES

	Actual 2013	Actual 2014	Actual 2015	Actual 2016	Budget 2017
REVENUES					
Water Rates	$3,395,861	$3,214,760	$3,731,502	$3,732,267	$3,806,912
Fees and Other Service	$70,034	$60,034	$54,040	$82,529	$84,179
Other Revenues	$57,475	$48,415	$63,827	$65,778	$67,094
TOTAL REVENUES	**$3,523,370**	**$3,323,209**	**$3,849,369**	**$3,880,573**	**$3,958,185**
EXPENSES					
Operation & Maintenance Expenses					
Salaries Outside Employees	$311,503	$313,915	$330,124	$335,941	$361,600
Power & Other Utilities	$25,389	$24,667	$38,017	$42,711	$46,982
Materials, Supplies and Parts	$87,961	$80,156	$144,734	$235,113	$242,166
Transportation Expenses	$21,182	$26,027	$18,573	$18,073	$19,880
Miscellaneous Expenses (inc. water)	$906,549	$1,455,399	$1,065,475	$1,183,104	$1,242,259
Total Operation & Maintenance Expenses	*$1,352,584*	*$1,900,164*	*$1,596,924*	*$1,814,941*	*$1,912,887*
General & Administrative Expenses					
Salaries Inside Employees	$365,438	$264,631	$251,139	$258,553	$221,671
Employees Benefits	$317,709	$325,748	$389,185	$243,260	$248,125
Office Supplies & Postage	$46,092	$46,462	$28,796	$38,597	$39,755
Insurance - Vehicles, Liability & Work Comp	$34,100	$34,758	$35,379	$45,492	$46,857
Legal & Accounting	$50,621	$43,171	$67,780	$61,988	$63,848
Engineering & Professional Services	$26,467	$70,897	$89,772	$76,682	$78,983
Fees & Miscellaneous Expenses	$269,582	$108,217	$304,371	$189,816	$227,779
Total General & Administrative Expenses	*$1,110,009*	*$893,884*	*$1,166,421*	*$914,387*	*$927,017*
TOTAL EXPENSES	**$2,462,593**	**$2,794,048**	**$2,763,345**	**$2,729,328**	**$2,839,904**
Taxes (Property, B & O, Income)	**$170,359**	**$164,129**	**$188,624**	**$200,964**	**$175,003**
Annual Debt Payments-Loans/Bonds (P&I)	**$143,052**	**$148,052**	**$213,535**	**$214,140**	**$209,567**
Total Outstanding Debt-Loans/Bonds (P&I)	$2,106,678	$1,858,577	$1,812,573	$1,557,472	$1,511,469
Net CIP Expense	**$633,015**	**$499,207**	**$840,159**	**$1,041,406**	**$1,001,530**
Capital Contributions (SFC & GFC)	**(not available)**	**(not available)**	**$174,350**	**$440,927**	**$160,800**
TOTAL REVENUE REQUIREMENT	**$3,409,019**	**$3,605,436**	**$4,005,663**	**$4,185,837**	**$4,226,004**
BUDGET SURPLUS (DEFICIT)	**$114,351**	**$282,227**	**$18,056**	**$135,663**	**($107,019)**

