City of Arlington

Final

Comprehensive Wastewater Plan

A General Sewer Plan

Prepared by:

City of Arlington

With assistance from:

RH2 ENGINEERS PLANNERS SCIENTISTS

and

FCS GROUP Solutions-Oriented Consulting

October 2015

Cover photos:

Foreground photo shows the WRF Headworks with three Huber 3 mm corkscrew fine screens. Background photo shows the Kubota Flat Plate membrane cartridges in a drawn-down bay in the membrane bioreactor (MBR). Nominal pore size is 0.04 mm, with an effective pore size of 0.02 mm.

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APPROVED
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City of Arlington Certification

Chapters 1, 2, 3, 5, and 8 of this Comprehensive Wastewater Plan were prepared by City of Arlington staff under the direction of the following registered professional engineer. Chapter 10 was prepared by FCS Group under the direction of the same. In addition, City of Arlington staff authored a portion of Chapter 4 and provided support to Chapters 6 and 7.

10-06-15

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RH2 Engineering Certification

Chapters 4, 6, and 7 of this Comprehensive Wastewater Plan were prepared for the City of Arlington under the direction of the following registered professional engineers. In addition, RH2 Engineering, Inc. staff provided support to Chapters 1, 2, 3, 5, and 8.

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Executive Summary

ES.1 PURPOSE OF THE PLAN

The City of Arlington's (City) wastewater collections, reclamation (treatment), disposal, and reuse systems form a complex and sophisticated infrastructure. The wastewater utility matches qualified staff to the operational and maintenance (O&M) requirements of these systems, implements a capital improvement program (CIP) to schedule replacements of necessary components to keep the systems working optimally, and assures compliance with all federal and state laws and permit conditions. The primary purpose of the City's Comprehensive Wastewater Plan (CWP) is to serve as the nexus for:

- Preparing the wastewater system and personnel to meet the City's future growth,
- Evaluating current service levels
- Evaluating current O&M activities,
- Setting CIP goals and priorities to match City Comprehensive Plan,
- Reviewing compliance with City policies and state/federal regulations, and
- Evaluating Wastewater Utility funding requirements.

This comprehensive evaluation identifies existing conditions, assesses repair and replacement needs to serve existing customers, forecasts the demands of anticipated growth, develops improvements and solutions, and identifies schedules and funding mechanisms for implementing them. Done well, this CWP will help assure a resilient and sustainable means for transforming the human waste stream in Arlington into a clean, high quality resource, thereby protecting human and environmental health. This CWP also complies with Washington State Department of Ecology (Ecology) regulations under Washington Administrative Code (WAC) 173-240-050, which requires preparation of General Sewer Plans.

ES.2 CHANGES SINCE THE LAST COMPREHENSIVE WASTEWATER SYSTEM PLAN

The City's last CWP was completed in 2008. The following changes have occurred since the last update that affect wastewater system planning for the City.

- Upgrade and expansion of treatment facilities from a Sequential Batch Reactor with capacity of 1.0 MGD to a Membrane Bioreactor with Biological Nutrient Removal with capacity for 2.67 MGD. The Water Reclamation Facility (WRF) is easily expanded to accommodate 4.0 MGD simply by adding additional membrane units.
- Modifications to pumps and other equipment affecting capacities at 12 Lift Stations.
- Installation of telemetry system at all lift stations.
- Extension of the NPDES permit to 2019, and issuance of a Reclaimed Water permit allowing for discharge and reuse of reclaimed water in a constructed wetland adjacent to the WRF and the Stillaguamish River.
- Development of a constructed wetland (Old Town Wetland) which will serve as an adaptive management measure for temperature and copper and other metals if loading increases or river water quality declines.
- Construction of a reclaimed water lines from the new Water Reclamation Facility to the Old Town Wetland, and in a segment of 67th Avenue near the Cemetery.
- Extension of Sewer Collection system to SE areas of the City of Arlington.
- Replacement of undersized sewer (15") on the 67th Interceptor with larger pipe (24").
- Assessment of existing sewer collection system in Old Town Arlington area.
- Installation of new sewer for development in the Arlington Airport Business Park.

ES.3 SUMMARY OF KEY ELEMENTS

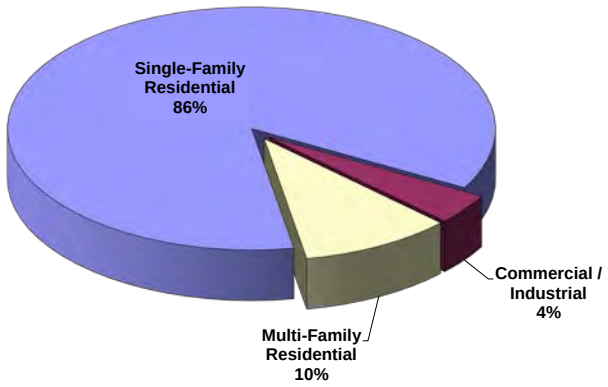
This CWP contains: a description of the existing wastewater system and service area; a forecast of future wastewater collection and treatment demands; policies and design criteria for wastewater system operation and improvements; wastewater system hydraulic analyses; the operations and maintenance program; staffing requirements; a schedule of improvements; and a financial plan to accomplish the improvements. A summary of the key issues related to these elements is provided in the following sections.

ES.3.1 Customers within the Wastewater Service Area

The City provides wastewater service to approximately 16,116 residents through 4,650 residential connections within its wastewater service area boundary, which is the City's Urban Growth Area (UGA). In addition, the City collects wastewater via side sewers from 520 commercial and

industrial facilities. An estimated 1,100 parcels with septic systems within the City will be required to connect to the collections network whenever their drain fields should fail.

2014 Sewer Service Connections by Customer Class



ES.3.2 Infrastructure

The Wastewater Department manages assets with a replacement value of approximately $132 million allocated as follows:

Facility	Value (2015)
Water Reclamation Facility	$ 75,000,000
Biosolids Compost facility	$ 7,500,000
Lift Stations	$ 8,850,000
Collection System	$ 40,500,000
Total	**$ 131,850,000**

Components within the Water Reclamation Facility (WRF) includes a headworks, biological nutrient removal (BNR), membrane bioreactor (MBR), ultraviolet radiation disinfection, a sludge digester, and solids handling. The WRF produces effluent of either Class B or Class A Reclaimed Water quality. Upgrades during the 20 year planning cycle are limited to additional MBR cartridges in existing filter bays in the WRF as necessary to increase plant capacity to accommodate growth.

The Biosolids Composting Facility (BCF) takes some of the digested and dewatered biosolids and produces Class A Exceptional Quality compost. No upgrades are proposed for the BCF in the 20 year horizon.

Twelve lift stations currently operate throughout the service area to route collected wastewater through the sewer collection system. Six of the lift stations will require capacity improvements, while two (LS-02 and LS-11) will likely require total replacement. Two additional stations will need to be constructed to accommodate growth west of I-5 and in the Island Crossing area.

The sewer utility maintains approximately 72 miles of force main and gravity sewer pipe. The sewer pipe is composed of various pipe material including PVC (79%), concrete (11%), and ductile iron (9%). The most common sewer pipe diameter is 8-inches (72%).

All existing pipe is considered young and within its design life, including: 0-10 years (41 percent of total length); 20-30 years (38 percent); and 50-60 years (21 percent). By 2035, total main length is estimated to be 78.6 miles. Replacement of 7,700 feet of the oldest pipe will result in 15 percent aged 70 to 80 years. All remaining pipe will be less than 50 years old.

ES.3.3 Historic and Forecast Demand

Annual average day flow rates into the WRF over the last six years (2009 to 2015) range from 1.07 to 1.21 MGD, with an average flow of 1.1 MGD. Maximum month flows ranged from 1.34 to 1.66 MGD, with an average flow of 1.51 MGD and a peaking factor of about 1.35. Maximum day flows ranged from 1.73 to 2.47 MGD, with an average of 2.15 MGD and a peaking factor of about 1.92. Inflow and infiltration are considered non-excessive per EPA standards.

Average day influent is forecast to increase relative to 2013 levels by 0.55 MGD to 1.66 MGD in 2024, an increase of 50%. Maximum month flows in 2024 will be 2.32 MGD, an increase of 0.83 MGD, or 56%.

Average day influent is forecast to increase relative to 2013 levels by 1.16 MGD to 2.27 MGD in 2035, an increase of 105%. Maximum month flows in 2035 will be 3.17 MGD, an increase of 1.68 MGD, or 113%. The NPDES permit allows a maximum month influent of 2.67 MGD into the WRF, so expansion of the MBR (additional cartridges in existing bays) will be required during the second planning decade.

ES.3.4 Staffing for Operations and Maintenance

The City's Wastewater Department staff are well-qualified, technically trained personnel equipped to operate and maintain the existing infrastructure. City staff regularly participates in safety and training programs to keep abreast of the latest changes in the wastewater industry and to ensure a smooth and safe operation of the collection, treatment, re-use, and composting systems. The current staff of nine (one supervisor and eight field crew), is one shy of the 10 estimated at the time of the WRF upgrade to fully staff all functions of the utility. With hydraulic and waste loading

below forecast and 2.25 management personnel in Public Works Administration, however, the City is capable of adequately operating the wastewater system, complying with the minimum Ecology requirements, and accomplishing the preventive maintenance tasks at the desired frequency. The City will add staff in the future, as necessary and as allowed by budget, to meet the increasing requirements of system operation and maintenance, due to customer growth and increased regulatory requirements.

