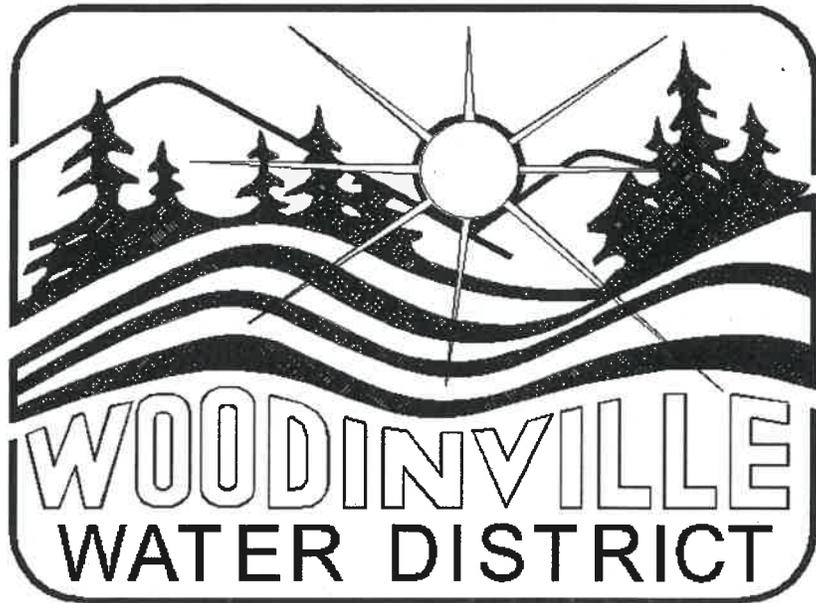


Woodinville Water District

2022 General Sewer Plan Update



Final Version
For DOE Approval



Ref #WWDI00001907
May 2023





STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Northwest Region Office

PO Box 330316, Shoreline, WA 98133-9716 • 206-594-0000

August 1, 2023

Patrick Sorensen
General Manager
Woodinville Water District
17238 NE Woodinville Duvall Rd
Woodinville, WA 98072

Re: Woodinville Water District Wastewater Comprehensive Plan Update and General Sewer Plan – July 2023

Dear Patrick Sorensen:

The Department of Ecology (Ecology) has reviewed the Woodinville Water District Wastewater Comprehensive Plan Update and General Sewer Plan, dated May 2023. Pursuant to RCW 90.48.110 and WAC 173-240-030, Ecology hereby approves this document as a General Sewer Plan. A copy of the plan's cover page with Ecology's approval stamp is enclosed for your records.

Ecology's review and approval is limited to assuring compliance with the State water quality laws and regulations listed above. Nothing in this approval shall be construed as satisfying other applicable federal, state, or local statutes, ordinances, or regulations.

Sewage facilities within the planning area boundary must be constructed according to the approved General Sewer Plan or amendments thereto. Ecology notes that this general sewer plan included standard design criteria for collection system facilities. Therefore, engineering reports and plans and specifications for sewer lines extensions, including pump stations, need not be submitted for approval. However, Ecology approval is necessary for sewer line extensions in the following situations:

Patrick Sorensen
Woodinville Water District
Page 2

- The proposed sewers or pump stations involve installation of overflows or bypasses.
- The proposed sewers or pump stations discharge to an overloaded treatment, collection, or disposal facility.

If you have any questions concerning this approval, please contact Sean Wilson at sean.wilson@ecy.wa.gov or 425-577-4864.

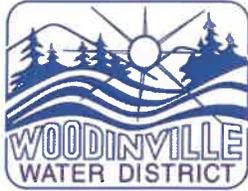
Sincerely,

A handwritten signature in black ink that reads "Rachel McCrea". The signature is written in a cursive style with a long horizontal flourish at the end.

Rachel McCrea
Water Quality Section Manager
Northwest Region Office

Enclosure

cc: Sean Wilson, Ecology (NWRO) Permit Engineer
Dan Cardwell, King County Utilities Technical Review Committee
Evan Henke, David Evans and Associates Inc.



WOODINVILLE WATER DISTRICT

17238 N.E. Woodinville-Duvall Road
P.O. Box 1390
Woodinville, Washington 98072-1390
(425) 487-4100
FAX (425) 485-6381

COMMISSIONERS
Chuck Clarke
Aleksandra Kachakov
Pamela J. Maloney
Tim Schriever
Karen Steeb

GENERAL MANAGER
Patrick Sorensen

September 22, 2022

To: Board of Commissioners
Woodinville Water District Rate Payers
Reviewing Public Regulatory Agencies

Subject: Introduction of the September 2022 Woodinville Water District General Sewer Plan

Over the last two years the District Engineer and District staff has worked with its consultant David Evans & Associates, Inc., staff to update its General Sewer Pan. The last Plan update was adopted in 2007. The 2022 General Sewer Plan update builds off the needs identified in the 2007 Plan while considering the growth of the Woodinville Water District's sewer collections system over the last 15 - years and its projected needs going into the future.

District staff and the consultant have carefully evaluated the future needs of the sewer system going into the future. As described within the Plan's Executive Summary and the forthcoming 9 chapters future sewer line capacity requirements, ongoing growth, and maintenance needs have been carefully projected forward. As recommended in this document the District will need to continue to review, re-evaluate, and modify the policy direction and recommendations found in this document as conditions will likely change over time.

Some of the key takeaways as described in the Executive Summary that will require on going review of this Plan include:

1. The ongoing demands brought on through high density redevelopment growth and **sewer pipe upsizing needs in the Central Business District in downtown Woodinville.**
2. Yet unidentified construction projects and improvements that will be identified through our **developing Asset Management and Seismic Resiliency Evaluation** programs.
3. As described in the Executive Summary **sewer rates will likely increase significantly over the next few years** because of **inflationary costs** associated with the District collecting wastewater from its customers and **increased wastewater treatment costs passed on to the Woodinville Water District through the King County Water Treatment Division.** The District must pay King County to treat all its collected wastewater. The County is facing significant increases in the cost of treating its wastewater at its sewer treatment plants. All these yet unknown costs are mandated by other regulatory requirements beyond the District's control.
4. There will also likely be **revisions in the District' current Sanitary Service Area (SSA) over the next few years** with other adjacent sewer service providers. These adjustments are brought upon by existing inter-local agreements and prior court decisions. In some situations, the

District will lose customers while in other situations gaining other customers. These changes will impact sewer revenues and operating expenses.

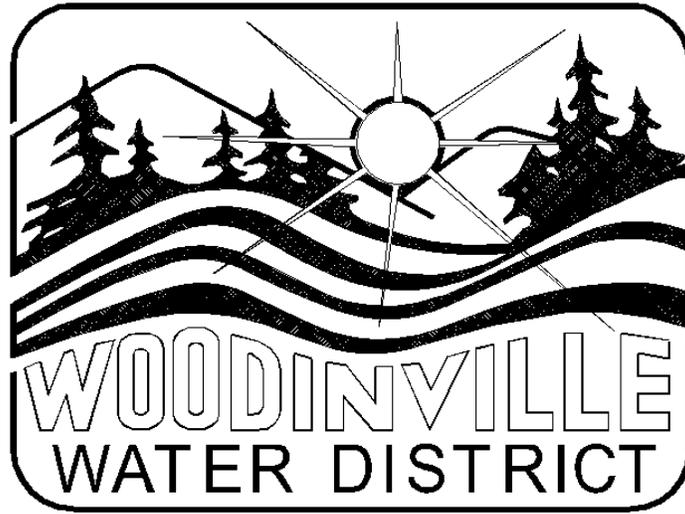
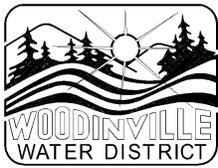
These are but a few of the most significant issues identified in the revised 2022 General Sewer Plan. With this evaluation and identified information the Board of Commissioners will adopt the General Sewer Plan and the updated capital improvement plan needed to support required improvements over the next several years. The Plan will then be submitted to the various regional and State regulatory agencies for their review and ultimate acceptance.

Finally, special recognition needs to be made to District staff, the Board of Commissioners, and David Evans and Associates for their long and patient involvement in this process. I specifically want to thank District Engineer Ken McDowell and the Engineering Department for managing this effort over the last two years. Both Covid and the David Evens merger added a degree of complexity and time to this process. Thank you everyone.

Sincerely yours,



Patrick Sorensen
General Manager



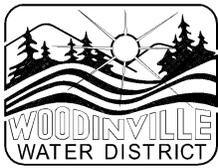
Woodinville Water District
GENERAL SEWER PLAN

September 2022

Board of Commissioners

Chuck Clarke
Aleksandra Kachakov
Pamela J. Maloney
Tim Schriever
Karen Steeb

General Manager
Patrick Sorensen



Plan Certification

1. Preparation

This Plan was prepared under the supervision of a Registered Professional Engineer licensed in the State of Washington.



Evan Henke, P.E.
David Evans and Associates, Inc.
14432 SE Eastgate Way, Suite 400
Bellevue, WA 98007

D: 425.586.9750

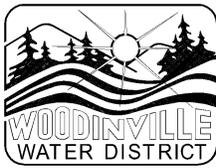


2. Adoption

This Plan has been reviewed and adopted by the Commissioners and Manager of the Woodinville Water District.

Resolution No. 4053

Dated: September 19, 2023



**WOODINVILLE WATER DISTRICT
KING COUNTY, WASHINGTON
RESOLUTION NO. 4053**

A RESOLUTION of the Board of Commissioners of Woodinville Water District, King County, Washington, adopting the WWD 2022 General Sewer Plan.

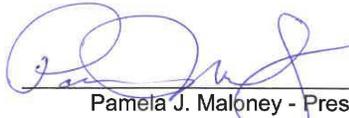
BE IT RESOLVED by Board of Commissioners of Woodinville Water District, King County, Washington, that the Woodinville Water District 2022 General Sewer Plan of the District, a copy of which is incorporated herein by this reference, is hereby adopted.

This Resolution supersedes Resolution 3608.

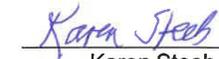
ADOPTED by the board of Commissioners of Woodinville Water District, King County, Washington, at a regular meeting thereof this 19th day of September 2023.

Attest:

Tim Schriever - Secretary



Pamela J. Maloney - President



Karen Steeb - Vice President

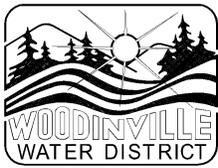
Tim Schriever -Secretary



Aleksandra Kachakov - Commissioner



Chuck Clarke - Commissioner



EXECUTIVE SUMMARY

The following is a summary of the *General Sewer Plan*, presenting the principal findings and recommendations of this report. Readers should note that the 2022 General Sewer Plan (Plan) presents historical information and trends, and then builds on that basis to project anticipated needs for the future. Trends, assumptions, regulations and even construction techniques will change over time and may effect some of the recommendations and conclusions discussed in the Plan. The Plan is intended to serve as a basis which is periodically reviewed, adjusted and amended as new information becomes available. The District is implementing an Asset Management program which could identify additional repair/replacement and change the priorities of identified projects.

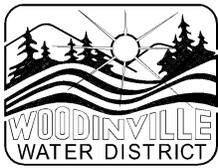
KEY ISSUES OVERVIEW

CBD-CIC [Policy, Rates, CIP] - High density redevelopment within the downtown City of Woodinville Central Business District is projected to exceed the capacity of the existing sewer collection mains. Upsizing the existing sewer mains forms the majority of the Capital Improvements Plan (CIP). The District has a standing policy that development should bare the cost of the development's impact to the sewer system. However, the District recognizes that the District is responsible for replacing many of the existing aging mains. In order to accommodate development and protect the interests of the existing ratepayers, the District adopted the Central Business District – Capacity Increase Charge (CBD-CIC) in early 2022.

The CBD-CIC assesses the development project a fee based on the additional capacity required to serve the development. The fee covers the portion of the cost to upsize the main and will be added to the rate based funds for replacing the existing capacity. The District will be responsible for directing the construction. This policy only applies to replacement of existing mains, Development will remain responsible for constructing new mains (extensions). The District will need to monitor near term projects to ensure development based funding portion and rate based funding portion are adequate to allow the construction to proceed.

Asset Management and Seismic Resiliency [Policy, Rates, CIP] - The District is implementing a GIS based management system and will be performing a study to evaluate seismic risk and potential changes to the construction standards. Both elements are likely to identify additional construction projects and may change the extent and prioritization of existing CIP projects.

Rates – Ratepayers see two charges for sewer service; collection charges administered by the District and treatment charges administered by King County Water Treatment Division (KCWTD). District rates are expected to increase in



proportion to inflation. KCWTD has released preliminary information that their rates will see significant increases in the coming years. The District's rates are sufficient (with periodic inflation increases) to fund the planned operations and CIP.

Sanitary Service Area revisions – The District's current Sanitary Service Area (SSA) includes several areas along the western District boundary where sewer service is actually being provided by adjacent sewer providers (Northshore Utility District, City of Bothell) through inter-local agreements. This came about as a result of court cases and in response to the topography. This Plan restates the SSA to clarify which areas remain the responsibility of the District and which areas will remain being serviced by other providers.

BACKGROUND (Chapter 1)

The subject of this plan is the public wastewater collection system, operated and maintained by the Woodinville Water District (WWD)(District). The District is a municipal corporation in the form of a special purpose district, subject to RCW 57. The District provides public water and sewer service to incorporated and unincorporated land area in northern King County. The incorporated area includes all of the City of Woodinville and small areas of the cities of Bothell and Kirkland. The unincorporated area includes the City of Woodinville Urban Growth Area (UGA) and a northerly portion of the City of Redmond UGA.

WWD is bounded by Snohomish County to the north, Bothell to the west, Redmond to the south and unincorporated King County to the east.

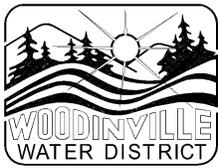
The District was formed in 1959 as Water District #104 and began providing sewage collection in 1973.

This plan has been prepared in the context of the following land use planning documents.

- Woodinville Water District – 2007, General Sewer Plan
- Woodinville Water District – 2019, Comprehensive Water System Plan
- City of Woodinville – 2015, Comprehensive Plan
- King County – 2016 (2020), Comprehensive Plan
- City of Bothell – 2018, Wastewater Comprehensive Plan
- City of Kirkland – 2018, General Sewer Plan
- Northshore Utility District – 2006, Wastewater System Plan
- Puget Sound Regional Council – Population and Growth

POLICY (Chapter 1)

Preparation of this plan identified that significant pipe upsizing would be required to support zoning density increases by the City of Woodinville within their Central Business



District (CBD) redevelopment area. This led the District into developing and implementing a new Central Business District – Capacity Improvements Charge policy (CBD-CIC). The policy collects funds from developers at the time they apply for sewer service in, order to fund the capacity increase required to provide sewer service to the developer’s project. Collected funds are proportionate to the development’s impact to the existing collection system. The collected funds will be used to partially fund the Capital Improvement Projects located within the CBD area. The remaining funds required will come from District sources and are intended to represent the portion of project cost involved in replacing existing capacity.

FACILITIES (Chapter 2)

The District owns, maintains, and operates approximately 290,000 feet of collection piping ranging from 6” to 21”, 3 sewage pump stations and 3 sewer siphons. The District conveys all sewage to King County Wastewater Treatment Division, where it is routinely treated at the Brightwater Treatment Plant. Additionally, the District’s Administrative and Maintenance facility (Office) serves both the water and sewer functions of the District.

SEWER SERVICE AREA (Chapter 3)

This Plan revises (reduces) the sewer service area (SSA) to 4,498 acres within WWD’s 18,958-acre corporate boundary, or approximately 23.7% (SSA: Corporate Area). The District originally showed 5,261 acres of SSA, however 763 acres of that area is being served by adjacent sewer providers through Interlocal Agreements.

The totals above do not include an additional 46 acres that are being served by WWD outside of WWD’s SSA by Inter Local Agreement, located in the SW district.

POPULATION (Chapter 3)

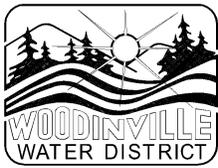
Of the 3,700 District sewer customers, there are approximately 3,100 residential accounts and 600 accounts designated as commercial, industrial, or municipal. The current served population is estimated to be 8,500 and continues to grow at 2% per year.

FLOW MONITORING (Chapter 4)

In preparation of this plan sewer flow meters were installed for several dry and wet weather months in the District’s 11 largest basins. In most basins evidence of excessive Inflow and Infiltration (I&I) was not found, and all basins were within or below typical I&I levels.

DESIGN CRITERIA (Chapter 4)

The design criteria used in this comprehensive plan is based on *Criteria for Sewage Works Design* established by the State of Washington Department of Ecology, District historical design criteria, actual usage records and other accepted standards for wastewater system design and construction. For planning purposes, a value of 80



gallons per capita per day (population basis) and 180 gallons per day per Equivalent Residential Unit has been used throughout this plan.

EVALUATION (Chapter 5)

A hydraulic model was assembled, calibrated, and used to analyze pipe capacity under future build-out conditions. The model identified approximately 12,400 lineal feet (LF) of pipe for potential replacement due to capacity shortfalls, which represents 3.7% of all pipe. Operations staff identified an additional 4400 lf of pipe for potential replacement due to condition concerns, which represents 1.5% of all pipe and brings the total 5.2% of the collection system. Seismic resiliency is introduced with the District planning a formal study for the fall of 2022.

CAPITAL IMPROVEMENT PLAN (Chapter 8)

This *General Sewer Plan* update identifies projects that will be necessary to maintain existing service and expand the capacity of the in-place system to meet identified needs. The Plan also identifies the most likely routing and sizing of future system extensions and serves as guidance for development within the sanitary service area.

The Capital Improvement Plan has four components, based on the source of the project.

Pipe Condition	4400 lf of pipe and manholes	\$ 2,300,000
Service Area Reclaim	400 lf of pipe and manholes	\$ 200,000
Pipe Capacity	12,400 lf of pipe and manholes	\$ 6,500,000
District Internal Projects	Equipment, software, etc.	\$ 300,000
Total CIP		\$ 9,300,000

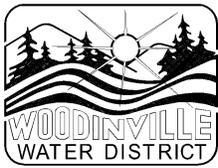
The CIP is not a static value. The value shown is based on current (2022) information. There are several factors that may affect the CIP in the coming years:

- Implementation of the Asset Management program may identify additional work required.
- The results of the planned Seismic Resiliency study may identify additional work required.
- Local municipalities may revise the allowable zoning.
- Other pertinent information may come to light.

As new information comes in it must be reviewed for impact and possible revision to the CIP.

CIP FUNDING (Chapter 9)

The capacity-based portion of the CIP will be partially funded through an estimated \$ 2,800,000 in charges through the CBD-CIC policy. This reduces the total CIP cost thru

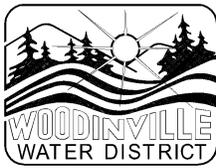


rate revenue to \$ 6,500,000 over a 10-year period. This amount is consistent with the current rate structure and budget forecasts.

RECOMMENDATIONS

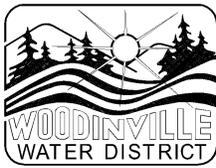
Based on the information presented in this report, it is recommended that Woodinville Water District:

1. Adopt the *General Sewer Plan* for improvements as set forth herein.
2. Submit copies of this report to appropriate regulatory agencies for approval.
3. Review and update the sewer general facilities charge based on the adopted Capital Improvement Plan.
4. Begin scheduling the recommended wastewater collection system improvements, proportionate with growth trends.
5. Continually monitor new information (i.e., Asset management findings, population trends, seismic resiliency recommendations, etc) for potential revisions to Capital Improvement Plan.
6. Continue evaluation of the sewer collection system for excessive inflow and infiltration and implement reasonable measures to reduce such flows. Basin 3 showed the highest storm related flows.
7. Periodically review the Plan and update it to conform to actual growth patterns and population levels and to remain consistent with land use designations in the sewer service area.

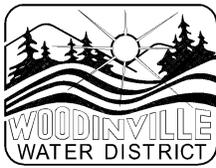


Woodinville Water District General Sewer Plan

	Page
* PREPARATION	
** EXECUTIVE SUMMARY	
1 DESCRIPTION OF SEWER SYSTEM AND BACKGROUND	
1.1 Purpose and Need for Plan	1-1
1.2 Adoption	1-2
1.3 Ownership and Management	1-2
1.4 System History and Background	1-7
1.5 District Policies	1-15
1.6 Service Area Characteristics	1-19
1.6.A Sewer Service Area	
1.6.B Topography	
1.6.C Geology	
1.6.D Water Resources	
1.7 Public and Private Water Facilities	1-28
1.7.A District Water Facilities	
1.7.B Private Water Wells	
1.8 Municipal Sewage Treatment	1-33
1.9 Onsite Sewage Disposal Systems	1-33
1.9.A Schools	
1.9.B Shopping Center	
2 EXISTING SANITARY FACILITIES	
2.1 Existing Pipe System	2-1
2.1.A Bypass Manholes	
2.2 Lift Stations	2-6
2.3 Siphon Systems	2-10
2.4 King County Transmission Facilities	2-11
3 PLANNING CONSIDERATIONS AND DATA	
3.1 Reference Planning Documents	3-1
3.2 Service Area Description	3-1
3.2.A Sewer Service Area Revisions	
3.3 Land Use	3-9
3.3.A Growth Management Act	
3.3.B City of Woodinville	
3.3.C King County	
3.4 Relationships with Adjacent Sewerage Agencies	3-17

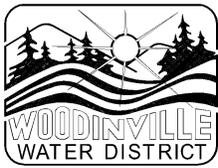


3.4.A	City of Bothell	
3.4.B	City of Redmond	
3.4.C	Northshore Utility District	
3.4.D	Cross Valley Water District	
3.4.E	King County Department of Natural Resources	
3.5	Population and Forecasts	3-19
3.5.A	Existing Sewer Connections	
3.5.B	Population and Growth	
3.5.C	Industrial Customers	
4	WASTEWATER FLOWS AND DESIGN CRITERIA	
4.1	Program Approach and Goals	4-1
4.1.A	Overview	
4.1.B	Approach and Basin Delineation	
4.1.C	Goals	
4.2	Primary Basin Descriptions	4-5
4.3	Flow Monitoring	4-7
4.4	I & I Comparison	4-12
4.4.A	Program Overview	
4.4.B	Comparison with 2007 Study	
4.4.C	I & I at Monitored Basins	
4.5	Residential Sewage, SFR and ERU	4-17
4.6	Peaking Factors	4-18
4.7	Sewage Design Criteria Summary	4-19
5	COLLECTION SYSTEM EVALUATION	
5.1	System Data and GIS Data	5-1
5.2	Model Development	5-1
5.2.A	Basin Delineation	
5.2.B	Flow Distribution and Calibration	
5.2.C	Flow Development	
5.3	Hydraulic Capacity Analysis	5-9
5.3.A	Model Results	
5.3.B	Model Results Deficiency Summary	
5.4	Identification of Existing Condition Deficiencies	5-14
5.5	Evaluation Of Service by Adjacent Agencies and Unserved Area Extensions	5-15
5.5.A	Study Area A (Reclaim)	
5.5.B	Study Area B (Wedge)	
5.5.C	Study Area C (East Unsewered)	
5.6	Seismic Resiliency	5-27
5.7	Technical Alternatives	5-27
5.7.A	Water Conservation	
5.7.B	Reclaimed Water	



5.7.C Alternative Collection Systems

6	OPERATIONS AND MAINTENANCE PROGRAM	
6.1	District Management and Personnel	6-1
6.1.A	Organization	
6.1.B	Certification and Training	
6.2	Asset Management	6-6
6.2.A	Overview of Requirements	
6.2.B	Implementation of an Asset Management Plan	
6.2.C	Program Goals	
6.2.D	Maintenance Management	
6.3	Activities to Meet Standards	6-9
6.4	Design and Performance Provisions	6-10
6.5	Monitoring Program	6-11
6.6	Staffing Projections	6-11
6.7	Emergency Response	6-12
6.8	Safety Procedures	6-12
7	DISTRICT STANDARDS	
7.1	Performance and Design Criteria	7-1
7.1.A	Gravity Sewers	
7.1.B	Laterals and Side Sewers	
7.1.C	Manholes	
7.1.D	Lift Stations	
7.1.E	Force Mains	
7.1.F	Inverted Siphons	
7.1.G	Easements	
7.2	Policies and Requirements for Developers	7-4
7.3	Standard Specifications and Details	7-5
8	CAPITAL IMPROVEMENTS PROGRAM	
8.1	Costing	8-1
8.2	Condition Based CIP	8-7
8.3	Routing Based CIP	8-9
8.4	Hydraulic Capacity CIP	8-11
9	FINANCIAL	
9.1	Current Rate Structure	9-1
9.2	System Development Fees	9-2
9.3	Operations and Maintenance	9-2
9.4	Capital Improvements	9-4
9.5	Capital Improvement Plan Funding	9-5



GLOSSARY TOC-1

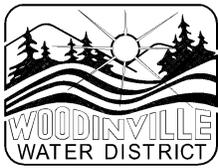
ABBREVIATIONS TOC-2

LIST OF TABLES

1-1	General Sewer Plan Requirements per WAC 173-240-050	1-1
1-2	WWDC Policies	1-16
2-1	District Collection System Inventory	2-1
2-2	Lift Station Summary	2-8
3-1	Growth Projections	3-20
3-2	Industrial Customers	3-21
4-1	WWD – Sewer Flow Monitoring Summary Oct 2019 – Feb 2020	4-11
4-2	I & I Rate Comparison	4-12
4-3	Flow Contribution Comparison	4-17
4-4	Sewage Design Criteria Summary	4-19
5-1	Model Results Summary (Capacity Deficiency)	5-12
5-2	Condition Deficiencies	5-14
6-1	Routine Operation & Maintenance	6-9
6-2	Performance Audit Outline	6-10
7-1	Minimum Pipe Slope Criteria for Sewer Mains	7-2
8-1	Planning Level Unit Pipe Project Costs	8-2
8-2	Condition Based CIP	8-8
8-3	Routing Analysis CIP	8-10
8-4	Capacity Based CIP	8-12
9-1	Sewer Rates	9-1
9-2	Sewer Maintenance Fund	9-3
9-3	CIP Funding Requirements	9-5

LIST OF FIGURES

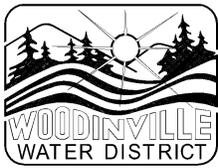
1-1	Vicinity Map	1-5
1-2	District Boundary	1-9
1-3	Adjacent Municipalities	1-11
1-4	Adjacent Providers	1-13
1-5	Topo and Aerial	1-21
1-6	Terrain and Critical Areas	1-23
1-7	WWD Sewer Service By Agreement	1-25
1-8	Water Well Locations	1-31
1-9	Schools	1-37
2.1a	Sewer System (West)	2-3
2.1b	Sewer System (East)	2-5
2-3	KCWTD Transmission Mains	2-13
3-1	Existing Sewer Service Area	3-5



3-2	SSA Revisions	3-7
3-3	Woodinville Corporate and UGA Boundaries	3-11
3-4	Woodinville Future Land Use Designations	3-13
3-5	Zoning	3-15
4-1	All Basins	4-3
4-2	Flow Meter Locations	4-9
4-3	Basin 1 12/19-12/22 Event (Example)	4-15
5-1a	Sewer System Model Basins (west)	5-5
5-1b	Sewer System Model Basins (east)	5-7
5-5a	Study Area A (Reclaim)	5-17
5-5b	Study Area B (Wedge)	5-21
5-5c	Study Area C (Eastern Unsewered)	5-25
6-1	Organizational Chart - Woodinville Water District	6-3
8-1a	Capital Improvement Program – Project Locations (west)	8-3
8-1b	Capital Improvement Program – Project Locations (east)	8-5
8-2	Basin 3 – CIP	8-13
8-3	Basin 8 – CIP	8-15
8-4	Basin 9 – CIP	8-17

APPENDICIES

- A. Sewer System Map & Basin Maps
- B. Flow Monitoring & Hydraulic Modeling
- C. SEPA Checklist and Determination
- D. CIP Sheets
- E. 2021-2022 Financial Summary
- F. Interagency Agreements – Separately Bound Document
- G. EPA Asset Guidelines
- H. Correspondence (forthcoming)
- I. Seismic Resilience Guide



GLOSSARY

100-year flood: A flood with a water elevation that has a 1-percent chance of being equaled or exceeded in any given year.

Average Wet Weather Flow: Wastewater flow during period when groundwater table is high and precipitation is at its peak, generally from October to May in the Woodinville area.

Class 1 Stream: A perennial or intermittent stream that is used by threatened or endangered fish or larger numbers of other fish, or that is used as a direct source of water for domestic use.

'Class A' Water: This is a high-quality water reclaimed by advanced treatment from sewage for use in non-potable applications. It is oxidized, coagulated, filtered, and disinfected with < 30 mg/L of BOD and TSS, < 2 NTU of turbidity, and < 2.2 coliforms per 100 ml.

II: Combined effect of Infiltration and (direct) inflow.

Infiltration: Groundwater entering the sewage collection system through defective joints, pipes, and improperly sealed manholes.

Inflow: Sewage flows resulting from stormwater runoff entering the sewage collection system, typically through manhole covers, roof leaders, and area drains connected directly to sewer, cross connections from storm drains and catch basins, and direct flows into broken sewers.

Maximum Monthly Flow: Average daily flow during the highest flow month of the year.

National Flood Insurance Program: Federally funded program providing flood insurance to property owners in flood plains provided the local government meets certain criteria for management of flood damage risk.

Orange Book: *Criteria for Sewage Works Design*, published by the Washington State Department of Ecology

Peak Hourly Flow: Wastewater flow during the highest flow hour.

Peaking Factor: The ratio between the average daily flow and peak hourly flow.

Sensitive Area: Area in which development potential is limited by environmental factors such as steep slopes, wetlands, and valuable natural habitat.

Sewer Lateral: A sewer with no other common sewers discharging into it.

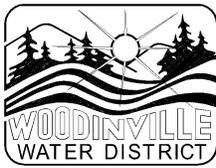
Sewer Submain: A sewer that receives flow from one or more lateral sewers.

Sewer Main or Trunk: A sewer that receives flow from one or more submains.

Sewer Interceptor: A sewer that receives flow from a number of main or trunk sewers, force mains, etc.

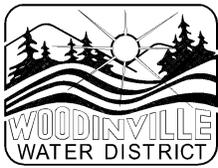
Tight Lined: A sewer main that is restricted to having only an initial connection (source of sanitary flow) and no further connections.

Urban Growth Area: Area in which urban development must be contained, as stipulated by the Growth Management Act.

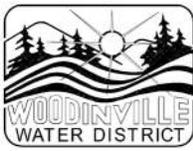


ABBREVIATIONS

AADF	Average Annual Daily Flow
AWWF	Average Wet Weather Flow
AWWM	Average Wet Weather Month
CFR	Code of Federal Regulations
CIP	Capital Improvement Program
CMMS	Computerized Maintenance Management System
CWA	Clean Water Act
CWPP	County Wide Planning Policy
DOH	Washington State Department of Health
DOE	Washington State Department of Ecology
District	Woodinville Water District
EPA	United States Environmental Protection Agency
ERU	Equivalent Residential Unit
ERUw	Equivalent Residential Unit (wet weather)
ESA	Endangered Species Act
FEMA	Federal Emergency Management Act
FPS	Feet per second
FOG	Fats, Oils and Grease
FWPCA	Federal Water Pollution Control Act (“The Clean Water Act”)
GMA	Growth Management Act
GPCD	Gallons per capita per day
GPAD	Gallons per acre per day
GPD	Gallons per day
GPM	Gallons per minute
HPA	Hydraulic Project Approval
I & I	Infiltration and Inflow
JARPA	Joint Aquatic Resources Permit Application
KCDNR	King County Department of Natural Resources and Parks
KCWTD	King County Wastewater Treatment Division, a division of King County Department of Natural Resources and Parks, formerly referred to as “Metro”.
LF	Lineal Feet
MGD	Million Gallons per Day
mg/L	Milligrams Per Liter
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
 OCD	Washington State Office of Community Development
OFM	Washington State Office of Financial Management
PSRC	Puget Sound Regional Council
PVC	Polyvinyl Chloride
q/Q	Ratio of modeled flow (q) to allowable pipe capacity flow (Q)



RCW	Revised Code of Washington
RFP	Request for Proposals
SEPA	State Environmental Policy Act
SFR	Single Family Residential
SFRw	Single Family Residential wet weather (excludes irrigation)
SRF	State Revolving Fund
SSA	Sanitary Service Area
UGA	Urban Growth Area
USFWS	United States Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WWD	Woodinville Water District
WWDC	Woodinville Water District Code



CHAPTER 1 – DESCRIPTION OF SEWER SYSTEM AND BACKGROUND

1.1 PURPOSE AND NEED FOR PLAN

This 2022 General Sewer Plan (Plan) is prepared for Woodinville Water District (District) to fulfill the requirements of Chapter 173-240-050 of the Washington Administrative Code (WAC) and Chapter 90.48 of the Revised Code of Washington (RCW). The WAC requirements are outlined in **Table 1-1**.

Table 1-1 General Sewer Plan Requirements per WAC 173-240-050		
WAC Reference Paragraph	Description of Requirement	Location in Document
3a	Purpose and need for proposed plan	Section 1.1
3b	Who will own, operate, and maintain system	Section 1.3
3c	Existing and proposed service boundaries	Figure 3-1, 3-2
3d	Layout map showing boundaries; existing sewer facilities; proposed sewers; existing and proposed pump stations and force mains; topography and elevations; streams, lakes; and other water bodies; water systems	Figures 1-2, 1-5, 1-6, 2-1a, 2-1b, 3-1, 8-1a, 8-1b
3e	Population trends	Section 3.5
3f	Existing domestic and/or industrial wastewater facilities within 20 miles	Section 1.8 and 1.9
3g	Infiltration and inflow problems	Section 4.
3h	Treatment systems and adequacy of such treatment	Section 1.8
3i	Identify industrial wastewater sources	Section 3.5.C
3j	Location of all existing and private wells, or other sources of water supply, and distribution structures	Figure 1-8
3k	Discussion of collection, treatment and disposal alternatives	Sections 5.7
3l	Define construction cost and O&M costs	Chapter 8 & 9
3m	Compliance with management plan (City Comprehensive Plan)	Appendix D
3n	SEPA compliance	Appendix E



The Plan provides a comprehensive guide to assist the District with managing and operating the sewer system and coordinating expansions and upgrades to the infrastructure for the next twenty years. The Plan serves as a guide for policy development and decision-making processes for the District. It also provides other agencies and the public with information on the District's plans for sewer system extensions within the area designated as the boundary established under the Growth Management Act (Sewer System Service Area).

The Plan evaluates existing and future capacity of the sewer system based on current and anticipated future wastewater flow rates. Future wastewater flow rates are estimated from existing flow data and population growth projected within the sewer service area.

1.2 PLAN ADOPTION

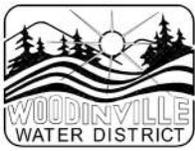
This Plan was reviewed by the staff and commissioners of Woodinville Water District and adopted by Resolution XXXX on MM/DD, 2022. During the development of the Plan, relevant portions were shared with neighboring sewer providers and served municipalities.

1.3 OWNERSHIP AND MANAGEMENT

The Woodinville Water District (WWD)(District) is located in northern King County as shown on **Figure 1-1, Vicinity Map**. The District office, including administrative and operations facilities, is located at:

17238 NE Woodinville-Duvall Road
Woodinville, WA 98072

The District is a public sewer and water system governed by an elected five-person board of commissioners, with a service area boundary on file with King County. The water service area boundary extends considerably beyond the sewer service boundary authorized under the Growth Management Act.