TABLE 9.2
PROJECTED BUDGETS

	Budget 2018	Budget 2019	Budget 2020	Budget 2021	Budget 2022	Budget 2023	Budget 2024	Budget 2025	Budget 2026	Budget 2027	Budget 2028
REVENUES											
Water Rates	3,883,050	3,960,711	4,138,943	4,325,196	4,519,830	4,723,222	4,935,767	5,157,877	5,389,981	5,632,530	5,885,994
Fees and Other Service	85,863	87,580	89,332	91,118	92,941	94,799	96,695	98,629	100,602	102,614	104,666
Other Revenues	68,436	69,804	71,200	72,624	74,077	75,558	77,070	78,611	80,183	81,787	83,423
TOTAL REVENUES	**4,037,349**	**4,118,096**	**4,299,475**	**4,488,938**	**4,686,847**	**4,893,580**	**5,109,532**	**5,335,117**	**5,570,766**	**5,816,931**	**6,074,083**
EXPENSES											
Operation & Maintenance Expenses											
Salaries Outside Employees	368,997	376,560	384,279	392,155	400,193	408,396	416,767	425,309	434,027	442,923	452,001
Power & Other Utilities	51,680	56,848	76,033	95,786	105,365	115,901	127,491	140,240	154,264	169,691	186,660
Materials, Supplies and Parts	249,431	256,914	264,622	272,560	280,737	289,159	297,834	306,769	315,972	325,451	335,215
Transportation Expenses	21,868	24,055	26,460	29,106	32,017	35,219	38,740	42,614	46,876	51,563	56,720
Miscellaneous Expenses	1,304,372	1,369,590	1,438,070	1,509,973	1,585,472	1,664,746	1,747,983	1,835,382	1,927,151	2,023,509	2,124,684
Total Operation & Maintenance Expenses	*1,996,348*	*2,083,968*	*2,189,463*	*2,299,581*	*2,403,784*	*2,513,420*	*2,628,815*	*2,750,315*	*2,878,290*	*3,013,137*	*3,155,280*
General & Administrative Expenses											
Salaries Inside Employees	226,344	232,284	238,379	244,634	251,054	257,642	264,403	271,341	278,461	285,769	293,268
Employees Benefits	253,088	258,149	263,312	268,579	273,950	279,429	285,018	290,718	296,532	302,463	308,512
Office Supplies & Postage	40,947	42,176	43,441	44,744	46,086	47,469	48,893	50,360	51,871	53,427	55,030
Insurance - Vehicles, Liability & Work Comp	48,262	49,710	51,201	52,737	54,320	55,949	57,628	59,356	61,137	62,971	64,860
Legal & Accounting	65,764	67,736	69,769	71,862	74,017	76,238	78,525	80,881	83,307	85,807	88,381
Engineering & Professional Services	81,352	83,793	86,306	88,896	91,562	94,309	97,139	100,053	103,054	106,146	109,330
Fees & Miscellaneous Expenses (Training)	234,612	241,651	248,900	256,367	264,058	271,980	280,139	288,544	297,200	306,116	315,299
Total General & Administrative Expenses	*950,369*	*975,498*	*1,001,309*	*1,027,819*	*1,055,048*	*1,083,017*	*1,111,744*	*1,141,253*	*1,171,563*	*1,202,698*	*1,234,680*
TOTAL EXPENSES	**2,946,717**	**3,059,466**	**3,190,772**	**3,327,400**	**3,458,832**	**3,596,437**	**3,740,560**	**3,891,568**	**4,049,853**	**4,215,835**	**4,389,960**

TABLE 9.2
PROJECTED BUDGETS

	Budget 2018	Budget 2019	Budget 2020	Budget 2021	Budget 2022	Budget 2023	Budget 2024	Budget 2025	Budget 2026	Budget 2027	Budget 2028
EXPENSES											
Taxes (Property, B & O, Income)	**181,556**	**183,643**	**185,754**	**187,889**	**190,048**	**192,233**	**194,442**	**196,677**	**198,937**	**201,224**	**203,537**
Annual Debt Payments-Loans/Bonds (Principal & Interest)	**506,427**	**715,631**	**1,015,576**	**968,358**	**968,925**	**1,370,105**	**1,367,547**	**1,364,389**	**1,343,479**	**1,217,303**	**1,350,327**
Total Outstanding Debt-Loans/Bonds (Principal & Interest)	14,520,646	16,514,219	15,923,588	15,029,231	14,178,123	18,322,281	17,310,882	16,289,885	15,259,283	14,236,189	13,325,199
Net CIP Expense	**716,856**	**5,549,562**	**7,203,000**	**675,000**	**473,000**	**932,512**	**738,000**	**4,498,000**	**547,000**	**739,000**	**464,000**
Capital Contributions (SFC & GFC)	188,300	411,279	427,118	447,144	471,701	489,677	512,248	539,792	564,346	594,194	612,020
TOTAL REVENUE REQUIREMENT	**4,054,918**	**9,508,302**	**11,595,102**	**5,158,647**	**5,090,806**	**6,091,287**	**6,040,549**	**9,950,634**	**6,139,270**	**6,373,363**	**6,407,825**
BUDGET SURPLUS (DEFICIT)	**170,731**	**(4,978,928)**	**(6,868,508)**	**(222,565)**	**67,742**	**(708,030)**	**(418,769)**	**(4,075,726)**	**(4,158)**	**37,762**	**278,278**
Ending Balance, all funds	**10,526,049**	**8,047,121**	**1,178,613**	**956,048**	**1,023,791**	**5,315,761**	**4,896,992**	**821,267**	**817,109**	**854,870**	**1,133,148**