ES.3.5 Wastewater System Evaluation

Wastewater flows were modeled through 12 lift stations and 14 drainage basins using SewerCAD version 8i. Flow increases for 2024 and 2035 scenarios occur primarily due to growth in six focus areas:

- Island Crossing (LS #11, 14);
- UGA expansion west of I-5 and the I-5 rest areas (LS #6, 14, 15);
- Airport Business Park (LS # 5, 3);
- Manufacturing Industrial Center (LS #12, 4, 3);
- Hilltop at SR 9 and SR 531(Gleneagle and Primary Interceptor gravity mains); and
- Central Arlington (Kent Prairie) mixed use developments (LS #2, Primary Interceptor).

The flow capacity of individual pipe segments and pipe networks were evaluated against the ratio of flow depth (d) to pipe diameter (D) at peak hour flow scenarios. Pipes with (d/D) >0.8 are deemed to be at capacity and recommended for upgrade.

- Under existing conditions, portions of the primary interceptor (trunk line) along 67th Avenue NE (4,520 feet) and West Avenue (760 feet) are at or near capacity. The City is monitoring the primary interceptor to confirm flow levels before selecting pipe segments and schedule for upgrade.
- By 2024, another 10,345 feet of pipes are considered deficient in their capacity to convey wastewater flows. Most of this distance is in the Primary Interceptor, approximately 3,000 feet are eight-inch mains in Gleneagle's arterials.
- By 2035, yet another 3,075 feet of pipes in Gleneagle will be under capacity and in need of an upgrade.

Lift station capacities are based on estimated peak hour capacity with one pump in operation.

- Model results suggest lift stations 2, 4, 5, and 7 are currently at or near capacity during peak hour events. Lift station 4 exceeds capacity during storm events. The City is monitoring these lift stations to validate priority and scheduling of improvements

- Prior to 2024, LS #6 is targeted to be rerouted away from LS #5, reducing loading to that lift station and others downstream. By 2024, two new lift stations (LS-14 and LS-15) will need to be constructed to support flows from Island Crossing, the WSDOT rest area and other areas west of I-5. No lift stations are forecast to have capacity deficiencies at this time.
- Lift stations 8, 11, and 12 may require upgrades to accommodate projected flows by 2035.

As mentioned previously, targeted upgrades for the WRF are limited to the installation of additional membranes in existing filtration bays between 2024 and 2035

ES.4 PROPOSED WASTEWATER SYSTEM IMPROVEMENTS AND FINANCING PLAN

This CWP identifies a capital improvement program (CIP) with annual expenditures over the first decade (2024), and lump sum expenditures over the second decade (2035). The 20-year CIP total is $20.043 million in 2015 dollars. With costs escalated to the year of planned spending at an annual rate of 3.0 percent, the 20-year total is $25.822 million. Most of CIP projects are preliminarily scheduled for the first decade, with a total of $17.443 million to be spent by 2024. Only $2.60 million in projects are slated to occur in the second decade. The actual implementation of these improvements will be predicated on growth.

A financial strategy to fully fund the CIP and operating expenses and service existing and new debt is also presented. The plan relies primarily on cash funding from rates and connection charges. Connection revenue of about $175,000 per year after 2015 from 40 connections per year is assumed. Annual rate increases of 2.0 percent are proposed after 2018, this expected to be at or near the rate of inflation. Under this scenario, the operating fund ends each year with a minimum of 45 days of O&M expenses. Capital projects are financed with cash, except for years 8, 9, and 10 (ending 2025), when approximately $7.0 million in new revenue bond debt will need to be issued. This new debt issued at that time will bring total debt to approximately $9.1 million.

A study is underway at the time of this writing to evaluate costs of service and rates by customer class. Preliminary indications suggest decreases in both rates and connection charges are feasible prior to the implementation of the financing plan described herein. Chapter 9 of this CWP may be amended in the foreseeable future depending on the final recommendations of the rate study.

1 Introduction

1.1 WASTEWATER UTILITY OWNERSHIP AND MANAGEMENT

The City of Arlington (City) is a municipal corporation that owns, operates, and maintains a public wastewater utility under NPDES Permit WA0022560. The utility is managed by the Wastewater Department, in the City's Public Works' Utilities Division. The utility serves the City and its Urban Growth Area (UGA) with the exception of a portion of the Smokey Point neighborhood within the southwest corner of the City.

1.2 OVERVIEW OF EXISTING SYSTEM

The City's existing incorporated area and UGA creates a Wastewater Service Area totaling approximately 6,048 acres (9.45 square miles). This excludes the portion of Arlington's Smokey Point neighborhood whose wastewater service is provided separately by the City of Marysville.

In 2014, approximately 16,121 Arlington citizens received sewer service through 4,297 residential customer connections. An additional 394 connections served commercial, industrial, and institutional customers.

The City's wastewater utility consists of one supervisor and eight treatment, collections, and compost staff. A single treatment facility currently reclaims 1.1 million gallons per day (MGD) (capacity of 2.67 MGD expandable to 4 MGD) of municipal wastewater influent. Membrane filtration, biological nutrient removal, and ultraviolet disinfection processes produce effluent of Class A or B reclaimed water quality. Collections staff maintain 12 pump stations and approximately 68 miles of gravity collection and force main pipes. Biosolids are either composted with wood waste at a dedicated facility to create Class A compost, or land applied in Eastern Washington. A summary of wastewater utility data is provided in **Table 1-1**.

Table 1-1. 2014 Wastewater Utility Data

Description	Data
Population (Wastewater Service Area)	16,121
Wastewater Service Area (acre)	6,048
Total Connections	4,691
Average Gallons Per Capita Per Day (gpcd)	66
Average Daily Flow (MGD)	1.07
Number of Pump Stations	12
Total Length of Sewer Main (miles)	67.4
Total Dry Tons Biosolids Produced, 2014	278
Total Dry Tons Biosolids Composted, 2014	87

1.3 AUTHORIZATION AND PURPOSE

In February 2014, the City initiated an update to its Comprehensive Wastewater Plan (Plan, CWP). RH2 Engineering (RH2) was retained in March 2014 to provide modeling and analytical support. FCS Group was also retained to provide financial planning assistance for the utility, including financial analyses for this CWP and conducting a utility rate study. The City previously prepared Comprehensive Sewer System Plans in October 1995 and September 2008. The purpose of this updated Plan is to:

- Comply with all requirements of a General Sewer Plan (GSP) under WAC 173-240-050.
- Quantify existing and projected sewerage volumes and flow rates.
- Determine the overall reliability and vulnerability of existing sewer lift (pump) stations.
- Analyze whether the treatment and operational objectives of the wastewater reclamation facility and biosolids composting facility are achieved.
- Evaluate whether the existing wastewater collections and treatment systems are sufficient to meet minimum requirements mandated by the Department of Ecology (DOE) and the City's own policies and design criteria.
- Identify capital and operational improvements that will resolve existing system deficiencies and accommodate future needs of the City of Arlington and its Wastewater Utility.
- Prepare a schedule of improvements that meets the goals of the City's financial program.

In addition, this CWP serves, by adoption, as a critical element of the 2015 Update to the City of Arlington's General Comprehensive Plan. Consistency between the plans, and the 2015 Update to Snohomish County's Plan, has been assured during their concurrent preparation. Arlington is forecast to accommodate a total of 24,937 citizens and at least 12,224 jobs by 2035. As stated in its 2015 Comprehensive Plan update, the City is taking a proactive role in attracting developments to meet the needs of its citizens, prioritizing alternative uses of land and public resources, and identifying in explicit terms the impact proposed developments will have on the community. Six focus area were identified in Arlington's 2015 Comprehensive Plan as being the most suitable for future residential, industrial and retail growth; these same focus areas were evaluated in this CWP to assure adequate wastewater infrastructure to assure a high level of service to existing customers, and to facilitate the growth of new customers. See chapter 3 for additional Land Use discussion.

1.4 SUMMARY OF PLAN CONTENTS

A brief summary of the content of the chapters in the Plan is as follows.

- **Chapter 1** introduces the reader to the City's Wastewater Utility, the objectives of the Plan, and the Plan organization.
- **Chapter 2** presents the Wastewater Service Area and describes the existing wastewater utility.
- **Chapter 3** presents related plans, land use and population characteristics.
- **Chapter 4** identifies existing wastewater flow rates and projects future rates.
- **Chapter 5** presents the City's operational policies and design criteria.
- **Chapter 6** discusses the sewer system analyses and existing system deficiencies.
- **Chapter 7** presents proposed wastewater utility improvements, their estimated costs and an implementation schedule.
- **Chapter 8** discusses the Wastewater Utility's operations and maintenance program.
- **Chapter 9** summarizes the financial status of the Wastewater Utility and presents a plan for funding wastewater improvements.

1.5 LIST OF ABBREVIATIONS

The abbreviations listed in **Table 1-2** are used throughout this Plan.