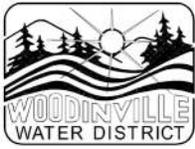
The current District commissioners, including contact information, are:

Chuck <u>Clarke</u> ,	Email Chuck	Voicemail 425-487-4151
Aleksandra <u>Kachakov</u> ,	Email Aleksandra	Voicemail 425-487-4155
Pamela J. <u>Maloney</u> ,	Email Pam	Voicemail 425-487-4152
Tim <u>Schriever</u> ,	Email Tim	Voicemail 425-487-4154
Karen <u>Steeb</u> ,	Email Karen	Voicemail 425-487-4153

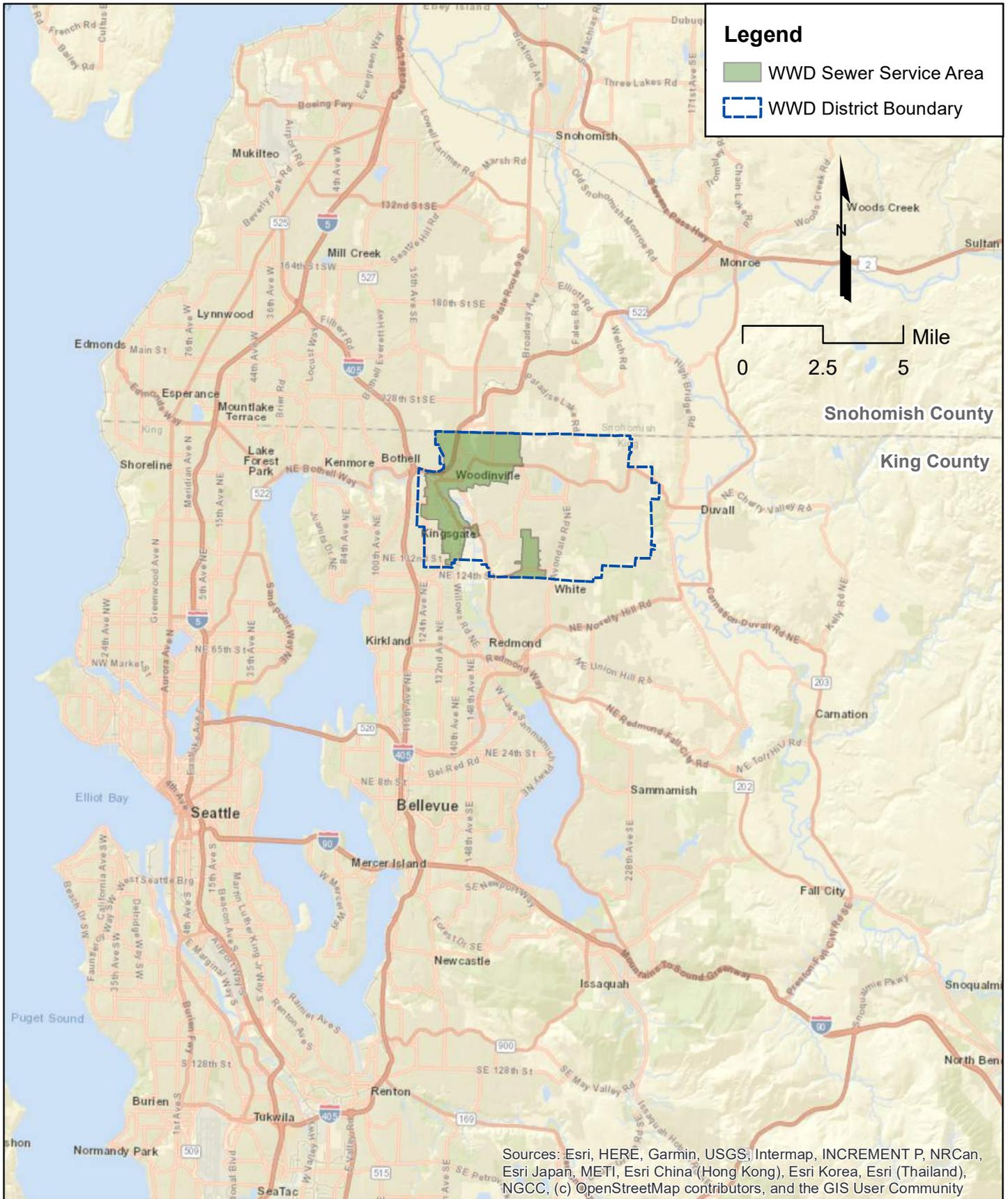
The direct management of the District is by:

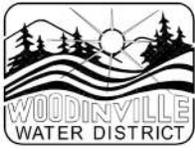
Patrick Sorensen	General Manager	psorensen@woodinvillewater.com	PH: 425-487-4103
Ken McDowell, PE	District Engineer	kmcdowell@woodinvillewater.com	PH: 425-487-4104

Thirty-six (36) employees comprise the District staff. The District maintains a website to communicate with ratepayers, potential developers and interested general public: woodinvillewater.com.

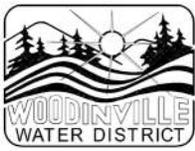


(Page Intentionally Left Blank)





(Page Intentionally Left Blank)



1.4 SYSTEM HISTORY AND BACKGROUND

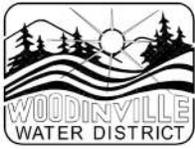
The District is located in King County, Washington, approximately 13 miles northeast of Seattle with offices as shown in **Figure 1-2, District Boundary**. The District service area is generally bounded on the north by Snohomish County, on the east by an unincorporated area of King County, to the south by the City of Redmond, and on the west by the cities of Bothell and Kirkland. **Figure 1-3, Adjacent Municipalities** presents a map of the District showing the water service area, the sewer service area, the UGA boundary, the City of Woodinville and the surrounding municipalities. Not all of the adjacent municipalities provide water or sewer service directly, there are other adjacent special purpose districts that provide water and sewer service and are shown on **Figure 1-4, Adjacent Providers**.

The prior sewer comprehensive plan was prepared in 2007. During the past 14 years the District has continued to manage the sewer facilities in a proactive fashion and utilize newer technologies to provide quality service to the District's rate payers. Several key projects have had a positive impact on the sewer system, including:

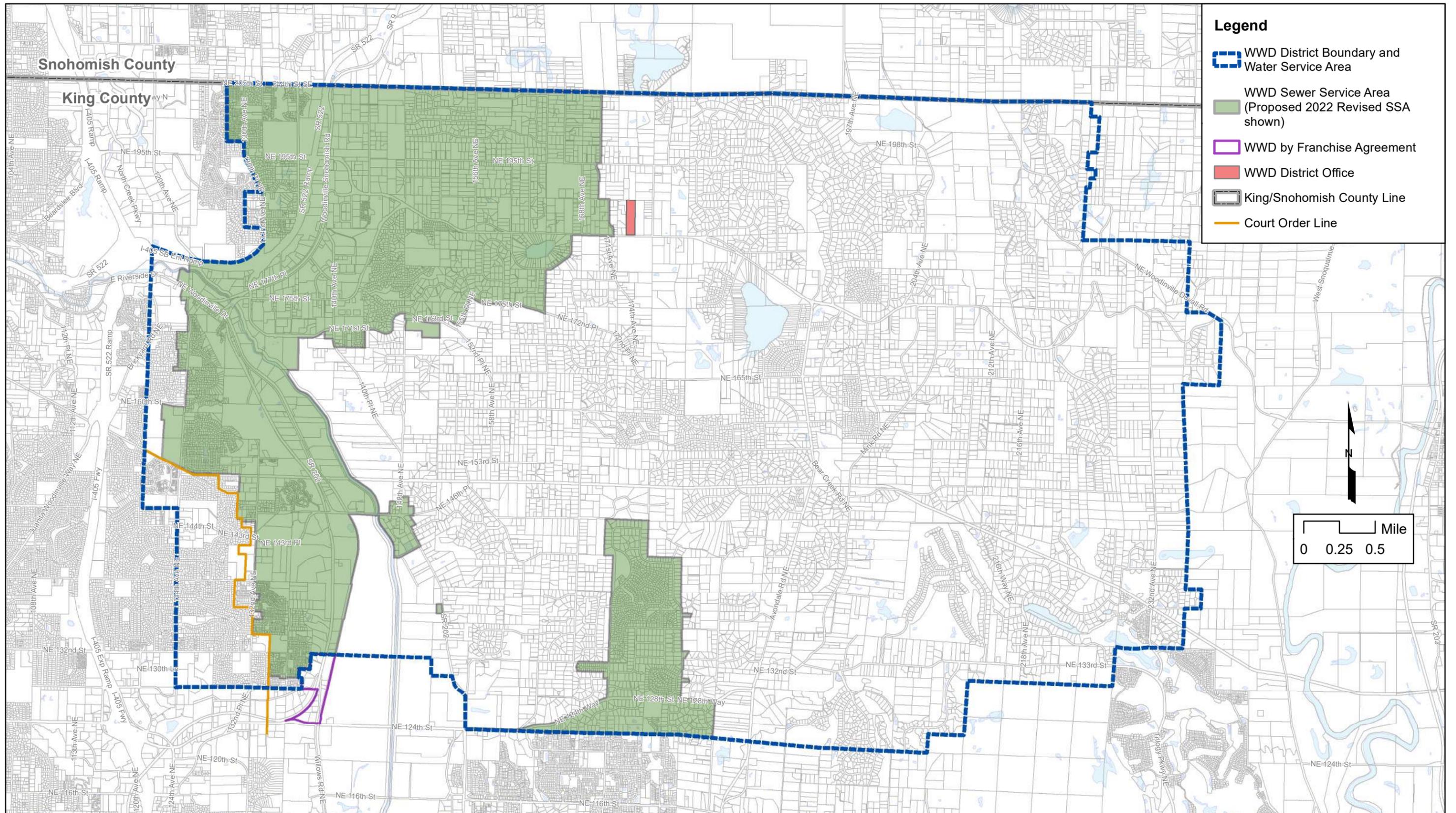
- Expanded website, including the ability to receive online payments.
- Expanded Graphical Information System (GIS) with a surface survey of all manholes to aid in locating facilities and ensure a common datum.
- King County Brightwater WWTP came online and redirected several of the sewage transmission mains that the District discharges into.

The Woodinville Water District (formerly Water District No. 104) was established in 1959 and the first sewer system in the community was constructed in 1973. The District is presently the fifth largest water district in King County, serving approximately 14,000 water accounts, but relatively small as a sewer district with approximately 3,700 sewer accounts.

Sewer service is limited by Washington State's Growth Management Act. Sewer service may only be provided in areas that are incorporated or within Urban Growth Area (UGA) claimed by those municipalities, together with a few other exceptions. The Sanitary Service Area (SSA) is a subarea of the District's larger corporate and Water system boundary, primarily defined by the UGAs of Woodinville, Redmond, Bothell and Kirkland. After the initial SSA was established, an agreement with Northshore Utility District and others resulted in Court Order No. 607978 which established the "**Court Order Line**" in the southwest corner of the District. The District's SSA was not revised at that time, however Northshore Utility District is responsible for providing sewer service to all properties that lie southwest of the Court Order Line. The SSA and revisions are further discussed in Chapter 3.



(Page Intentionally Left Blank)

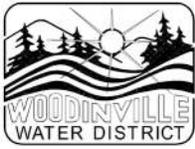


Legend

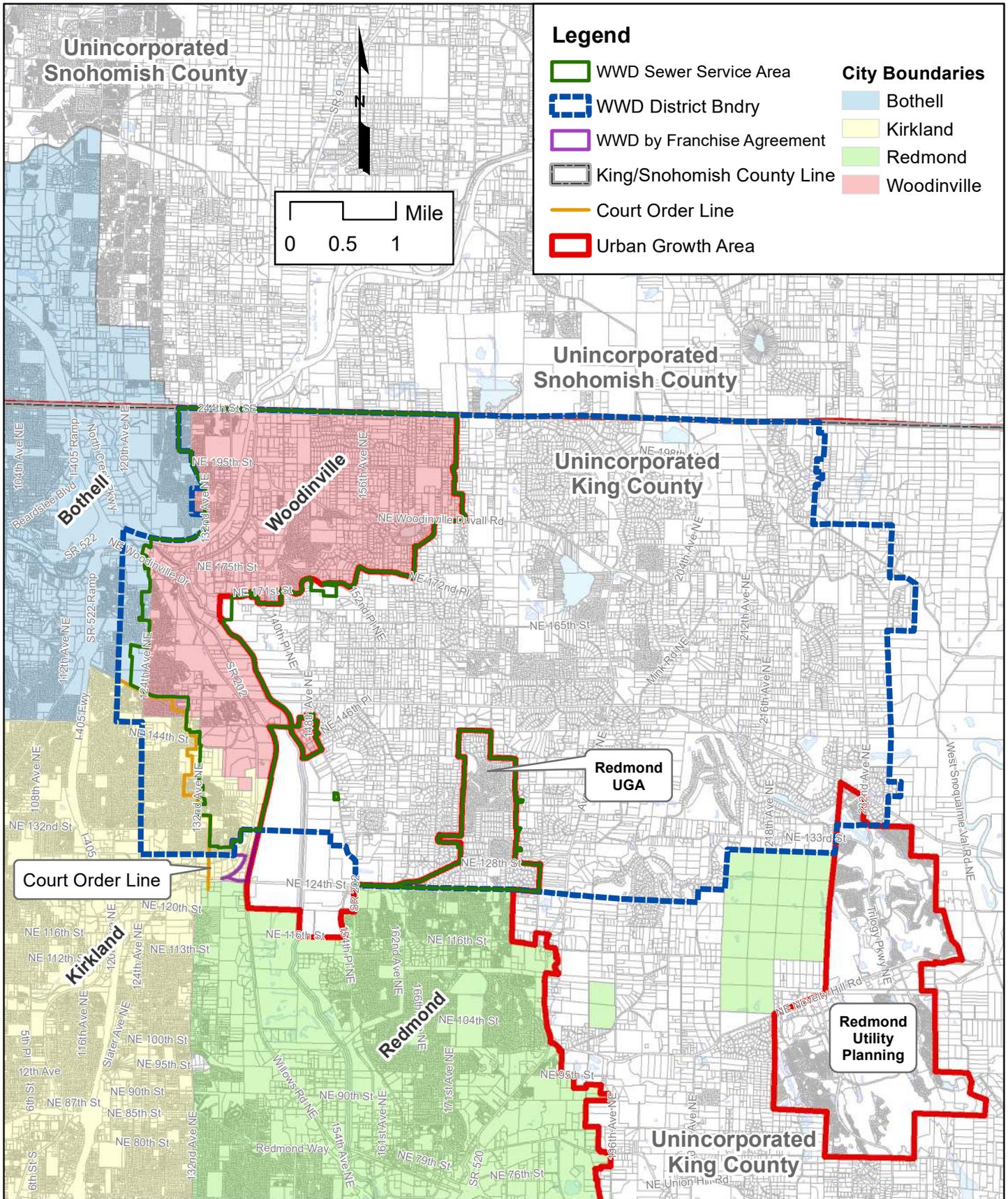
-  WWD District Boundary and Water Service Area
-  WWD Sewer Service Area (Proposed 2022 Revised SSA shown)
-  WWD by Franchise Agreement
-  WWD District Office
-  King/Snohomish County Line
-  Court Order Line

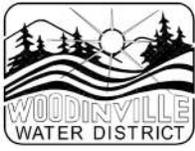
N

0 0.25 0.5 Mile



(Page Intentionally Left Blank)

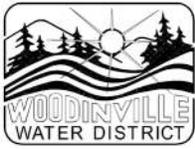




(Page Intentionally Left Blank)



(Page Intentionally Left Blank)



The District is responsible for providing sanitary sewer service to customers within that portion of its boundaries inside the UGA that are not served by other agencies such as the City of Bothell or the Northshore Utility District. Some of the area within the UGA may eventually be annexed by the Cities of Woodinville, Kirkland or Redmond. Customers outside the UGA are required to use onsite sewage systems.

Of the 3,700 sewer customers, there are approximately 3,100 residential accounts and 600 accounts designated as commercial, industrial or municipal. The majority of sewer customers also receive water service from the District, though some water customers are served by adjacent agencies' sewer service areas such as Northshore Utility District. Separate water and sewer service providers primarily occurs along the western limits of the District.

The sanitary sewage flows are collected and conveyed through District-owned sewer facilities and discharged into sewer transmission mains owned and operated by King County.

Planning for future wastewater operations requires the District to address the following:

- Land use decisions within the District water service boundary are determined by the City of Woodinville, the City of Kirkland, the City of Redmond, the City of Bothell and King County. The sewer service area is directly affected primarily by the City of Woodinville and by King County, and to a lesser extent by the Cities of Bothell, Kirkland, and Redmond.
- The District must coordinate its planning efforts with the planning efforts of King County, Department of Natural Resources, Wastewater Treatment Division (KCWTD) to ensure that there is adequate conveyance and treatment capacity.

1.5 DISTRICT POLICIES

The District has reviewed all past resolutions and codified those into a published code; *WOODINVILLE WATER DISTRICT CODE* (WWDC). The WWDC is updated whenever the WWD Commissioners adopt a new or revised policy. Table 1-2 lists the policies that have a direct impact on the sewer system. The content has been paraphrased and the reader is directed to the full version of the WWDC, published on the District's website, to review in detail any code/policy listed.

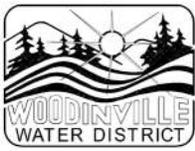


Table 1-2 WWDC Policies		
Ref.	Title	Content
4.04	WATER AND SEWER SYSTEM DEVELOPER EXTENSIONS GENERALLY	Policy for water and sewer developer extensions including pricing, design standards, variance procedures, reimbursements, and general manager authority
4.05	CHARGE IN LIEU OF ASSESSMENT/HOOKUP IN LIEU OF ASSESSMENT (HUILOA) AGREEMENTS	Agreements for Charge/ hookup In Lieu Of Assessment. Covering reasons and methods for a property to connect to the systems without assessment.
4.06	SERVICE CONNECTION AGREEMENT TO CONSTRUCT SERVICE CONNECTIONS TO DISTRICT SYSTEM	Describes the form and process required for new service connections to the system.
4.08	APPLICATION AND AGREEMENT FOR DEVELOPER EXTENSIONS	Describes the form and process required for developer extensions to the system.
4.12	STANDARD SPECIFICATIONS FOR WATER AND SEWER DEVELOPER EXTENSIONS	Adoption of standard specifications for water and sewer developer extensions.
4.20	UTILITY LOCAL IMPROVEMENT DISTRICTS	Policies for the creation and maintaining of Local Improvement Districts by the District Commissioners including assessments, boundaries and notification processes.
4.32	CAPITAL CONSTRUCTION LOCAL FACILITIES CHARGES	Description of the method for calculating the Local Facilities Charge, and policy for installment payment plans.
4.36	COMPREHENSIVE PLANS	Adoption of General Sewer Plan and Comprehensive Water System Plan.
4.44	SIDE SEWER CONNECTIONS	Describes policy for connections to side sewers, including permits, records, construction specifications, inspections and hold harmless.
4.48	PUBLIC SANITARY SEWER SYSTEM	General sanitary sewer system policies including prohibited connections, required connections, timing requirements for connection, illegal connections, inspector's right of entry, abandoned septic tanks, and approved contractors

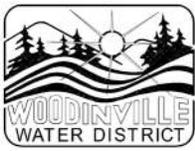
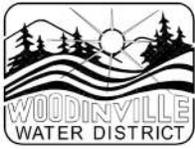


Table 1-2 WWDC Policies		
Ref.	Title	Content
4.52	ON-SITE SEWAGE DISPOSAL SYSTEMS	Policy for providing water service to properties with on-site sewer disposal systems.
4.56	WATER AND SEWER SYSTEM DEVELOPMENT FEES	Descriptions of water and sewer system development fees, as well as other connection charges.
4.60	RATES AND CHARGES	Rates and charges for Water and Sanitary Sewer service and street lighting. It also includes reference to the rate schedule and the Final billing charge rules, billing period and water restrictions surcharges.
4.64	CENTRAL BUSINESS DISTRICT CAPITAL IMPROVEMENT CHARGE	Describes application and calculation of additional connection charges to respond to increases in (development) population density triggering capital improvement projects.
4.68	BILLING AND COLLECTION PROCEDURES	Outlines procedures for billing and collection as well as applications for service, collection enforcement, adjustments and appeals.
4.70	WATER AND SEWER—MISCELLANEOUS PROVISIONS	Damage to district property and meter rules
4.76	FAT, OIL AND GREASE MANAGEMENT PROGRAM	Outlines requirements for commercial establishments, inspection, applications for new sewer connections, compliance dates, enforcement, violation penalties, measurement, tests and analyses.
4.88	UNAUTHORIZED USE OF DISTRICT FACILITIES	Describes a list of prohibited uses of district facilities, including disconnection without prior authorization, tampering with district equipment, and the penalties for the violations.

Sewer service to any properties outside the designated UGA boundary is not permitted by King County. There are two exceptions to this policy as quoted below from King County Comprehensive Plan 2000, Policy I. F-242:

“Public sewer expansions shall not occur in the Rural Area and on Natural Resource Lands except where needed to address; (1) specific health and safety problems threatening the existing uses of structures or (2) the needs of public schools or public school facilities.



Public sewers may be extended, pursuant to this policy, only if they are tight lined and only after a finding is made by King County that no reasonable alternative technologies are technologically or economically feasible.

Utility providers shall ensure, through a signed agreement between the school district and the utility provider, that any sewer service permitted for the school district is designed only to serve public school facilities.

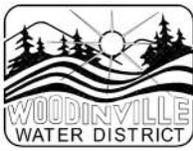
Public sewers which are allowed in the Rural Area or on Natural Resource Lands pursuant to this policy shall not be used to convert Rural Area land or Natural Resource Lands to urban uses and densities or to expand permitted non-residential uses.”

In conforming to the requirements of the County, the District’s policy for sewer service remains unchanged from that presented in the 1979 “Comprehensive Sewerage Plan”, which stated that the District recognized that its function was not to plan land uses for the service area, but to respond to land uses planned by the community through the proper authorities. The District’s facilities, their encumbrances, and their impact on the community are not to be used as tools for implementing unscheduled changes in the planned land use for any area.

It is the District’s policy that property owners desiring sewer service are responsible for initiating a sanitary sewer request. Property owners are responsible for the financing of new sewer developments and/or extensions. Financing for these extensions can be through conventional means as a Developer Extension, or a Utility Local Improvement District can be formed if approved by the Commissioners.

New sewer facilities desired by a Developer within the District service area shall be constructed by the Developer and then deeded to the District. The Developer must first apply for sewer service, at which time the proposed sewer design will be reviewed by District engineers to ensure compliance with the District and County standards and design criteria. Sewer extensions shall follow the “Standard Sewer Specifications of the Woodinville Water District for Developer Extensions” as approved by the District. Approval of Developer Extension Agreements is at the discretion of the Board, and such DE Agreements will be approved when it is in the best interest of the public.

District policies are set and reviewed by the District Board of Commissioners, to be consistent with the policies of King County and the Woodinville City Council. The District may find it necessary from time to time to reevaluate their policies based on County and City land use, policies and ordinances.



1.6 SERVICE AREA CHARACTERISTICS

The sewer service area lies entirely within King County in the north end of the Sammamish River Valley. Woodinville Water District lies to the east of Interstate 405, just east of the City of Bothell and due north of the City of Redmond. The City of Woodinville is entirely within the District's service area. The topography within the sewer service area is flat within the Sammamish Valley, and rolling to hilly with a few steep slopes into the stream corridors and several small to modest areas of wet soil outside of the Valley.

1.6.A Sewer Service Area

The existing WWD corporate area encompasses approximately 19,000 acres. The current WWD Sewer Service Area (SSA) covers 5,261 acres and combines the City of Woodinville UGA and the eastern portions of the cities of Bothell and Kirkland, as well as the northern portion of the City of Redmond's UGA (English Hills area). The City of Woodinville UGA includes the current City limits and parcels between the Sammamish River and 140th Avenue NE. The City of Woodinville Urban Growth Area covers approximately seven square miles. Sewer service is limited to properties within the UGA boundary and incorporated areas. There are also several smaller areas where service is being provided under inter-local agreements. The extent of the WWD SSA is shown on **Figure 1-2: District Boundary**. Additionally, there is a 46 acre area that is served by WWD through an interlocal agreement, as shown on **Figure 1-7: WWD Sewer Service By Agreement**.

This Plan includes several pragmatic revisions to the District's western sewer service area limits that will reduce the SSA by 763 acres to 4,498 acres. The revisions reflect a review of how unsewered areas are most likely to receive service and document where sewer service has already been extended. Sewer service area revisions are more thoroughly discussed in Chapter 3.

1.6.B Topography

Figure 1-5, Topo and Aerial is an aerial photograph of the District water service area and immediate surroundings.

The topography of Woodinville is characterized by rolling terrain. Along the north eastern boundary of the SSA the elevation is approximately 350 feet. To the west from there, the ground quickly rises to over 450 feet at the easterly ridge of the Sammamish Valley, drops to 25 feet in the Sammamish Valley, and then once again rises to over 400 feet near the westerly edge



of the District. **Figure 1-6, Terrain and Critical Areas** highlights the range of topography and critical areas seen within the District's SSA boundary.

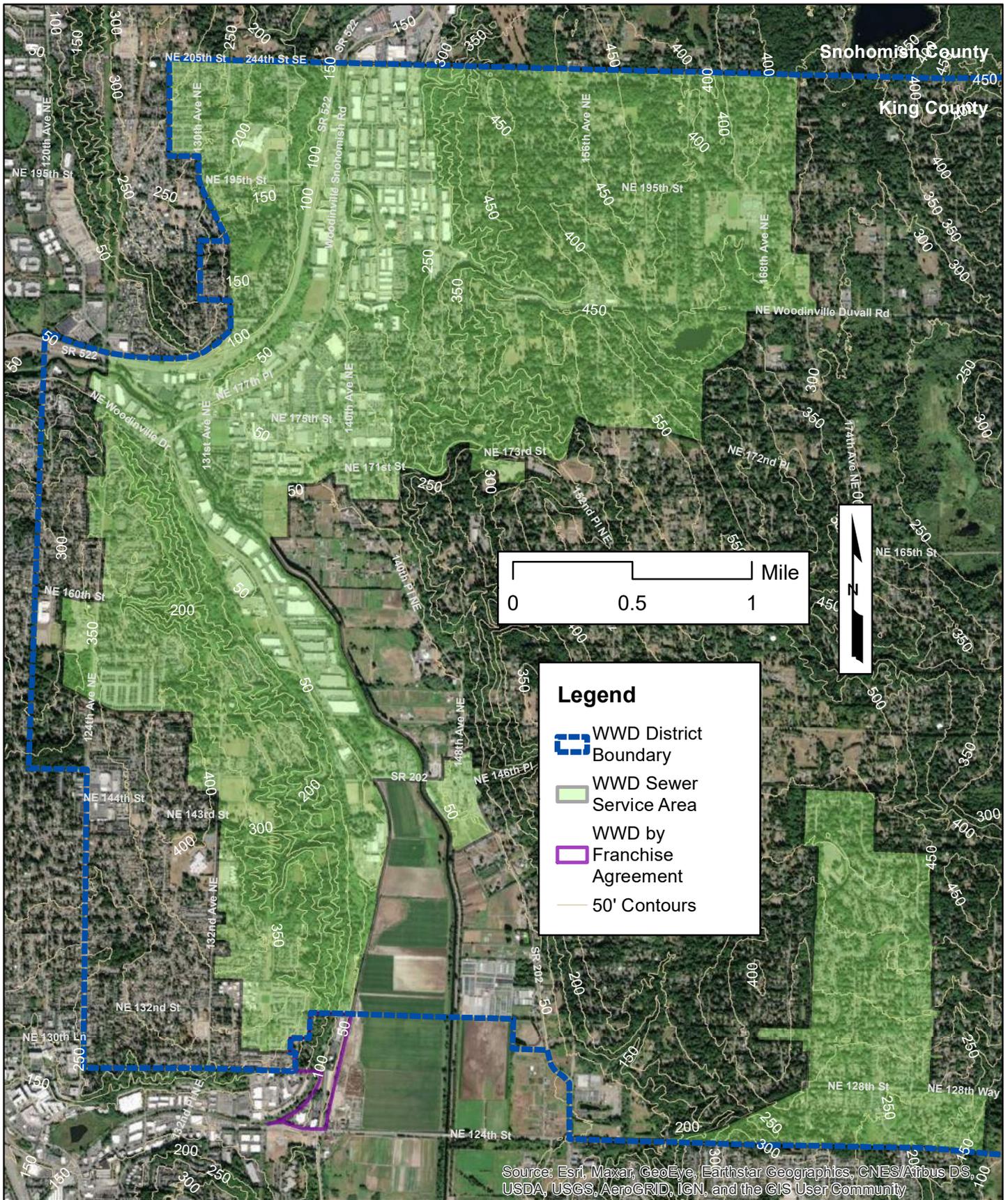
1.6.C Geology

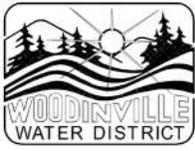
The retreat of glaciers at the end of the last ice age formed the rolling terrain characteristic of the Woodinville area. Erosion and flooding of low lying areas during that period resulted in soil deposits of three primary classifications as identified by the United States Department of Agriculture, Soil Conservation Service. These soil types are the Alderwood Association, the Everett Association, and the Puget-Earlmont-Snohomish Association, which are described below:

The Alderwood Association is the most prevalent soil type and represents approximately 75 percent of the soil in the Woodinville Water District. The soil is moderately well drained and has a weakly consolidated to strongly consolidated substratum at a depth of 24 to 40 inches. Permeability is moderately rapid in the upper horizons but very slow in the consolidated substratum. These moderately well drained acidic forested soils formed in loamy glacial till and occur on rolling till plains and moraines. A seasonally high water table rises to within 2 to 3-½ feet of the surface.

The Everett Association forms the primary soil around Cottage Lake, Cottage Lake Creek, and Bear Creek. Soils of the Everett series are the second most extensive in King County. Everett soils are located on outwash plains, terraces and fans and occur on slopes ranging from 0 to 65 percent. These soils are glacial outwash, characterized as somewhat excessively drained, gravelly, gently undulating soil underlain by sand and gravel and found on terraces.

The Puget-Earlmont-Snohomish Association includes poorly drained and somewhat poorly drained, nearly level soils that have layers of peat within a few feet of the surface. The seasonal high water table usually varies from 0 to 2 feet below the surface. This classification is generally found in major stream valleys, such as the Sammamish Valley.



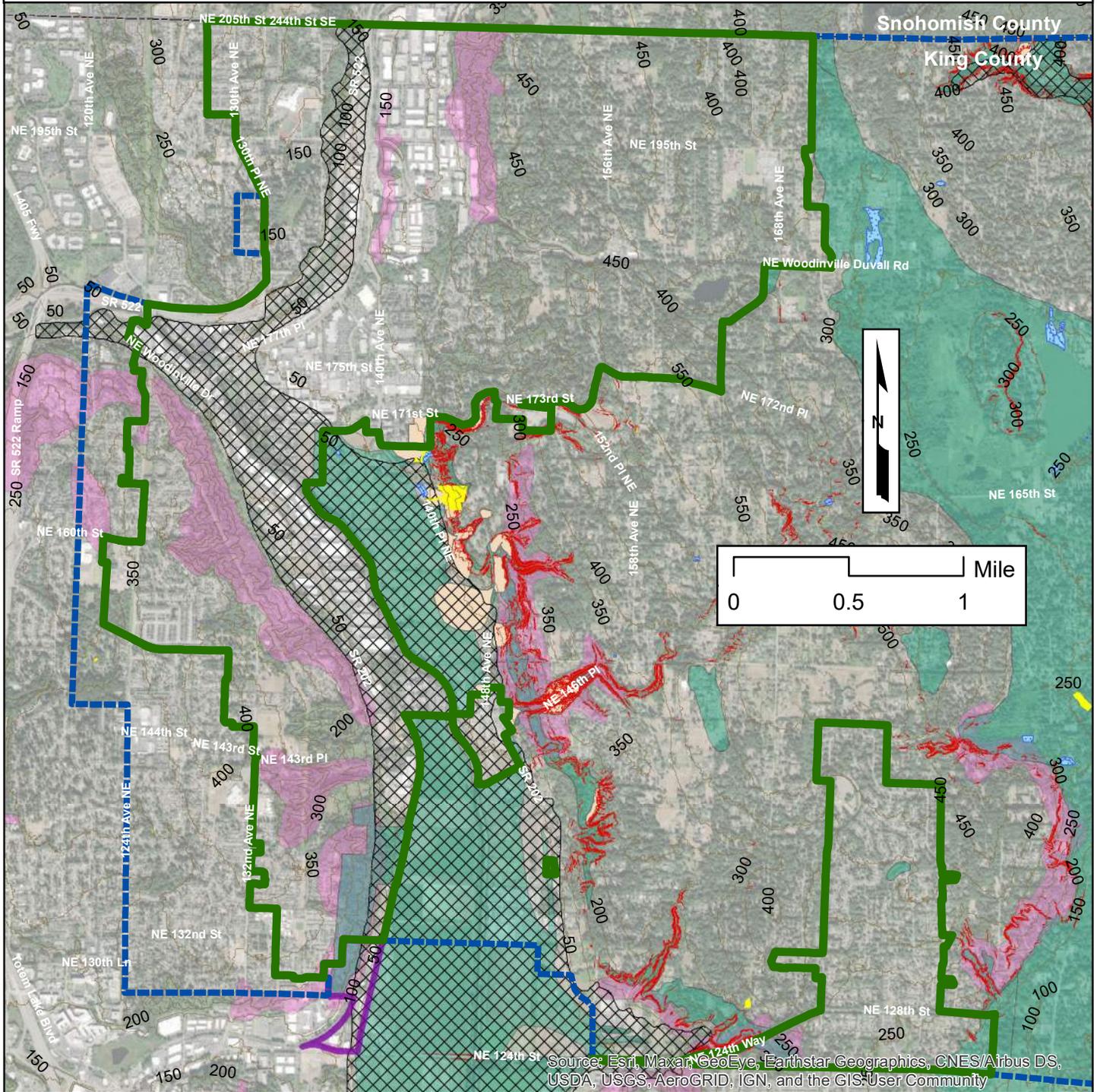


(Page Intentionally Left Blank)

Legend

-  WWD Sewer Service Area
-  WWD by Franchise Agreement
-  Critical Environmental Sensitivity Areas
-  Seismic Hazard
-  Erosion Hazard
-  WWD District Boundary
-  50' Contours
-  Wetlands
-  Steep Slope Hazard
-  King/Snohomish County Line
-  Landslide Hazard
-  Critical Aquifer Recharge Area

Note: Critical Area information sourced from King County GIS data



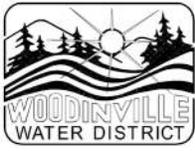
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



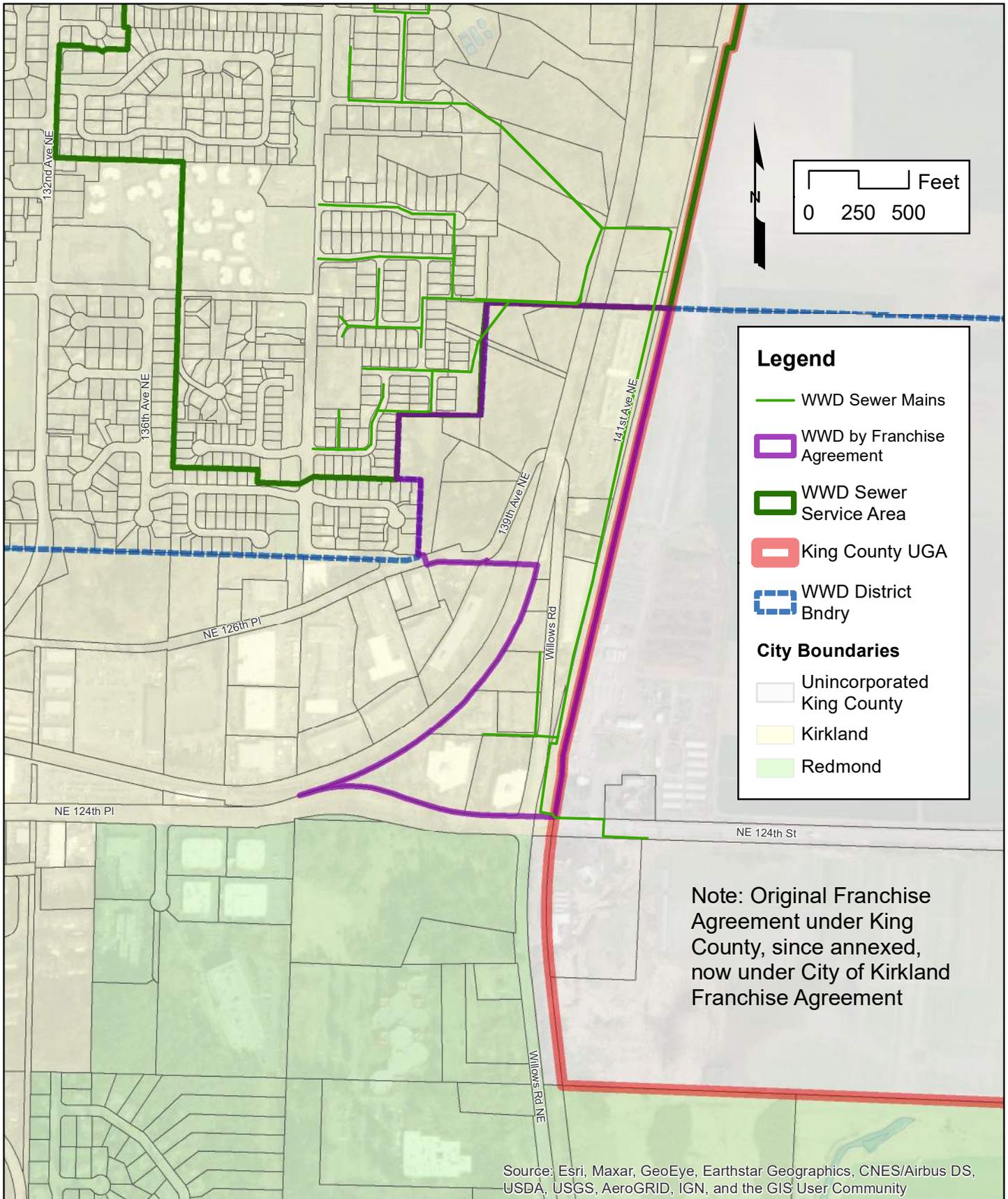
Terrain and Critical Areas

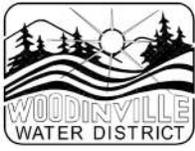
FIGURE 1-6

Comprehensive Sewer Plan



(Page Intentionally Left Blank)





(Page Intentionally Left Blank)



1.6.D Water Resources

Water Supply – The District purchases its water from the City of Seattle. The water is primarily supplied from the City of Seattle’s Tolt River Pipeline, which collects water from the South Fork of the Tolt River. As a backup, the City of Seattle’s Eastside Supply Line from the Cedar River system can also serve the District. Groundwater wells are further discussed in Section 1.7 below.

Surface Water – The dominant surface water feature in the sewer service area is the Sammamish River, which flows to the northwest. The Sammamish River basin and the Little Bear Creek basin are the major drainage basins. Woodinville Creek is tributary to the Sammamish River.

Lake Leota, which has an area of 10 acres, is located within the City of Woodinville, the UGA and the District Sewer Service Area boundary.

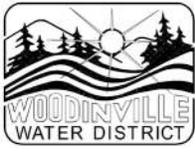
In addition, there are three other notable lakes within the District water service area, but outside of the sewer service area allowed by the UGA. These lakes are Cottage Lake, Paradise Lake, and Welcome (Holiday) Lake. Cottage Lake is the largest lake within the District service area at 63 acres in size.