Values in Dollars.

9.3 AVAILABLE REVENUE SOURCES

Developer Financing

Developers of presently unimproved property will finance many of the new facilities constructed in the District. All of the improvements required for service to property within new plats or commercial and industrial developments or re-developments will be designed and constructed in accordance with either the District's *Developer Extension Manual.* In some cases, latecomer's agreements may be executed for any water main serving property other than the property owned by the developer that is financing the project.

Combination Financing by the District and Developers

It may be necessary in some cases to require the owner to construct a larger diameter line than is required by the current development in order to provide for the comprehensive development of the District. The District may enter into a latecomer's agreement or reimburse the developer for the extra cost of increasing the size of the line over that which is required to service the property under development. Oversizing should be considered when it is necessary to construct any pipe over eight inches in diameter in single-family residential areas to comply with the water system plan. Construction of any pipe in multi-family, commercial or industrial areas that is larger than the size required to serve that development is considered oversizing.

Revenue Bonds

Transmission lines and improvements to supply and storage facilities that are of a general benefit to a major portion of the District may be financed by revenue bonds. Improvements that will benefit primarily a single developer should be financed by the developer developing the property. The District may use whatever funds are available for the payment of the debt service on the revenue bonds. A major source of these funds is from the sale of water to the District customers. However, all funds, such as general facilities/connection charges or latecomer charges may be used for debt service.

Water distribution improvements that will cause extraordinary increases in the value of the properties receiving service may be financed through the establishment of a utility local improvement district (ULID). The financing is accomplished through the sale of revenue bonds. These bonds are retired with income from the assessments and/or other funds of the District.

Grant/Loan Funds

The state and federal authorities have previously provided funds under the various grant programs for the construction of major improvements to or rehabilitation of water systems. The primary programs available at this time are the Drinking Water State Revolving Fund loan and Public Works Trust Fund loan. The District should continuously monitor the activities of the state or federal agencies to determine the requirements of these programs or of any new grant or loan programs that may be developed in the future.

State budget challenges in recent years have prompted the legislature to divert funding services and funds on hand from the Public Works Trust Fund Program. The District has recently secured a pre-construction loan from this program. However, it is not known if the Public Works Trust Fund will return to its prior strength, or if so, what changes might be made.

General District Revenues

The District updated their general facilities charge (GFC) and Capital Improvement Program in 2017. The GFC update included establishment of different charges for domestic water service and fire flow service. As described in Section 9.2, projects will be supported by revenue from GFCs, developer projects and contributions, and from water service charges. The District will update the GFC again once this Plan is adopted.

It is expected that the capital improvement projects developed in Chapter 8 will be financed by general District revenues, loans, bond sales and cash on hand.

Reserve Funds

The 2017 Rate Study included specific attention to maintaining adequate operating reserves and capital contingency reserves. Each reserve level was determined based on review of industry standards and evaluation with the District management staff and Board. For operating reserves, a minimum of 90 days of operating and maintenance expenses was identified and implemented with the rates adopted in 2017 and 2018. Those values changes as the budget and connections increase but the range from 2017 through 2026 was $693,000 to $947,000. For capital contingency reserves a target of two percent of total assets in service was established. This value ranges from $463,000 to $784,000. Given the significant expense of the near-term 575 zone reservoir project, rates are forecast to achieve that within several years. This analysis will be updated with the 2019 update of the rate study.