Table 1-2. Abbreviations

Abbreviation	Description
AAF	Average Annual Flow
ac	acres
BNR	Biological Nutrient Removal
BOD	Biochemical Oxygen Demand
CIP	Capital Improvement Program
City	City of Arlington
COD	Chemical Oxygen Demand
DOE	Department of Ecology
DOH	Department of Health
EPA	Environmental Protection Agency
ERU	Equivalent Residential Unit
fps	feet per second
GMA	Growth Management Act
gpm	gallons per minute
hp	horsepower
I/I	Infiltration and Inflow
MBR	Membrane Bioreactor
MDF	Maximum Day Flow
MMF	Maximum Month Flow
MG	Million Gallons
mgcd	million gallons per capita per day
MGD	Million gallons per Day
mg/L	Milligrams per Liter
mi^2	square miles
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety & Health Administration
PHF	Peak Hour Flow
RW	Reclaimed Water
SBR	Sequencing Batch Reactor
TDH	Total Dynamic Head
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UGA	Urban Growth Area
WAC	Washington Administrative Code

2 Wastewater System Description

2.1 INTRODUCTION

This chapter defines the City of Arlington's (City) wastewater service area, and provides an overview of the wastewater utility with its component sewer collections, wastewater treatment, and disposal and reuse systems as they exist in 2015. It estimates septic systems within the service area and identifies adjacent water and sewer systems. The existing wastewater system described herein is analyzed and evaluated for performance under current conditions, as well for projected demands in about 10 and 20 years (2024 and 2035). The results of these analyses are presented in **Chapter 6.**

2.2 WASTEWATER SERVICE AREA

2.2.1 Wastewater Service Area Definition

The City is located in northwestern Snohomish County, Washington, at the confluence of the North Fork and South Fork of the Stillaguamish River. The City's corporate boundary encompasses an area of approximately 6.216 acres (9.71 square miles), as shown in **Figure 2-1,** Wastewater Service Area. An urban growth area (UGA) on the periphery of the City, identifying the area in which the City can grow by annexation, totals an additional 388 acres (0.61 mi^2). Since the previous Comprehensive Wastewater Plan, the City has annexed Island Crossing, the Country Charm Conservation Area, and smaller parcels in the southeast corner of the City near the intersection SR 9 and SR 531. For much of the City, the city limits are currently coincidental with the UGA. The City is currently proposing changes to its UGA as described below.

2.2.2 Expansion Area West of I-5

The City of Arlington's water (not wastewater) service area extends north from the City of Marysville to the Stillaguamish River, and west of the existing City limits at I-5 to the BNSF railroad tracks. An agreement between the Cities of Arlington and Marysville places the boundary between the two Cities for future UGA expansion approximately along 184th Street. The City of Arlington (City) has petitioned Snohomish County for Urban Growth Area (UGA) expansion into

approximately 190 acres bounded by I-5 to the east, 184th Street to the south, 23rd Avenue on the west, and 200th Street on the north. This area lies entirely within the Rural Urban Transition Area (RUTA) established by Snohomish County. The petition is currently before the Snohomish County Council, and a decision is expected in 2016.

With these authorities and pending decision in place, the City of Arlington (City) is beginning planning its delivery of water and sewer service to an area that is absent of any utility infrastructure. Long-term planning will cover the approximately 900 acres of the water service area bounded by 184th and 200th Streets, and I-5 and the railroad. This Comprehensive Wastewater Plan will focus on the anticipated 190 acre UGA fronting along I-5.

2.2.3 Wastewater Infrastructure and the Service Area Boundary

The City's existing wastewater service area boundary generally follows the 6,604 acres (10.3 mi^2) of the City's UGA as shown in **Figure 2-1**. The largest exception (about 555 acres) is in the southwest corner of the City where the portion of the Smokey Point neighborhood south of 180th Street and west of 43rd Avenue is served both water and sewer by the City of Marysville. The City also serves the Washington State Department of Transportation (WSDOT) rest areas along I-5. Altogether, the Wastewater Service Area contains about 6,049 acres.

Just because an area is "served" does not mean that an existing or proposed structure can readily connect to a sewer main. The City's existing wastewater collection system generally extends from just south of 172nd Street NE, north to the South Fork and mainstem of the Stillaguamish River, east to the intersection of 212th Street NE and 87th Avenue NE, and west to I-5 at Island Crossing, as shown in **Figure 2-2**, Existing Sewer System. Existing parcels in the UGA that do not yet contain wastewater collections infrastructure include the following neighborhoods: Kunze Tracts (88th Dr.); Meadowbrook (89th Ave.); The Eagles (84th Ave.); Pioneer Park (62nd Dr.); Camelot Terrace (204th Pl.); and Prospect Point, Sau Turn, Cedar Village, and adjacent areas (Cemetery Rd., 196th Pl.. near 45th Dr. Sewer main has just recently been installed to begin serving the Star, Thompson, and Hilltop areas.

2.2.4 Wastewater Source Characterization

The service area primarily contains customers who generate sewage typical of domestic uses or low strength. As shown later in **Chart 4-1**, 96 percent of customer connections are residential, and four percent are commercial and industrial customers. Most of the commercial and industrial customers are very similar to residential customers in terms of effluent strength. For example, several, large industrial facilities in the City are not individually monitored due to mainly domestic and low production strengths, including: Alpha Technologies; Cuz Concrete; Powder Fab; Ecoating Solutions; Round Gold (recently moved); and Superior Powder Fabrication (new).

Three Significant Industrial Users (SIUs) are currently metered and monitored under the Wastewater Department's Pretreatment Program. These include, from the largest to smallest discharger: Ace Acme Septic; Snohomish County Solid Waste Transfer Station; and the

Snohomish County Decant Facility. Data from 2010 indicate these three facilities discharge less than 5 MG annually, or about one percent of the total annual influent to the WRF. Perhaps the discharger of the greatest volume and strength of effluent in recent history was US Marine/Bayliner Boats, who discontinued operations in the City between 2008 and 2010.

2.3 HISTORY

Arlington was incorporated in 1903. Construction of the sewer system began in 1913. Throughout the years, the system was extended to serve the greater downtown area with a combined sanitary sewer/storm sewer system. This system collected the City's wastewater and channeled it through a 36-inch-diameter trunk line to a discharge location on the banks of the Stillaguamish River, near the current wastewater reclamation facility location. All of the City's raw sewage was discharged into the river untreated until 1959.

Much of the downtown area sewer system that remains today consists of this legacy infrastructure. Between 1957 and 1959, a separate storm drain system was constructed in areas served by the old combined sewers. Roof drains and some other sources of inflow may remain connected to the sewer in that area. The remaining sewer collection system is relatively new, with the majority of the construction occurring within the last 20 years.

The City's first wastewater treatment plant, featuring primary treatment for the removal of settled solids and surface scums, was completed in 1959. Effluent discharged to the river through the same combined storm and sewer outfall as before. In 1974, the plant was upgraded to secondary treatment for the degradation of organic matter. A new wastewater outfall located just east of the old location was constructed and is still used today. This plant was one of the first secondary treatment facilities in the State of Washington. In 1998, the City upgraded its plant to a sequencing batch reactor (SBR) facility for improved secondary treatment. Again, the SBR technology selected was at the time considered cutting edge.

Sudden growth in the City subsequent to the 1998 expansion caused the wastewater treatment plant to approach capacity by 2004. This required the City to enhance the existing treatment process and begin planning for an expansion to the treatment plant. At the same time, a biosolids composting facility was added to reduce sludge disposal costs and provide beneficial reuse through production of Class B quality compost.

As part of the State's clean-up efforts for the Stillaguamish River, increasingly stringent discharge limits were placed on the treatment plant's discharge, requiring an increase in treatment technology to produce cleaner effluent. Beginning 2008, with completion in 2011, the treatment plant was upgraded and expanded for improved removal of conventional contaminants through membrane biofiltration (using membrane bioreactors [MBR]), and additional treatment for the removal of phosphorus and nitrogen using advanced biological nutrient removal. With this upgrade, the facility can produce effluent of Class A reclaimed water quality. Instead of a wastewater treatment

plant (WWTP), it is referred to as a water reclamation facility (WRF). With pre-designed expansion for capacity increases, the WRF is intended to serve the City well beyond 2025.

2.4 GEOLOGY AND SOILS

The City is located in northwestern Snohomish County, Washington, at the confluence of the North Fork and South Fork of the Stillaguamish River. At least three landforms converge here that affect how the City manages its water resources: the Marysville Trough, Getchell Plateau, and Stillaguamish River Floodplain. The Marysville Trough and Getchell Plateau were formed during the last glacial epoch—the Vashon—ending approximately 13,000 years ago. The Stillaguamish floodplain formed as the river cut through these formations since that time.

The Marysville Trough consists of terraces and areas of low relief extending from Old Town, south and southwest through the airport and Smokey Point areas, continuing south to the Snohomish River. The landform is underlain by outwash—gravels and sand deposited by meltwater as the glacier advanced and then receded. The outwash is from 100-to-200 feet deep and provides good infiltration, except where a groundwater divide is very shallow along SR 531 (172nd St), or where wetlands have developed. Approximately 55 percent of the wastewater service area is located on soils developed in glacial outwash, such as the Everett gravelly sandy loam.