Water Quality

Lake Leota’s water quality is fairly good. However, in recent years, the watershed has seen substantial growth as the Woodinville area population has grown. As this growth continues and as local shoreline alteration occurs, implementation of erosion and nutrient control measures will become increasingly important to preserve lake water quality. Monitoring data has been collected at Lake Leota by volunteers since 1998. The residential homes around Lake Leota currently utilize septic systems and it is reasonable to anticipate that as environmental requirements increase there will be more pressure to develop a public sewer around the lake. Public sewer will require a large capital investment in a regional lift station to convey the flow westward to the KCWTD connections.

Cottage Lake has been characterized, based on historical water data, as a biologically highly productive water body since the early 1970s. The lake continues to experience frequent and intense algal blooms in the spring and fall.

Paradise Lake has fair water quality. Wetland chemistry influences the lake, giving it its dark color and shallower Secchi depth. Paradise Lake is eutrophic (high biological growth). Erosion and nutrient control measures are important within the watershed to preserve the existing lake water quality, especially as land develops in the watershed or local shoreline



alteration occurs. Monitoring data has been collected at Paradise Lake by volunteers since 1996.

Welcome (Holiday) Lake has good water quality. Erosion and nutrient control measures are important within the watershed to preserve the existing lake water quality, especially as land develops in the watershed or local shoreline alteration occurs. Monitoring data has been collected at Welcome Lake by volunteers since 1996.

Groundwater – The Woodinville Water District is bisected by the King County Redmond-Bear Creek Valley Groundwater Management Area. King County developed five Groundwater Management Areas in concert with the provisions of WAC 173-100. These areas were developed to promote the quality and quantity of groundwater supplies. There are several groundwater monitoring wells located within the District service area.

Groundwater is threatened by several common human activities. As the region is developed and an increase in paved surfaces is seen, water that used to soak in and replenish aquifers is instead diverted into storm drains. Besides being depleted, groundwater can be contaminated by landfills, septic systems, and underground fuel tanks.

1.7 PUBLIC AND PRIVATE WATER FACILITIES

1.7.A District Water Facilities

The Woodinville Water District covers about 18,960 acres and serves about 14,780 water accounts. It is supplied by the City of Seattle Public Utilities through the Tolt Pipeline and the Tolt Eastside Supply Line, which run through the District service area. The District has eight (8) active connections and one unused connection to the Tolt Pipeline and two (2) active connections to the Tolt Eastside Supply Pipeline. Each connection is separately metered.

The WWD water system is described in detail in *Woodinville Water District Comprehensive Water System Plan, March 2019*.

The District owns and maintains one well near the District office as an emergency standby water source. Specific information is provided in the Water System Plan. The District has nine (9) emergency interties. The District has formal intertie agreements with the City of Bothell and the City of Redmond, Northshore Utility District and Cross Valley Utility District..

The District water pipe system totals about 1,400,000 feet, or 260 miles, of 4-inch through 18-inch water mains in 20 service or pressure zones regulated through 45



pressure reducing valves. The District owns and operates five water pumping stations.

The District operates eight water storage reservoirs with a total capacity of 14,900,000 gallons.

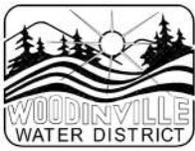
Average Day Demand in 2021 was about 3.68 million gallons per day. The District sees an average potable water demand of 207 gallons per day for Single Family Residential-w (wet weather – excludes irrigation)(SFRw), this same value is also referred to as Equivalent Residential Unit-w (ERUw).

1.7.B Private Water Wells

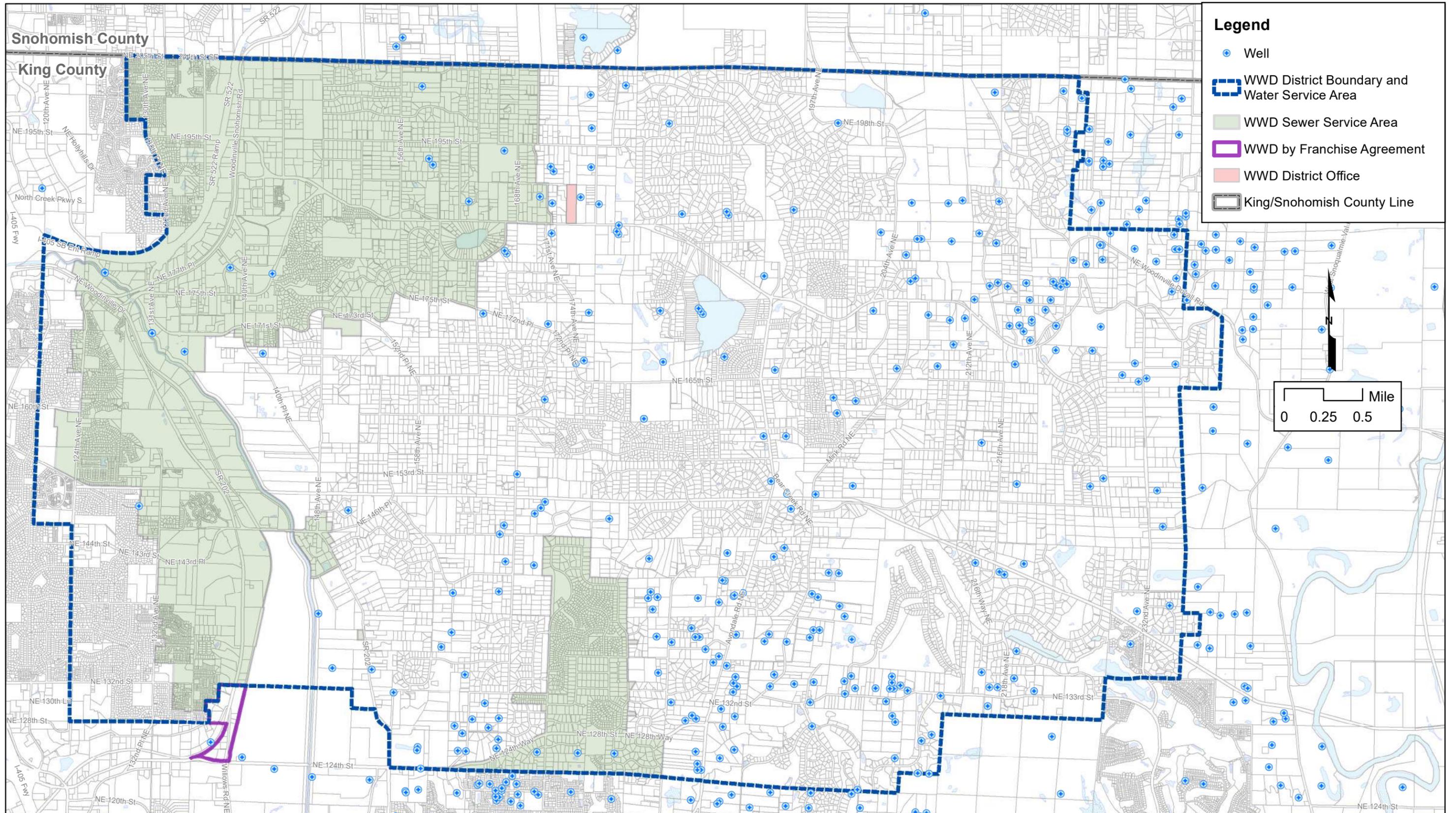
There are a number of wells that are on record with the Washington State Department of Ecology within the District boundary, as seen on **Figure 1-8: Water Well Locations**. Wells within the service area serve individual water supply, are resource protection wells, or have been decommissioned. These wells are typically privately owned, shallow (less than 100 feet deep) wells, with low capacities of 20 gpm or less.

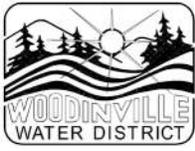
There are 224 wells located within the District boundary. Of these 224 wells, one is classified as a Group A well (wells with 15 or more connections as recorded by the Washington State Department of Health), 49 are classified as Group B wells (wells with 2 to 14 connections, as recorded by the Washington State Department of Health), and 174 are classified as King County wells (most of which are private wells of individual home owners).

It is assumed that these 224 wells serve about 300 homes, which therefore are not water customers of the District.

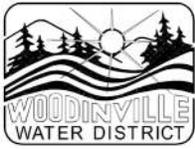


(Page Intentionally Left Blank)





(Page Intentionally Left Blank)



1.8 MUNICIPAL SEWAGE TREATMENT

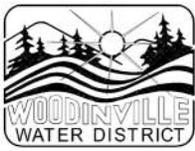
Woodinville Water District does not provide wastewater treatment. The District collects and conveys wastewater to King County Wastewater Treatment Division for treatment, reuse, and/or disposal. Currently, King County is routing the collected sewage northward to the Brightwater Wastewater Treatment Plant, located just north of the District. The facility has capacity to treat up to 36 MGD.

1.9 ONSITE SEWAGE DISPOSAL SYSTEMS

There are many privately owned and operated onsite sewage disposal systems within the District's sewer service area (SSA). Most of these systems lie in the eastern portion of the District's SSA. The east sloping topography and larger rural lots of this area have been and remain an obstacle to providing cost efficient public sewer service. The District is not involved with the operation and maintenance of any septic systems. Failure of onsite sewage facilities within the UGA, or development of the properties, may necessitate the need for an extension of sewerage facilities to be constructed by the affected property owners.

It is estimated that approximately 80 percent of the District's residential water customers use onsite sewage disposal systems, most of these customers being outside the UGA. Approximately 25 percent of these customers are inside the UGA. Onsite sewage disposal system depicts a facility located typically on a single lot or tax parcel which incorporates a septic tank discharging to a drain field. Operated properly, onsite sewage disposal systems are an acceptable means of treating and disposing of sewage on a small scale at low development densities.

However, if onsite sewage disposal systems are improperly used, maintained, or are constructed in soils with poor percolation rates, operating problems may develop. Repair scenarios in accordance with WAC 246-272-16501 then may be required by Seattle-King County Public Health authorities to resolve the problem. These repairs may include the addition of treatment devices like a sand filter, a different disposal technique like a mound, or disinfection, or an advanced treatment process may be required. In severe cases, individual properties may be required to use holding tanks and haul sewage to an approved discharge point.



1.9.A Schools

There are seven schools within the District service area that lie outside of the Woodinville UGA as shown on **Figure 1-9: Schools**. Five of these schools are not served by sewers due to their locations outside of the UGA boundary and are listed below:

Bear Creek Elementary	–	Northshore School District
Cottage Lake Elementary	–	Northshore School District
East Ridge Elementary	–	Northshore School District
Timbercrest Junior High	–	Northshore School District
Woodinville Montessori School	-	Private

Wilder Elementary of the Lake Washington School District is served by the City of Redmond sewer system.

Hollywood Hill Elementary School of the Northshore School District is outside of the urban growth area but is connected to the Woodinville Water District sewer system through a private sewer siphon.

Two Northshore School District schools located within the SSA and UGA, but are located in the eastern unsewered area, are listed below;

Wellington Elementary	–	Northshore School District
Leota Junior High	–	Northshore School District

The Northshore School District currently trucks sewage from their public schools listed above that are not presently connected by sewer mains. The sewage is hauled to the Woodinville Senior High School site, which is served by Woodinville Water District sewers, and discharged into a sewer manhole at that location.

Woodinville Montessori School has an onsite septic system to dispose of their sewage.

Seven schools are located within the District service area and within the UGA that are served by sewers as follows:

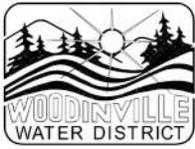
Woodinville Senior High	–	Northshore School District
Kamiakin Junior High	–	Lake Washington School District
John Muir Elementary	–	Lake Washington School District
Sunrise Elementary	–	Northshore School District
Woodmoor Elementary	–	Northshore School District
Mack Elementary	–	Bellevue Christian
Chrysalis School		



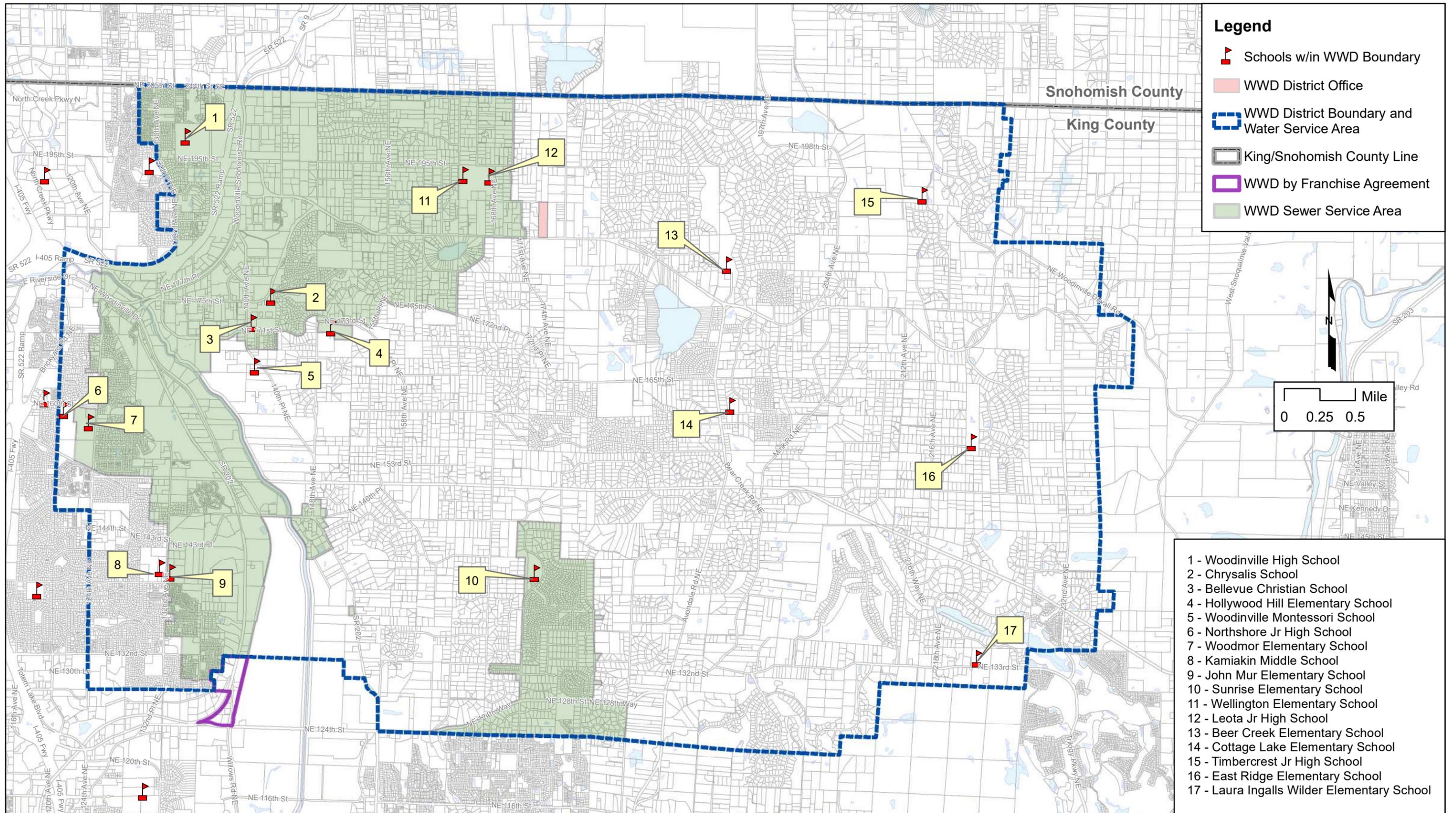
Woodinville Senior High, Bellevue Christian – Mack Elementary, and the Chrysalis School are located within the City of Woodinville.

1.9.B Shopping Center

The Casetta Lago Shopping Center is located at 19150 NE Woodinville-Duvall Road in Woodinville. Shopping center sewage is currently trucked from the site as site constraints do not allow for adequate onsite sewage facilities for all wastewater generated by the various businesses. Toilet waste and similar sewage from the shopping center is collected into a holding tank and trucked into the City of Woodinville. Grey water from other wastewater sources is treated and discharged to a drain field immediately north of the shopping center.



(Page Intentionally Left Blank)





CHAPTER 2 EXISTING SANITARY FACILITIES

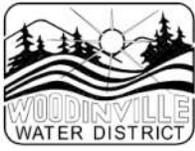
2.1 EXISTING PIPE SYSTEM

Based upon review of the District’s GIS data and available record drawings, the District has approximately 55 miles of sewer main ranging in size from 6-inches to 21-inches. The extent of the collection and conveyance system is shown on **Figure 2-1a: Sewer System (West)** and **Figure 2-1b: Sewer System (East)**. There may be minor collector sewers, private systems, or force main that are not reflected in this total. Currently there are 1694 pipe segments. An inventory of the existing District gravity collection system piping is seen in **Table 2-1**.

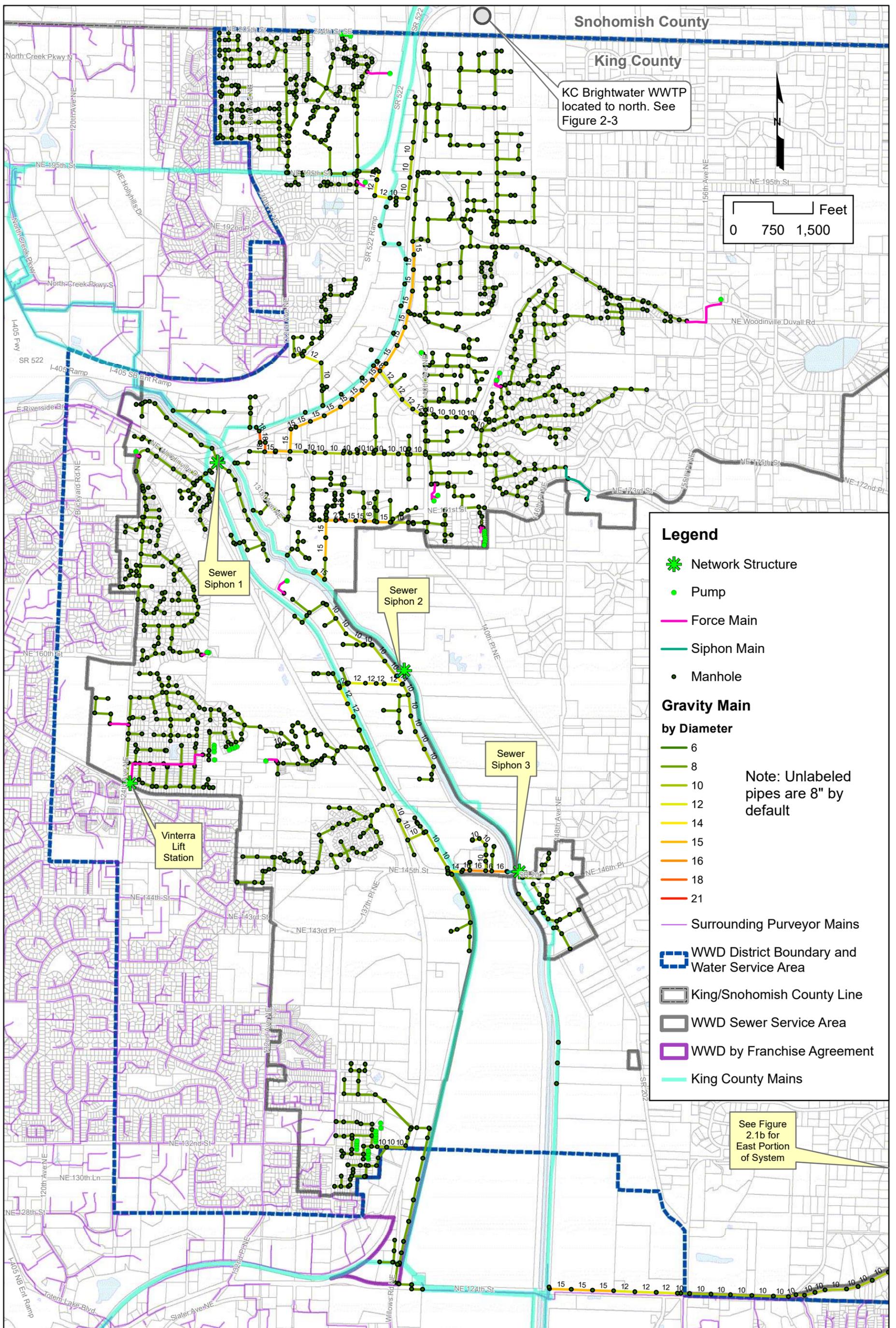
Table 2-1 District Gravity Collection System Inventory Pipe Length in Feet							
Pipe Dia.	CIPP	Clay	CONC	DI	HDPE	PVC	Grand Total
6			427	53		200	680
8	438	545	12255	17123	6322	213344	250027
10			2636	3175	1751	13389	20951
12				340	1994	4518	6852
14				376	185		561
15			5934			3267	9201
16				83	824		907
18				159		571	730
21						115	115
Grand Total	438	545	21252	21309	11076	235404	290024

In addition to the gravity sewers shown in **Table 2-1**, the District pipe system includes 3700 LF of 4” and 6” Force Main serving the Sunrise, English Hills, and Vinterra sewage lift stations.

The District maintains approximately 1700 manholes.



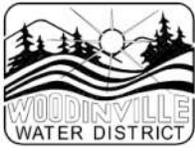
(Page Intentionally Left Blank)



Sewer System (West)

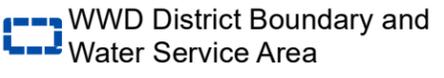
FIGURE 2-1a

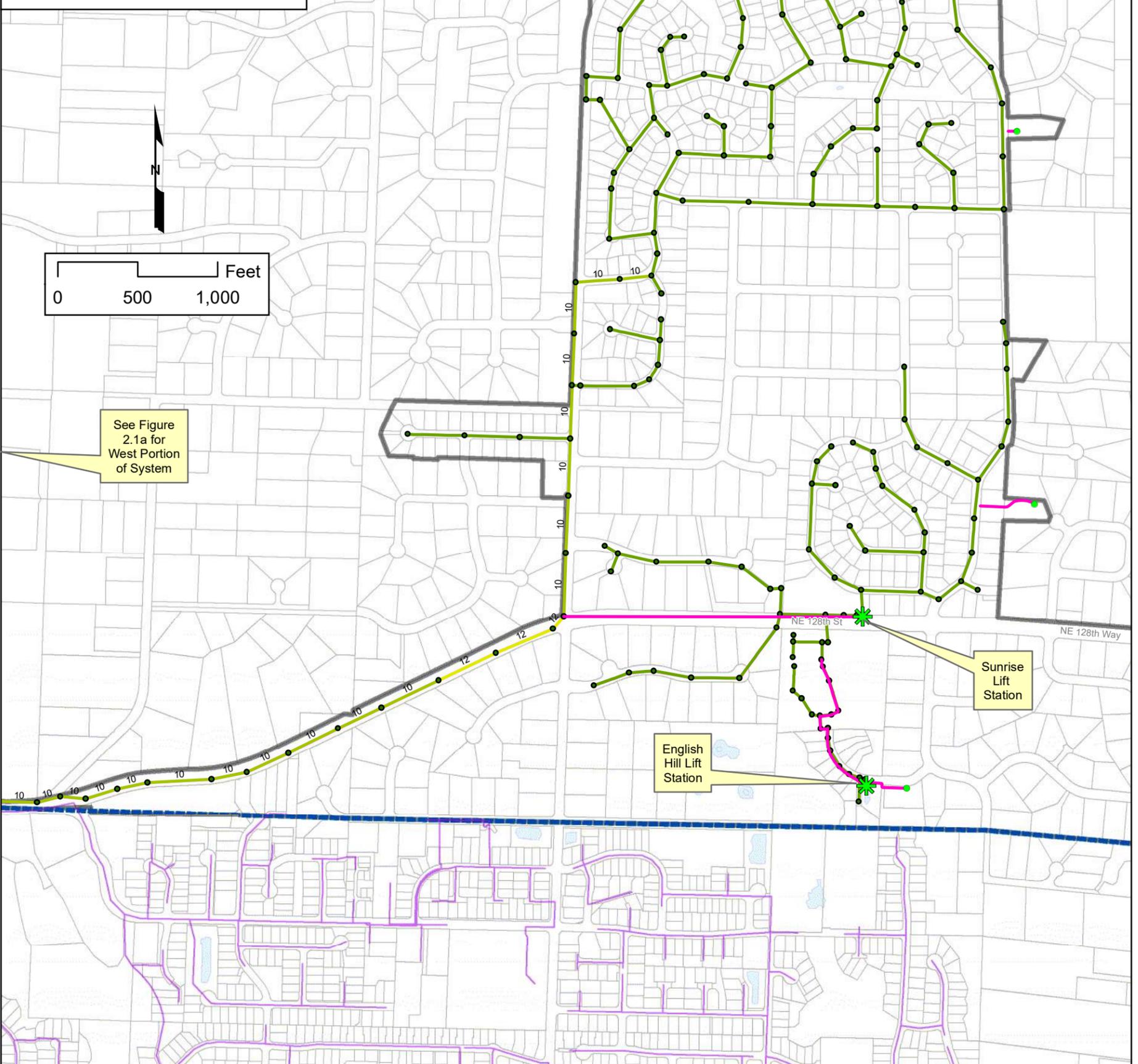
Comprehensive Sewer Plan



(Page Intentionally Left Blank)

Legend

-  Network Structure
 -  Pump
 -  Force Main
 -  Manhole
- Gravity Main
by Diameter**
-  6
 -  8
 -  10
 -  12
 -  14
 -  15
 -  16
 -  18
 -  21
- Note: Unlabeled pipes are 8" by default
-  Surrounding Purveyor Mains
 -  WWD District Boundary and Water Service Area
 -  WWD Sewer Service Area





(Page Intentionally Left Blank)



2.1.A Bypass Manholes

Continuing development led to capacity concerns within the pipe system serving Town Center within the City of Woodinville, and the construction of a new sewer connection into the KCWTD Little Bear Creek Trunk. To help address concerns with existing infrastructure, three older manholes were reconstructed to divert normal wastewater flow into this new trunkline. The manholes retain the bypass capability for high flow conditions that would send wastewater into the older pipe system (Basin 8). Bypassing is setup to be performed manually but during more significant flow events the water level can get above the slide gates and automatically bypass to help prevent surface level surcharging. These three manholes are described below and shown on *Appendix B-Figure 5-2.8 Basin 9 – Build Out By Zoning*.

Manhole 185 in NE 178th street at 143rd Avenue NE collects normal flow from the northeast and east for discharge west through a 10-inch pipe (IE 117.08) in NE 178th Street. An 8-inch pipe south in 143rd Avenue NE remains available for bypass.

Manhole 981 in 140th Avenue NE at NE 178th Street collects normal flow from the north and east for discharge west through a 12-inch pipe (IE 74.36) in NE 178th Street. The 8-inch bypass remains available to flow south in 140th Avenue NE.

Manhole 976 in the Woodinville-Snohomish Road at NE 178th Street collects normal flow from the north and east for discharge west through an 18-inch connection (IE 56.84) into the Little Bear Creek Trunk owned by King County. The bypass line is the 15-inch pipe continuing south in the Woodinville-Snohomish Road.

2.2 Lift Stations

The District currently owns and operates three (3) lift (pump) stations. The lift stations are shown on **Figure 2-1a: Sewer System (West)** and **Figure 2-1b: Sewer System (East)**.

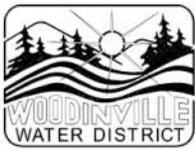


Table 2-2 Lift Station Summary					
Station	Style	# Pumps	Hp	Flow	Emg. Power
Vinterra	Wetwell w/storage	2	40	* 337	Yes
English Hill	Wetwell w/storage	2	7.5	100	Yes
Sunrise	Wetwell w/storage	2	15	270	Yes

* See description below

- **Vinterra Lift Station** - this is the latest station added to the District and was brought on-line in the summer of 2016. The station is located NE of the intersection of 124th Avenue NE and the Tolt Pipeline (near NE 150th Street). The station is a duplex pump configuration in a 72" wetwell. Each pump is sized to provide approximately 430 gpm, with about 90 gpm being recycled into the wetwell through a wetwell washing system, leaving approximately 337 gpm being discharged through the force main. This station has a separate valve vault and an emergency power generator. The wet well was sized to provide a minimum of 1 hour of storage.



- **English Hill Lift Station** - This lift station is on NE 124th Street east of 172nd Avenue NE. The lift station was sized to only serve the English Hill and Kempir developments. The lift station has two 7.5 HP Cornell submersible pumps with a design capacity of 100 GPM assuming, one pump out of service. This capacity is sufficient to meet the needs of full build-out of the developments. Emergency power is provided. Telemetry is provided to monitor eight functions. Station wet well design provides about two hours of emergency storage volume.



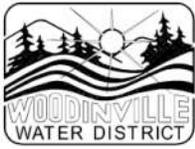
- **Sunrise Lift Station** - This station is located at NE 128th Street east of 172nd Avenue NE. This lift station was sized to serve part of the English Hills development that is inside the District and within the UGA boundary. The lift station has two submersible pumps, Cornell Model 4NNT-SUB 15-4 L000KF with 15 horsepower motors. The pumps alternate in the 'lead' and 'lag' roles. Telemetry is provided for eight alarm conditions. Emergency power is provided. Station design provides about two hours of emergency storage volume.



2.3 SIPHON SYSTEMS

Three inverted siphon systems transport sewage from the western portion of the District under the Sammamish River and tie into King County's Sammamish Valley Interceptor. These facilities are shown on **Figure 2-1a: Sewer System (West)** and described below:

- **Siphon No. 1:** The northernmost siphon consists of two barrels; one is a 6-inch steel barrel, and the second barrel is an 8-inch High Density Polyethylene (HDPE)



pipe encased in a 12-inch HDPE pipe. The northern siphon crosses the Sammamish River east of NE 175th Street. The facility is being rehabilitated (2020-2022) to upgrade controls and incorporate an automated flushing cycle via a slide gate. A single submersible pump will discharge to the 8" barrel should the siphon experience high water levels.

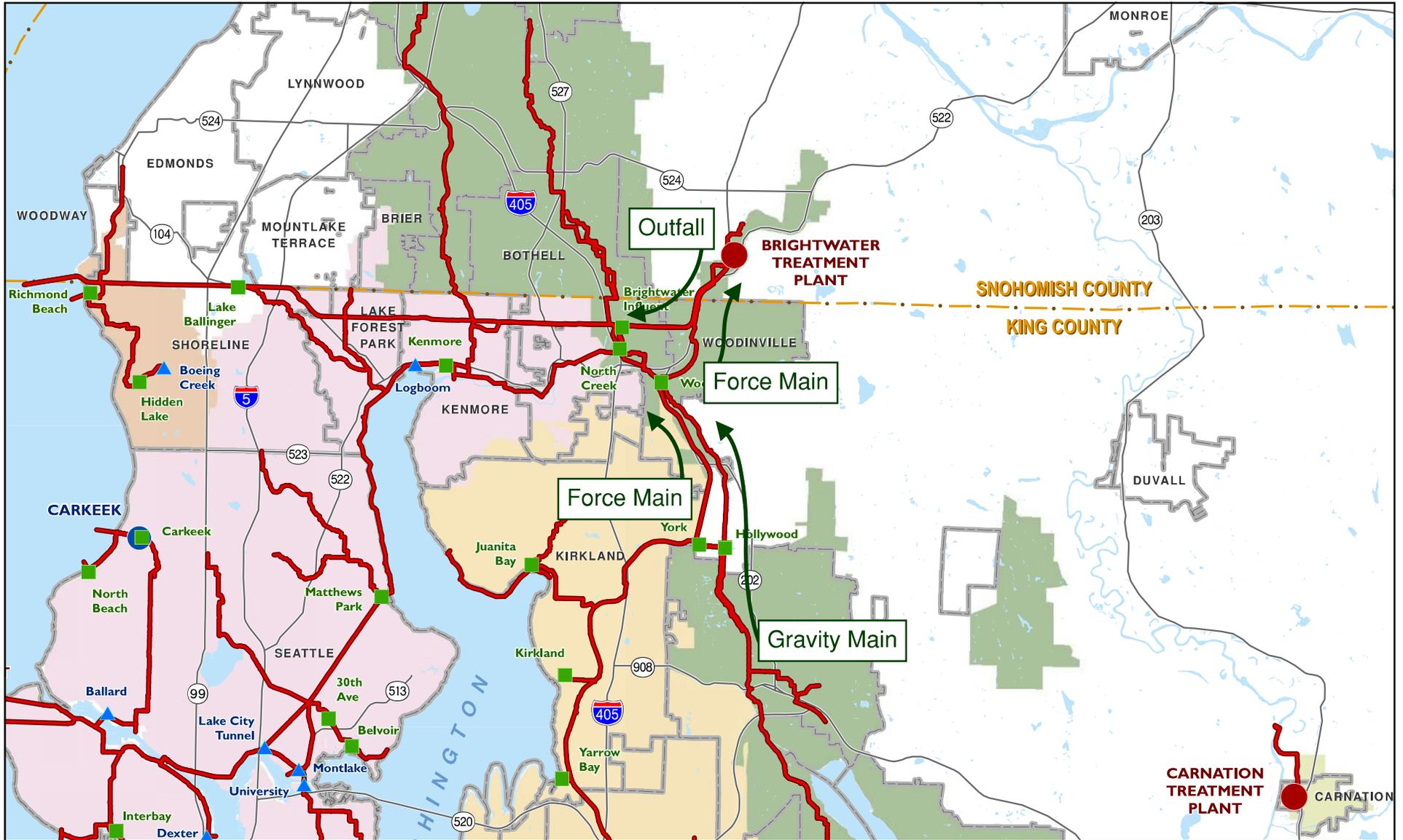
- **Siphon No. 2:** This flushing siphon was built in June 1978 with two barrels, one 6-inch and one 10-inch, with a rock catcher and crosses the Sammamish River west of Gold Creek Park.
- **Siphon No. 3:** The southern siphon was built in September 1984 with two barrels with a rock catcher; one is a combination of 6 and 8-inch diameter pipe and the second barrel is an 8-inch pipe with weir control. The southern siphon crosses the Sammamish River at NE 145th Street.

Siphon operation requires more maintenance attention than gravity sewers because under 'no flow' conditions solids will settle at the bottom of the siphon and may plug the pipe. Hence the Ecology 'Design Criteria' require siphons have two pipe barrels in case a blockage occurs. WWD also incorporates the use of automatic flushing to reduce the frequency of maintenance required.

2.4 KING COUNTY TRANSMISSION FACILITIES

The King County Wastewater Treatment Division is responsible for transmission, treatment, and disposal of all wastewater collected within their defined service area, which includes all of the WWD Sewer Service Area. KCWTD brought the Brightwater Wastewater Treatment Plant online in 2011. Currently, all of the WWD wastewater is conveyed northerly to the new plant.

KCWTD facilities within the District vicinity are shown on **Figure 2-1a: Sewer System (West)**. The County operates and maintains two interceptors within the District's service area, as well as the Woodinville Pump Station. **Figure 2-3: KCWTD Transmission Mains** shows the local area mains and their typical flow direction.



KC Transmission Mains

FIGURE 2-3



CHAPTER 3 – PLANNING CONSIDERATIONS AND DATA

3.1 REFERENCE PLANNING DOCUMENTS

The preparation of this plan relied on several relevant published documents:

- Woodinville Water District – 2007, General Sewer Plan
- Woodinville Water District – 2019, Comprehensive Water System Plan
- City of Woodinville – 2015, Comprehensive Plan
- King County – 2016 (2020), Comprehensive Plan
- Puget Sound Regional Council – Population and Growth
- Washington Administrative Code 173-240-050
- ‘Criteria for Sewage Works Design’ by Washington State Department of Ecology

3.2 SERVICE AREA DESCRIPTION

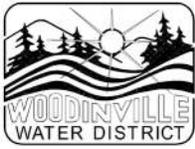
The existing 5261-acre sewer service area for the District lies within the urban growth area as defined by King County and can be described as comprised by two primary areas and the western edge that interacts with the cities of Bothell and Kirkland, as shown on **Figure 3-1: Existing Sewer Service Area** and summarized below:

City of Woodinville lies generally along the valley formed by the junction of Little Bear Creek and the Sammamish River, with slopes rising to the east and west. Elevations reach about 300 feet to the west, and crest to the east is at about 450 feet above sea-level. Most, but not all, developed properties between these crests are currently served by sewers. Easterly of the east crest, topography slopes much more gradually towards Lake Leota. This eastern area is within the city limits and the UGA, so is eligible to be served by sewers; however, none have yet been extended.

The Sammamish River Valley area south of the City of Woodinville includes a UGA area with residential and commercial zoning areas on the slopes west of the river valley. Most of the valley floor is outside the UGA and not eligible for sewer service, though still within the water service area for the District.

City of Redmond UGA includes a northern appendage known as English Hills and the area around the Sunrise Elementary School. These uplands extend in elevation from about 200 to 500 feet above sea-level. That part north of NE 124th Street is served by the District.

Bothell/Kirkland: In addition there are smaller areas along the western edge of the SSA that lie within the cities of Bothell and Kirkland. Although the existing SSA extends into the City of Kirkland, there is a 489 acre area that lies westerly of a judicial line (Court Order Line, see Section 1.4 and 3.2.A) that identified Kirkland/Northshore Utility District as the sewer provider.



3.2.A Sewer Service Area Revisions

The western edge of the existing sewer service area (SSA) is very complex due to hilly topography, court decisions, and the availability of neighboring sewer agencies to provide gravity service. In the preparation of this plan, a thorough review of the western boundary area and several inter-local agreements was performed to delineate actual sewer service for lots in the area. A revised SSA was then developed to delineate existing service areas as well as the most efficient sewer provider for unsewered properties given the expected flow paths of wastewater.