9.4 PROGRAM JUSTIFICATION

King County Water District No. 49 completed a rate study in 2017. The rate study included all sources of funds and made assumptions regarding growth, cost of living increases, debt issuance costs, and general facilities charge rate increases. The District periodically reviews its revenue forecast and compares how close they were to the actual revenue.

As indicated above, the District will be updating the 2017 rate and connection charge study in 2019 based on the recommendations and updated capital improvement plan in Chapter 8.

9.5 ASSESSMENT OF RATES

In October 2007, a three-tiered block rate structure was designed to encourage water conservation. The three-tiered block rate structure applies only to the single family residential customer class.

The water rate is composed of two charges. The first is a flat fee based on meter size that all customers pay. The second is the water consumption charge which is based on amount of water used. The water rates effective January 1, 2018 are shown in Table 9.3.

TABLE 9.3
2018 WATER RATE STRUCTURE

Category	Base Rate	0-10 ccf	11-16 ccf	17+ ccf
Single family Residential	$37.21	$3.58	$4.41	$6.06
Multi-family Residential	$28.94	$4.13	$4.13	$4.13
Commercial				
5/8" – 3/4"	$61.46	$4.13	$4.13	$4.13
1"	$152.97	$4.13	$4.13	$4.13
1-1/2"	$306.77	$4.13	$4.13	$4.13
2"	$489.79	$4.13	$4.13	$4.13
3"	$979.58	$4.13	$4.13	$4.13
4"	$1,530.54	$4.13	$4.13	$4.13
6"	$2,079.59	$4.13	$4.13	$4.13
8"	$4,897.86	$4.13	$4.13	$4.13
Irrigation				
5/8" –3/4"	$30.04	$6.06	$6.06	$6.06
1"	$75.25	$6.06	$6.06	$6.06
1-1/2"	$152.97	$6.06	$6.06	$6.06
2"	$245.58	$6.06	$6.06	$6.06

As stated in Section 9.4 above, rates will be reviewed periodically to ensure the block rates are sufficient to meet the required revenue demands of the District and to insure adequate funds are available to meet all O&M, CIP and debt service requirements.

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CHAPTER 10 – MISCELLANEOUS DOCUMENTS

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CHAPTER 10

MISCELLANEOUS DOCUMENTS

10.1 STATE ENVIRONMENTAL POLICY ACT (SEPA)

A SEPA checklist has been prepared in support of the District's proposed action to adopt this updated water system plan. The District is the Lead Agency and the District's Superintendent is the designated SEPA official. The District reviewed the checklist and issued a Determination of Non-significance (DNS) prior to adoption of the plan and submittal for review by DOH and other agencies. A public hearing was held at the District's office on February 27, 2019. No comments were received from any public agency or private individual prior to or at the hearing. Copies of the DNS, distribution list and checklist are included in Appendix H.

10.2 AGREEMENTS

As referenced in previous chapters, copies of intertie agreements with surrounding districts are on file at the District office.

10.3 OTHER DOCUMENTS

Other documents as referenced throughout the plan are included in the following appendices.

10.4 REFERENCES

The following references were used in the creation of this plan.

- *Washington State Department of Health - Group A Public Water Systems Chapter 246-290 WAC, March 30, 2012*
- *Washington State Department of Health - Water System Design Manual, December, 2009*
- *Washington State Department of Health – Water System Planning Handbook, April, 1997*
- *King County Water District No. 49 - Comprehensive Water Plan, February 2017*
- *City of Burien - Comprehensive Plan, December 2017*
- *City of Normandy Park - Comprehensive Plan* January 2016
- *City of SeaTac - Comprehensive Plan, December, 2017*
- *Seattle Public Utilities 2019 Water System Plan*

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