The Getchell Plateau rises from Old Town southeast along Burn Road, extending toward Lake Stevens and Snohomish. The Brekhus-Beach area and the Crown Ridge, Arlington Terrace, and Gleneagle neighborhoods are situated on this ridge. The landform is underlain by glacial till—unsorted, gray silt, sand, and gravel deposited directly beneath the advancing glacier and compacted to form a very dense "hardpan". Typically around 70 feet thick, the silt content and density of the till impedes the vertical flow of water, resulting in greater water runoff and locally high water tables during the wet season. Glacial till is absent in the Marysville Trough and Stillaguamish floodplain, having been eroded away. Approximately 29 percent of the wastewater service area is located on soils underlain by glacial till, such as the Tokul gravelly loam.

The Stillaguamish River Floodplain is underlain by post-glacial alluvium consisting of sand and gravel with cobbles and boulders. Its largest extent begins at the confluence and continues downstream to the west, and includes portions of the Portage Creek and March Creek tributaries. It is typically between 0 and 30 feet thick in the area, but does reach 100 feet below the surface of the Stillaguamish valley. The City's Haller well field located at the confluence, and the Old Town Wetland west of the WRF and SR 9 is situated in this alluvium. The Island Crossing neighborhood is also located on the floodplain. Approximately 13 percent of the wastewater service area is located on soils developed in alluvium, such as the Norma loam and Puget silty clay loam.

2.5 TOPOGRAPHY

The topography of the City's wastewater service area is highly variable. The lowest areas within the service area are located on the Stillaguamish River Floodplain near Interstate 5 at Island

Crossing where the elevation is approximately 40 feet. Much of the wastewater service area is within the Marysville Trough. Elevations range from 120 feet west of the Arlington Airport to 115 feet in downtown Arlington. The highest areas served are in the southeastern portion of the service area on the Getchell Plateau. Elevations near the intersection of 91st Avenue NE and NE 172nd Street reach approximately 480 feet. Slopes are steepest at the transitions between the three major landforms, where elevation changes of 80 to 100 feet at slopes of about 100 percent are not uncommon.

2.6 CLIMATE

The City of Arlington experiences a marine climate typical of the Puget Sound region. Summers are relatively dry and cool, while winters are mild, cloudy and rainy. The average temperature in summer is 62˚F, and the average temperature in winter is 40˚F, with temperatures occasionally falling below freezing (Barrett Consulting Group 1995).

Average annual precipitation in Arlington is approximately 46 inches, as measured at the Arlington Water Department near the confluence of the North and South Forks of the Stillaguamish River. Annual precipitation across the wastewater service area ranges from 42 inches (west of I-5 and south of SR 531) to about 49 inches to the east-southeast on the Getchell Plateau. October through April are the wettest months. The prevailing winds are from the south or southwest during the wetter months and from the northwest or west during the drier months.

Fall and winter weather is generally wetter than normal during La Nina conditions when tropical moisture originating in the South Pacific Ocean is delivered via the "Pineapple Express" to the Pacific Northwest (Taylor 1998). At the same time, the polar jet stream passes through the Bering Strait before heading toward the Pacific Northwest. These phenomena generate the larger storm events influencing Wastewater Service Area. The risk of flooding is greatest when warm, heavy rains fall on accumulated snow after larger snowstorms. The large floods of 1996, 1997, and 2009 were rain-on-snow events generated during La Nina conditions.

2.7 WATER RESOURCES

2.7.1 Watersheds

The City straddles the divide between two river basins, the Stillaguamish and the Snohomish, which are regionally recognized as Water Resource Inventory Areas (WRIAs) 5 and 7, respectively. Approximately 58% of the land in the wastewater service area drains to the Stillaguamish River, either directly to the mainstem or the South Fork Stillaguamish, or via Portage Creek. The remaining 42% of the service area drains to the Snohomish River estuary at Ebey Slough via the Middle Fork Quilceda Creek.

2.7.2 Water Quality

The larger rivers form the northern (Stillaguamish) and eastern (South Fork Stillaguamish) boundaries of the wastewater service area and are significant considerations in the management of

the Wastewater Utility. Most or all segments of these rivers are identified (listed under CWA 303d) as impaired for fecal coliform, dissolved oxygen, and temperature. Clean-up plans developed under two Stillaguamish Total Maximum Daily Load studies (TMDLs) are enforced through the NPDES wastewater discharge permit for the WRF, and the NPDES Phase II stormwater general permit for Arlington and other cities. On the south end of the wastewater service area, the Middle Fork Quilceda Creek is impaired for fecal coliform and is subject to the Lower Snohomish Tributaries TMDL.

Various studies have suggested that some of the problems with depressed dissolved oxygen levels in the mainstem Stillaguamish and the lower Snohomish River tributaries are related to a nutrient-driven mechanism. High nutrient loads from point and nonpoint source pollution drive the excessive growth of algae and other organisms, which may produce oxygen during daylight hours, but then continue to respire and consume large amount of oxygen during night-time hours. This continuous day-night cycling can plunge dissolved oxygen levels below water quality standards. However, during modeling of river dissolved oxygen concentrations for the Stillaguamish TMDL, Ecology was unable to adequately model the river using known point and nonpoint influences, including BOD loading from the City's WWTP. The Washington State Department of Ecology (Ecology) hypothesized that nutrient loading from the City's WWTP and other unknown sources were causing the DO depressions, but did not have adequate information with which to develop wasteload allocations for phosphorus and nitrogen for the WWTP. A supplemental TMDL study implemented in 2012 sought to improve upon the understanding of which processes were causing the DO impairment. However, during that effort, no excursions of dissolved oxygen outside of surface water quality standards were observed. No reports have been drafted and released as of this writing, but Ecology staff has suggested river water quality has improved. During this time frame, the City evaluated and implemented the best available technology for achieving nutrient reductions during the wastewater reclamation process.

Accordingly, the TMDLs affecting the City also address nutrient sources in most nonpoint source runoff. These sources are often associated with fecal coliform sources, including sediments, animal wastes, failing septic systems, and fertilizers.

In a separate study, Read (2006) evaluated trends in Stillaguamish basin water quality (bacteria, temperature, dissolved oxygen, and sediment) using data from multiple sources. Some data at some locations were collected as early as 1959, but most were collected between 1994 and 2006. Many of the river and stream stations analyzed, including those near Arlington, showed improvements for all parameters, including some statistically significant changes. However, despite improving or maintained conditions, fecal coliform bacteria in the mainstem and South Fork Stillaguamish Rivers and in Portage Creek still do not meet water quality standards. In addition, trends in water temperature and sediment in the South Fork near Arlington were shown to be degrading. Results are summarized in Table 2-1. For the mainstem Stillaguamish downstream of the WRF the trends are generally favorable. For water temperature in the South

Fork entering the reach with the WRF outfall, temperature trends are worsening, and may require adaptive management measures be implemented by the City.

Table 2-1. Trend analysis of water quality in the Stillaguamish Watershed from 1959 through 2006[a,b]

Stream Name	Bacteria	Temperature	Oxygen	Sediment
Mainstem Stillaguamish—Arlington	None*	Improving	Improving	Improving
South Fork Stillaguamish—Arlington	Improving*	Worsening	None	Worsening
Portage Creek	Improving*	Improving	None	Improving

[a] Table is an abbreviated version of Table 3 in Svrjcek and Lawrence (2007)

[b] Recent analysis of water quality data (Read 2006) indicate whether the trends for the parameters and water courses shown are improving, staying the same (no trend, or none), or worsening. A dark gray box indicates the trend is statistically significant ($p<0.05$). An asterisk indicates bacterial pollution remains a problem (does not meet WQS).

Copper and lead appeared on the 1998 303d list as exceeding state water quality criteria in the Stillaguamish River near Arlington, and lead was on the list for Portage Creek as well. These exceedances were deemed to not require TMDL development, due to suspicions about the reliability of the data.

Similarly, Quilceda Creek also appears on the Section 303(d) list as requiring TMDL development for lead, copper, zinc, and dissolved oxygen. However, Johnson, et. al. (2001) indicated that these metals are not present in concentrations approaching the water quality criteria in Quilceda Creek. Previous listings were due to measuring total recoverable metals, which are not comparable to the water quality standards. Ecology does not anticipate developing a TMDL for these metals unless new information indicates the need.

Further water quality data collection could result in a requirement to develop a metals TMDL for these water bodies. Metals are commonly found in stormwater runoff, and development of a metals TMDL in the future would require the issue to be addressed in a future Comprehensive Wastewater Plan update.

2.7.3 Fisheries

Fish are known to inhabit all rivers and streams within or adjacent to the Wastewater Service Area. These include both anadromous fish—those ocean-going fish who spend a portion of their life-cycle in fresh water streams, and resident fish—those fish that spend their entire life in fresh water

streams. Accordingly, nearly all life stages of fish and their subsequent habitat requirements are present in area streams year round.

Three species that inhabit area streams are federally listed as threatened under the Endangered Species Act. These are addressed individually below.