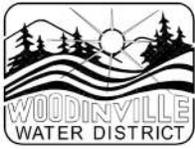
The revised SSA removed area from the District's responsibility and transferred it to other providers. The majority of area proposed to be removed is the area southwest of the "Court Order Line". The line was the result of a Superior Court Judgement No. 607978, ("Judgement") that was handed down regarding the sewer service boundary between NE Lake Washington Sewer District, (NUD) and King County Water District 104, (Woodinville Water District). Resolution 105 was approved by Water District 104 on July 6, 1964, settling the existing litigation based on topography and the availability of service from existing facilities. This area is shown in **Figure 3-2: SSA Revisions**.

All of the above area removed under the revised SSA remains within the District's 18,958-acre corporate boundary and Water Service Area (WSA). The Woodinville Water District (WWD) would continue to supply water service to all properties in the WSA. Sewer service under the revised SSA would be provided by the City of Bothell and the Northshore Utility District (NUD), as appropriate. These agencies are shown on **Figure 1-4: Adjacent Providers**.

The Plan also identifies a 46-acre area that lies outside of the current District corporate boundary and SSA, that is receiving sewer service from the District through an Interlocal Agreement with the NUD.

The revised SSA will result in:

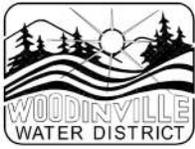
- 209 acres located in SE Bothell, removed from the existing SSA and transferred to the Northshore Utility District. Much of this area is currently being served by NUD.
- 561 acres located in NE Kirkland, removed from the existing SSA and transferred to the Northshore Utility District. Much of this area is currently being served by NUD. Most of this area is part of the Court Order that defined sewer service providers for these neighborhoods.
- 52 acres located in W Woodinville, removed from the SSA and transferred to the Northshore Utility District.
- 59 acres of additional area being served through annexations and being "grandfathered".



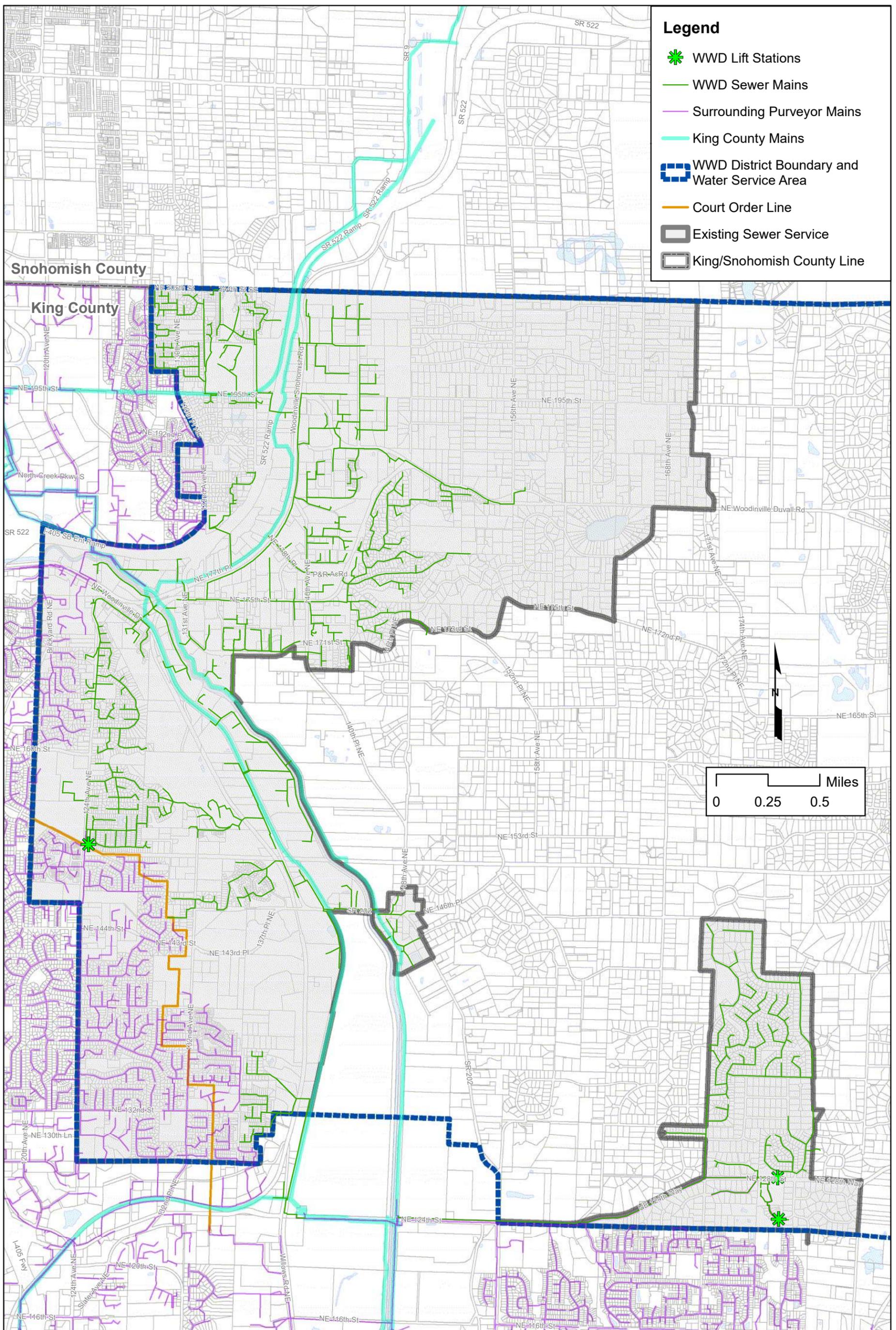
This revision will reduce the WWD SSA by 763 acres from 5,261 acres (pre-2021) to **4,498 acres** and more accurately reflect the actual flow conditions that require District responsibility.

To clarify, the transfers occurring under the revised SSA regards only the responsibility for sewer service. No physical assets such as pipes and manholes are proposed to change ownership. The revised SSA has been used for all general maps presented in this plan and is the basis for planning area calculations in this chapter.

Even with the revised SSA in place, there are areas where adjacent sewer providers will continue to provide service within the District's SSA. This will occur until such time as downstream capacity improvements, and sewer main rerouting projects, are constructed. Details of this construction is described in Chapter 5.



(Page Intentionally Left Blank)



Legend

-  WWD Lift Stations
-  WWD Sewer Mains
-  Surrounding Purveyor Mains
-  King County Mains
-  WWD District Boundary and Water Service Area
-  Court Order Line
-  Existing Sewer Service
-  King/Snohomish County Line

Snohomish County

King County

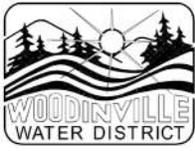
Existing Sewer Service Area

FIGURE 3-1

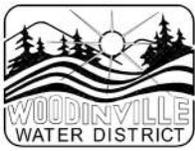
Comprehensive Sewer Plan



(Page Intentionally Left Blank)



(Page Intentionally Left Blank)



3.3 LAND USE

3.3.A Growth Management Act

The State of Washington adopted the Growth Management Act with the intent of concentrating most new development and population gains within urban areas of the more populous and rapidly growing counties. These counties are required to define an urban growth boundary within which urban services like sewers are provided, and any new parcels created outside that boundary must be low density with sufficient acreage to support onsite sewage disposal systems conforming to State Health regulations.

Only two exceptions to the prohibitions of sewers outside the urban growth boundary are recognized under state law:

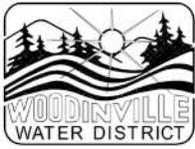
- Public schools outside the urban growth boundary can be served by sewers, but are not required to be served.
- Areas of existing development outside the urban growth boundary where sufficient onsite sewage disposal systems have failed as to create a “severe public health hazard”, as determined by King County – Dept. of Health, can be served by sewers.

Sewers provided in either of these cases can be satellite systems limited to serving just the qualified and defined parcels; or a sewer extension can be “tight-lined” to convey wastewater from the qualified and defined parcels into the urban growth area for connection to the existing sewer system. The south and east limits of the SSA is consistent with The City of Woodinville’s UGA. **Figure 3-3: UGA Limits** shows the UGA boundary in relation to the City of Woodinville and its neighboring agencies.

Additionally there are a few parcels that lie outside of the UGA limits that have been included in the District’s SSA and are receiving sewer service. Most of these connections either predate the Growth Management Act or were annexed into the SSA as the result of a failing septic system.

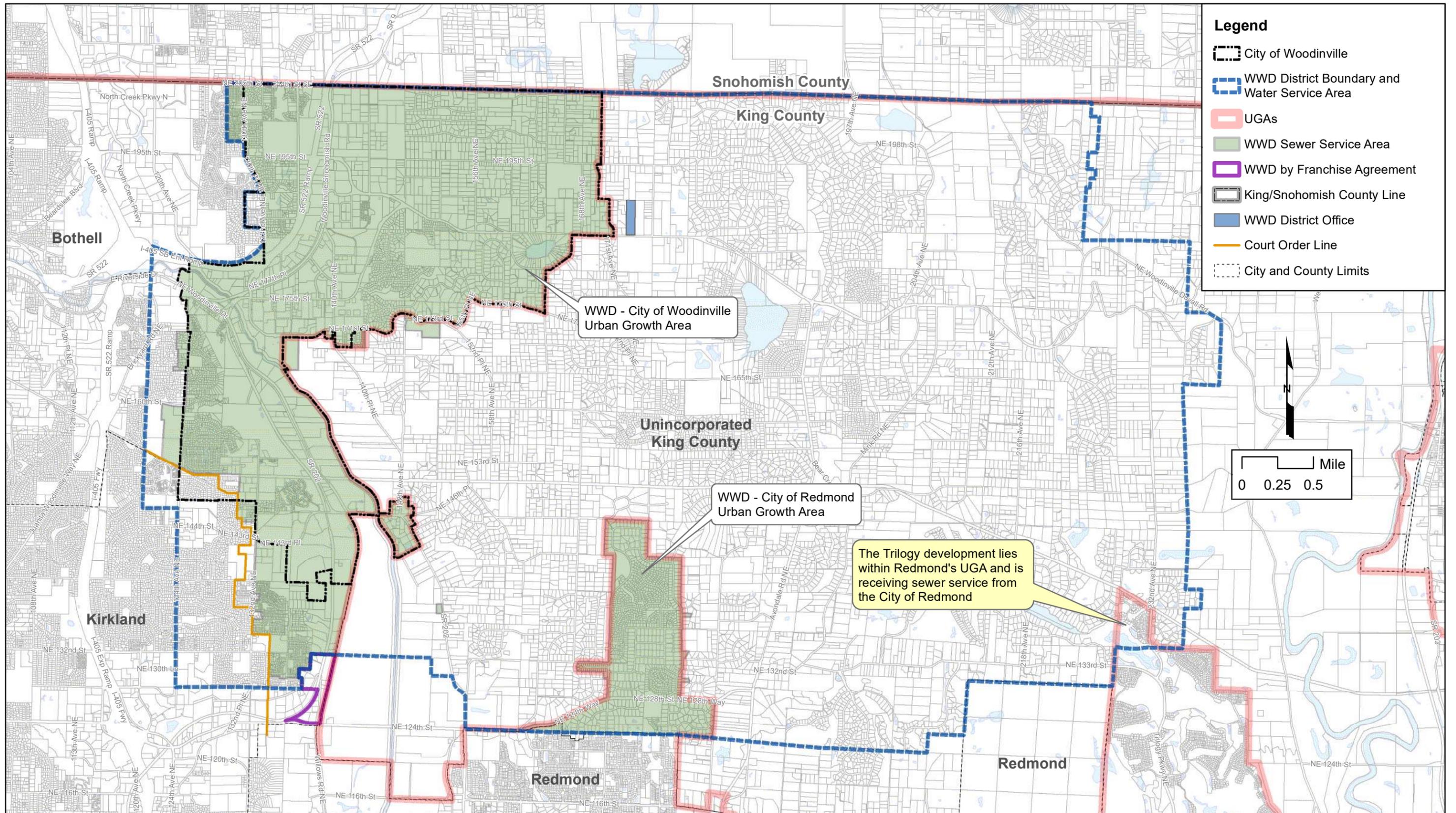
3.3.B City of Woodinville

The City of Woodinville updated the city’s Comprehensive Plan in 2015. **Figure 3-4: Woodinville Future Land Use Designations** identifies the projected use. Relative to the District, the most significant effect of the plan update was the “upzone” of the density and extent of the Central Business District (CBD). The CBD has a stated density of 36 housing units per acre, however application of several exceptions and allowances has allowed significantly higher densities.



3.3.C King County, Bothell, Kirkland and Redmond

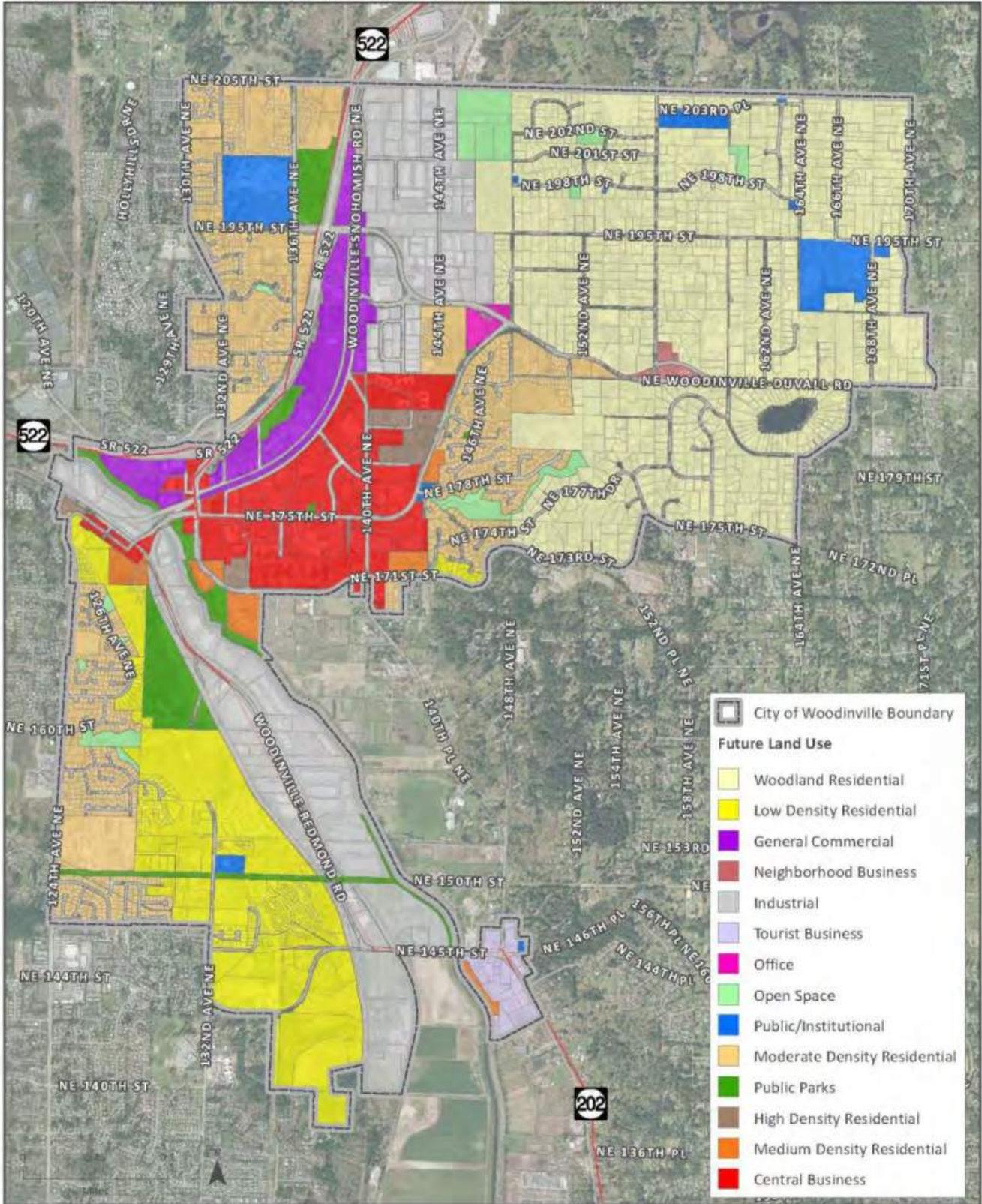
Land Use within the District's service area but outside the cities' urban growth boundaries is administered by King County. Almost all of the SSA within the land jurisdictions of Bothell, Kirkland and Redmond is zoned for residential lots. **Figure 3-5: Zoning** shows the zoning summary currently assigned by the various jurisdictions where the land is within the SSA. The land use (population density is used in Chapter 4 to establish future (build out) sewage flow projections.





(Page Intentionally Left Blank)

CITY OF WOODINVILLE FUTURE LAND USE DESIGNATIONS



Date: December, 2015
Source: City of Woodinville, BERK



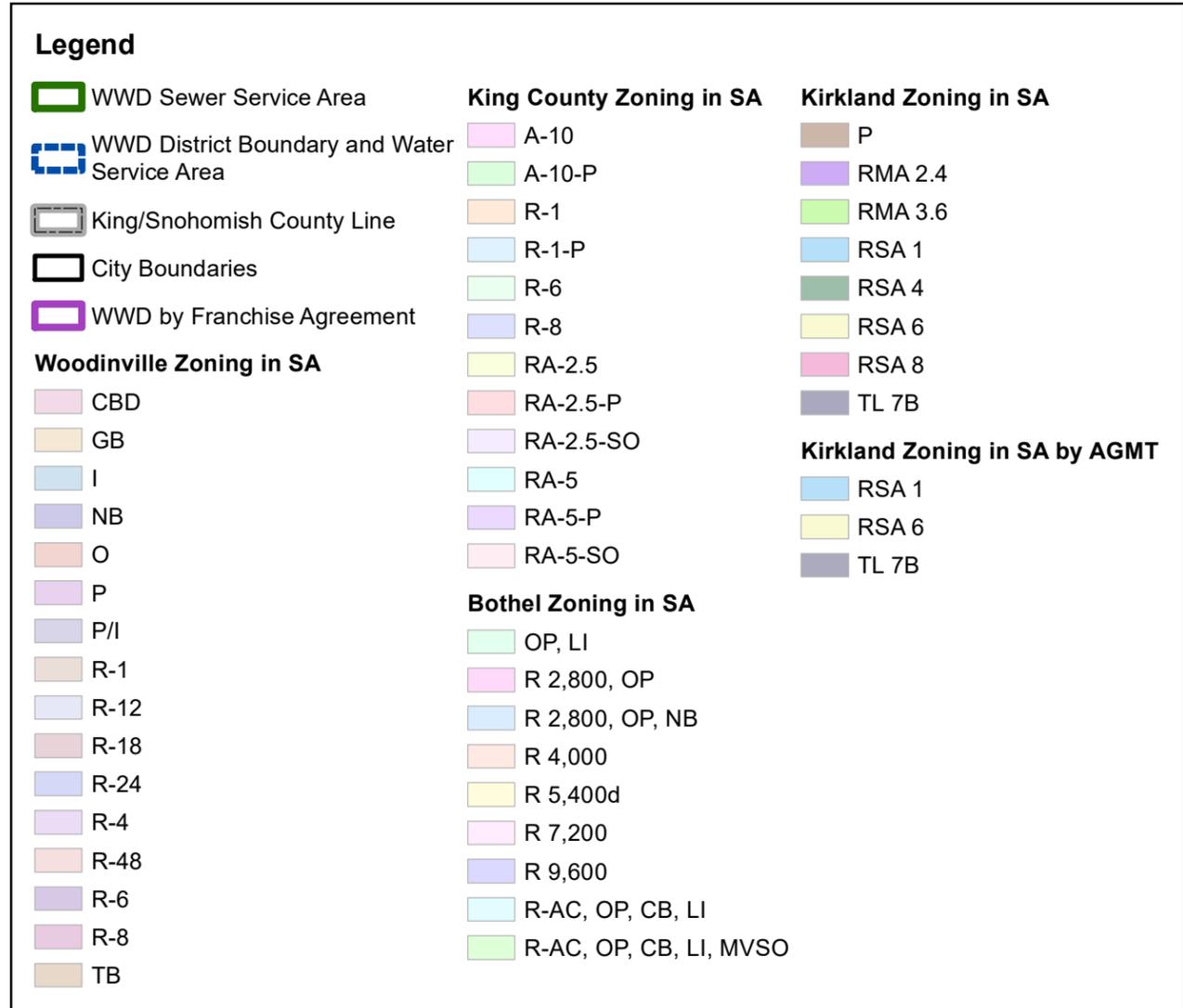
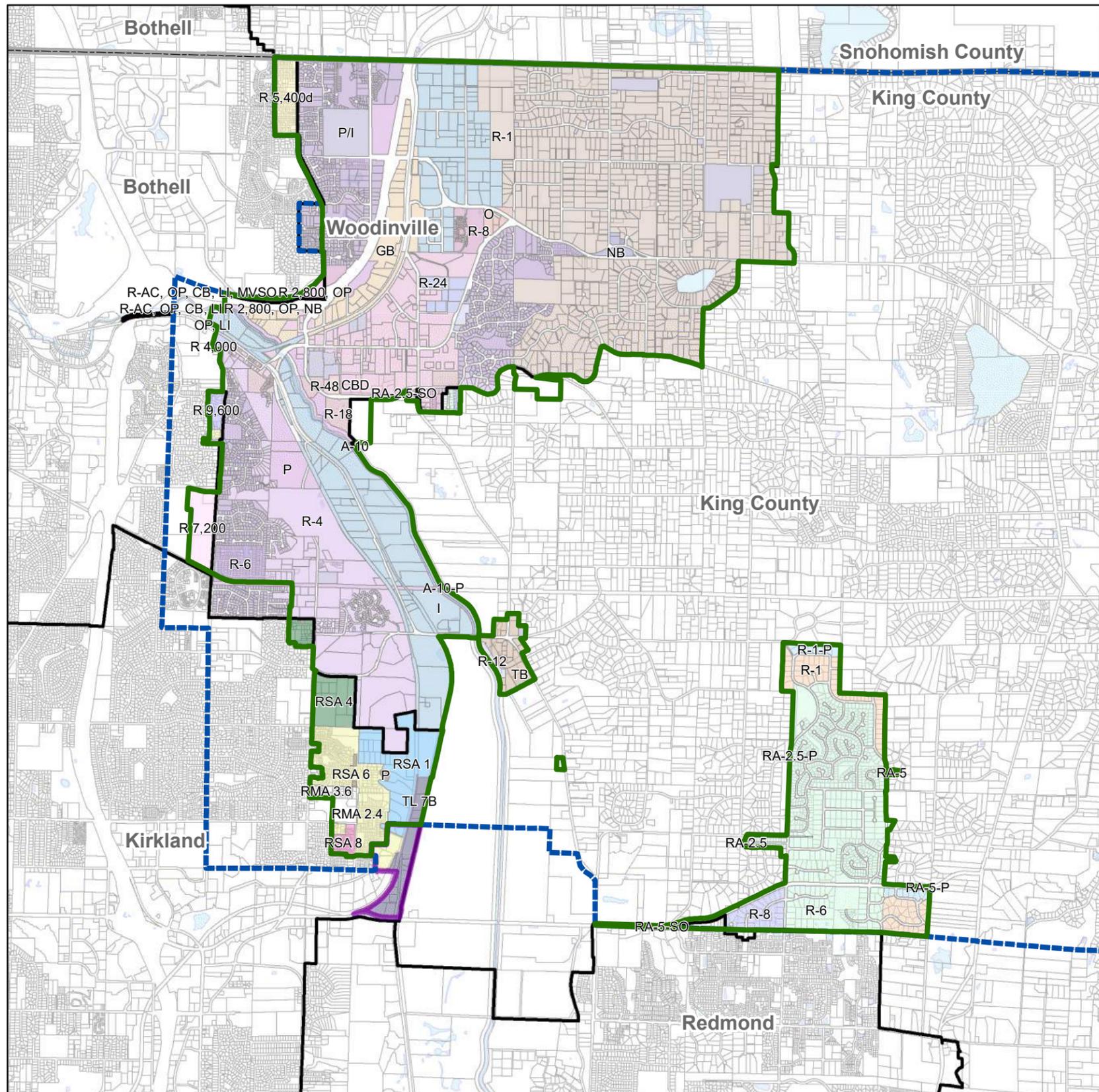
City of Woodinville Future Land Use Designations

FIGURE 3-4

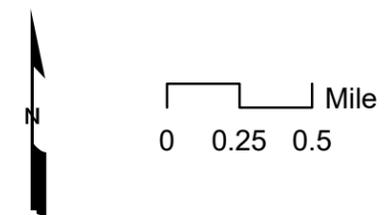
Comprehensive Sewer Plan

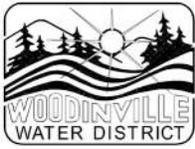


(Page Intentionally Left Blank)

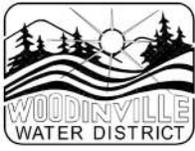


Note: Zoning for areas outside of service area not shown for clarity





(Page Intentionally Left Blank)



3.4 RELATIONSHIPS WITH ADJACENT SEWERAGE AGENCIES

Sewerage agencies surrounding the District and municipalities are shown in **Figures 1-3 and 3-3**. Interagency agreements are included in Appendix F and F-1 as separately bound documents. Most of the interagency agreements allow a neighboring agency to provide sewer service within the District's SSA, to the specific properties identified, until the District has the facilities to serve the property. Once the District is in position to provide service, the current provider will transfer the facilities to the District.

3.4.A City of Bothell

Woodinville Water District Resolution 309, dated January 19, 1970, is included in Appendix F and represents an agreement between the City of Bothell and the District regarding pending and future annexations by the City of Bothell.

3.4.B City of Redmond

In July 1988, the District signed an interlocal agreement, included in Appendix F, with the City of Redmond to set future water and sewer service area boundaries. The common service boundary is the extension of NE 124th Street.

The Trilogy at Redmond Ridge Urban Planned Development (formerly known as Blakely Ridge) Master Planned Development in the southeastern corner of the District's water service area is bisected by the District WSA boundary, but is outside of the District's SSA. The District has agreed to consider allowing the City of Redmond to provide sewer service to the portion within the District because the District does not have sewer facilities in the vicinity; however, water service will be provided by the District to the lots within WWD's WSA.

3.4.C Northshore Utility District

The Northshore Utility District is located along the southwestern corner of the District's sewer service area. Resolution 105, dated July 6, 1964, set the boundaries for sewer service and annexation issues between the two agencies (Court Order Line). Because of the topographical difficulty of providing service to the Kingsgate area, the Northshore Utility District actually provides service to this area within the District's sewer boundary. The two agencies also have a number of interim agreements where the Northshore Utility District is allowed to serve some parcels within the District's service area boundaries until such time in the future when the District has the facilities to provide sewer service to these parcels.

3.4.D Cross Valley Water District

The Cross Valley Water District is located in Snohomish County north of the District and east of State Route 522 at the county line. Historically, Cross Valley utilized a small portion of the District's sewer mains to convey flow to the King County transmission mains. The creation of the KCDNR Brightwater treatment facility has eliminated that need. Cross Valley Water District no longer has any sewer interaction with the District. WWD does still provide water service to 39 residences in Cross Valley through an interlocal agreement.

3.4.E King County Department of Natural Resources

In May 1973 and March 1989, the District entered into a long-term agreement with the Municipality of Metropolitan Seattle (Metro), as the regional sewerage authority, to provide sewage treatment and disposal as well as interception/conveyance of the District's collected wastewater. **Figure 3-6** shows one of these facilities.



Figure 3-6 – King County York Pumping Facility

King County and Metro merged in 1994, and the regional sewer system, established in the 1960s to clean up the waters of Lake Washington and the central Seattle waterfront, became the responsibility of the King County Department of Natural Resources, Wastewater Treatment Division (Metro/WTD). Now the Department of Natural Resources is known as the Department of Natural Resources and Parks. In



this Comprehensive Plan, the regional sewer system is referred to as the KCWTD system.

KCWTD owns and operates the Hollywood, Woodinville and York pump stations, the Sammamish Valley Interceptor, the Little Bear Creek Trunk and all other downstream conveyance, treatment and disposal facilities. District wastewater flows through these facilities for treatment and disposal. A discussion of the King County facilities is found in Chapter 1.

3.5 POPULATION AND FORECASTS

3.5.A Existing Sewer Connections

Of the 3,700 District sewer customers, there are approximately 3,100 residential accounts and 600 accounts designated as commercial, industrial or municipal. All sewer customers receive water from the District, though some water customers send their sewage to adjacent agencies like Northshore Utility District or the City of Bothell, and others are connected to on-site septic systems. Most of the existing customers for sewer service by the Woodinville Water District are within the City of Woodinville city limits; however, about 700 residential accounts are within the City of Redmond UGA.

3.5.B Population and Growth

Based on current connections and a county wide average of 2.3 people per housing unit (connection), the population served by the sewer system is in the range of 8500. The PSRC reports that the City of Woodinville was approaching a population of 13,000 in 2020. A large portion of the difference in these values is the large unsewered area in the NE portion of the SSA.

There are several sources for growth projections. WWD completed their Comprehensive Water Plan Update in 2019, the City of Woodinville completed their Comprehensive (UGA) Plan in 2015 and the Puget Sound Regional Council (PSRC) maintains an ongoing database of population and growth projections utilized by the cities and counties alike. **Table 3-1: Growth Projections** compares the different sources. The table suggests that population density and resulting sewer flows could be expected to grow, on average, between 1% and 2% per year over the next 20 years. These projections do not take into account large (re)-development projects that can place a sudden and localized demand onto the utility systems.

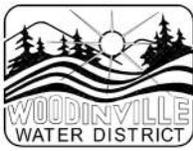


TABLE 3-1: Growth Projections

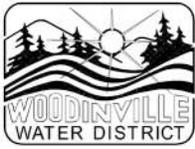
Source	Description	2020	2025	2030	2035	2040	Net Annual Growth Rate
PSRC-Current (pop)	City of Woodinville	12477	13690	15006	16303	17570	2.04%
	KC Rural UGA (comparative)	114828	118437	121854	123527	123673	0.39%
COW -CP (2015) (pop)	City of Woodinville	12703	14357	16226	17318	17785	2.00%
WWD Water (2019) (ERU)	ERU - Med	18691	19407	20150	20822	21476	0.74%
WWD Water (2019)(MGD)	Max Day Demand	10.6	11.2	11.7	12.3	12.8	1.03%

Actual wastewater flows (and water demand) are expected to grow at a slightly lower rate than the population at large due to water conservation measures (i.e., Low flow toilets) being incorporated into new construction and remodeling. Additionally, there has been a steady trend of much of the recent growth taking the form of high density housing located closer to the urban centers. The high density growth tends to have a lower per housing unit water and sewer impact as compared to Single Family Residences located in the rural areas. The downside to this trend is that increases in sewer flows are being projected into the older portions of the existing collection system.

The Woodinville Water District is in a responsive position relative to growth. The cities and county determine the potential extent through Urban Growth Area limits, then the cities determine the land use and density through zoning. Finally, the actual growth achieved is the result of numerous factors:

- Overall Economy
- Area Economic Health
- Business Decisions
- Home Pricing
- Cost of Utility Extensions
- Environmental Permitting Issues
- Water Conservation and Building Codes

Growth is not uniform. The rate of growth is expected to decrease as an area approaches full development. The City of Woodinville is projecting a rate of 2.8%



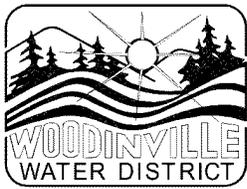
for the next 5 years, declining to 0.6% in years 15-20. Secondly, actual growth can be very erratic. One or two large projects may come on-line in a single year providing an 8% increase, followed by several years of low or no growth.

The intent of sewer system piping is that it can provide over 50 years of useful life. For purposes of analyzing the wastewater collection system, this plan focused more on the projected flows at full development (build out) as all of the growth projections for the 20 year horizon are approaching build out, with the exception of the easterly unserved basins. Analysis is detailed in Chapter 4.

3.5.C Industrial Customers

Currently the District has 6 accounts that have been identified as part of the King County Industrial Waste Program and are subject to additional permitting and testing requirements.

Table 3-2 Industrial Customers		
KC Account No	Company Name	July-September 2021 Surcharge Treatment Cost (magnitude indicator)
5101180	Ste. Michelle Wine Estates	\$26,525.03
5102438	Black Raven Brewing Co.	\$3,138.22
5105988	North Cascades Inc.	\$12,914.46
5419910	Garden Fresh Foods Inc.	\$4,680.86
5421300	Precor Inc. – Plant 2	n/a
	Kiewit	(new connection, minimal history)



CHAPTER 4 – WASTEWATER FLOW MONITORING AND DESIGN CRITERIA

4.1 PROGRAM APPROACH AND GOALS

4.1.A Overview

In support of preparing this Plan, the District elected to do a period of flow monitoring to refine the data available and improve the accuracy of the hydraulic model. To do cost effective flow monitoring, collection basins were delineated based on applicability of installing temporary flow monitors. Where possible, the flow monitors were installed near the connection point to King County (KC) transmission mains.

King County had previously done an area wide Inflow and Infiltration study in the early 2000's. The KC basins were used as the analysis basis in the District's 2007 General Sewer Plan. This Plan has attempted to use similar basins and designations where possible, but the basins presented here may not be directly comparable with the earlier efforts due to monitoring points, changes in basin size and connection points.

4.1.B Goals

The primary goals were to produce a site-specific data set that reflected current conditions and would serve as the basis for the hydraulic capacity model analysis to follow. Data points included:

- Basin flow magnitudes and diurnal pattern
- Determination of sanitary peaking factors
- Determination of Inflow and Infiltration magnitudes
- Correlation with Rainfall events

Flow data for model calibration

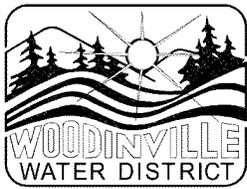
4.1.C Approach And Basin Delineation

Basins were delineated based on potential metering locations and the ability to define the developable land area that would contribute. The 2007 General Sewer Plan used basin designations such as WDN001 and WDN002. The basins have been re-defined for this plan to coincide with available monitoring points and to provide more definition to the basin's extents. The basins have been grouped into series (1-13) (21-25) (31-34) (41-43) depending on their status and features.

Figure 4-1: All Basins shows the delineation of these basins. Each basin is shown with a unique identifier with a circle such as ④ for basin 4. The basins are generally described in Section 4.2 however additional delineation for basins 1-13 is as follows:

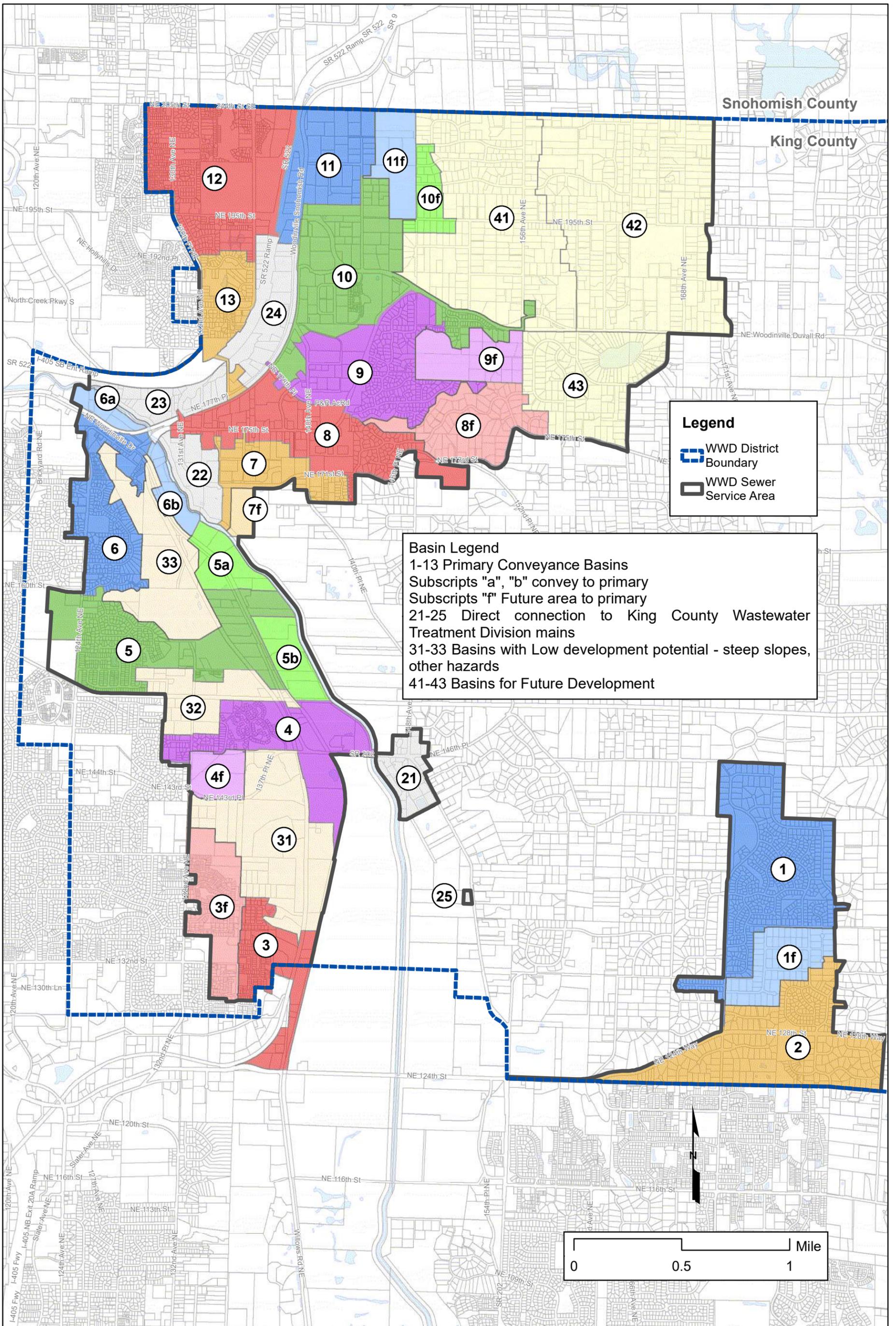
Primary conveyance basins (1-13)

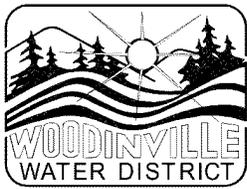
Subscripts and subareas are shown to differentiate between area that that did not contribute to the flow monitoring measurements within the primary basins.