Puget Sound Chinook salmon were listed in 1999 with recent populations at about 7% of historic levels. In the Stillaguamish basin, most Chinook spawn in the mainstem river, the forks, and the larger tributaries, and rear throughout the river system. After hatching, most juvenile Chinook spend one to five months rearing in freshwater before migrating to the estuary, but, under current degraded habitat conditions only, 1-2% will rear in freshwater for a full year (SIRC 2005). Two distinct populations are recognized in the Stillaguamish basin. The North Fork Stillaguamish Chinook is the stronger population, with an average number of 1,080 fish returning in the summer to spawn (SIRC 2005). The South Fork/mainstem Stillaguamish Chinook begin arriving in mid-September with a current average population of only 246 fish (SIRC 2005). In the immediate vicinity of the City, Chinook salmon typically do not utilize Portage and Eagle Creek systems, except for temporal rearing use at their confluence with the rivers, or as flood refuge during inundation of the Stillaguamish floodplain. In the Snohomish basin, the Quilceda watershed generally provides low levels of Chinook salmon use as far upstream as Middle Fork Quilceda Creek, and they do not utilize Edgecomb Creek. Ebey Slough, however, provides extensive Chinook rearing habitat for out-migrants.

Listed in 1998, bull trout need cold water to survive, so they are seldom found in waters where temperatures exceed 59-64 °F (USFWS 2008). These fish may exhibit three different life histories—resident (non-migrating), adfluvial (migrating to rivers and larger streams), and anadromous (migrating to the ocean). In the Stillaguamish basin, four local populations of bull trout, including North Fork and South Fork Stillaguamish, are known to be anadromous (SIRC 2005). Resident populations also occur. Bull trout are opportunistic foragers, and the USFWS considers the entire distribution area for Coho salmon to be potential foraging habitat for bull trout. Hence, mimicking the distribution of Coho salmon, bull trout are presumed to occupy the rivers and all small streams in the vicinity of Arlington. Similarly, in the Snohomish basin, bull trout have not been confirmed, but are suspected to inhabit Edgecomb Creek and other tributaries and reaches of Quilceda Creek. Ebey Slough is also presumably a high traffic area for bull trout when they out-migrate during the warm summer and early fall months. Immature adults will overwinter at the head of Ebey Slough (Shared Strategy 2007).

Puget Sound steelhead trout were listed in 2007. In the Snohomish basin, the Quilceda watershed generally provides low levels of steelhead trout use as far upstream as Middle Fork Quilceda Creek, but they are not known to utilize Edgecomb Creek. The Stillaguamish River also hosts several populations of steelhead, but their essential habitats in the basins managed by Arlington have not yet been mapped.

2.8 WASTEWATER COLLECTION FACILITIES

2.8.1 Sewer Drainage Basins

The City's existing wastewater service area is comprised of 14 sewer drainage basins, as shown in **Figure 2-3**, Wastewater Collections Drainage Basins. The portion of the City's southwest UGA served by the City of Marysville is also shown in this figure.

2.8.2 Collection Piping

The City has approximately 67.4 miles of sewer piping, including collection sewers, interceptors and force mains. There are approximately 7.8 miles of force main throughout the system. A majority of the system is 8-inch-diameter gravity main, totaling nearly 49 miles. **Table 2-2**, Sewer Piping Inventory summarizes the pipe by diameter. Pipe size and location are illustrated in **Figure 2-2**.

Table 2-2. Sewer Main Inventory

Diameter (in)	Total Main Length (mi)			% of Entire System
	Force	Gravity	Total	
4	0.05	0	0.05	0.1%
6	5.34	0.21	5.56	8.2%
8	2.43	46.4	48.83	72.4%
10	0	4.74	4.74	7.0%
12	0	3.7	3.7	5.5%
15	0	1.86	1.86	2.8%
16	0	0.36	0.36	0.5%
18	0	0.28	0.28	0.4%
24	0	1.56	1.56	2.3%
36	0	0.46	0.46	0.7%
Totals	7.83	59.57	67.41	100.0%

2.8.3 Lift Stations

The City currently owns, operates, and maintains 12 wastewater lift stations numbered 1 through 13 and excluding 10. The characteristics of each lift station are summarized in **Table 2-3**, Lift Station Characteristics. A description of the telemetry system, pump control logic, lift stations, and the potential for sewage overflows or bypass at lift stations follows. Additional details on each lift station are provided in **Appendix A**.

Table 2-3. Lift Station Characteristics

Lift Station	Year Designed	Pump Station				Pumps			Wet Well		Standby Power Supply	Potential for Bypass to Waters of the State
		Manufacturer	Model	Serial No.	Force Main Dia. (in)	HP	TDH (ft)	Capacity (gpm)	Diameter (ft)	Depth (ft)		
01	2009	Davis EMU	----	----	4	10	unknown	200 200	unknown	----	WRF Generator	None
02	1989	Smith & Loveless, Inc.	Duo-Duct	06-0103-C	8	15 15	33 33	500 500	8	21±	On-site Generator	Negligible
03	1987	Smith & Loveless, Inc.	Duo-Duct	06-0101-C	3	7.5 7.5	46 46	200 200	6	15.5±	On-site Generator	None
04	1990	Smith & Loveless, Inc.	Duo-Duct	06-0105-C	8	15 15	60 60	400 400	12	21±	On-site Generator	None
05	1990	Smith & Loveless, Inc.	Duo-Duct	06-0107-C	8	15 15	30.5 30.5	450 450	12	24±	On-site Generator	None
06	1992	Smith & Loveless, Inc.	Duo-Duct	06-0108-T	8	15 15	50.7 50.7	500 500	12	26±	On-site Generator	None
07	1995	Smith & Loveless, Inc.	Duo-Duct	06-0110-Z	6	10 10	74 74	176 176	12	26±	On-site Generator	Negligible
08	1996	Smith & Loveless, Inc.	Duo-Duct	06-0112-C	6	10 10	76 76	225 225	12	18±	On-site Generator	Negligible
09	1997	Smith & Loveless, Inc.	Duo-Duct	06-0114-C	6	10 10	79 79	225 225	12	21±	On-site Generator	Very Small
11	1978	Barnes	Submersible	----	6	20 20	98 98	115 115	6	22±	Portable Generator*	Very Small
12	2001	Smith & Loveless, Inc.	Duo-Duct	06-0118	6	5 5	33 33	250 250	12	27±	On-site Generator	Negligible
13	1994	Myers	Submersible	----	2	3	----	100 100	6	11.5±	Portable Generator*	Negligible

* See text for other handling alternatives to power for these lift stations

Telemetry and Supervisory Control

Successful operation of any municipal wastewater system requires gathering and using accurate sewer system information. A telemetry and supervisory control system gathers information and can efficiently control a system by automatically optimizing facility operations. A telemetry and supervisory control system also provides instant alarm notification to operations personnel in the event of equipment failure, operation problem, flood, fire or other emergency situations.

The City's telemetry and supervisory control system (SCADA) initially controlled lift station operations through phone lines connecting floats in each wet well to the control logic of the SCADA system located at the wastewater treatment plant. SCADA would then turn pumps on and off to operate each lift station within a range of wet well levels.

Telemetry and communications were improved with an upgrade to Mission Communications in 2009. Remote telemetry units at each of lift station have the capability to monitor 2 analog and 8 digital inputs. A transducer system senses the real time wet well level, high wet well level, low wet well level, communication, power failure, generator failure, pump status, pump starts, flow, pump runtime, in service mode, and water in drywell. The units utilize cellular type communication with a web based interface to continuously monitor and communicate this information to the SCADA system. At high and low set points unique to each lift station, SCADA has the ability to start and stop pumps, respectively, as needed. Each lift station can also be accessed and controlled remotely from any web server. The two original floats remain in place in each wet well to provide backup pump control and alarm sensing in the event of a failure of the Mission Communications system.

Lift Station No. 1 - Northwest Corner of Sewer Treatment Plant

Lift Station No. 1, located at the northwest corner of the wastewater treatment plant, was constructed in 1998. This small submersible type pump station serves the treatment plant site, stormwater runoff from the site, associated public works' offices, and a few properties located in the far northern region of the City. This station was upgraded in 2010 along with the Wastewater Treatment Upgrade. The station was retrofitted with new controls and new pumps now capable of 200 GPM and still maintains the existing 4" force main. The emergency generator providing backup power to the WRF also serves Lift Station No. 1.

Lift Station No. 2 - LID 20/204th Street

Lift Station No. 2, located on 204th Street near 71st Avenue NE, was constructed in 1989 for Local Improvement District (LID) 20. It is a wet well/dry well Smith and Loveless Duo-Duct package pump station. It is equipped with two 15 horsepower pumps, each with a capacity of 500 gpm at 33 feet of total dynamic head. A recent impeller upgrade using Smith & Loveless Xpellers reduced clogging of the pumps and also resulted in the nine percent increase in capacity from 460 gpm. The wet well is 8 feet in diameter and approximately 21 feet deep. As described previously, a transducer system senses the wet well fluid level, and two floats in the wet well provide backup

pump control and alarm sensing. The lift station has an 8-inch force main and is equipped with an emergency generator.