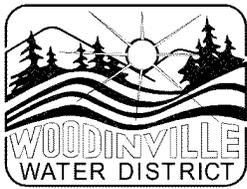
- “a” and “b” subscript denotes areas that flow into a primary basin area, shown as **5_b**
- “f” is used to denote unsewered Future basin areas that will extend from a primary basin, shown as **8_f**

Flow monitors were installed at 10 of the 13 large basins with the intent of collecting continuous data during both dry and wet season periods. The work included installation of a rain gauge at the WWD office.





(Page Intentionally Left Blank)



4.2 CONVEYANCE BASIN DESCRIPTIONS

Basin 1 comprises about 201 acres in the English Hills area within the City of Redmond urban growth area. The sewer service area consists of existing served area, 141 acres, that is essentially fully developed except for a few parcels and a large block of existing homes on septic systems, 60 acres. It is all single family with one elementary school.

Basin 2 has about 93 acres developed as single family on either side of NE 124th St. and is within the City of Redmond urban growth area. Two existing lift stations, operated by the District, are located within this basin. This basin was not flow monitored as all the discharge came through lift stations.

Basin 3 presently has 93 acres of area, but only 46 developed acres located to the south of the District. Most is single family residential up-slope of the railroad. The next-largest portion of the area is zoned for mixed use and commercial.

Basin 4 includes about 150 acres west and up-hill from the Chateau St. Michelle Winery on NE 145th Street within the City of Woodinville, as well as a portion of residential east of the river. About 40 acres are developed industrially and the remainder is single family.

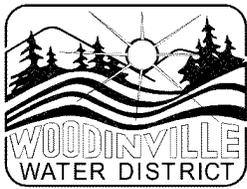
Basin 5 serves approximately 209 acres west of the Sammamish River and the Woodinville-Redmond Road within the City of Woodinville. Approximately 135 acres are single family, and the rest is industrial.

Basin 6 includes approximately 124 acres along the western boundary of the City of Woodinville east of 124th Avenue NE and north of NE 160th Street. Approximately 9 acres are multi-family or mixed use, 8 acres are commercial or religious, 3 are industrial, and the remainder is single family.

Basin 7 currently serves approximately 54 developed acres east of the Sammamish River along NE 171st Street in downtown Woodinville. Approximately 4 acres are single family, 10 acres of multifamily, and the remainder is commercial. This Basin contains the southern extent of the City of Woodinville's Central Business District.

Basin 8 includes approximately 182 acres along NE 175th Street in downtown Woodinville. Except for approximately 7 acres of multi-family, 8 acres of public/institutional, and 46 acres of single family, the rest of the basin is commercial/mixed use. This Basin contains the central majority of the City of Woodinville's Central Business District.

Basin 9 has approximately 176 acres east and uphill from B8 along NE 175 Street. Except for 35 acres of commercial, 23 acres of multi-family residential and 1 acre of



public/institutional, it is all residential. This Basin contains the northern extent of the City of Woodinville's Central Business District.

Basin 10 encompasses approximately 226 acres in the City of Woodinville east of Woodinville-Snohomish Road and up the Woodinville-Duvall Road. Approximately 40 acres are single family residential, approximately 42 are commercial/mixed use, and the rest are industrial.

Basin 11 includes approximately 104 acres in the City of Woodinville, east of Washington SR 522 and north of B10. Within the basin there are approximately 12 acres of commercial use, with the remainder for industrial use.

Basin 12 includes approximately 189 acres in the City of Woodinville, west of Washington SR 522 and north of B10. Within the basin, there are approximately 18 acres of park, 38 acres of public/institutional, and the rest is single family.

Basin 13 includes approximately 46 acres in the City of Woodinville, west of Washington SR 522 and south of B12. Within the basin, there are approximately 4 acres of commercial, and the rest is single family. This basin was a low priority for monitoring and was not modeled as staff reported no capacity concerns.

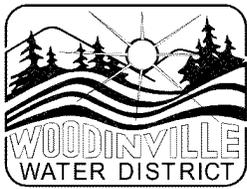
The above 13 basins reflect those within the UGA and are of primary importance due to the current or future development density and were targeted for flow monitoring as discussed earlier. The other basins are secondary with general descriptions as follows:

Basins 21-25 are small basins with direct connections into the King County Wastewater Treatment Division (KCWTD) mains. These basins were not targeted for flow monitoring and their direct connections resulted in their exclusion from the modeling.

Basins 31-34 are basins with topography that typically prevent development such as steep slopes.

Basins 41-43 are basins within the existing SSA that is presently unsewered.

Basin numbers not listed above or outside the ranges provided above are to be considered reserved for future delineations. Future delineations should be selected based on the features described above. Examples: If another basin was identified in the future that possessed steep slopes, then Basin 35 would be appropriate. If it had a direct connection to KCWTD mains then 26 would be appropriate, etc.



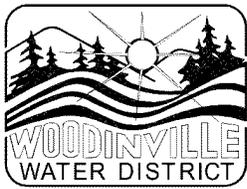
4.3 FLOW MONITORING

Flow monitoring was performed by Hach Data Delivery Service using Hach FloDar meters with cellular data transmission. The FloDar units use a form of radar to collect velocity and flow depth information and do not require submersion into the actual waste stream. Flow monitoring was performed from October 2019 through February 2020. This period proved beneficial as it provided initial dry weather flows (October through mid-November 2019) and caught several high rainfall events including the severe storms during late December 2019. January and February continued to be very wet and provided a good representation of saturated ground conditions.

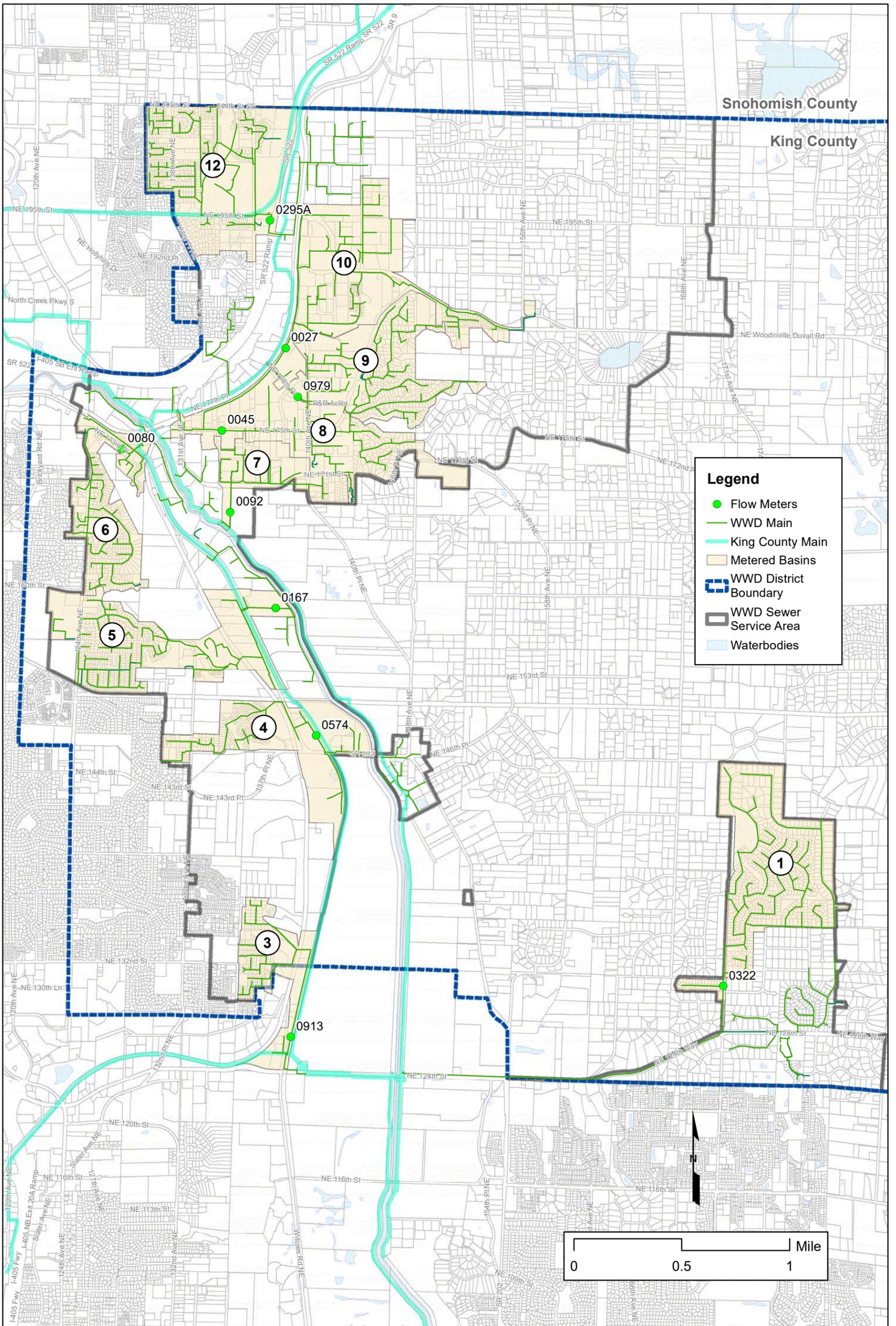
Detailed descriptions of each manhole location selected for flow monitoring is included in Appendix A and the locations are shown on **Figure 4.2: Flow Meter Locations** which also indicates the basin area monitored.

Table 4-1: Sewer Flow Monitoring Summary summarizes the data collected, lists estimated flow, and compares that to the actual flows measured, finally the Table lists the observed flow Peaking Factor and I & I. These values are used to calibrate the hydraulic model and verify the modeling parameters being used. A description of the columns is as follows:

- Basin – As described in Section 4.2 above.
- Metered Manhole – Manhole identifier utilized for flow meter installation.
- Acres – Estimated acreage of the basin or acreage of the basin that would have flow passing through the flow meter.
- Estimated (Est.) Sanitary Sewer (SS) Load – Estimated sewer flow in gallons per minute (gpm) derived from the water use data on a per acre basis. To help eliminate high water use from irrigation, water data used represented the average wet weather monthly (AWWM) flows.
- Observed (Obs) Dry Average (Avg) – The observed average dry weather flows from the flow meter data.
- Estimated AWWM to Sewer – A comparison of the overserved dry average flow with the water use data, expressed as a percentage.
- Overserved Dry Peak – Peak daily flows taken from flow meter data during dry weather.
- Observed Peaking Factor (PF) – A comparison of the observed peak flow and observed average flow expressed as a multiplication factor.
- Observed Storm Peak – Peak flow rate of sewer flow during wet weather as taken from flow meter data.
- Observed Wet Average – Average flow rate during wet weather.
- Observed Inflow and Infiltration (I&I) – Difference in observed wet weather and dry weather flow data, expressed as gallons per day per acre [of the basin].

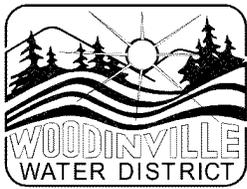


(Page Intentionally Left Blank)

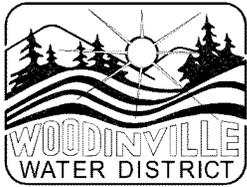


Legend

- Flow Meters
- WWD Main
- King County Main
- Metered Basins
- WWD District Boundary
- WWD Sewer Service Area
- Waterbodies



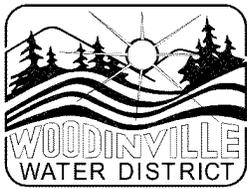
(Page Intentionally Left Blank)



General Sewer Plan

TABLE 4-1: WWD – Sewer Flow Monitoring Summary Oct 2019 – Feb 2020

Basin	Metered Manhole	Acres [basin / meter]	Est. SS Load [AWWM] (gpm)	Obs Dry Avg (gpm)	Est. AWWM to Sewer	Obs Dry Peak (gpm)	Obs PF	Obs Storm Peak (gpm)	Obs Wet Avg (gpm)	Obs I & I (gpad)	Notes
1		305.8	53.9								
1a	322	246.5	0.0	41.7	77.4%	76.8	1.8	212.6	124.2	517.2	SFR
2		103.3	0.0								missing
2a	Sunrise LS		0.0								RTM
3		92.6	33.2								Extensive O&M flushing reported
3a	913		0.0	28.3	85.2%	46.5	1.6	127.8	91.9	1043.1	
4		150.0	18.0								
4a	574		0.0	15.5	86.1%	27.9	1.8	114.8	70.8	571.2	
5		208.7	34.6								Unresolved
5a	167		0.0	133.2	385.4%	179.0	1.3	346.0	217.5	610.8	Data Irregular
6		124.1	36.7								SFR + School
6a	80	122.1	0.0	19.9	54.2%	31.9	1.6	73.7	46.2	368.3	
7		87.9	34.1								
7a	92		0.0	33.4	97.9%	44.7	1.3	106.9	49.0	324.1	
8		182.1	75.8								
8a	46		0.0	68.1	89.8%	108.3	1.6	142.1	81.6	140.5	
9		175.7	100.1								
9a	979		0.0	99.4	99.3%	146.4	1.5	270.4	186.7	750.1	
10		225.6	98.4								
10a	27		0.0	91.8	93.3%	138.5	1.5	355.8	162.7	479.8	
11		104.4	46.2								
11a	1485		0.0	38.8	84.0%	42.4	1.5	149.0	44.9	186.3	



4.4 I & I COMPARISON

4.4.A Program Overview

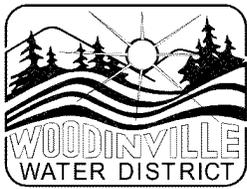
Infiltration/Inflow (I & I) is stormwater and/or groundwater that enters the sewer system. Infiltration enters the pipes system through cracks in pipes and manholes. Inflow enters through improperly connected storm drains, down spouts, and sump pumps. Most inflow comes from stormwater and most infiltration comes from groundwater. I & I affects the required capacity of conveyance and treatment facilities and, ultimately, the rate the customer pays to operate and maintain them. If not continually monitored and policed, I & I gradually increases as pipe joints degrade and inappropriate connections are added.

4.4.B Comparison with 2007 Study

The prior 2007 General Sewer Plan worked with non-specific data supplied by King County (circa 2001) to estimate I & I rates. Since then, WWD has added a significant portion of new sewage collection piping and has been actively inspecting and correcting pipe deficiencies when found. **Table 4-2: I & I Rate Comparison** presents the older data and the results from the flow monitoring. The basin numbers (and contributory acres) listed are in the same general area but are not directly comparable.

TABLE 4-2: I & I RATE COMPARISON				
2007 Basin ID	2007 I&I (gpac)	2021 Basin	Observed 2021 I & I (gpac)	2021 Model Input (gpac)
WDN 001	671	1	517.2	1100
WDN 002	441	2	NO	NM
WDN 003	131	3	1043.1	1200
WDN 004	3994	4	571.2	1200
WDN 005	1134	5	610.8	1100
WDN 006	356	6	368.3	700
WDN 007	731	7	324.1	700
WDN 008	637	8	140.5	700
WDN 009	275	9	750.1	1100
WDN 010	737	10	479.8	700
LBEARA 03	1487	11	186.3	700
		12	NO	1100
		13	NO	NM

*NO – Not Observed, NM – Not Modelled, gpac – Gallons per acre, per day



The basin comparison shows many consistencies and a few significant differences. As new piping systems are brought online, there would be an expectation that I & I rates would decrease at least in the near term, while systems are new and more watertight. The swing in Basins 3 and 4 is partially accounted for by differing boundaries. The District also notes that frequent flushing is done in the Foxbrier neighborhood (Basin 3) to prevent backups, attributing to the higher observed I&I rate.

The industry standard benchmark is 1100 gpad for existing collection systems. New construction routinely comes in below 300 gpad and then increases over time. I & I flows above 1100 gpad often have the effect of increasing the systems physical and maintenance cost. Most of the District's basins are well below the threshold, with only Basin 3 approaching. The general conclusion is that the WWD system is within or below the standard range of expected I & I flows and does not show systematic problems that would indicate poor construction or monitoring.

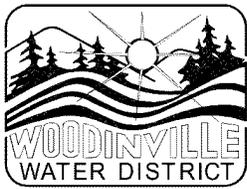
The I & I rates (Model Input) shown on Table 4-3 for future estimation of flows and modelling are intended to be moderately conservative, reflect the monitoring data collected and recognize the relative shortness of the period producing the observed data.

4.4.C I & I At Monitored Basins

Figure 4-3 is an example to illustrate the flow monitoring data collected at each monitored basin. Appendix B contains similar charts for each monitored basin. The figures graphically show the response of the system flow for both average dry weather and during a major rainfall event. Figure 4.3 has additional text to clarify what each line or bar is representing

- Bars (vertical) = Rainfall in inches per hour denoted on right axis for the large storm event listed.
- Gold line = average dry weather flow in GPM, denoted on left axis.
- Blue line = the actual flows in GPM, denoted on the left axis, observed during the storm event.

Comparing the shape of the blue gold lines yields the basin response to large rain events and produces the observed Peaking Factor used in the system analysis.



(Page Intentionally Left Blank)

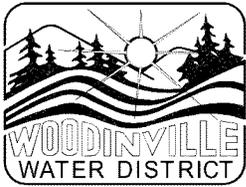
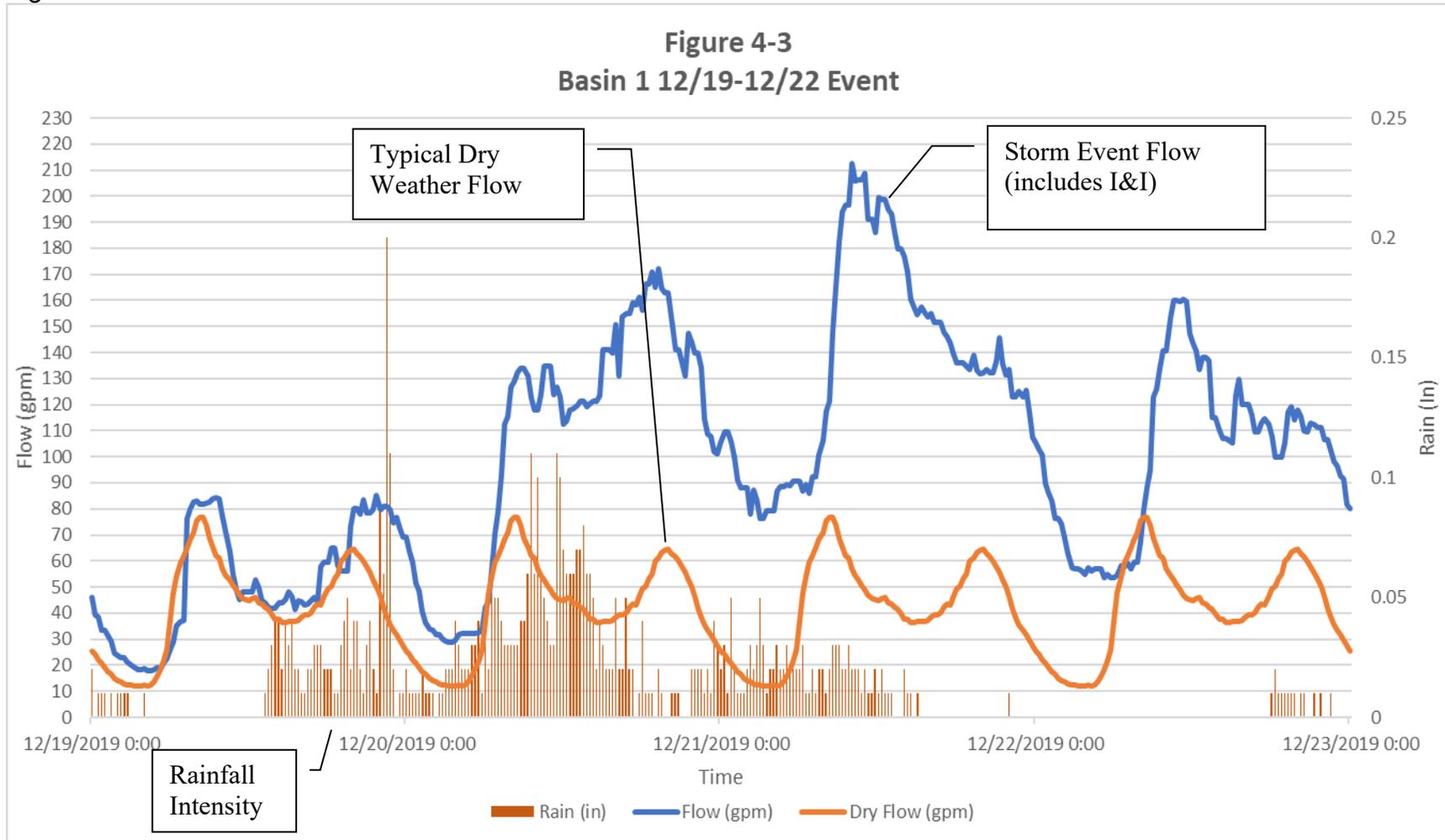
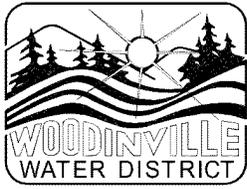
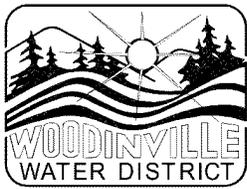


Fig 4-3 basin 1





(Page Intentionally Left Blank)



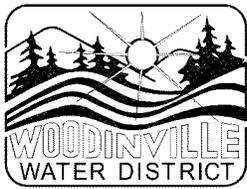
4.5 Residential Sewage, SFR and ERU

The terms Single Family Residential (SFR) and Equivalent Residential Unit (ERU) are synonymous, both terms are used to express values in terms of an average residential home within the service area. The District has a wide variety of Single Family Residential (SFR) units. The unsewered water service area generally has larger homes on large lots while the SFR lots receiving sewer service tend to be on 6000 sf to 10,000 sf lot size. The District’s current Water System Plan found an average water consumption of 207 gpd for SFR.

The prior Sewer System Plan (2007) found an average of 87% of purchased water correlated to sewer flows. This is consistent with the data collected during the Flow Monitoring (see Appendix B), where the basins with a majority of SFR had an average of 85.2% of estimated (winter) water purchases showing in the sewage flows.

The other variable to be aware of is the population density that is producing the sewage flows. KC reports an overall average of 2.6 people per SFR. The Dept. of Ecology Criteria for Sewage Works (Orange Book) recommends a loading of 100 gpcd (inclusive of I & I allowance). Analysis of several sewer basins within the Puget Sound basin and accounting for I & I as a separate element has shown that a value of 80 gpcd for sewage flow is more applicable and produces accurately sized collection systems. **Table 4-3: Flow Contribution Comparison** evaluates the varying sewage and water unit rates in the context of the District SSA monitored.

TABLE 4-3: FLOW CONTRIBUTION COMPARISON					
SFR Water and Sewer Accts, Basins 1,3,4,10,11 w/full period occupancy		912			
Total Water Purchase (winter period)		187726.4			
Average SFR-Water gpd		205.8		Historical CWP 207.0	
	Est. Density	Pop.	GPCD (water)	Est. W:SS @ 87% (gpcd)	Planning Use (SS-gpcd)
	2.6	2371.2	79.2	68.9	80
	2.3	2097.6	89.5	77.9	
	2.0	1824.0	102.9	89.5	

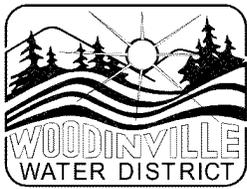


The data shows that the flows and contributions per capita and per housing unit are consistent with both prior planning efforts and DOE guidelines. The District will continue to use a value of 80 gallons per person per day (gpcd), excluding I & I, for planning and evaluation.

4.6 Peaking Factors

Figure 4-3 illustrates both typical and storm influenced (I & I) sewage flows. Sewage flow does not arrive uniformly, instead it follows a rising and falling pattern known as the diurnal curve. The diurnal curve is specific to each basin and land use. Residential diurnal curves typically show a morning and late afternoon peaks with very low flow over night. Commercial properties tend to have the same low period overnight followed by a flatter peak during business hours. Peaking Factors are used to transition from the average daily flow to the Peak flow that may result. Peaking factors are a standard practice in sewer design and are used to ensure that collection system analysis and design incorporate a reasonable factor of safety. The DOE guidelines set a minimum value of 2.5 and provide a chart relative to basin size that would suggest a value of 4.0 (inclusive of I & I) be used for the District's basins.

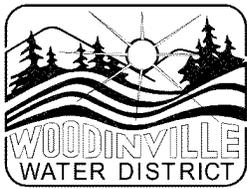
This plan is utilizing a hydraulic model that allows for the separation of I & I from the sanitary flow. This allows for the use of a lower peaking value but requires that the acres of contributory area be calculated. The peak flow ratio observed during monitoring averaged 1.6. For design and analysis this plan will use a Peaking Factor of 3.0 for primarily residential basins, with a factor of 4.0 for being used for Basins 7, 8 and 9 due to the Central Business District and its potential for high flows.



4.7 Sewage Design Criteria Summary

Table 4-4: Sewage Design Criteria Summary collects and shows the different variables used in the analysis and design within this plan.

Table 4-4: Sewage Design Criteria Summary			
Criteria	Value	Unit	Comment
Inflow and Infiltration (Low)	700	Gpad	Used in modeling and flow estimation. Value for new construction or data based existing basin areas of I & I < 500 gpad observed.
Inflow and Infiltration (Typ)	1100	Gpad	Used in modeling and flow estimation. Value for aged basins or data based existing basin areas of 500 < I & I < 1000 gpad observed.
Inflow and Infiltration (Hi)	1200	Gpad	Used in modeling and flow estimation. Value based on existing basin areas of I & I > 1000 gpad observed or where data has lower confidence.
Equivalent Residential Unit (ERU) – Sewage, also SFR-sewage	180	Gpd	Used in planning, financial assessment and reporting
Sewage contribution per person	80	Gpcd	Used in modeling and flow estimation.
Peaking Factor	3.0	-	Used in modeling and flow estimation for residential basins.
Peaking Factor	4.0	-	Used in modeling and flow estimation for the Central Business District.
Population Density (avg SFR)	2.25	C/SFR	Average from residential homes, applicable to average lots < 10,000 SF
Population Density (large SFR)	2.60	C/SFR	Average from residential homes, applicable to large lots > 10,000 SF, site specific may further increase to 3.0+
Population Density (MF)	2.00	C/HU	Average for multi-family Housing Units, typically under 1500 SF, used to calculate ERU
Potable Water-AADF (per SFR)	207	G/ERU	See Comprehensive Water Plan
Sewage:Potable ratio	87%	-	Used to estimate sewage flow from water consumption records, excludes irrigation.
Pipe Capacity Limit	80%	-	Trigger point for evaluation and scheduling of a pipe improvement.



CHAPTER 5 – COLLECTION SYSTEM EVALUATION

This Chapter utilizes the planning projections, basin area revisions, flow monitoring results and design criteria developed in the earlier chapters to develop a hydraulic model of the primary collection/transmission sewer mains and evaluate the estimated pipe capacity. This chapter also reports on pipe condition deficiencies, as identified by the Operations staff, that would not otherwise be flagged in the hydraulic simulation (model). The developed information and identified deficiencies will serve as the basis for the Capital Improvement Project (CIP) plan presented in Chapter 8. The final sections of this chapter evaluate means of serving properties not currently connected to sewer collection system and discuss alternative collection systems.

5.1 SYSTEM DATA AND GIS DATA

WWD maintains a Geographical Information System (GIS) based on software sold by the company ESRI. This consists of a large database that contains the physical information relating to each element (pipe, manholes). The database was built up by the WWD staff by manually entering the data from the record (as-built) drawings.

One of the significant efforts made during the preparation of this plan was to analyze the GIS data, identify concerns and make corrections where appropriate. WWD had previously performed an elevation survey of all sewer manholes, this provided a current, trusted baseline.

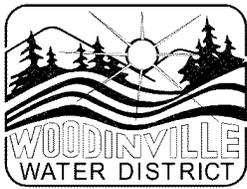
One of the larger reoccurring problems found was pipe invert elevation errors. Many of these were traced to the use of differing elevation datums. The District currently requires that NAVD 88 datum be used, however many of the earlier pipe installations were installed under NGVD or assumed datums and this information had been placed into the GIS database. The GIS database is the basis for the hydraulic model to follow.

The engineer spent a significant amount of time identifying and correcting the datum errors and returned a revised GIS database to WWD, where the data is currently in use. Data maintenance is an ongoing activity. The District has strengthened several internal procedures for data review and data entry into the GIS system

5.2 MODEL DEVELOPMENT

A hydraulic model has two primary components; the physical pipe system and the variable flows (Loading) that are routed through the piping system. The flows can be further grouped into the Sanitary flow, Infiltration flow and Inflow:

- Sanitary flow is the sewage (gray water, black water) discharged from the connected structure and typically flows in a diurnal pattern.



- Infiltration and Inflow (I & I), as described in Chapter 4, is the combined flow element from groundwater infiltration and stormwater (rainfall) entering into the collection system.
 - Infiltration flow is ground water entering the system through pipe joints and structural deficiencies. Infiltration tends to be at a consistent rate and is related to the ground water table and pipe condition.
 - Inflow (direct) represents the flow that is seasonal, routinely tied to rainfall, and enters the system through illegal connections, such as roof downspouts tied to the side sewer piping or dripping through a low-lying manhole cover.

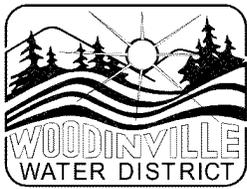
5.2.A BASIN DELINEATION

Basin limits and areas where delineated by identifying the discharge point to the KC transmission mains and working upstream. The basins were then further subdivided into sub-basins. All the flow from a sub-basin is introduced to a mid or upper manhole (node) and then routed through the pipes (links), adding flow as it progresses downstream.

Only a portion of the basin piping is modeled. The upper reaches of the collection system generally do not warrant analysis as the pipes serving small sub-basins typically have more than adequate hydraulic capacity, even at minimum slopes. A schematic of the modeled system is shown in **Figures 5-1a and 5-1b** along with the sub-basin overlay. Individual model Basin maps are included in Appendix B. Data for each sub-basin of tributary sewer collection area is summarized for each scenario in the model input summary spreadsheets included in Appendix B. Flow is introduced from each sub-basin at a generally centrally located manhole or node in each sub-basin.

5.2.B FLOW DISTRIBUTION AND CALIBRATION

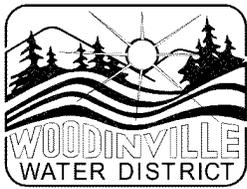
All the lots in the sewer basins receive their potable water from the District. This provided a data set of both water volume and location. Winter water consumption provides a good data point for the magnitude of potable water being discharged as sewage. For this Plan, winter water meter records for all accounts within a sub-basin were tallied and then injected at a node within that sub-basin. These flows were then compared to the dry weather flow monitoring performed. The tallies and distribution provided strong correlation with the observed flows. Future sanitary flows targets are then calculated and applied as a multiplier to the baseline flows to preserve the distribution of flow.



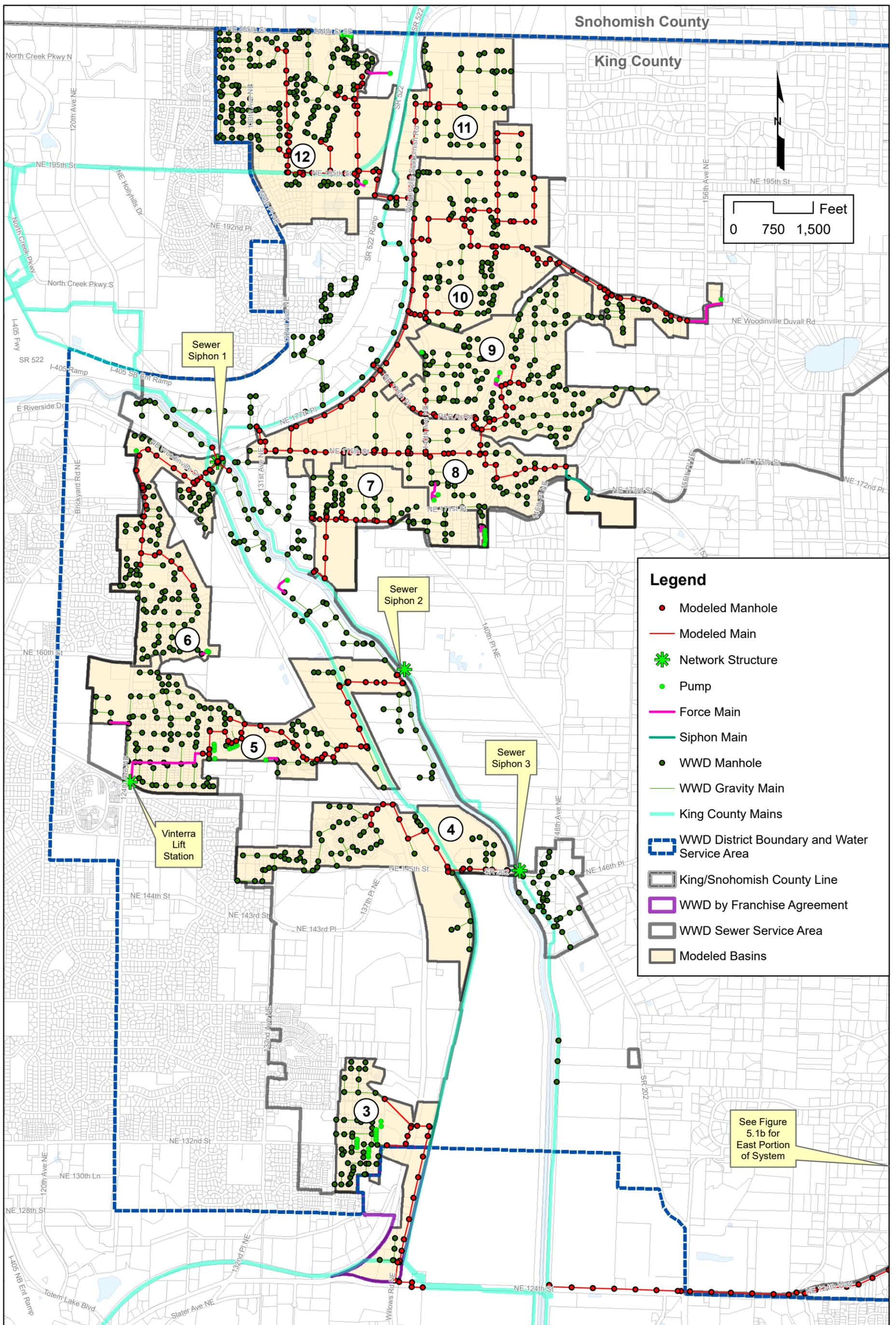
5.2.C FLOW DEVELOPMENT

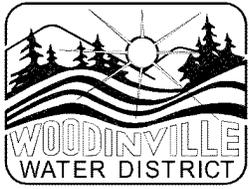
For each basin, a land use (Zoning) overlay was used to calculate the acreage within each zoning and resulting future (Build-Out) population density. The District's Sewage Design Criteria (see Section 4.7) was then applied to generate flow. I&I is added separately based on the flow monitoring performed.

Sewer pipe is a long-term asset. Modern pipe materials, properly installed, can provide 50+ years of service. For that reason, this Plan focused pipe capacity evaluations on the Build Out (BO) condition. The BO condition that the basin is fully developed to the extent of the current zoning. The actual timing of infill extension or (re)development is subject to market conditions that are difficult to anticipate.



(Page Intentionally Left Blank)

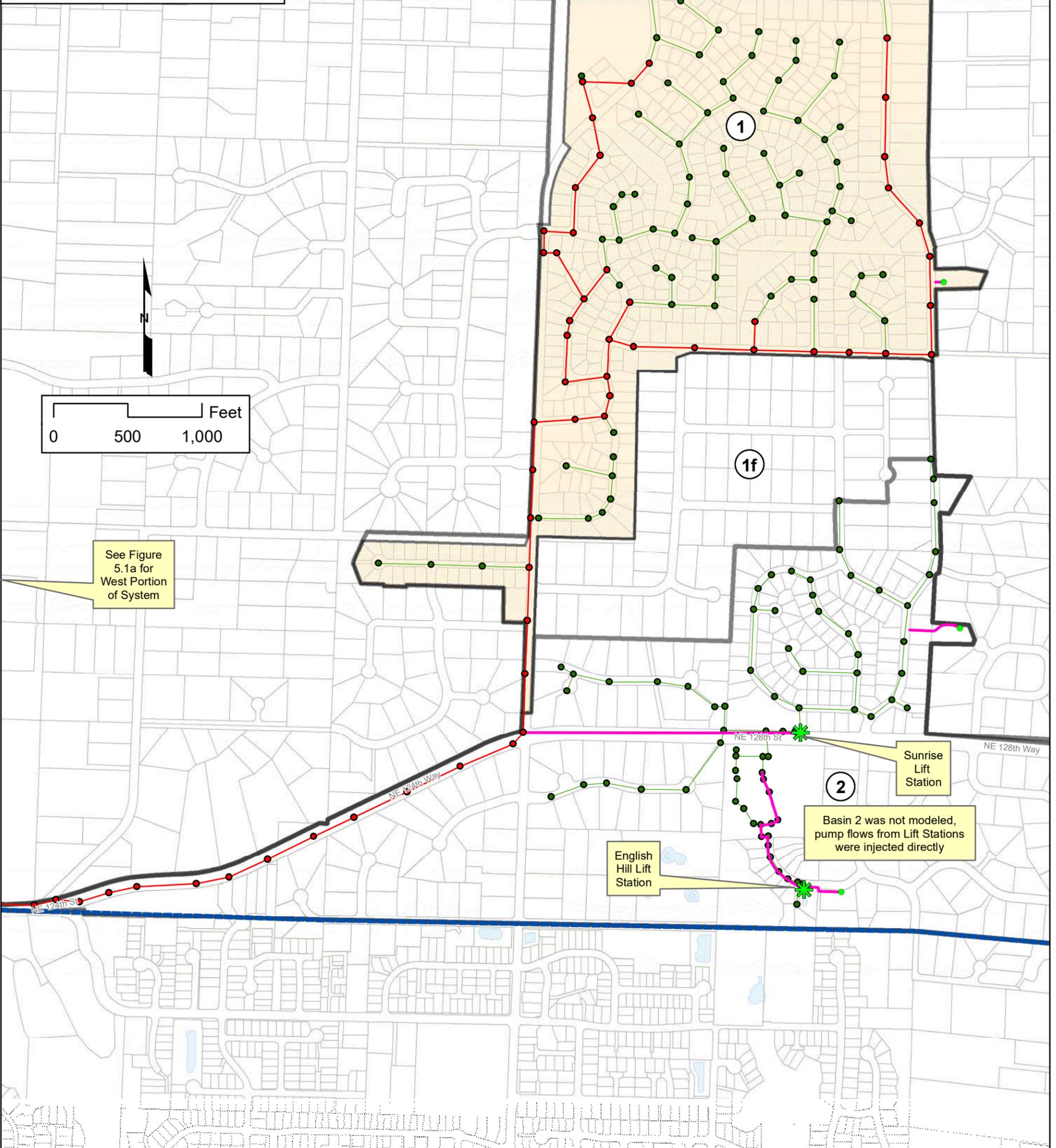


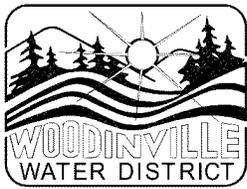


(Page Intentionally Left Blank)

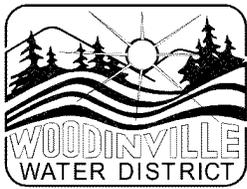
Legend

- Modeled Manholes
- Modeled Mains
- ✱ Network Structure
- Pump
- Force Main
- WWD Manhole
- WWD Gravity Main
- ▭ WWD District Boundary and Water Service Area
- ▭ WWD Sewer Service Area
- ▭ Modeled Basin





(Page Intentionally Left Blank)



5.3 HYDRAULIC CAPACITY ANALYSIS

The existing gravity collection system was evaluated for hydraulic capacity by means of a computer model. The hydraulic modeling software, InfoSewer (Innovyze, Inc.), has been used to analyze the major gravity lines within the collection system for current conditions, and build-out (i.e., full development of the service area). The “model” is comprised of 11 independent electronic files, one for each basin analyzed. Of the thirteen (13) primary sewage collection basins identified, two (2) basins were not developed into hydraulic models, Basin 2 was excluded as its peak flow rate is controlled by the lift station pump discharge and Basin 13 was excluded as the current and future acreage served was well within the capacity for an 8” pipe. While the model(s) are based on the information in the GIS database, by importing the data into the model, changes and results are not directly shared and require export/import to move data from one source to the other.

The hydraulic model consists of an integrated collection of physical attributes for the collection system and assignment of forecast flows from sanitary contributions and inflow and infiltration. The physical attributes represent the manholes (nodes) and conduits (pipe) through which the flow is conveyed. Hydraulic contributions can be introduced at nodes representative of their point of collection in the system, and those contributions can be represented in a variety of methods.

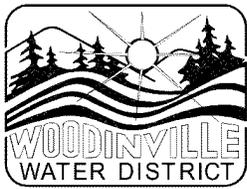
Inflow and infiltration are estimated together as a peak hour flow, as described above, and input in the model as a fixed peak hour flow, at representative nodes in each basin. In the model, the peak sanitary flow and peak inflow and infiltration are additive, whereas a heavy rain could occur overnight, hours before the time of peak sanitary flow.

In the model, the discharge from each of the pump stations to a downstream portion of the gravity collection is included as a fixed discharge to the downstream manhole (i.e., existing force main discharge).

The model predicts the hydraulic grade line for connected pipe segments, starting at the flow line of the downstream pipe outlet. This presumes the connecting KC Transmission mains have capacity greater than or equal to the influent flow rate and are therefore not allowing the pipe to surcharge the upstream collection system.

The upper reaches of the collection system generally do not warrant detailed capacity analysis as the pipes serving small sub-basins typically have more than adequate hydraulic capacity, even at minimum slopes. The modeled pipes represent approximately 1/3 to 1/2 of the basin piping, the remaining upstream collector pipes are assumed to be adequate, provided that the remaining upstream basin is less than 100 acres of SFR homes, due to the following:

- An 8” sewer pipe at minimum slope has a capacity of approximately 400 gpm.



- Each typical SFR home contributes 180 gpd = $(PF=3, (3 \times 180)/1440 = 0.375$ gpm, with a conservative value of 6 homes per acre = 2.25 gpm/acre.
- An average Inflow and Infiltration rate of 1100 gpad = 0.764 gpm/acre.
- Combined estimate = $2.25 + 0.77 = 3.02$ gpm per acre.
- **A typical 8" sewer pipe can support $(400/3.02) = 132$ acres of SF residential homes.**

Data for each sub-basin of tributary sewer collection area is summarized for each scenario in the model input summary spreadsheets and basin maps showing modeled pipes are included in Appendix B.

The model was run under several different scenarios to establish baseline flows, build-out flows, build-out flows with pipe improvements, future basin additions and variations of flow diversion into adjacent basins. The majority of the system was modelled with a peaking factor of 3. The Central Business District, located in Basins 7, 8 and 9 was modelled using a peaking factor of 4 to account for the increased variability of usage associated with the forecast zoning.

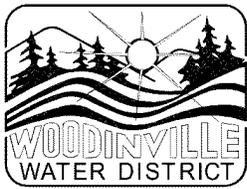
5.3.A MODEL RESULTS DISCUSSION

The majority of the piping modeled showed adequate capacity for Build-Out Flows, with the significant exception of Basin 8 (Woodinville Central Business District). The central spine of **Basin 8** is a 10" concrete sewer main that does not have sufficient capacity to accept the future flows from a "up-zoned" redeveloped basin. Most of the 10" pipe "spine" will need to be upsized.

Basin 9 has a similar issue, with the 12" portion of its central trunk requiring upsizing. Additionally, an allowance for pipes that were not specifically modelled, but may be encountered during any specific design, within the Central Business District, is recommended. This has resulted in the District developing the Central Business District – Capacity Improvement Charge (CBD-CIC) policy described in Chapter 1 to address future development impacts in Basins 7, 8 and 9.

Basin 3 has a long stretch of 8" piping laid on a very flat slope. The District has the option to reclaim two neighborhoods in the SW of Basin 3 that are currently being served by Northshore Utility District, under an interlocal agreement. The downstream Basin 3 projects (Willows Road) will need to occur before the upstream reconnections are advised.

The other significant potential impact would be routing future flows from the northeastern SSA area that is currently unserved. The routing would join into the top (high point) of Basin 10 or alternately may be routed westerly along NE 201st ST and discharge into Basin 11. The large unserved area would overwhelm the existing Basin 10 or Basin 11 piping and will require one or two regional sewage



lift stations to cross the east/west ridge. Given the expense and low probability of an easterly service extension, no further planning analysis was performed for this area, at this time. See also section 5.5.C for potential pipe layout.

5.3.B MODEL RESULTS DEFICIENCY SUMMARY

Table 5-1: Model Results Summary presents the pipe capacity deficiencies and required upsize improvement by basin. The Table includes columns for “q/Q” and “Rev q/Q”. The q/Q is the percentage of pipe capacity utilized under forecast flows in the existing piping. The Rev q/QA shows the impact of upsizing the pipe diameter which increases the pipe flow capacity (Q) and results in decreasing the percentage utilized. A general limit of not exceeding q/Q of 80% is recommended. Only the pipes that were identified as having a current or future capacity deficiency are included in the table. The full listing of each basin’s model results, for all modelled pipes, is included in **Appendix A**.

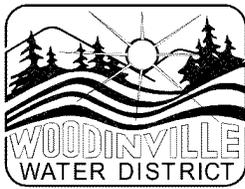


Table 5-1: Model Results Summary (Capacity Deficiency)

BASIN	From MH	To MH	Dia. (in)	Length (ft)	Slope	Total Flow (cfs)	q/Q	Rev. Dia.	Rev. q/Q
1	NO capacity deficiencies found.								
2	NO capacity deficiencies found.								
3	919	918	8	177	0.006	1.08	94.70%	10	52.20%
	918	917	8	398	0.005	1.36	138.10%	10	76.20%
	917	916	8	402	0.006	1.36	126.60%	10	69.80%
	916	915	8	399	0.004	1.36	151.20%	12	51.30%
	915	914	8	413	0.004	1.36	152.80%	12	51.80%
	914	913	8	390	0.003	1.36	169.50%	12	57.50%
	913	0912B	8	222	0.004	1.36	142.30%	12	48.30%
	0912B	1066	8	192	0.002	1.58	274.30%	15	51.30%
	1066	0912A	8	32	0.004	1.58	172.00%	15	32.20%
	0912A	912	8	32	0.006	1.58	142.30%	15	26.60%
	912	911	8	347	0.003	1.58	188.90%	15	35.30%
	911	910	8	63	0.009	1.58	119.00%	15	22.30%
	910	909	8	23	0.009	1.58	115.30%	15	21.60%
	909	908	8	243	0.016	1.58	87.30%	15	16.30%
	908	907	8	86	0.015	1.58	89.90%	15	16.80%
	907	906	8	207	0.082	1.58	38.40%	15	7.20%
4	NO capacity deficiencies found.								
5	934	679	8	352	0.009	1.18	88.30%	12	30.00%
	679	235	8	14	0.107	1.18	25.20%	12	20.00%
	235	234	8	272	0.009	1.18	85.10%	12	28.80%
6	78	0077A	8	4	0.006	1.04	97.10%	10	53.60%
7	NO capacity deficiencies found; however, an allowance is recommended to be created for pipes not specifically modeled that may be encountered during development.								
8	134	133	8	247	0.004	0.78	82.6%	10	45.6%
	132	127	8	212	0.004	1.47	166.3%	12	56.4%
	326	125	8	204	0.017	1.47	78.2%	10	43.1%
	125	124	8	300	0.036	1.47	54.4%	10	30.0%
	124	0062A	8	88	0.026	2.40	103.1%	12	35.0%
	0062A	62	8	80	0.069	2.40	63.8%	12	21.6%
	62	61	8	350	0.023	2.40	109.7%	12	37.2%

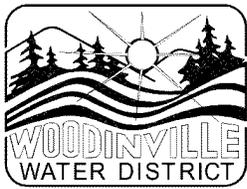
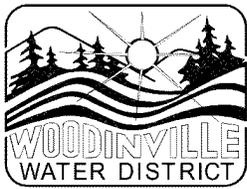


Table 5-1: Model Results Summary (Capacity Deficiency)

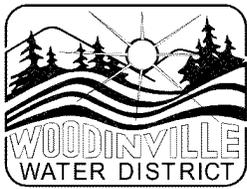
BASIN	From MH	To MH	Dia. (in)	Length (ft)	Slope	Total Flow (cfs)	q/Q	Rev. Dia.	Rev. q/Q
8	61	60	10	286	0.044	3.20	59.0%	12	36.3%
	60	58	10	50	0.011	3.81	141.3%	15	47.9%
	58	57	10	177	0.010	3.81	146.4%	15	49.7%
	57	55	10	259	0.010	3.81	145.8%	15	49.4%
	55	54	10	198	0.010	4.42	168.3%	15	57.1%
	54	52	10	172	0.006	4.42	216.0%	15	73.3%
	52	50	10	133	0.005	4.42	230.4%	15	78.2%
	50	49	10	149	0.006	4.42	219.5%	15	74.4%
	49	47	10	119	0.005	4.42	242.0%	18	50.5%
	47	46	10	341	0.007	5.02	225.6%	18	47.1%
	46	45	10	210	0.013	5.02	173.0%	18	36.1%
	45	44	10	159	0.013	5.02	168.7%	18	35.2%
	44	18	10	300	0.007	5.02	226.0%	18	47.1%
	18	17	15	273	0.009	6.05	83.2%	18	51.1%
	17	0016A	15	22	0.039	6.05	39.9%	18	24.6%
	0016A	16	15	199	0.009	6.05	83.2%	18	51.1%
	16	14	18	181	0.010	6.05	47.9%	18	47.9%
14	13	18	90	0.004	6.05	72.9%	18	72.9%	
13	12	18	209	0.004	6.05	81.8%	21	54.2%	
12	W11A04	18	91	0.003	6.05	91.1%	21	60.4%	
9	459	65	8	166	0.021	2.80	134.3%	12	45.6%
	65	981	8	91	0.021	2.80	135.4%	12	45.9%
	981	980	12	86	0.017	3.69	67.8%	15	37.4%
	980	979	12	183	0.013	3.69	77.5%	15	42.7%
	979	978	12	267	0.011	3.69	82.3%	15	45.4%
	978	977	12	352	0.012	3.69	79.7%	15	44.0%
977	976	12	332	0.013	3.69	75.7%	15	41.8%	
An allowance is recommended to be created for pipes not specifically modeled that may be encountered during development.									
10	NO capacity deficiencies found.								
11	NO capacity deficiencies found.								
12	NO capacity deficiencies found.								



5.4 IDENTIFICATION OF EXISTING CONDITION DEFICIENCIES

Table 5-2 provides a list of noted discrepancies in need of addressing, as identified by the Operations staff members. This information from Operations formed the basis for the priority rankings shown below. It should be noted that priority rankings are likely to change over time as new or updated information becomes available, or as emergencies develop.

TABLE 5-2: Condition Deficiencies						
Basin	From	To	Dia.	LF	Comments	Priority
General	-	-	-	-	Need capability to monitor and log wastewater flow. Recommend addition of a portable data logging flow meter.	High
23	MH 03	M-MH W1197	8	960	[NE 178 th ST] Older concrete pipe, roots, structural.	Med
4	SP-3				Replace top hatch at Siphon 3	Low
Vary	Vary				MH sealing, root intrusion MH – 296A, 500, 912, 979, 989, 990	Low
3	MH 920				Improve access	Low
2	SR LS				Full Rehab of Sunrise Lift Station	Low
3	MH 919	MH 1066	8	2590	[141 st Ave NE] sags, roots, flat slope. See also capacity issues.	Low
6	MH 776	MH 69-J	8	2030	Older Concrete pipe is failing structurally. Much of the pipe is adjacent to Sammamish Slough. Northerly section was a recent emergency repair using slip lining. 1 RR crossing required. Reconstruct westerly through parking lot(s).	High
6	MH 772	MH 87	8	1511	[NE Woodinville Dr.]86-87 roots/sag, all other old concrete	Med
7	MH 91		15	108	Remove reverse angle by adding 2 MH and pipe on diagonal.	High
8	MH 62	MH 18	10	2910	[NE 175 th ST] Older concrete pipe, roots, structural. See also capacity issues. Bursting or parallel cut/cover replacement with upsize.	High
8	MH 13	MH 12	18	209	Sag	Low



5.5 EVALUATION OF SERVICE BY ADJACENT AGENCIES AND UNSERVED AREA EXTENSIONS

As discussed in Chapter 3, there were several areas along the western extent of the District's (original) Sanitary Service Area (SSA) where sewer service was being provided by adjacent providers due to challenging topography and the availability of gravity service by others. Most of these areas were being served under inter-local agreements. A review and adjustment of the SSA (see Chapter 3) eliminates most of these situations by formally transferring the responsibility for providing sewer service to the agency best positioned.

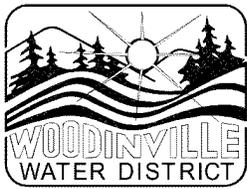
Any discussion of transferring customers and infrastructure from one utility to another necessarily introduces various financial and legal ramifications that require resolution. Some examples are outlined below:

- Value of the existing infrastructure being transferred
- Responsibility for outstanding debt (if any)
- Benefit to the rate paying customers being transferred
- Cost of the additional facilities and how costs are recovered

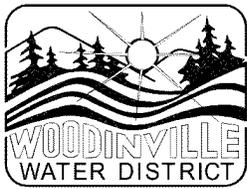
These issues cannot be resolved within a General Sewer Plan; however, the Plan can identify which service areas may be appropriate for a more complete evaluation and negotiation. Most of the areas within WWD's SSA that are served by adjacent agencies contain provisions within the inter-local agreement providing for the facilities to be reverted to WWD once the District has the means to serve the area.

5.5.A STUDY AREA A

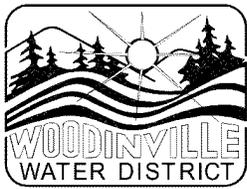
As shown in **Figure 5-5a**, Study Area A lies within the District boundary, revised SSA and is between 132nd Ave NE and 136th Ave NE on the east and west, respectively, and NE 129th St. on the south and NE 140th St. to the north. Topography and available sewer mains originally provided for Northshore Utility District (NUD) to serve. However, the WWD gravity system has expanded over the decades and specifically designed extensions that would allow for service to most of this area. Two short gravity extension will allow approximately 140 connections to be routed to WWD. These pipe extensions are proposed to the Capital Improvement Plan in Chapter 8.



(Page Intentionally Left Blank)



(Page Intentionally Left Blank)



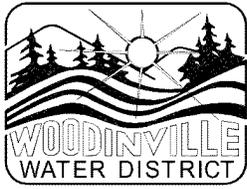
5.5.B STUDY AREA B (THE WEDGE)

As shown in **Figure 5-5b**, Study Area B lies within the District boundary, revised SSA and is between 132nd Ave NE and SR 522 on the east and south, and NE 195th St. on the north. The area west of 132nd Ave NE is served by the City of Bothell and has been removed from WWD's SSA. The area is challenged by the two adjacent depressions forming a small lake (north) and wetland (south) areas.

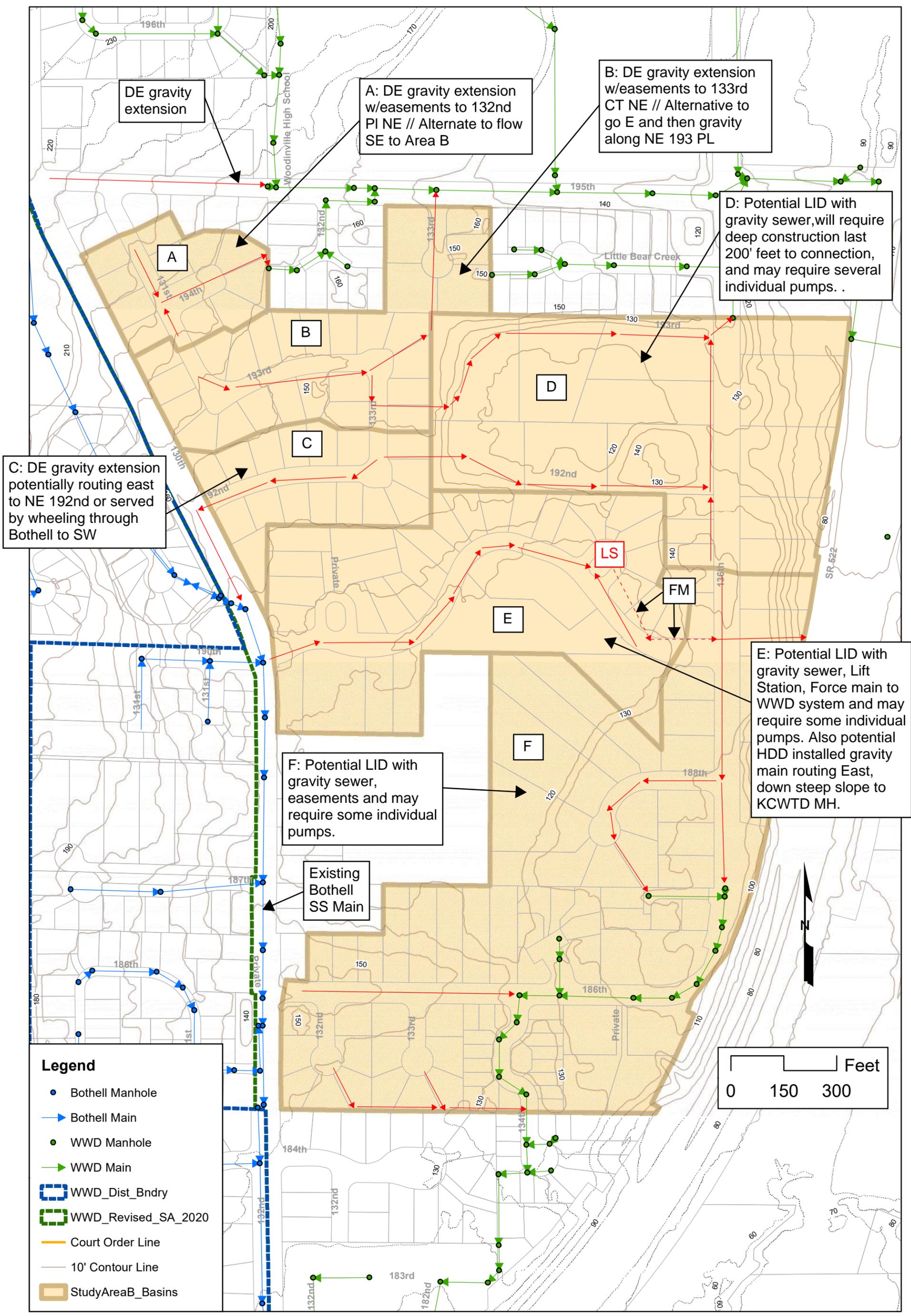
A review of these area shows that there are partial gravity solutions available depending upon the specific sub-basin being focused on.

- Sub-areas A and B have alternate routes NE to NE 195th St. Or could flow E to a gravity extension along NE 192nd St. Easements will be required.
- Sub-area C is positioned to either go to NE 192nd St or flow westerly to the City of Bothell main in 132nd Ave NE.
- Sub-area D can flow eastward by gravity and a deep connection to MH 1416. The area around the small lake is currently characterized by large lots and resulting low housing density. Some of the homes sited waterward of the shared driveway will likely still require individual pump to reach a gravity sewer located upslope. The gravity sewer mains projected here would provide the basis for the sewer service to the westward and upslope sub-areas A, B and C. There is a potential that this would be a good application of a Local Improvement District (LID) that could allocate the construction cost to the lots benefitting.
- Sub-area E is characterized by the relatively flat, low-lying area around the wetland. It is most likely that a lift station will be required to serve this area. An alternative to a Lift Station may be a deep Horizontal Directional Drill bore from the low point, heading easterly to existing manholes adjacent to SR522. There is a potential that this would be a good application of a Local Improvement District (LID) that could allocate the construction cost to the lots benefitting.
- Sub-area F appears to have sufficient slope to provide gravity sewer service to most lots, easements and individual pumps may be required.

All these potential projects are seen as stemming from (re)development and will not be added to the CIP.



(Page Intentionally Left Blank)



DE gravity extension

A: DE gravity extension w/easements to 132nd PI NE // Alternate to flow SE to Area B

B: DE gravity extension w/easements to 133rd CT NE // Alternative to go E and then gravity along NE 193 PL

D: Potential LID with gravity sewer, will require deep construction last 200' feet to connection, and may require several individual pumps. .

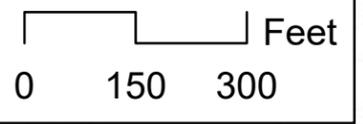
C: DE gravity extension potentially routing east to NE 192nd or served by wheeling through Bothell to SW

E: Potential LID with gravity sewer, Lift Station, Force main to WWD system and may require some individual pumps. Also potential HDD installed gravity main routing East, down steep slope to KCWTD MH.

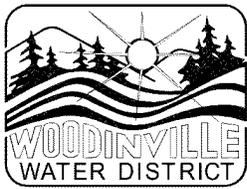
F: Potential LID with gravity sewer, easements and may require some individual pumps.

Existing Bothell SS Main

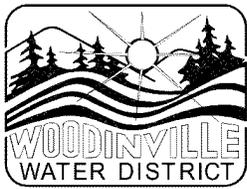
- Legend**
- Bothell Manhole
 - ➡ Bothell Main
 - WWD Manhole
 - ➡ WWD Main
 - ▭ WWD_Dist_Bndry
 - ▭ WWD_Revised_SA_2020
 - Court Order Line
 - 10' Contour Line
 - ▭ StudyAreaB_Basins



Study Area B
FIGURE 5-5b
 Comprehensive Sewer Plan



(Page Intentionally Left Blank)

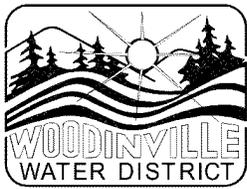


5.5.C STUDY AREA C (EASTERN UNSEWERED AREA)

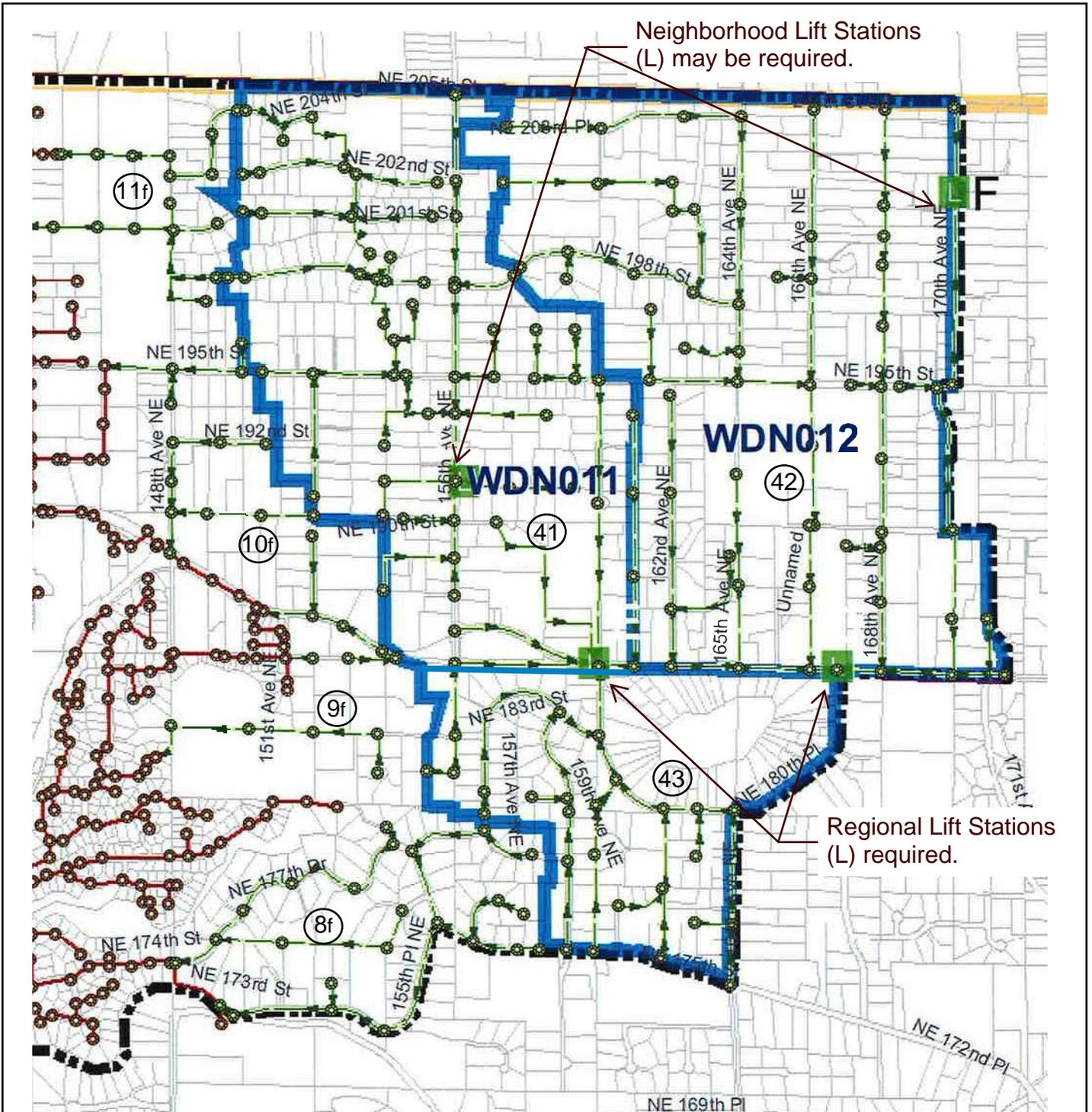
As shown in **Figure 5-5c**, Study Area C, the eastern unsewered area lies within the District boundary, revised SSA and is generally the NE portion of the SSA. The primary obstacles that have prevented sewer service from extending into this area are the topography, large parcels, and low population density. The basin is separated from the existing collection and King County transmission mains by a North/South ridge. The land in this area generally slopes E-SE towards Lake Leota. A concept review shows that is likely at least two (2) regional lift stations will be required and a very long discharge force main routing westerly (Woodinville-Duval Rd) over the ridge. The existing piping in Basin 10 does not have the capacity for the added force main discharge. The gravity portion of the discharge route will either require a parallel pipe or upsizing replacement of the existing pipe.

This area is further challenged by the sizing of the force main and lift station(s). The force main should be sized for the full development and the lift stations will be sized both to handle the incoming peak flow and maintain a minimum velocity of 3.5 feet per second in the force main. The challenge is that initially the flow will be relatively small compared to build out conditions. Possible solutions include installing two parallel pipes for the force main, of which only one will be initially used, the second being placed in service as the flows increase.

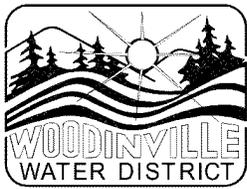
A detailed preliminary layout was prepared for the prior Sewer Plan (2007) and has been reproduced in Figure 5-5c.



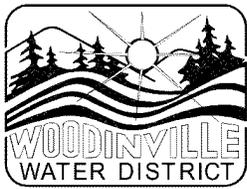
(Page Intentionally Left Blank)



Eastern SSA layout reproduced from 2007 Comprehensive Sewer plan. Current basin identifiers (42) and descriptive notes have been added.



(Page Intentionally Left Blank)



5.6 SEISMIC RESILIENCY

Wastewater collection systems are at risk of damage during a seismic event. Current design practices and building codes mitigate for the above grade facilities, but do not specifically address in ground piping. There are several risks to be considered, including broken pipes, separated pipe joints and “floated” manholes. All of which can lead to service outages, potential sewage spills and extensive repairs.

There are different ground motions occurring during a seismic event and different soil types will respond in different ways. Ground movement in a slip plane or fault is likely to shear the pipe, rolling ground movement may separate joints and sandy/silty soils are subject to liquefaction which could allow for pipes and manholes to “float” out of position.

In the past decade there have been strategies emerging to mitigate some of the risk around seismic events, including:

- Using gasketed pipe with deeper bells to allow for more lateral movement before failure.
- Using restrained joint pipe to counter joints pulling apart.
- Using fused HDPE pipe to eliminate joints and increase flexibility before failure.

Each strategy addresses some of the risk from a seismic event but also can have some undesirable impacts:

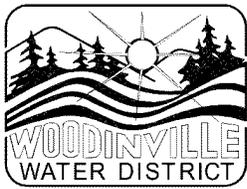
- Stronger, restrained joint pipe will increase construction costs.
- Fused flexible pipe is more likely to have sags, following any ground movement, which can lead to blockages.
- Structure connections must be redesigned to preserve the benefit of improved joints.

The District has recognized this challenge and is planning to authorize a detailed study of the risk and potential mitigations beginning in the fall of 2022. Allowances have been incorporated into the Capital Improvement Plan (see Chapter 8) to provide for initial budgeting for new work that may be identified.

5.7 TECHNICAL ALTERNATIVES

5.7.A WATER CONSERVATION

The District has been a regional leader in the establishment of water conservation measures. Together with King County and the Department of Health, the District promotes water conservation and works with Seattle Public Utilities to help develop the Regional Conservation Program.



Average water consumption has been reduced through the District's water conservation program. The decline in water consumption should be reflected in reduced wastewater pumping costs. Sizing of wastewater facilities will, however, not be significantly affected by water conservation because wastewater facilities are sized based on peak wastewater flow rates (including infiltration and inflow) that occur in the winter, whereas reductions in water use as a result of conservation are most significant in the summer when highest water demands occur due to irrigation.

5.7.B RECLAIMED WATER

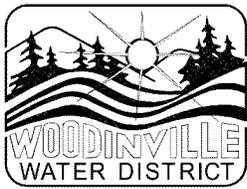
Wastewater recycling and reuse is an alternative for reducing water demands, particularly irrigation demands. Industrial and fire protection uses are also a possibility. The King County Brightwater wastewater treatment facility receives flow from the WWD and can produce Class A reclaimed wastewater. The District is solely a collection agency and has no apparent authority over whether this water is produced or not. The District may install infrastructure for reclaimed water, if desired and as approved by agencies having jurisdiction. However, a cost-benefit analysis was not within the scope of this report. Any use of reclaimed water is not expected to have a significant impact on the sewer collection system.

5.7.C ALTERNATIVE COLLECTION SYSTEMS

The District currently has a conventional gravity sewer collection system to serve the entire service area supplemented by three (3) District-owned and operated lift stations. Gravity sewer collection systems typically require the lowest level of operation and maintenance when installed correctly. Alternative collection systems may include individual grinder pumps, Septic Tank Effluent Pumping (STEP) systems and vacuum piping systems. These systems often offer a lower initial install cost, but come with a much higher life-cycle cost.

The District does allow for individual homes to utilize a privately owned grinder pump system to discharge to a District owned gravity main, when conditions warrant. The STEP system for an individual home could also be similarly connected. What is not allowed is for pumped discharge systems to share a common force main (discharge pipe). The Dept. of Ecology requires that if a shared force main is used, then each of the individual pumps should be owned and maintained by the District. This would move the operations and maintenance cost for all of the individual pumps from the respective home owners to the District. In most cases a single community lift station would have provided more efficient service and be more equitable to other rate payers.

Grinder Pump Systems An individual grinder pump station could be provided for each home, with electric power provided by the house electric panel. The pump would



discharge through a 1-1/2 inch lateral into a common gravity system in the public right-of-way. Grinder pumps typically experience more rapid wear with a useful life range of approximately 6-16 years before replacement is needed. This is highly variable on many factors not easily predictable. The advantages of a grinder pump system include:

- The ability to get sewer service to isolated or low elevation (relative to gravity sewer mains) locations
- Smaller collection system piping has lower capital costs
- Can be used with conventional gravity sewers
- Can accommodate large elevation differences and long distances
- Some system costs (pump chamber, pump, and controls) are borne by the property owner

Disadvantages of a grinder pump system include:

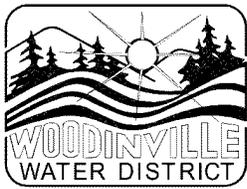
- Sizeable structure remains on the property
- Higher maintenance costs (borne by property owner)
- Extended power outages can cause plumbing backups

The District would consider individual grinder pumps to serve specific lots too low in elevation for a gravity sewer connection if the pump discharges into a standard side sewer connection, which then flows by gravity into the District sewer main. Individual grinder pump feasibility will be reviewed on a case by case basis.

WWD should not consider individual grinder or shared grinder systems that utilize a shared force main, as this type of configuration forces the District into becoming responsible for each pump and discharge line.

Septic Tank Effluent Pump (STEP) System Wastewater from each service is discharged into a conventional-type septic tank, where the solids settle out and are retained in the tank. The tank has to be periodically pumped out (vactored) to remove the solids build up. A screened effluent pump mounted in the septic tank discharges through a small diameter lateral to the sewer force main in the street. Electric power for the pump is provided by the residential service panel with the costs borne by the property owner. The sewer main in the street is typically 3 to 4 inches in diameter. All piping is installed with the minimum cover needed for adequate protection. The advantages of a STEP system include the following:

- Smaller sewage collection piping has lower capital costs
- Solids removal occurs in the septic tank
- Can be used with conventional gravity sewers
- Some system costs (septic tank, pump, and controls) are borne by the property owner
- Can accommodate large elevation differences and long distances



Disadvantages of a STEP system include:

- Sizeable structure remains on the property
- Extended power outages can cause plumbing backups
- Removal of solids from the septic tanks must occur periodically
- Failure of a check valve could result in a sewage spill and resulting damages on private property.

As the system would use a shared discharge force main, all of the individual pumps and controls would need to be owned and operated by the District. Currently, the District does not allow for shared force mains due to the added costs and risks involved.

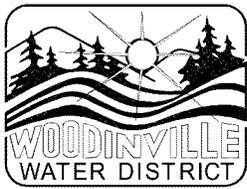
Vacuum systems are described below. There are few of these systems installed in the U.S. primarily due to the reliance on mechanical components and proprietary suppliers. Vacuum systems have a high operating cost and would require additional staff training in their operation and maintenance. Vacuum systems are not conducive to expanding collection systems.

Vacuum Sewers Vacuum sewers rely on a central vacuum pump station to constantly maintain below atmospheric pressure in small diameter manifold piping. Atmospheric pressure is separated from the vacuum in the manifold by a vacuum interface valve. The gravity vacuum valve is typically in a sump serving about two homes. When the sump fills with sewage, hydrostatic pressure trips the interface valve open, and air pressure forces the sewage into the manifold and down the pipe to a central collection tank. The valve closes after a preset duration of time.