Lift Station No. 3 – Snohomish County Transfer Station

Lift Station No. 3 is located at the North County Recycling and Transfer station on 63rd Avenue NE. The wet well/dry well Smith and Loveless Duo-Duct package pump station was constructed in 1987. It has two 7.5 horsepower pumps, each with a capacity of 200 gpm at 46 feet of total dynamic head. A recent impeller upgrade using Smith & Loveless Xpellers reduced clogging of the pumps without affecting pump capacity. The wet well is 6 feet in diameter and approximately 16 feet deep. As described previously, a transducer system senses the wet well fluid level, and two floats in the wet well provide backup pump control and alarm sensing. The lift station has a 3-inch force main and is equipped with an emergency generator. A technical evaluation of Lift Station No. 3 was conducted in 2007 by MSA. A detailed memorandum dated April 2007 is archived in Wastewater Department files.

Lift Station No. 4 - AAMP

Lift Station No. 4 is located on 59th Avenue NE near Arlington Advanced Manufacturing Park (AAMP). The station was constructed in 1990. It is a wet well/dry well Smith and Loveless Duo-Duct package pump station with two 15 horsepower pumps. Each pump has a capacity of 400 gpm at a total dynamic head of 37 feet. A recent impeller upgrade using Smith & Loveless Xpellers reduced clogging of the pumps, but also resulted in a five percent decrease in capacity from 420 gpm. (The issue is being addressed with the manufacturer as of this writing.) The lift station has an 8-inch-diameter force main. The wet well is 12 feet in diameter and is approximately 21 feet deep. As described previously, a transducer system provides for sensing of wet well fluid level, and two floats in the wet well provide for backup pump control and alarm sensing. The lift station is equipped with an emergency generator for backup power supply.

Lift Station No. 5 - Westside Airport

Lift Station No. 5 is located near the Westside Airport at approximately 51st Avenue NE and 172nd Street NE. The wet well/dry well Smith and Loveless Duo-Duct package pump station was constructed in 1990. The lift station is equipped with two 15 horsepower pumps, each with a capacity of 450 gpm at 30.5 feet of total dynamic head. A recent impeller upgrade using Smith & Loveless Xpellers reduced clogging of the pumps without affecting pump capacity. The wet well has a diameter of 12 feet, and a depth of approximately 24 feet. As described previously, a transducer system senses the wet well fluid level, and two floats in the wet well provide backup pump control and alarm sensing. The lift station has an 8-inch force main and an emergency generator.

Lift Station No. 6 - I-5 Rest Stop/WSDOT

Lift Station No. 6 is located on Smokey Point Boulevard near the I-5 rest stop. The lift station was constructed in 1992. It is a wet well/dry well Smith and Loveless Duo-Duct package pump station

with two 15 horsepower pumps. Each pump has a capacity of 500 gpm at 50.7 feet of total dynamic head. A recent impeller upgrade using Smith & Loveless Xpellers reduced clogging of the pumps without affecting pump capacity. The wet well has a diameter of 12 feet and a depth of approximately 26 feet. As described previously, a transducer system senses the wet well fluid level, and two floats in the wet well provide backup pump control and alarm sensing. The lift station pumps to an 8-inch diameter force main. The facility is fenced and equipped with an emergency generator.

Lift Station No. 7 – High Clover Park

Lift Station No. 7 is located in High Clover Park at 198th Avenue NE and 47th Avenue NE. The wet well/dry well Smith and Loveless Duo-Duct package pump station was constructed in 1995. It has two 10 horsepower pumps, each with a capacity of 176 gpm at 74 feet of total dynamic head. A recent impeller upgrade using Smith & Loveless Xpellers reduced clogging of the pumps without affecting pump capacity. The wet well is 12 feet in diameter and approximately 26 feet deep. As described previously, a transducer system senses the wet well fluid level, and two floats in the wet well provide backup pump control and alarm sensing. The lift station has a 6-inch force main. The facility is fenced and equipped with an emergency generator.

Lift Station No. 8 - Highland View

Lift Station No. 8, located near the intersection of 67th Avenue NE and Highland View Drive was constructed in 1996. It is a wet well/dry well Smith and Loveless Duo-Duct package pump station. The station is equipped with two 10 horsepower pumps, each with a capacity of 225 gpm at 76 feet of total dynamic head. A recent impeller upgrade using Smith & Loveless Xpellers reduced clogging of the pumps without affecting pump capacity. The wet well is 12 feet in diameter and is approximately 18 feet deep. As described previously, a transducer system provides for sensing of wet well fluid level, and two floats in the wet well provide for backup pump control and alarm sensing. The lift station pumps to a 6-inch diameter force main. The site is fenced and the station is equipped with an emergency generator.

Lift Station No. 9 - River Crest

Lift Station No. 9, located north of the River Crest subdivision and just south of SR 530, was constructed in 1997. The wet well/dry well Smith and Loveless Duo-Duct package pump station has two 10 horsepower pumps. Each pump has a capacity of 225 gpm and a total dynamic head of 79 feet. A recent impeller upgrade using Smith & Loveless Xpellers reduced clogging of the pumps without affecting pump capacity. The wet well is 12 feet in diameter and 21 feet deep. As described previously, a transducer system provides for sensing of wet well fluid level, and two floats in the wet well provide for backup pump control and alarm sensing. The River Crest Lift Station discharges to a 6-inch force main. The site is fenced and the station is equipped with an emergency generator for backup power supply.

Lift Station No. 10 – Cedar Stump

Lift Station No. 10, located near Cedar Stump, was abandoned December 6, 2001.

Lift Station No. 11 - Island Crossing

Lift Station No. 11, located at Island Crossing, was purchased from the City of Marysville sewer system. It was originally constructed in 1978 and the pumps were replaced in 2000. It is a submersible type (wet well only) pump station with two 20 horsepower Barnes pumps. Each pump has a capacity of 115 gpm at 98 feet of total dynamic head. Capacity has declined from 120 gpm in recent years due to age. The wet well is 6 feet in diameter and is approximately 22 feet deep. A transducer system provides for sensing of the wet well fluid level. The Island Crossing Lift Station pumps to 6-inch and 8-inch force mains. The site is not fenced, nor is it equipped with an emergency generator. A technical evaluation of Lift Station No. 11 was conducted in 2007 by MSA. A detailed memorandum dated April 2007 is archived in Wastewater Department files.

The facility does not have backup power onsite. When a power outage is observed or detected through the SCADA system, staff check all facilities and record the existing level of the fluid in the wet-well. This level dictates the amount of time Wastewater staff has and the approach they should take to relieve the load on the lift station. The preferred alternative is to use the City's vactor truck to remove the fluid from the wet well and discharge it at the Water Reclamation Facility at intervals of no less than 24 hours. The other alternative is to mobilize a trailer mounted generator at the site in the case of a prolonged outage. The Arlington Fire Department does have two trailer mounted portable generators that the Wastewater Department can utilize during these periods. The lift station is equipped to easily accommodate the portable generator, and it can operate normally with the generator in place.

Lift Station No. 12 - Crown Park

Lift Station No. 12 is located near Crown Park on 59th Avenue NE south of 172nd Street NE. It is a wet well/dry well Smith and Loveless Duo-Duct package pump station. The station has two 5 horsepower pumps, each with a capacity of 250 gpm at 33 feet of total dynamic head. The facility is fenced and equipped with an emergency generator. The wet well has a depth of approximately 27 feet. As described previously, a transducer system provides for sensing of wet well fluid level, and two floats in the wet well provide backup pump control and alarm sensing. The lift station discharges to an 8-inch force main.

Lift Station No. 13 - Yarmuth S/P

Lift Station No. 13 is a submersible type lift station, equipped with two grinder pumps with a capacity of 100 gpm that pump to a 2-inch force main. This small lift station, located south of the intersection of 215th Street NE and 87th Avenue NE, serves six residences. Formerly a private sewer system, the City took over management of this lift station and a new electrical panel was installed in 2006. A float system consisting of a High, Lag, Lead, Off, and Low senses the fluid level in the wet well and controls operations.

This facility has no backup power on site. For extended outages, the City has three alternatives to assure successful interim operations. The simplest (and the one used the only time an extended outage required it) is the use of the utility's trash pump to pump the LS reservoir's contents to the adjacent manhole on a gravity line located only about 6 feet away. Two other alternatives are the use of either a portable generator or the vactor truck.

Risk of Bypasses and Overflows Discharging to Waters of the State

Wastewater and Stormwater staff have thoroughly inventoried their respective collection and discharge systems. The City's efforts to create separate sewer systems began in the 1950s, and apparently have been quite successful, as no points meeting definitions of combined sewer overflows are known to exist. Therefore, the risk of overflows or bypasses via overwhelmed pipes and points of physical connection to unintended water sources and outfalls is negligible.

During periods of heavy flow, lift station wet wells are designed to provide adequate storage given the drainage area, diameter and length of force main, and pump characteristics. The lift stations have redundancy in wet well monitoring and in communications with SCADA through the Missions Communications transducers, float switches, and cellular lines. Each lift station is equipped with two pumps even though it is fully functional with one, thus providing redundancy in pump operations as well. Therefore, the risk of overflows or bypasses resulting from mechanical failures is also negligible.

Every lift station is also equipped to handle power outages. As described above and as shown in **Table 2-3**, each lift station has a standby generator that is maintained for emergencies. One exception is Station 11, which is equipped for use with portable generators available from the Fire Department, or which may be maintained using a vactor and transport method. The only other exception is Station 13, which is perfectly situated for use with a portable generator, trash pump, or vactor truck. Therefore, the risk of overflows or bypasses resulting from electrical failures is also negligible.

In summary, the City has multiple practices or "barriers" in place, making it highly unlikely for sewage to flow or overflow and reach waters of the State. The only plausible scenario would be one where operator error resulted in the inadvertent setting of a wet well level or other operating criterion, causing the overflow of sewage to the street or surrounding land, and then the subsequent flow to low-lying stormwater infrastructure. In this rare situation, staff are equipped to notify the State and rapidly implement containment, clean-up, and monitoring procedures. **Table 2-3** demonstrates the relative range of risks for untreated sewage from lift stations to reach waters of the State based on the above considerations and the proximity of lift stations to either surface waters or stormwater facilities. Because Lift Stations 9 and 11 are situated on the Stillaguamish floodplain, they are assumed to possess the greatest risk—though very small—of a sewage overflow of reaching waters of the State.

2.9 WASTEWATER TREATMENT AND DISPOSAL FACILITIES

2.9.1 Water Reclamation Facility

The City's first wastewater treatment plant was constructed in 1959 on the same site occupied today. It featured primary treatment using a clarifier for the removal of settled solids and surface scums from sewage collected via a then-new, separate collection system. Effluent discharged to the Stillaguamish River through the same combined storm and sewer outfall on its south bank that had been in use for decades.

In 1974, the WWTP was upgraded from primary treatment facility to one of the first secondary treatment facilities in Washington State. A new outfall was added as well. The plant consisted of the influent structure, one oxidation ditch with a single return-activated-sludge (RAS) pump, one secondary clarifier, a sludge holding tank, a chlorine tank and a laboratory, and had a capacity of 1 million gallons per day (MGD). The effluent was discharged through the new outfall into the thalweg of the Stillaguamish River, and the lime-stabilized liquid sludge was hauled away to City-owned property at the Arlington Airport for application onto grass fields surrounding the airport runways.

In 1998, the treatment facility was upgraded to a then state-of-the-art Sequencing Batch Reactor (SBR) with a capacity of 2 MGD. The City upgraded the aeration capacity of the WWTP and made some solids handling improvements in 2004.

Beginning 2008, with completion in 2011, the treatment plant was expanded and upgraded to meet TMDL clean-up objectives for the Stillaguamish River. Upgrades included improved removal of conventional contaminants using membrane biofiltration, and tertiary treatment for the removal of phosphorus and nitrogen using biological nutrient removal. With these upgrades, the facility can produce effluent of Class B reclaimed water quality. Instead of a wastewater treatment plant (WWTP), it is now referred to as a water reclamation facility (WRF) to communicate this distinction. With pre-designed expansion for capacity increases, the WRF is intended to serve the City with a capacity of 2.67 MGD well beyond 2025. It is expandable to 4 MGD with the addition of membrane cartridges in pre-constructed, vacant filtration bays.

2.9.2 Disposal Facilities

Stillaguamish River Outfall

Effluent of reclaimed water quality is discharged from the WRF to a single-port outfall in the Stillaguamish River at River Mile 17.7. The discharge is into the mainstem of the Stillaguamish River approximately 500 feet below the confluence of the North and South Forks (and 400 feet downstream of the City's Haller Well Field on the south bank of the river). The final 209-foot section of the outfall is a 24-inch diameter ductile iron pipe constructed in 1991 to replace a prior 16-inch outfall damaged from high river flows the previous winter. Two hundred eleven (211) feet of 16-inch diameter pipe remains between the newer 24- inch outfall section in the river and a manhole at the top of the south bank of the river (MH #3). This 16-inch segment is schedule to be

upgraded to 24 inches when influent flows average 1.7 MGD. The single port diffuser is the 12-inch diameter end of a 24-inch x 12-inch reducer discharging horizontally at the river bottom. The outlet port is approximately 45 feet south of the thalweg of the river at low flows. The outfall was in good condition during August 2006 field studies in preparation for the WRF upgrade. No visible leaks were found in the submerged portion of the outfall pipe during a dye study for the outfall mixing zone.

Old Town Wetland

In 2011, the City completed construction of a 9.8 acre wetland site designed to treat stormwater from 284 acres of Old Town (downtown) Arlington prior to its discharge to the Stillaguamish River. With the March 2014 NPDES permit renewal, the City also obtained a permit for the reuse of reclaimed water in the Old Town Wetland. The reclaimed water can help maintain wetland vegetation and functions through the dry summer months. It will also provide a slower release of water to the river after percolation to and storage in riparian groundwater.

The wetland was also designed with wastewater benefits in mind, however. Static temperature models (in the 2007 WRF engineering report) suggest that future reclaimed water production rates may be too great and too warm, resulting in increases in river temperature that are not consistent with surface water quality standards established in WAC 173-201A. Routing reclaimed water through the constructed wetland was identified as an adaptive management measure where temperature reductions may be achieved through vegetative shading and blending with groundwater. Reclaimed water use in the wetland—now—provides opportunity to grow the vegetation that would provide the shading, and evaluate the effectiveness of the concept prior to the potential for exceedance of the water quality standard for temperature.

Biosolids Composting Facility

Sludge from the WWTP is trucked to the BCF, amended with a carbon source (e.g., wood chips, hog fuel), and arranged in aerated static piles. Over time, biological activity naturally decomposes the sludge at elevated temperatures, creating stabilized biosolids that can be used beneficially for land application as compost. The BCF produces Class A Exceptional Quality biosolids.

The BCF began operation on a city-owned 2.8 acre site in 2004. Soon after beginning operation, it received an odor complaint from neighbors of the facility. It temporarily suspended hauling biosolids for a couple days, but received clearance from the Puget Sound Clean Air Agency that it could continue production. The City modified a sludge thickening process in January 2006 which prevented septic conditions, and reduced odors. The 2011 WRF upgrade also changed solids handling to aerobic digestion resulting in higher quality sludge and further reducing odors. Since the initial complaint, the City has received no odor complaints related to the BCF.

The BCF was designed to process 15.5 cubic yards (CY) of biosolids per day. Although the annual average loading to the BCF is about 10 CY of biosolids per day, the loading occasionally exceeds the current capacity of 15.5 CY per day. At one point the City considered marketing the compost

for homeowner and commercial use, but the City's own demand has grown such that virtually all compost produced is reserved for City projects. Examples of beneficial uses for the compost include soil amendment in parks, ball fields, rain gardens, the cemetery, and other construction and landscaping projects.

Expansion and upgrade of the BCF was considered at the same time as the expansion and upgrade to the WRF. Additional storage areas for raw materials, compost piles, and finished compost, and mixing equipment and odor control were considered. Hauling and land application in eastern Washington were shown to be more cost-effective than upgrade and expansion, however, and the decision was made to continue BCF operations at their existing levels.

Off-site Land Application

According to recent Annual Biosolids Reports submitted to Ecology, the WRF produced 278 dry tons of biosolids in 2014 of which approximately 87 dry tons (31%) were composted at the BCF and approximately 191 dry tons (69%) were land applied as Class A biosolids on Ecology-approved agricultural lands near Snohomish, WA. Land application has also occurred near Wilbur and Vantage, WA in recent years. Land application sites are monitored to assure nutrients meet agronomic rates and do not result in accumulations that may migrate and contaminate ground and surface waters.

2.10 ONSITE SEPTIC SYSTEMS

It is not known that the City has ever maintained a record of parcels within its Wastewater Service Area which were served by onsite septic systems (OSS). Septic-related information can provide valuable insight with regard to expansion of the wastewater collection system and risks to the environment, water supply, and public health.

In May 2014, the City obtained a copy of an OSS database developed by the Snohomish Health District (SHD) and maintained by Snohomish County Surface Water Management (SWM). The database is known by the acronym DAVE-- Drainfield Awareness and Vital Education—after the Ecology grant enabling its initial development. DAVE was only briefly reviewed for this preliminary assessment. Data fields which are immediately used in an initial evaluation included: Location (Parcel_ID); SHD Review Status (EhSystemSt); Owner Type (UseCode); and Age (YrHouseB and YrInstal). At the time of this review, DAVE contained 83,649 records for all of Snohomish County.

DAVE was used as a lookup table in GIS using Location to select 1,301 records within the City of Arlington's existing city limits. SHD had conducted reviews of 643 records (49.6%), including about 70 to 78% of those installed in the 1960s and 1970s, and determined just 11 records no longer had an OSS. Applying this rate to all Arlington records, DAVE contains approximately 1,279 records of active OSS within city limits. A summary of DAVE records is contained in **Table 2-4**.

Residential sewage disposal is served by nearly 1,100 (85%) of all OSS in the City. Approximately 179 (14%) OSS serve commercial purposes (see **Table 2-4**).

The age of OSS within the City is fairly well distributed, with 10% to 25% of all OSS drainfields built or re-built in each of the five previous decades. Approximately 46% of septic systems were installed in the 1990s and 2000s, when rapid growth in and near the City and its UGA outpaced the construction of wastewater infrastructure (**Table 2-4**).