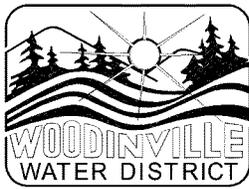
Sewage is propelled into the main at a high velocity due to the differential pressure of vacuum in the main and the higher atmospheric pressure behind the slug. Friction will eventually slow the sewage down and the sewage will flow to the lowest local elevation by gravity. The identical action will occur the next time the valve opens; the air rushing across the initial slug will lift that slug and force it further down the system. The initial slug will arrive at the central vacuum source after a number of valve openings. A transfer pump will deliver the accumulated storage to the treatment location once a sufficient volume accumulates in the collection tank at the central vacuum source. The advantages of a vacuum system include:

- Smaller sewage collection piping has lower capital costs
- Shallow trenches have minimal impacts to pavement during construction
- Some elevation differences can be overcome
- System is reliable during power outages because central station has a generator

Disadvantages of a vacuum system include:



- Central vacuum station is a significant capital cost for modest systems
- Mechanically complex system that requires a higher level of maintenance than gravity systems.
- All homes must connect into the system
- Ability to accommodate elevation differences is limited
- All services must be reasonably close to the central vacuum station



CHAPTER 6 – OPERATIONS AND MAINTENANCE PROGRAM

6.1 DISTRICT MANAGEMENT AND PERSONNEL

The District is composed of approximately thirty-six (36) full time positions, which are organized into distinct departments including General Administration, Finance, Engineering, Operations, and IT/GIS. The managers in each department report to the General Manager who is responsible for the overall management of the utility. The General Manager reports directly to the Board of Commissioners. The staffing requirements in the District could change as the number of customers increases, in response to new regulations, or to address other business needs.

6.1.A Organization

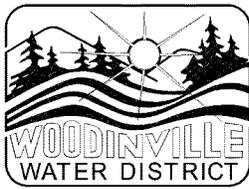
Figure 6-1 outlines the District staff and organization structure.

The General Administration department is led by the Administrative Services & Communications Manager. The department is responsible for providing administrative support to the commissioners, District departments, organizing staff training, human resources, employee hiring, maintaining District website, public records, public information, emergency preparedness and safety, records management, claims administration, and conservation. The Safety Officer provides safety training for all staff and leads the weekly safety meeting for the Operations crew.

The Operations department is led by the Operations & Maintenance Manager. The department is primarily responsible for operation and maintenance of the lift stations and force mains, including the gravity sewers and manholes.

The IT/GIS department is led by the IT Manager. The IT/GIS staff are responsible for the implementation, maintenance and support of all communications, network hardware, computer and telephone equipment, data storage and backup, physical security and cyber security initiatives, software, and services. The IT/GIS staff implement and manage all desktop and mobile mapping services used by other departments to support their daily functions. The Information Systems Supervisor is in the early stages of implementing an Asset Manager program.

The Engineering department is led by the District Engineer. This department is responsible for the design, design review, and inspection of new utility infrastructure and for development and management of all Capital Improvement projects. The engineering staff splits their time between the water and sewer systems. The rate of growth affects engineering staff requirements, as growth typically translates to the installation of new projects requiring engineering review



and construction inspection. Outside consultants are utilized for review and management of developer extension projects.

The Finance department is led by the Finance Manager. The department is responsible for payroll, employee benefits, customer service, billing, collection, accounts payable, and budget formulation.

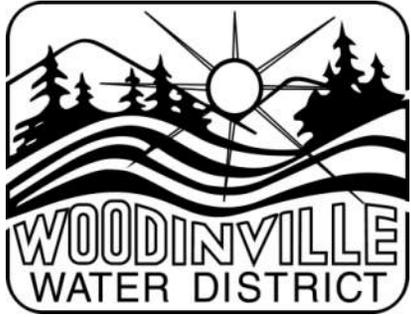
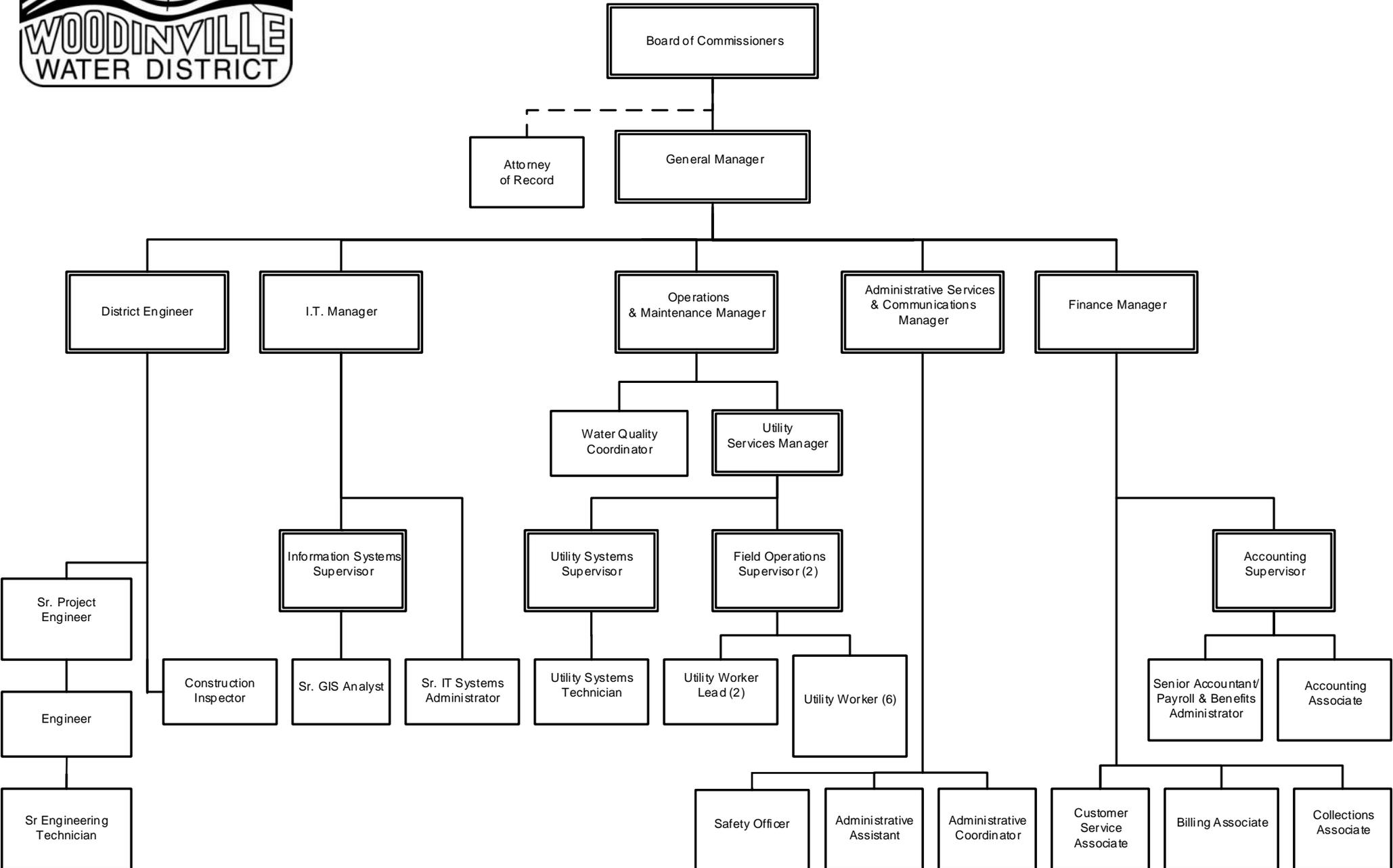
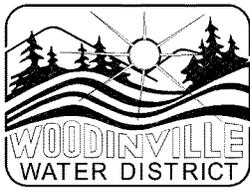
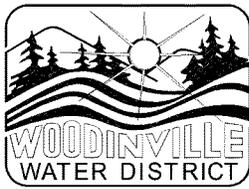


Figure 6.1 - Organization Chart
Woodinville Water District





(Page Intentionally Left Blank)



6.1.B Certification and Training

The District encourages its employees to obtain certification and training for skills relevant to operating and maintaining the sewer system. All operations staff must, at minimum, have the following:

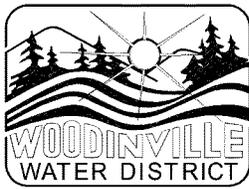
- A high school diploma or GED.
- A valid driver's license (a Commercial Driver's License may be required to operate some of the larger vehicles).
- Field staff must be
 - Certified for confined space entry (CSE),
 - NASSCO's Pipeline Assessment Certification Program (PACP).
 - Lateral Assessment Certification Program (LACP).
 - Manhole Assessment Certification Program (MACP).

The only certification recommended by the District for wastewater maintenance is State of Washington Wastewater Collection System Operator (WWCS) 1 certification.

The District provides employees with opportunities for training and certification relative to their position function. Each staff member annually receives approximately 24 hours training. Depending on the employee's function, training may include safety, confined space entry, record keeping, pump station electrical and instrumentation, pump station operation, public relations, vector truck operations and routine line maintenance, traffic control, emergency rescue procedures and sanitary sewer overflow (SSO)/emergency response. Training is provided in varying mixes of the following categories:

- Manufacturer training by various equipment suppliers and representatives
- On-the-job training in the field, the shop, or in the office
- In-house classroom training
- Industry-wide training at conferences and seminars away from the District

As an investment in development of its employees, the District pays for annual certification fees, for employee time and tuition for certification training courses and certification testing. The District also provides staff opportunities to continue their education necessary to maintain certification. Professional growth requirements for certification are met through continuing education units (CEU) that are recorded and maintained by the District. Time sheets are also coded to identify and track employee training hours. Water certified District personnel are required to obtain a minimum of three CEUs in each three-year renewal cycle.



6.2 ASSET MANAGEMENT

6.2.A Overview of Requirements

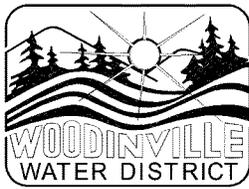
The largest and most valuable asset of the District is the utility infrastructure. The value of these assets may figure significantly in determining the rating of bonds for which the District qualifies. Prolonging the value of these assets by cost-effective annual maintenance, and thereby extending their service life, is one of the primary objectives of maintenance programs. The initial modern standardized framework for such a program was called Capacity, Management, Operations, and Maintenance (CMOM) and was promoted by the EPA. The initial maintenance actions performed by the District after CMOM was promoted by the EPA had aspects of the CMOM program. Asset Management is an improvement on CMOM and it represents the new goal for the District to achieve.

Wastewater system assets include pipes, manholes, lift stations and stationary equipment. An asset management program seeks to maximize the cost-effective utilization of these assets over their lifetime. Important parameters to an asset management plan are the Levels Of Service (LOS) and performance goals achieved over an extended period. Target levels of service are established relative to maintenance and operations and compared with actual levels of service to measure performance and adjust operating or maintenance activities. The five key components of an asset management plan include:

- Facilities inventory
- Condition assessment
- Asset valuation
- Operations, maintenance, repair, and replacement management
- Analysis and evaluation

The District is laying the groundwork in preparation for an Asset Management Program (“Program”). The District is following the Environmental Protection Agency’s (EPA) Best Practices Guide (see Appendix G) for assistance in establishing this Program and a future Asset Management Plan. The District has complete horizontal feature data sets of the sewer system in the Enterprise GIS, available on mobile devices and desktops. The plan for tracking maintenance, repair and/or replacement information for vertical sewer system assets will be addressed during Computerized Maintenance Management System (CMMS) implementation.

The District is using ITPipes Cloud based sewer line video inspection software to assist in establishing baseline condition scoring for each sewer pipe. The District has adopted the NASSCO (National Association of Sewer Service Companies) standards for pipe and manhole condition scoring. Staff are using the PACP v7 pipe template, which is a standard form used nationwide. Staff assigned to this



project have been PACP (Pipe), MACP (Manhole) and LAPC (Lateral) trained and certified. District GIS staff developed a Manhole Condition Assessment form which follows the NASSCO standards and will be used for baseline condition scoring of each manhole in the system. The condition and inspection data for both pipes and manholes will be migrated to a CMMS once the District completes the RFP process, and a vendor is selected.

6.2.B Implementation of an Asset Management Plan

The District is committed to following the EPA's Asset Management Best Practices Guide (see Appendix G). Asset management is typically implemented by answering the following five questions that reflect the five components mentioned above:

- What does the District own?
- Where is it located?
- What is its condition?
- What is its remaining service life?
- What is its value?

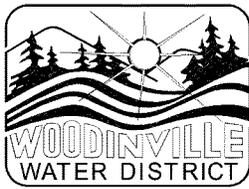
One of the key goals of a CMMS is to identify, prioritize and budget for future work. Knowing what future costs are anticipated allows for the charge rates to be balanced and provide a uniform series of steps, rather than sudden increases followed by held rates. Uniform rate increases are typically better received by the rate payers and a functioning CMMS system will aid in developing those rates.

6.2.C Program Goals

The mission of the Operations Department for the sewer system is to guard the health, safety, and welfare of the public by operating and maintaining the system in accordance with applicable codes, policies, and laws established by the County, State and Federal governments. The CMOM program was one tool utilized by the District to help achieve the goals and now the Asset Management program has replaced CMOM as the program goal.

Five (5) service standards have been established by the District to direct and measure the fulfillment of this mission, with the following affecting sewer operations:

- Flush and clean commercial and downtown sewer system piping twice every year
- Flush and clean the remainder of the sewer system piping on a five-year cycle
- Perform sewer locates within 48 hours of notification request



- Inspect sewer lift stations three times each week
- Perform annual inspections of all sewer easements to insure access for maintenance crews

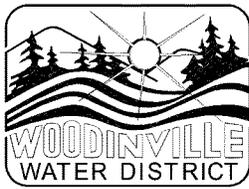
6.2.D Maintenance Management

The District has been using ArcGIS Online mapping and application services on mobile devices for routine asset inspection and data collection for many years, likely initiated as part of CMOM. The District implemented an on-premises ArcGIS Enterprise system in 2020, and the immediate goal is to rebuild the inspection and data collection maps, forms and dashboards used by field and office staff in ArcGIS Enterprise. Once this is accomplished, there will be one centralized SQL database for GIS feature data and maintenance records, putting the District in a much better position for Computerized Maintenance Management System (CMMS) implementation and integration, development of an Asset Management Plan and integration with other District information systems.

Work orders and service orders generated for repair or replacement of assets from the current financial system have no direct link with the assets in the GIS database. There is no mobile application for field crews to use when dispatched to do repair or replacement work via the current work order system. Labor, materials, and equipment are manually tracked and entered into the work order system at the office when the work is completed. The costs associated with the work on an individual asset cannot be easily accessed. All timesheet tasks are coded and relate to specific projects or categories of expenditure associated with line items in the District budget. The District is in the process of transitioning to a new management software system that provides improved features that will enable mobile access and integration with other District systems, such as GIS and CMMS.

Implementing a financial system and CMMS with direct links to the District's GIS will allow service and work order requests to be linked to specific assets. Integration with the financial system will also give the District the ability to evaluate and identify trends in repair or replacement costs and plan for future budgets.

Customer Service Customer Service requests are currently received through telephone calls to the Customer Support Specialist and referred to the Operations department. Typically, less than ten emergency calls are received each year, usually during the rainy winter months. In addition, the District receives a variable number of requests and non-emergency calls daily. The calls are presently being logged in Munis (software logging/tracking application). Munis is being replaced by a newer government/municipality management system in 2022 known as Caselle (software logging/tracking application).



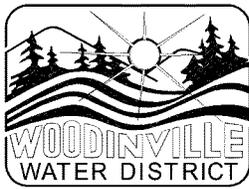
The Supervisor then determines the type of service being requested, creates a Service Order, and the data is entered into the service order database for tracking and storage. Likewise, equipment and system maintenance needs identified by field crews are reported to the Supervisor for initiation of a service order. Following is a summary of key information collected on the Service Order form:

- Customer identity—name, address, and telephone number
- Date of request
- Job number
- Description of work needed
- Itemized list of equipment, tools, materials, and labor used on the repair
- Date of Completion and means by which the customer was notified of the action.

6.3 ACTIVITIES TO MEET STANDARDS

Sewer system operations and maintenance (O&M) tasks are outlined in the *Weekly Workload Schedule* provided to the field crews each week by the Supervisor. In addition to routine monthly tasks, the weekly workload schedule includes specific tasks that have been identified through customer service requests, field inspections, equipment testing, or carried over from previous weeks. Routine duties include cleaning and inspection of sewer mains, manhole inspections, clearing easements, rat control, inspecting and testing lift stations and backup generators. A summary of key O&M activities with service standard goals as presented in Table 6-1.

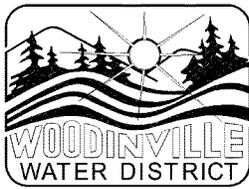
Table 6-1: Routine Operation & Maintenance	
Activity	Service Standard
Mainline Cleaning	Variable
Mainline Television Inspection	Up to 40,000 feet per year
Mainline Repairs	Within 30 days
Manhole Inspections	Variable
Manhole Adjustment & Repairs	As Needed
Easement Inspection & Clearing	Annually
Installed Cleanouts	As Needed
Customer Service Emergencies	Within 4 hrs.
Customer Service Problem Call	Within 48 hours
Lift Station Emergency Response	Within 2 hours
Lift Station Routine Inspect	3 times per week



6.4 DESIGN AND PERFORMANCE PROVISIONS

The District’s sewer system is designed to operate automatically with little day-to-day supervision. Routing operating, monitoring, record-keeping, and maintenance procedures have been established by the District to ensure safe, efficient, continuous operation of the sewer system. Provisions to design and measure performance towards achieving the goals identified above are outlined in Table 6-2:

Table 6-2: Performance Audit Outline	
Operations and Maintenance	Administration
Maintenance Scheduling	Financial
Sewer Cleaning	<ul style="list-style-type: none"> ▪ User Rates & User Charges ▪ Public Education & Outreach
Pump Stations	Personnel
<ul style="list-style-type: none"> ▪ Operation 	<ul style="list-style-type: none"> ▪ Organization
<ul style="list-style-type: none"> ▪ Emergency Response Plan 	<ul style="list-style-type: none"> ▪ Job Descriptions
<ul style="list-style-type: none"> ▪ Alarms & Monitoring 	<ul style="list-style-type: none"> ▪ Operator Safety
<ul style="list-style-type: none"> ▪ Inspection 	Equipment and Tools
<ul style="list-style-type: none"> ▪ Preventive & Routine Maintenance 	Legal – Sewer Use Resolution
<ul style="list-style-type: none"> ▪ Force Mains 	Engineering
Sewer System Evaluation	<ul style="list-style-type: none"> ▪ Development Review
<ul style="list-style-type: none"> ▪ Flow Monitoring 	<ul style="list-style-type: none"> ▪ Design Standards
<ul style="list-style-type: none"> ▪ Manhole Inspection 	<ul style="list-style-type: none"> ▪ Construction Inspection
<ul style="list-style-type: none"> ▪ Sewer Cleaning 	<ul style="list-style-type: none"> ▪ Sewer Evaluation & Rehabilitation
<ul style="list-style-type: none"> ▪ Internal Television Inspection 	Graphical Information Systems
<ul style="list-style-type: none"> ▪ Dye Testing 	<ul style="list-style-type: none"> • System Mapping
<ul style="list-style-type: none"> • Water Quality Monitoring 	Management Information Systems
Rehabilitation	Complaints
<ul style="list-style-type: none"> ▪ Mainline Repairs 	Public Relations
<ul style="list-style-type: none"> ▪ Manhole Repairs 	Emergency Maintenance & Contingency Plan
<ul style="list-style-type: none"> ▪ Service Laterals 	Spare Parts Inventory Management



6.5 MONITORING PROGRAM

Water Quality – The District is obligated by agreement with King County to have pretreatment requirements. Permits for specific industrial customers are issued by King County and administered by the County. The District does not conduct routine water quality monitoring of its wastewater. Aside from a few significant industrial users and some restaurants; the wastewater is essentially domestic in character.

Sanitary Sewer Overflows (SSO) – A component of the Operations is the management of combined sewer overflows (CSO's) and sanitary sewer overflows (SSO's). The District operates a separated sewer system and has no CSO's. An SSO occurs only rarely and usually due to a blockage in the sewer collection pipe system. When discovered, these are managed as an emergency event and reported as required by regulations.

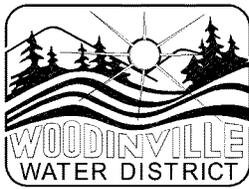
Flow Monitoring – The District does not currently have equipment for temporary monitoring of gravity flow. In the past, WWD has partnered with King County or contracted services to monitor flows when needed. In conjunction with this plan, WWD had a vendor monitor the ten largest sewage collection basins during both wet and dry periods, see Chapter 4 for more information. The District is evaluating purchasing a portable flow meter to assist with operations trouble shooting and to support the CBD-CIC policy implementation.

Fats, Oils and Grease (FOG) – The program is intended to monitor, identify sources, and reduce FOG in the sewer collection system. FOG congeals in the cooler wastewater flows and can form blockages that may result in SSO. These are often prevalent in flows from commercial food preparation and service locations where grease traps are poorly maintained or missing. Much of the program involves educating the FOG contributors to the problems they are creating.

6.6 STAFFING PROJECTIONS

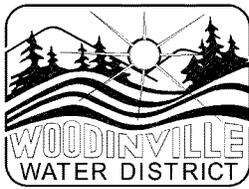
The District employed 36 persons (full time equivalence) in 2021. The District's Campus Conditional Use Permit was amended in 2021 to allow up to 45 full time employees. As customer growth continues; additional staffing will be required.

Future staffing needs for the sewer utility will be driven largely by the development of new facilities requiring operator and maintenance attention, such as lift stations or new regulations. Development is dependent on market conditions, of course.



- 6.7 EMERGENCY RESPONSE – Refer to the latest version of the Woodinville Water District Emergency Response Program. (December 2021) (on file at District Office)**

- 6.8 SAFETY PROCEDURES – Refer to the Woodinville Water District Safety Program Manual. (on file at District Office)**



CHAPTER 7 – DISTRICT STANDARDS

7.1 PERFORMANCE AND DESIGN CRITERIA

Sewer System Design Criteria and standards have been developed and periodically updated to maintain a consistent minimum level of service throughout the District. These criteria and standards facilitate planning, design, and construction of sewer system projects to achieve a predictable level of quality.

The District provides a copy of the latest **Standard Specifications for Developer Extensions** on their public website: <https://www.woodinvillewater.com/216/Standard-Specifications>. A listing of all standards, with current links, is provided at the end of this chapter.

The following is a partial list of criteria which affect sizing and siting of facilities. A detailed listing of design requirements for sewer systems is available in the “Criteria for Sewage Works Design,” prepared by the Washington State Department of Ecology, as revised December 1998. Additional information has been adopted by the District on specific design criteria, which is shown in the **Standard Specifications for Developer Extensions**. The District requires that all design be performed by a Professional Engineer currently licensed in the State of Washington.

7.1.A Gravity Sewers

The following are specifics developed for existing pipe design based on the “Criteria for Sewage Works Design” and the “Standard Sewer Specifications of the Woodinville Water District, whichever are more stringent. Future pipe capacities are developed from flows generated by flow simulation by the model, and future pipes are sized according to this flow simulation.

- Sewer mains shall be designed to accept the maximum hourly wet weather flow; minimum peak design flow is 400 percent of the average annual flow for laterals and 250 percent of the average annual flow for interceptors/trunks.
- Minimum sewer main diameter shall be 8 inches.
- Slopes shall maintain a mean minimum velocity of 2.0 ft/sec when flowing full. Minimum slopes are shown in **Table 7-1**, although greater slopes are desirable.

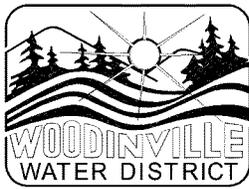
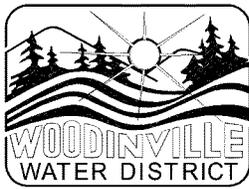


Table 7-1 Minimum Pipe Slope Criteria for Sewer Mains	
Sewer Size (inches)	Minimum Slope (feet/100 feet)
8	0.40
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06
36	0.05

- Polyvinyl chloride sewer pipe meeting the requirements of ASTM D3034 for SDR-35 wall thickness may be used in sizes up to 12 inches. Class 52 minimum ductile iron pipe rated for sewer use shall be used in locations where depth of cover exceeds 15 feet, for all installations of pipe 14 inches or greater in diameter, and for force mains.
A minimum horizontal separation of 10 feet shall be maintained between sewers and existing potable water lines, wherever possible. Smaller separations may be allowed per Section C1-9 of the “Criteria for Sewage Works.”
- Sewer mains shall have a depth of 8 feet when located in the right-of-way.

7.1.B Laterals and Side Sewers

- (Residential) Lateral sewers from the sewer main to the property line shall be 6-inch minimum diameter and shall be connected to the sewer main with a formed tee or saddle. The minimum depth at the property line is five (5) feet below the floor to be served or six (6) feet below the street, whichever is greater.
- (Commercial) Lateral side sewers shall connect to the sewer main at a manhole. The minimum depth at the property line is five (5) feet below the floor to be served or six (6) feet below the street, whichever is greater.
- A cleanout or inspection tee for each sewer lateral shall be provided at the property line to facilitate testing and maintenance.
- Side sewers from the right-of-way or easement property line to the building plumbing shall be a minimum of 4-inches in diameter, with cleanouts provided at every change in direction, and every 100 feet.



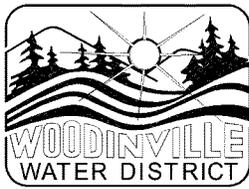
- Minimum side sewer depth of cover is 3 feet. The sewer shall be sufficiently deep to prevent freezing and physical damage and to allow the sewer to receive sewage from adjacent service connections by gravity.
- Maximum length of side sewers shall not exceed 150 feet.

7.1.C Manholes

- Manholes are required at the end of each sewer main to facilitate maintenance and future extensions.
- Manholes are required at every change in grade, pipe size, or alignment; at all sewer main intersections; and at a maximum spacing of 400 feet.
- Minimum manhole diameter is 48 inches, and manholes shall be at least 5 feet deep to the pipe invert with 0.1 of gradient fall through the manhole channel.
- Watertight manhole covers will be used, and not more than three adjustment rings shall be used to bring the manhole rim to street grade. Jointed manholes (bricks or cement blocks) will not be allowed. Pipe connections to manholes shall use flexible joints to help maintain water tightness upon settlement.
- Drop manholes shall only use external drops in manholes of 48-inch diameter unless internal drops are approved by the District Engineer.
- Manholes placed in areas of high ground water shall use “Rapid Seal” or other District approved means to prevent infiltration.

7.1.D Lift Stations

- Lift station siting should consider the impacts of noise, odor, vehicle access, and aesthetics, wherever possible. Sites should be selected to allow for future expansion as necessary. Flood protection shall be provided.
- Lift stations shall contain a minimum of two pumps, each capable of handling the expected maximum flow (minimum required is 250 percent of the average annual design flow). Where three or more pumps are used, the station must be able to pump the maximum flow with any one pump out of service.
- Variable speed pumps will be used where appropriate, to reduce the pump starts and stops, thus producing smoother flow patterns and minimizing the stagnant time delays that may produce septic conditions in the wet well.
- Pump suction and discharge openings shall be at least 4 inches in diameter.
- A sewage flowmeter (a minimum of a totalizer) shall be provided on all new pumping facilities.
- Emergency power shall be provided that, alone or combined with storage, will prevent overflows from occurring during any outage. The storage component, if required, shall be based on 2 days of projected flows.
- An alarm and telemetry system shall be provided for all sewage lift stations and integrated into the District’s SCADA system by the District’s selected vendor.
- Individual site pumps (grinder pumps) shall only be used where approved by the District and shall be owned and maintained by the property owner.



7.1.E Force Mains

- Minimum force main diameter is 4 inches for solids handling pumps. Smaller diameters are acceptable for grinder pumps or Septic Tank Effluent Pump (STEP) systems.
- At pumping capacity, velocities between 3.5 ft/sec and 8 ft/sec shall be maintained.
- Pipe material shall be sewer rated ductile iron, HDPE or as approved by the District Engineer.

7.1.F Inverted Siphons

- Inverted siphons shall not have less than two barrels with a minimum diameter of 6 inches.
- Appurtenances necessary for convenient flushing and maintenance shall be provided.
- Average flow velocities of at least 3.5 ft/sec shall be provided.
- A rock catcher and coarse screen shall be provided to prevent plugging.
- Facilities shall be provided to allow normal flow to be diverted from either barrel for cleaning or maintenance.

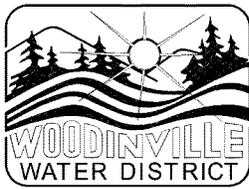
7.1.G Easements

- Minimum width of sewer easements is 20 feet but shall never be less than twice the depth of the sewer main.
- Joint utility easements (water and sewer) shall be a minimum of 25 feet. Larger easements shall be required if the depth of the sewer main exceeds 10 feet.

7.2 POLICIES AND REQUIREMENTS FOR DEVELOPERS

The District has developed a set of policies and procedures that provide a common basis for administering and extending the sewer system. These guidelines have progressed in response to the increased need for sewer service in response to developments and population growth and the continual updates to the land use regulations set forth by King County and the City of Woodinville for the sanitary service area. In general, the developer is required to extend the sewer collection system from the existing system, through the developer's project (development) to allow the further extension of the collection system.

The District's overall policy is that "Development pays for development", meaning that the developer (property owner) is responsible for all fees and charges related to extending sewer service to serve the property in question. The District may contribute



under specific situations that benefit the current rate payers such as pipe upsizing or additional placement depth for future needs.

The policies include the Developer Extension Agreement, the Standard Specifications and Details and related forms that are all available through the District's website: <https://www.woodinvillewater.com/157/Developer-Extension-Process> which further describes the process.

Development is responsible for the cost of increasing capacity within the existing collection system whenever their project will require capacity that exceeds what is currently allocated. For a more efficient means of construction sequencing, the District has adopted the Central Business District – Capacity Improvements Charge (CBD-CIC) policy that allows developers to pay for their off-site impacts and the District to construct capacity increasing (parallel or upsized pipes) projects in the order that is most beneficial.

7.3 STANDARD SPECIFICATIONS AND DETAILS

The following is a listing of the current specifications and standard details:

2020 Standard Specifications and Details

Resolution Number 3982 authorizes the updated Standard Specifications for all new Water and Sewer Developer Extensions submitted after April 20, 2021

Water and Sewer General Provisions

- [003- WATER AND SEWER-GENERAL PROVISIONS](#)

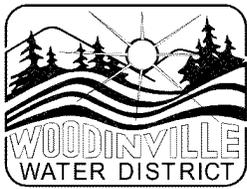
Sewer Standard Documents

- [Sewer Specifications - Construction \(PDF\)](#)
- [Sewer Specifications - Materials \(PDF\)](#)

Sewer Standard Details

- [GENERAL SEWER NOTES](#)
- [WWD STD SEW 1 Connection to Existing Manhole \(PDF\)](#)
- [WWD STD SEW 2 Standard Manhole Detail \(PDF\)](#)
- [WWD STD SEW 3 Saddle Manhole Detail \(PDF\)](#)
- [WWD STD SEW 4 Alternate Saddle Manhole Detail \(PDF\)](#)
- [WWD STD SEW 5 Shallow Manhole Detail \(PDF\)](#)
- [WWD STD SEW 5A Deep Manhole Detail Depths Greater Than 20-Foot \(PDF\)](#)
- [WWD STD SEW 6 Outside Drop Manhole Installation \(PDF\)](#)
- [WWD STD SEW 7 Inside Drop Manhole Detail \(PDF\)](#)
- [WWD STD SEW 8 Typical Longitudinal Trench Section \(PDF\)](#)
- [WWD STD SEW 8A Typical Transverse Trench Section \(PDF\)](#)
- [WWD STD SEW 9 Typical Trench Section in Easement Areas \(PDF\)](#)
- [WWD STD SEW 10 Trench Restoration \(PDF\)](#)
- [WWD STD SEW 11 Trench Dams \(PDF\)](#)
- [WWD STD SEW 12 Concrete Anchor for Sewer Mains in Steep Slopes \(PDF\)](#)

- [WWD STD SEW 13 Casing Details and Requirements \(PDF\)](#)
- [WWD STD SEW 14 Sewer Clean out Detail \(PDF\)](#)
- [WWD STD SEW 15 Standard Side Sewer Installation \(PDF\)](#)
- [WWD STD SEW 16 \(FLAT TOP MH\)](#)
- [WWD STD SEW 17 Side Sewer Installation on Existing Main \(PDF\)](#)
- [WWD STD SEW 18 Step and Ladder Details \(PDF\)](#)
- [WWD STD SEW 19 Channel and Ladder Location Details \(PDF\)](#)
- [WWD STD SEW 20 Watertight Manhole Casting and Frame \(PDF\)](#)
- [WWD STD SEW 21 Manhole Collar Detail \(PDF\)](#)
- [WWD STD SEW 22 Manhole Casting Adjustment in Asphalt Overlay \(PDF\)](#)
- [WWD STD SEW 23 Operations and Maintenance Vector Access Road \(PDF\)](#)
- [WWD STD SEW 24 Private Side Sewer Installation Requirements \(PDF\)](#)
- [WWD STD SEW 25 Private Side Sewer as Built Requirements \(PDF\)](#)



CHAPTER 8 – CAPITAL IMPROVEMENT PLAN

This Chapter builds on the system evaluation presented in Chapter 5 to organize, prioritize, and prepare preliminary (planning level) cost estimates for necessary sewer system improvements. The listed improvements are presented based on their underlying source:

- Operations based, known, condition assessment
- System Analysis routing evaluations
- Hydraulic Model based, capacity deficiencies

Figures 8-1a and 8-1b provides an overview of all Capital Improvement Plan (CIP) project locations and extents, more detailed figures are provided for sequential trunk line improvements in Basins 3, 8, and 9. Projects are designated with a “C-“ followed by a number for unique identification and will be referenced throughout this Chapter.

8.1 COSTING

The CIP is based on “Project Costs” and intended to capture all costs related to the work including:

- Survey
- Design Engineering & Plan Preparation
- Permitting
- Construction Cost
- Taxes
- WWD Staff (inspection and coordination)

The costs shown are based on historical project cost values and indexed to December 2020, with a Seattle Engineering News Record (ENR) Index value of 12840.41. Reader should use ENR or other cost inflation basis to adjust for the timing of actual construction. This plan was prepared during the 2020-2021 Covid 19 pandemic, costs do not generally reflect the emerging trends brought about by the pandemic. Trends included rapidly rising construction costs, supply chain disruptions and a reduction in the production rates. Another trend to monitor is increased efforts in permitting regulations and compliance.

Project costs relative to unit cost of pipe per lineal feet (LF) of pipe installed (repaired, lined, upsized, replaced) are shown in **Table 8-1** and are inclusive of both pipe, manholes and roadway restoration via patching. The unit price values include a small contingency for alternative materials such as Restrained Joint pipe where applicable. Specific project costs will be refined as each project moves through the design phase and means and materials decisions are made.

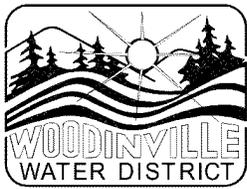
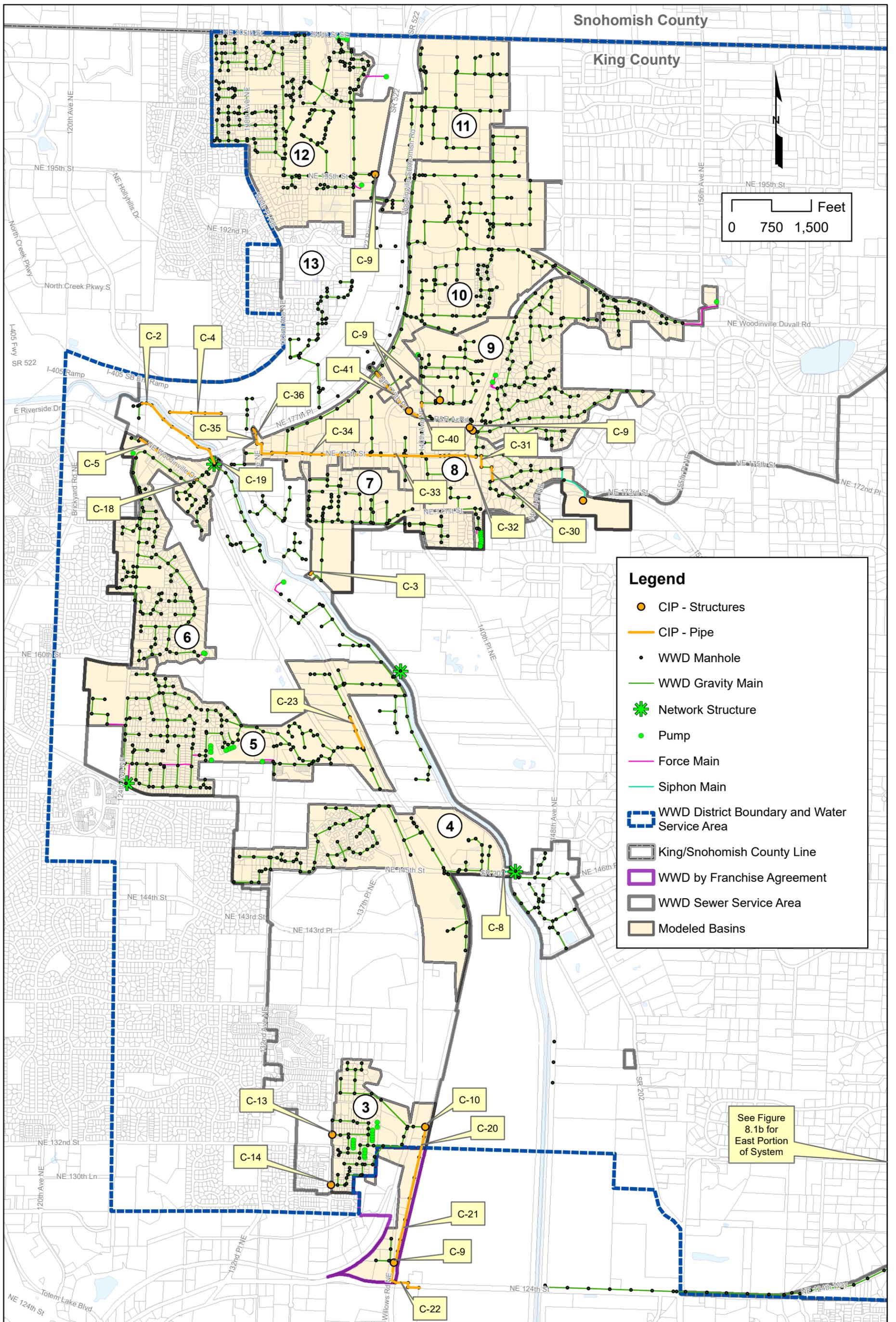


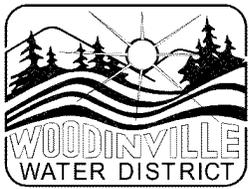
Table 8-1: Planning Level Unit Pipe Project Costs	
Cost Index	Seattle ENR, December 2020 = 12840.41
Pipe Diameter Installed (in)	Cost per LF
8	\$ 470
10	\$ 490
12	\$ 500
15	\$ 530
18	\$ 590
21	\$ 620
24	\$ 650



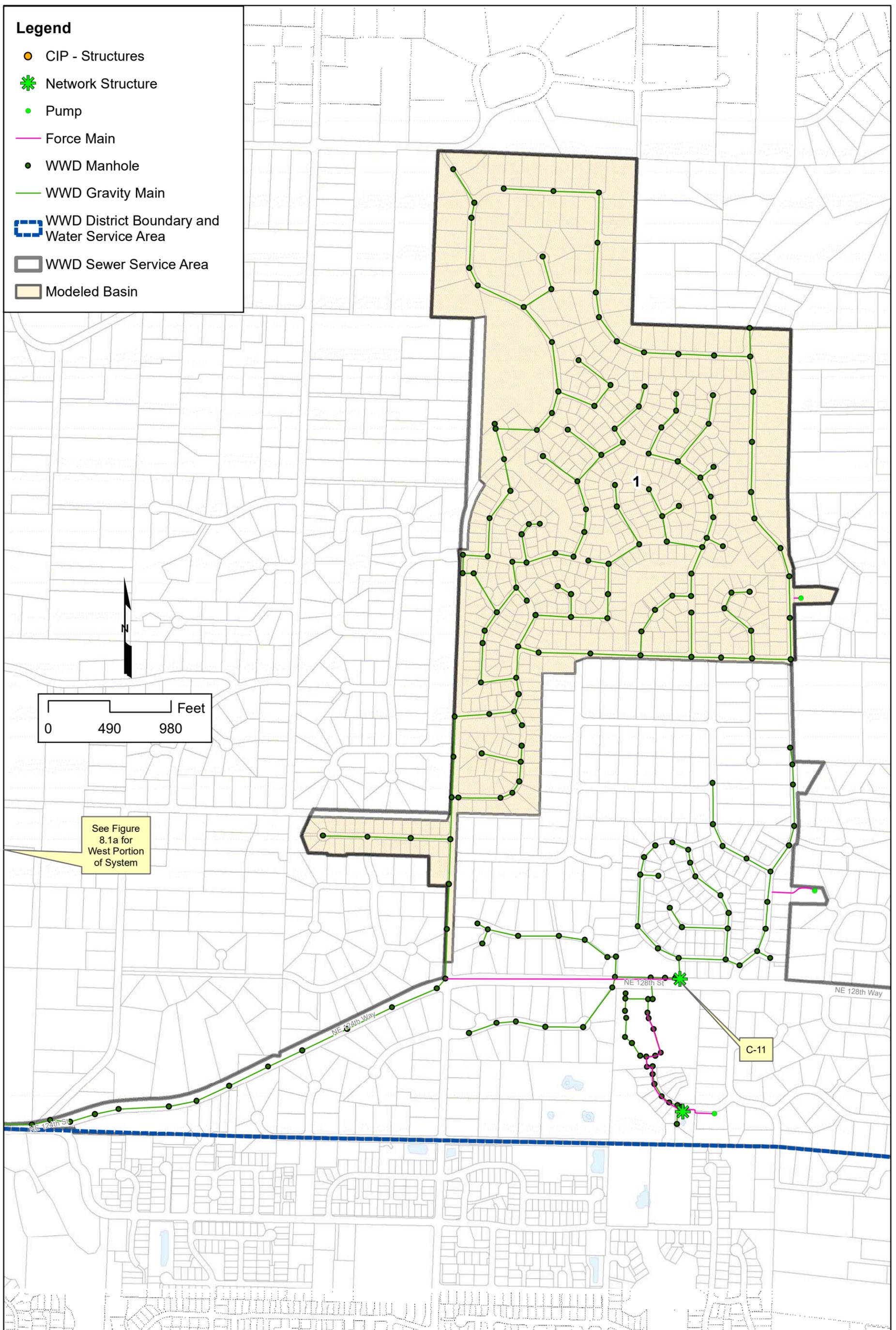
Capital Improvement Plan - Project Locations

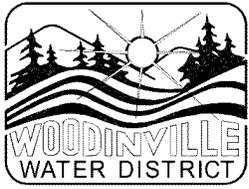
FIGURE 8-1a

Comprehensive Sewer Plan

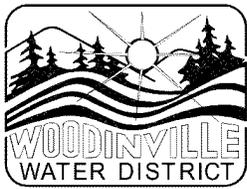


(Page Intentionally Left Blank)





(Page Intentionally Left Blank)



8.2 CONDITION BASED CIP

The Operations staff has reviewed the system and assisted in developing the projects listed in **Table 8-2: Condition Based CIP** to respond to known structural condition issues. As discussed earlier, projects that are to be developed in actionable projects have been assigned a “C-” reference number. Additionally, there are projects that have been identified as operational (condition) and as Capacity projects requiring pipe upsizing. These projects are listed in Table 8-2 with lowercase letter designations such as “(a)” or “(b)” and are shown for clarity. The capacity and condition projects do not include a cost as their improvements are included within the projects noted within the Table. The actionable project locations are shown on Figure 8-1a or 8-1b. The projects that have both condition AND capacity issues are included and costed in **Table 8-4: Capacity Based CIP**.

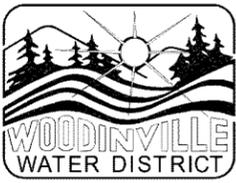
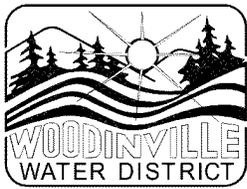


TABLE 8-2: Condition Based CIP								
CIP Ref #	Basin	From	To	Prop. Dia.	QTY	Scope	Budget (2020 \$)	Priority
C-1			Portable Sewer Flow Meter		1 EA	Purchase a portable flow meter for use in tracking flows in the network.	\$ 10,000.00	High
C-2	6	MH 0776	MH 1623	8	2030 LF	[Sammamish Slough] Size on size replacement, either via pipe bursting or CIPP. Note: Pipe segment MH71 to MH72 Was recently lined.	\$ 954,100.00	High
C-3	7	MH 0091		15	108 LF	Remove reverse angle turn by adding two manholes and a diagonal stretch of pipe. An easement will be required for this route change.	\$ 80,136.00	High
(a)	8	MH 0062	MH 0016	Varies 10-15	3396 LF	[NE 175 th ST] Older concrete pipe, roots, structural. Bursting or parallel cut/cover replacement with upsize. This project was identified by both Condition and Capacity. See projects C-34 and C-35 in Table 8-4 for costing.	\$ -	Med
(b)	8	MH 0016	MH W11-A04	18 to 21	572 LF	[NE 175 th ST ext] Older concrete pipe, roots, structural. Bursting or parallel cut/cover replacement with upsize. This project was identified by both Condition and Capacity. See costing included in Table 8-4. See projects C-35 and C-36	\$ -	Med
C-4	23	MH 0003	MH W11-97	8	960 LF	Size on size replacement, either via pipe bursting or CIPP, including replacement of approximately 4 manholes.	\$ 451,200.00	Med
C-5	6	MH 0772	MH 0078	8	1332 LF	[NE Woodinville Dr.] Size on size replacement, either via pipe bursting or CIPP including replacement of approximately 5 manholes.	\$ 626,040.00	Med
C-8	4	SP-3			1 EA	Replace top hatch at Siphon 3.	\$ 20,000.00	Low
C-9		Various			6 EA	Reseal manholes 296A, 500, 912, 979, 989, 990.	\$ 30,000.00	Low
C-10	3	MH 0920			1 EA	Improve access to existing manhole.	\$ 20,000.00	Low
C-11	2	SR LS			1 EA	Full repair and rehabilitation of Sunrise Lift Station.	\$ 80,000.00	Low
(c)	3	MH 0919	MH 912B	8	2398 LF	[141 st Ave NE] Sags, roots, blockages. Bursting or parallel cut/cover replacement with upsize. This project was identified by both Condition and Capacity. See costing included in Table 8-4. See projects C-15.	\$ -	Low
Total							\$ 2,271,476.00	

Projects (a), (b) and (c) are not assigned CIP #s or included in the Condition based costs as they represent projects that are also included in the Capacity section, Table 8-4.



8.3 ROUTING BASED CIP

There are two areas where services within the district's service area are currently being served by Northshore Utility District that could be re-routed into the WWD. Both areas are in Basin 3 in the SW portion of the District and re-route options are shown in **Figure 5.5b**. **Table 8-3** provides more specific information. Both projects are dependent on downstream Capacity projects C-20, C-21, C-22 being constructed and in use before the reroute connections are made.

Approximately thirty-six lots can be added with the connection at MH 1490, with approximately ten additional lots that could be served in the future if easements could be obtained to further extend the rerouting.

The connection at MH 1345 would add approximately 104 Townhomes, 163 single family residences, 40 apartment buildings and one elementary school.

It should be noted that the above projects should not be considered as recommendations. The decision and timing to perform these optional projects are at the District's discretion. The budget costs for these two reroutes are given in **Table 8-3** however DEA performed no cost-benefit analysis as such an analysis is outside the scope of this report. Factors such as staffing levels and funding sources influence such an analysis. The District should perform such an analysis if they decide to investigate further and prior to any final decisions.

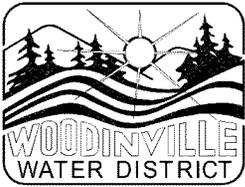
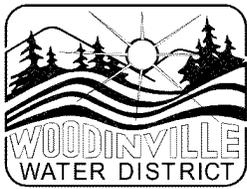


TABLE 8-3: Routing Analysis CIP

CIP Ref #	Basin	From	To	Prop. Dia.	QTY	Scope	Budget (2020 \$)
C-13 ¹	3	NUD	MH 1345	8	122 LF	Connection from existing Northshore Utility District network to MH 1345 to reclaim service area	\$ 57,340.00
C-14 ¹	3	NUD	MH 1490	8	286 LF	Connection from existing Northshore Utility District network to MH 1490 to reclaim service area	\$ 134,420.00
Total							\$ 191,760.00
<p>1. See description in section 8.3 for precursor project [141st Ave NE] required before these projects are constructed.</p>							



8.4 HYDRAULIC CAPACITY CIP

Per the hydraulic modelling discussed in Chapter 5, several projects have been identified to increase network capacity to meet forecast requirements. Figures 5-2.1 through 5-2.11 in Appendix A graphically show the segments which are forecasted to have capacity issues. Most of the work is in Basins 8 and 9. The work is tied to the Central Business District development in that area. Due to the quantity of work involved, and the difference between current density and forecast density, it is recommended that Central Business District projects be phased to coincide with development, starting with the downstream segments. **Table 8-4** lists the Capacity CIP projects. Figures 8-1a and 8-1b provide an overview of CIP project locations and Figures 8-2 (Basin 3), 8-3 (Basin 8) and 8-4 (Basin 9) show a more detailed view of the three larger capacity projects.

Contingency Allowances: The Capacity CIP includes an allowance in each of the Central Business District basins (basins 7, 8 and 9) to account for the pipe routing of any specific project that would concentrate flow into a pathway not specifically modelled for that flow and for the higher risk of encountering an unforeseen condition that could further escalate the project cost. Each significant redevelopment project will need to be evaluated after the developers have selected their preferred route. The fact that the redevelopment is occurring through the oldest portions of the sewer collection system and through areas that have been subject to several utility revisions increases the risk in these areas.

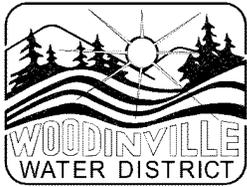
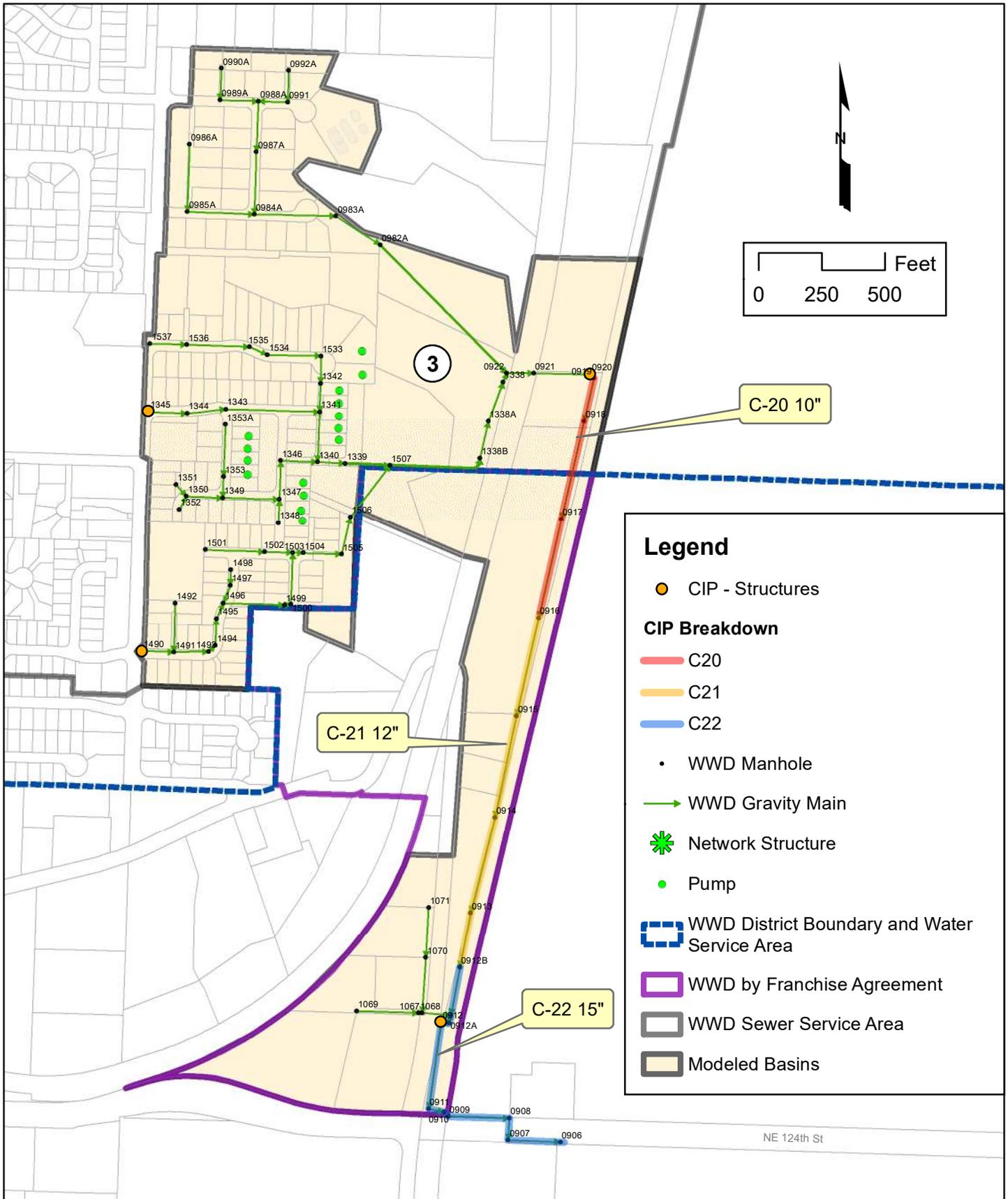
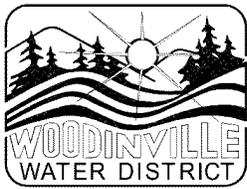


Table 8-4: Capacity Based CIP

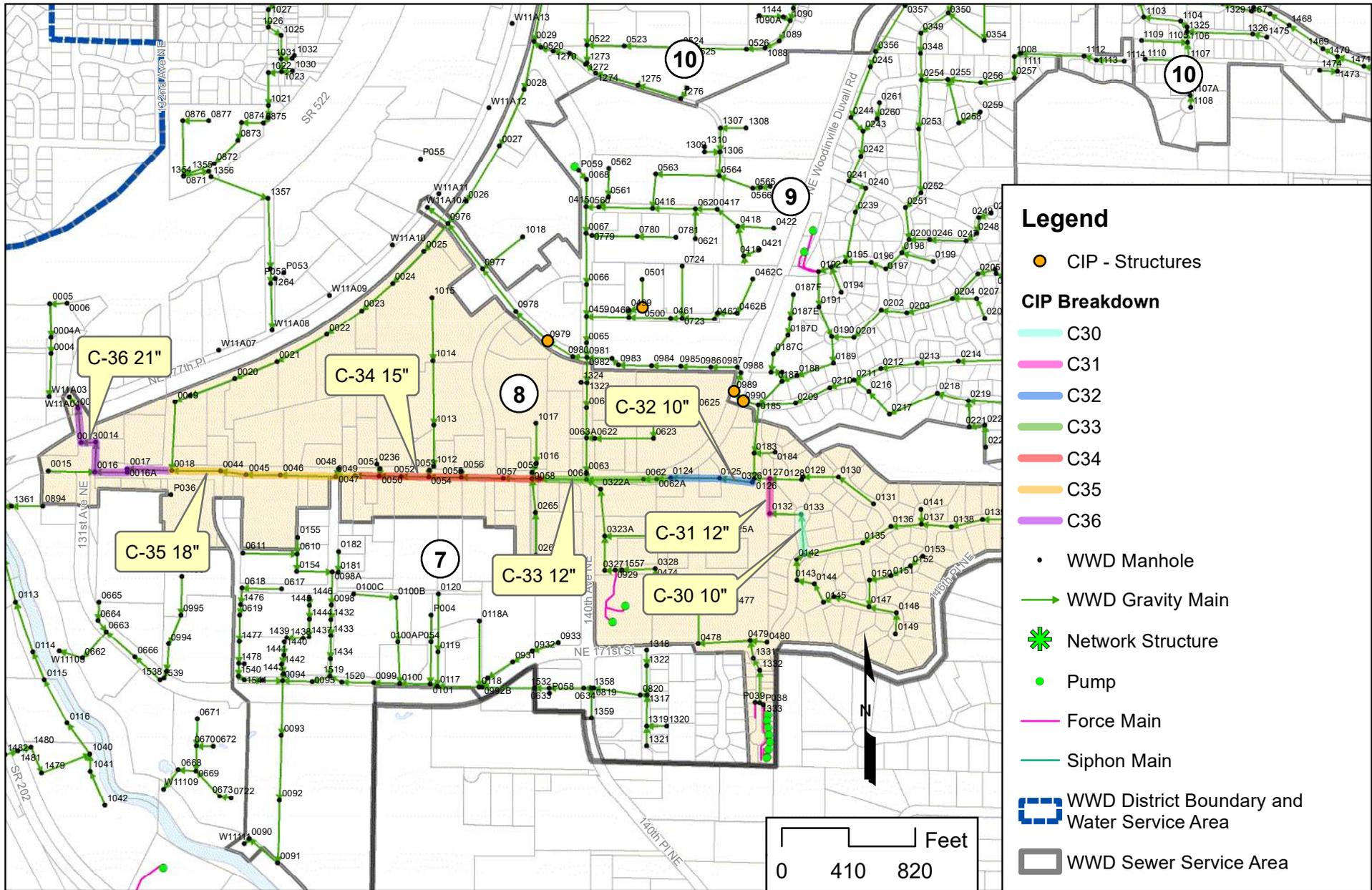
CIP Ref #	BASIN	From MH	To MH	Upsized Dia.	Length (ft)	Budget (2020 \$)
C-20	3	919	916	10	977	\$ 478,730.00
C-21	3	916	0912B	12	1424	\$ 712,000.00
C-22	3	0912B	906	15	1225	\$ 649,250.00
C-23	5	934	234	12	638	\$ 319,000.00
C-25 ¹	7	TBD	TBD	10	500	\$ 245,000.00
C-29 ¹	8	TBD	TBD	10	600	\$ 294,000.00
C-30	8	134	133	10	247	\$ 121,030.00
C-31	8	132	127	12	212	\$ 106,000.00
C-32 ²	8	326	124	10	504	\$ 246,960.00
C-33 ²	8	124	60	12	804	\$ 402,000.00
C-34 ²	8	60	49	15	1137	\$ 602,610.00
C-35 ²	8	49	18	18	1125	\$ 663,750.00
C-36 ²	8	18	W11A04	21	995	\$ 616,900.00
C-37 ¹	9	TBD	TBD	10	500	\$ 245,000.00
C-40	9	459	981	10	257	\$ 125,930.00
C-41 ²	9	981	976	15	1219	\$ 646,070.00
Total						\$ 6,474,230.00

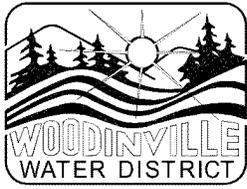
1. This project is an allowance for replacement of pipe not directly represented in the model.
2. This project is expected to be completed in phases alongside development, beginning with the downstream segments



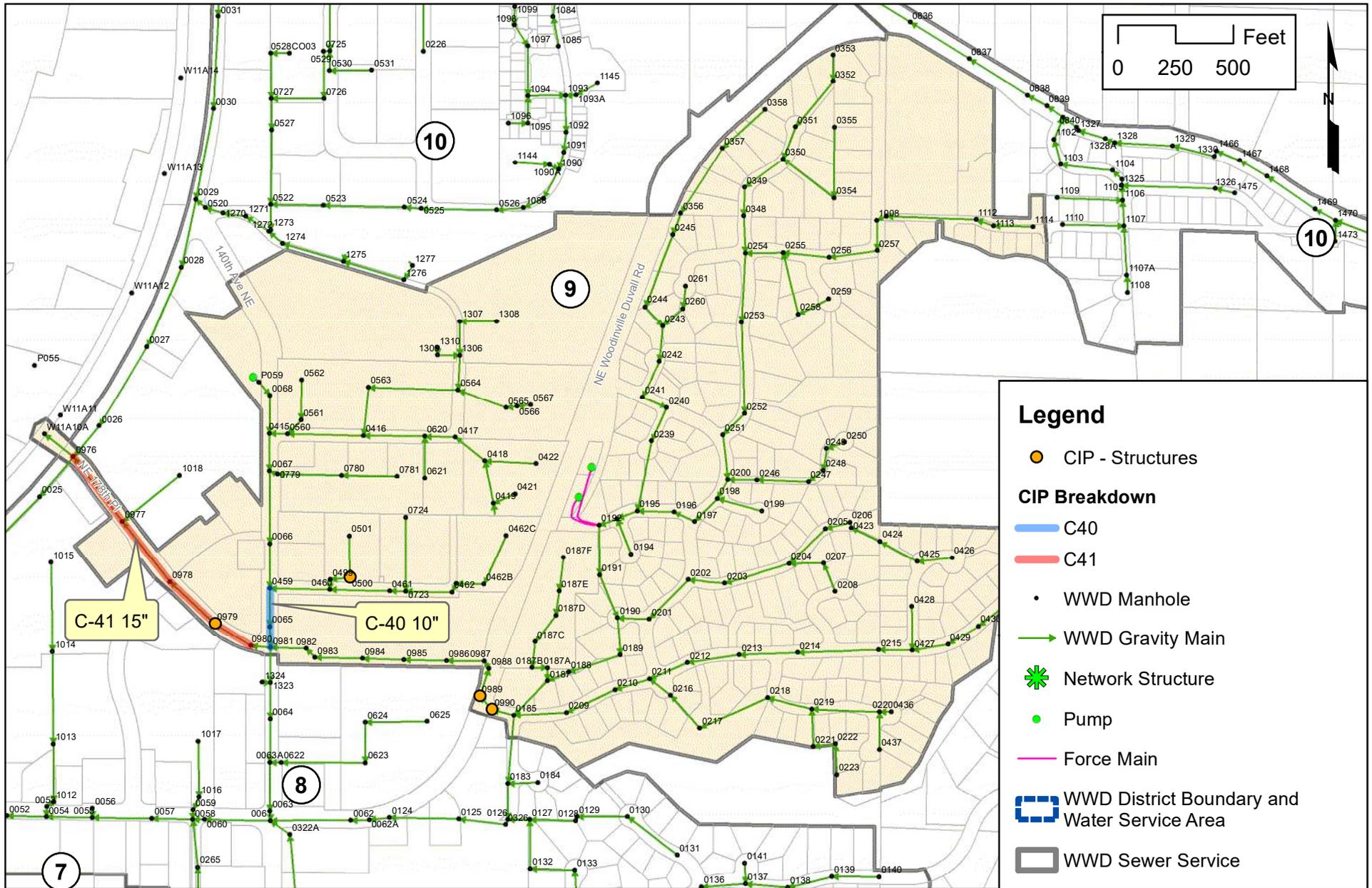


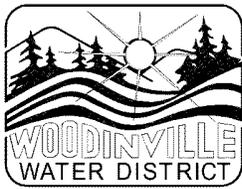
(Page Intentionally Left Blank)





(Page Intentionally Left Blank)





CHAPTER 9 - FINANCIAL

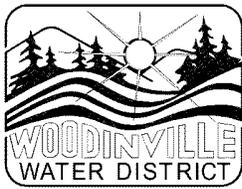
The District has a skilled financial department that prepares, monitors, reports and forecasts the financial needs and performance of the District. The complete biennial budget report for 2021-2022 is attached in Appendix E. Some of the following information is duplicated or summarized from the District’s 2021-2022 Budget.

9.1 CURRENT RATE STRUCTURE

Woodinville Water District prepared a final budget for 2021 and 2022 (see Appendix F for the sewer specific portions of the final budget). Within this document, the rates for 2018 through 2022 and the forecasted rates for 2023 through 2024 are shown. These sewer charges are summarized in **Table 9-1**, with the local program costs for the District identified separately from the treatment charges to be paid to the King County Wastewater Division. All charges shown are for 1 Equivalent Residential Unit (ERU). Connections are billed on a bi-monthly schedule.

Table 9-1: Sewer Rates				
Budget Year	Local Program Charges (month)	KCWTD Charges (month)	Effective Monthly Sewer Charge	Actual Bi-Monthly Charge
2018 Budget	\$ 27.15	\$ 44.22	\$ 71.37	
2019 Budget	\$ 27.15	\$ 45.33	\$ 72.48	
2020 Budget	\$ 27.15	\$ 45.33	\$ 72.48	
2021 Budget	\$ 27.96	\$ 47.87	\$ 75.83	
2022 Budget	\$ 28.80	\$ 49.27	\$ 78.07	\$ 156.14
2022 Low Income	\$ 23.80	\$ 49.27	\$73.07	\$ 146.14
2022 Industrial	\$28.80	\$ 87.83 per 1000 gal		By flow
2023 Forecast	\$ 29.66	\$ 52.23	\$ 81.89	
2024 Forecast	\$ 30.55	\$ 52.26	\$ 85.81	
2022 System Development (per ERU)	\$ 3,711.00			
2022 CBD-CIC Fee (per ERU)	\$ 558.00			

Table 9.1 shows that King County treatment cost will continue to comprise the largest component of the District rate structure, as has been true in years past.



9.2 SYSTEM DEVELOPMENT FEES

All new connections or changes of use that increase the sewer flow to the collection system are required to pay a System Development Charge (Connection Charge) to “buy in” to the existing collection system. The fee is due before side sewer permits are issued.

The 2022 System Development Fee is \$ 3,711.00 per Residential Customer Equivalent.

The District periodically reviews the capital expenditures into the system and adjusts (increases) the fee accordingly. Additionally, the District has incorporated an automated minimum annual increase linked to the inflation cost of construction as published by the Engineering News Record for Construction Cost Index.

The District has also implemented a Central Business District – Capacity Improvements Charge policy (CBD-CIC) fee. This fee applies to areas/lots that were identified as requiring significant existing pipe upsizing to support zoning density increases by the City of Woodinville within their Central Business District (CBD) redevelopment area. These include Basins 7, 8, & 9 as shown in **Figure 4-1**. The policy collects fees from developers at the time they apply for sewer service. The fees fund the capacity increase portion of a pipe replacement required to provide sewer service to the developer’s project. Collected fees are proportionate to the development’s impact to the existing collection system. The collected fees will be used to partially fund the Capital Improvement Projects located within the CBD area. The remaining fees will come from District sources and are intended to represent the portion of project cost involved in replacing existing capacity.

In 2022 the unit rate used in the CBD-CIC fee is \$558.00 per each additional ERU added over the average of the past 2 years historical use. A cost factor is also applied to the extent that the proposed density exceeds the planning density of 60 Dwelling Units per Acre set by the City of Woodinville.

9.3 OPERATIONS AND MAINTENANCE BUDGETS

Projected operating and maintenance expenses for the six-year planning period were also developed in the 2021-2022 final budget and were used to forecast the sewer rates needed in future years. **Table 9-2** shows the resulting balances in the Sewer Maintenance Fund. The full financial analysis is included in Appendix E.

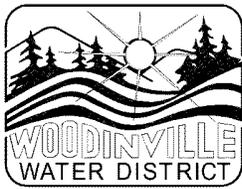
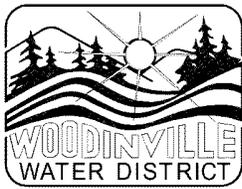


TABLE 9-2: SEWER MAINTENANCE FUND

Sewer Maintenance Fund Six-Year Financial Forecast Based on District Rate Model Projections (1)						
Actual & Forecasted Sewer Rate Increase: 2021 - 2022 Budget						
District Sewer Rates	3.0%	3.0%	3.0%	3.0%	3.5%	3.5%
Metro Sewer Rates	5.6%	0.0%	15.0%	0.0%	15.0%	0.0%
Total Rate Increase	4.6%	1.1%	10.5%	1.1%	10.9%	1.2%
Budget Overview	Budget		Forecast			
	2021	2022	2023	2024	2025	2026
Revenues						
Sewer Service Revenues (Including Rate Increases)	\$6,174,911	\$6,255,998	\$6,874,907	\$6,970,614	\$7,694,563	\$7,796,224
Interest Earnings	3,008	2,939	2,957	2,942	2,948	2,943
Loss on Impaired Investments						
Other Revenues	5,000	5,000	5,000	5,025	5,050	5,075
Total Revenues	6,182,920	6,263,937	6,882,864	6,978,582	7,702,561	7,804,242
Expenditures						
King County Wastewater Treatment Charges	\$4,165,379	\$4,178,016	\$4,724,465	\$4,744,943	\$5,379,401	\$5,402,951
Utility Tax	54,116	55,282	77,900	80,418	106,637	109,686
Sewer Operations	515,367	526,835	548,410	571,030	594,755	619,647
Indirect Overhead Chgs/ Capitalized Salary & Overhead	782,873	786,552	810,149	834,453	859,487	885,271
Annual Debt Service	0	0	0	0	0	0
Trsf to Equip. Replacement Resv	60,210	60,210	60,210	60,210	60,210	60,210
Capital Transfers from Rates	632,800	649,900	667,400	685,400	703,900	722,900
Total Expenditures	\$6,210,745	\$6,256,796	\$6,888,533	\$6,976,454	\$7,704,390	\$7,800,666
Net Surplus / (Deficit) of Revenues Over Expenditures	(\$27,826)	\$7,141	(\$5,669)	\$2,128	(\$1,828)	\$3,577
Funds Deducted from/(Added to) Operating Reserve	\$27,826	(\$7,141)	\$5,669	(\$2,128)	\$1,828	(\$3,577)
Net Ending Cash Flow Surplus/(Deficit)	0	0	0	0	0	0
Operating Reserve						
Beginning Reserve Balance	\$1,203,334	\$1,175,509	\$1,182,650	\$1,176,981	\$1,179,108	\$1,177,280
Funds (Deducted from) or Added to Operating Reserve	(27,826)	7,141	(5,669)	2,128	(1,828)	3,577
Transfer From Catastrophe Reserve	0	0	0	0	0	0
Ending Reserve Balance	\$1,175,509	\$1,182,650	\$1,176,981	\$1,179,108	\$1,177,280	\$1,180,856
<i>Target Reserve Level</i>	<i>\$823,000</i>	<i>\$828,000</i>	<i>\$924,500</i>	<i>\$933,600</i>	<i>\$1,045,300</i>	<i>\$1,055,400</i>
Reserve Balance Over / (Under) Target Level (2)	\$352,509	\$354,650	\$252,481	\$245,508	\$131,980	\$125,456
Notes						
[1] - Projections in this forecast are based on a District rate model developed by HDR, Inc., with updates needed to incorporate annual budget values.						
[2] - The Target/Minimum Resv level = 90 days of Sewer O&M expense plus 60 days of Metro wholesale expense, per the District's Adopted Financial Policies.						



Note: As shown in Table 9-2 Sewer Rates, the net difference between annual sewer revenue and forecasted expenditures for the year will be added to or deducted from the sewer operating reserve so the ending cash flow balance will always be zero.

9.4 CAPITAL IMPROVEMENTS

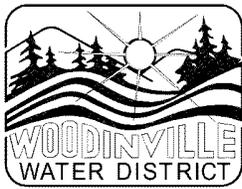
The development of the Capital Improvement Program was described in Chapter 5. It was detailed and costed in Chapter 8 and shown on Figures 8-1a and 8-1b. The CIP has been organized into three (3) categories.

- Improvements related to the **condition** of the existing piping that are recommended for construction in the next 6 years. Several pipes identified under condition will also need to be upsized due to capacity. These pipes are only costed under the capacity group below. CIP projects C-1 through C-11 estimated cost (rounded) \$ 2,300,000.
- Improvements regarding the **routing** of sewer main that will allow the District to reclaim sewer connections that are currently being served by Northshore Utility District. These projects require that a downstream capacity project be constructed before the rerouting proceeds. CIP projects C-13 through C-14 estimated cost (rounded) \$ 200,000.
- Improvements resulting from increases in allowable zoning and the need to provide additional flow **capacity**. The scheduling of most of these projects is linked to the rate that redevelopment occurs. Some of this group were previously identified in the condition section, but not costed or assigned a CIP project number in the condition section. Also note that approximately \$ 2,800,000 of the cost is projected to be collected from the (re)developments that are the source of the capacity increase need, see CBD-CIC policy. CIP projects C-20 through C-41 estimated cost (rounded) \$ 6,500,000.

The resulting Capital Improvements were summarized in Tables 8-2 (Condition), Table 8-3 (Routing) and Table 8-4 (Capacity). Please note that the CIP reference numbers are not continuous and purposely have gaps included. The following numbers have not been assigned; C-6, C-7, C-12, C15-C19, C24, C26-C28, C38-C39.

None of the listed improvements have been identified as posing a significant or immediate risk to public health or the environment. Accordingly, these improvements were prioritized based on growth, regulatory requirements, component reliability, and system development for implementation on the following basis:

1. Fiscal constraints imposed by the funds available for capital improvements generated through the adopted rate structure and other funding sources.
2. The desirability of avoiding major financial impacts to any one fiscal year.
3. The schedule of road improvements by King County and the City of Woodinville.



4. Preferences of the field crews to best manage their work load and schedules.

9.5 CAPITAL IMPROVEMENT PLAN FUNDING

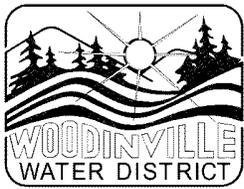
The District is well positioned to achieve the CIP construction over the next 10 years. **Table 9-3: CIP Funding Requirements** summarizes an example of how the City may employ funding in the near term. Actual routing of funds and timeframes are expected to be based on priority of needs. These needs are expected to change over time as updated information becomes available or emergencies develop.

Table 9-3: CIP Funding Requirements			
	Cost (rounded)	Span (years)	Budget per year
Condition based CIP	\$ 2,300,000	6	\$ 384,000
Routing Based CIP	\$ 200,000	8	\$ 25,000
Capacity based CIP	\$ 6,500,000	12	\$ 542,000
District Internal Projects	\$ 300,000	4	\$ 75,000
CBD-CIC Transfer In	(\$ 2,800,000)	12	(\$ 233,000)
		1-4 tally	\$ 793,000
Total	\$ 6,500,000	10	\$ 650,000

As shown in Table 9-2, the District is currently budgeting between \$630,000 and \$720,000 in capital funding through 2026. If the District continues that level of funding through 2032 they will be able to adequately fund all of the CIP and maintain their targeted Reserves level. Table 9-3 shows that funding at or above \$650,000 should allow for the CIP to be completed within 10 years if the District makes that commitment.

Actual scheduling will be performed by the District as they continue to monitor the physical condition and evaluate new or redevelopment requests. The District is also actively coordinating with the City of Woodinville to take advantage of street widening or resurfacing projects to avoid unnecessary surface restoration costs.

Please note that Cost and CBD-CIC revenue shown are multi-year averages and will not occur in a linear fashion. Project extent and timing will vary from year to year.



Capacity revenues (CBD-CIC) are likely to be even more sporadic and linked to the general business climate and economy health. Preliminary indications show that the CBD-CIC program is likely to generate the upsizing contribution in advance of the physical need. However the District will need to monitor fund intake against near term CIP scheduling and then make appropriate funding decisions.