Table 2-4. Septic Drainfield Age and Ownership within Arlington City Limits[a,b]

Decade in which Septic Drainfield was Installed	Count by Owner Type			Total		Records Validated	
	Residential	Commercial	Other	Count	Percent	Count	Percent of Row Total
1890-1959	35	6	1	42	3%	4	10%
1960-1969	139	8	1	148	12%	116	78%
1970-1979	256	18	3	277	22%	194	70%
1980-1989	169	52	8	229	18%	120	52%
1990-1999	266	47	4	317	25%	136	43%
2000-2009	215	47	1	263	21%	70	27%
2010-2015	2	1	0	3	0%	3	100%
Total Count	1,082	179	18	1,279	100%	643	50%
Total Percent	85%	14%	1%	100%	-	50%	-

[a] Snohomish Health District DAVE Database queried and evaluated by City of Arlington May 2014

[b] Database maintained and expanded by Snohomish County Surface Water Mgt.

The City partnered with SHD, SWM, and Ecology in 2010 to survey streams within the Portage Creek watershed in and adjacent to the City. The primary objective was to identify sources of bacterial contamination in the streams, including failing septic systems on streamside properties under jurisdiction of either the City or Snohomish County. Two separate surveys targeted wet season and dry season sources. The surveys detected no significant bacterial contamination, and no failing septic systems or other contaminant sources (e.g., stormwater, pet waste). That effort suggests that environmental and public health concerns from OSS need not drive expansion of wastewater collection systems into currently unserved areas of the City.

2.11 ADJACENT WATER AND SEWER SYSTEMS

The only other nearby sewer service system is the City of Marysville (Marysville). Marysville provides water and sewer service to a southwest portion of the City of Arlington (the Smokey Point neighborhood south of 180th Street and west of 43rd Avenue) and south of the Arlington

Airport (south of 172nd Street and west of 51st Avenue (**Figure 2-1**). The Marysville sewer service area encompasses approximately 21.3 square miles. Marysville's Sewer Comprehensive Plan was most recently updated in November 2011 and is available via their web page.

2.11.1 Water Systems Influencing Sewer Return Flows to the WRF

The Department of Health's Sentry Internet database was consulted in April 2014 to identify and describe Group A Community water systems in the vicinity of the City's Wastewater Utility. Water Facilities Inventory (WFI) forms were reviewed for basic operating information. Two larger, expanding Group A water systems produce water which returns via the sewer collections system to the WRF. In addition, there are two other expanding Group A systems in the area, and eight smaller, non-expanding Group A water systems. All of these water systems are shown in **Figure 2-4**. Each system is briefly summarized from their WFI form below.

The City of Arlington (Water System ID 02950K)

The City's existing water distribution system generally extends south to about 172nd Street NE, north to the South Fork of the Stillaguamish River, east to the intersection of 172nd Street NE and Burn Road, and west to Interstate 5. One exception is Arlington's Smokey Point neighborhood south of 180th Street, north of 166th Street, east of Interstate 5, and west of approximately 43rd and 51st Avenues. This area of Arlington is provided both water and sewer by the City of Marysville. As of 2014, the City has approximately 5,444 water service connections. The City serves a population of 16,245 persons in 4,835 dwelling units. There are 609 additional industrial, commercial, and industrial (ICI) and other connections.

Water supply to the City is provided through three sources. The Haller well field consists of three groundwater wells (and one reserve well) that are under the influence of surface water. A rapid filtration treatment plant has been recognized for producing some of the highest quality, filtered, disinfected potable water in the State for more than 12 years. This source produced 92% of the City's potable supply in 2013. The Airport well field produced 2% of the City's supply from a single, untreated groundwater well with chlorine disinfection. The remaining 6% of the municipal potable water supply is water purchased wholesale from the Snohomish County PUD. Water storage is provided by two reservoirs that have a total capacity of 4 million gallons (MG). In addition, the City's water system has 4 pressure zones with 8 pressure reducing stations, 1 booster pump station and more than 89 miles of water main. The City's water service area is shown in **Figure 2-4**.

Snohomish County PUD No. 1 – Lake Stevens (Water System ID 80907)

The Snohomish County PUD No. 1's (PUD) Lake Stevens water system (aka as PUD's Integrated System) abuts the City's eastern service area boundary, with most of its adjacent infrastructure near the southeastern corner of the service area. The PUD's WFI indicates approximately 17,739 water service connections. It serves a population of 43,695 in 17,324 dwelling units. The WFI indicates 415 additional industrial, commercial, and industrial (ICI) and other connections.

However, a recent transfer of the Sunnyside neighborhood from PUD to the City of Marysville is understood to have reduced PUD's active water customers by about 20%.

The PUD receives most of its water from approximately eight interties with the City of Everett. However, it has recently begun increasing the amount of water it produces from two wells near Lake Stevens at up to 2,400 gpm. The City of Arlington receives water from the PUD via a wholesale water supply line. In 2013, about 6% of the City's supply was a blend of Sultan River water and groundwater served by PUD.

2.11.2 Other Large, Expanding Group A Community Water Systems

The City of Marysville

Marysville's water system is located south of the City's service area boundary. Marysville's WFI indicates approximately 20,683 water service connections. It serves a population of 62,115 in 19,395 dwelling units. The WFI indicates 1,288 additional industrial, commercial, and industrial (ICI) and other connections. However, a recent transfer of the Sunnyside neighborhood from PUD to the City of Marysville is understood to have resulted in a significant increase in the number of Marysville's residential water customers.

Water is supplied to the system from Edward Springs, three groundwater wells near the springs, two other groundwater wells, a Ranney well in the Stillaguamish River, and an intertie with the City of Everett. A filtration plant for the Ranney well, located within Arlington city limits, serves only City of Marysville customers. Although interties between the two cities formerly existed, no interties currently exist. The only exception is Arlington water purveyed to a single service in an isolated portion of the Marysville service area).

Marysville has a large service area that extends well beyond its city limits. As described previously, Marysville serves water to Arlington's Smokey Point neighborhood. Marysville provides sewer service to those same customers, so no wastewater generated from Marysville water reaches Arlington's WRF.

Seven Lakes Water Association (Water System ID 77660)

Seven Lakes Water Association operates a water system in the lakes region of the lower Stillaguamish basin, west of the railroad which marks the western margin of Arlington's water service area. Seven Lake's WFI indicates approximately 2,223 water service connections. It serves a permanent population of 5,557 in 2,215 dwelling units. The WFI indicates three additional industrial, commercial, and industrial (ICI) connections. It also serves five recreational camps and RV parks where transient populations range from 1,905 in January to 8,075 in July and August.

Water sources include three deep wells (depths exceeding 150 to more than 330 feet) and one shallow well. Other reserve wells and an intertie with Marysville are maintained for emergency purposes. All services in this area are understood to utilize onsite septic systems for waste disposal.

2.11.3 Other Non-expanding Group A Community Water Systems

Arlington Terrace (Water System ID 27241A)

Arlington Terrace is a small water system located at about 192nd Street between 67th Avenue and SR 9, entirely within the City of Arlington's limits and water service area. The system serves about 104 people using 28 of 29 approved service connections. Two groundwater wells provide water to the Arlington Terrace system. The topography makes it difficult for the City to provide this neighborhood with water and sewer service. It is understood that all parcels utilize onsite septic systems for waste disposal.

McPherson Hills (Water System ID 529307)

The McPherson Hills private water system is located southeast of the Arlington Airport just outside of city limits but within the City's water service area. The system uses all of its 11 approved service connections to provide water to 30 people. One deep groundwater well provides the sole water source. All parcels utilize onsite septic systems for waste disposal.

Stilli Ridge Estates (Water System ID 187072)

Stilli Ridge Estates is a private water system located east of the City along Tviet Road. It is within the City's water service area. The system supplies 72 persons on 30 of 44 approved service connections with two shallow groundwater wells. One well is approximately 30 feet deep and produces 22 gpm, and the second well is approximately 40 feet deep and produces 31 gpm. All parcels utilize onsite septic systems for waste disposal.

New Start Landowners Association (Water System ID 22380M)

Formerly the Top of the Hill Water Association, New Start is a private water system located southeast of the Arlington Airport just outside of city limits but within the City's water service area. It is immediately adjacent to the McPherson Hills system. New Start supplies water to 90 people on 26 of 52 approved service connections with one deep groundwater well and a shallow emergency well. All parcels utilize onsite septic systems for waste disposal.

Meadowbrook Homeowner's Association (Water System ID 03449C)

Meadowbrook Homeowner's Association is a private water system located immediately east of the City along Tviet Road. It is within the City's water service area. The system supplies 35 persons using all 15 approved service connections with one deep groundwater well. There are no current plans for interties between this system and the City's water system. All parcels utilize onsite septic systems for waste disposal.

Eagle Ridge Water Association (Water System ID 24731H)

The Eagle Ridge Water Association is a private water system located north of the Stillaguamish River mid-way between I-5 and SR 9. It is outside of the City's water service area. Two shallow groundwater wells supply water to 250 people on 137 of 146 approved service connections. All parcels utilize onsite septic systems for waste disposal.

Silvana Water Association (Water System ID 79050)

The Silvana Water Association is located adjacent to the northwest corner of the Arlington water service area. A spring provides its sole water source to 150 residents on 44 unapproved connections, and eight ICI connections. It also provides service to a transient population of about 78 persons from May through October. All parcels are understood to utilize onsite septic systems for waste disposal.

Sudden View (Water System ID 12451F)

The Sudden View water system is a private water system which abuts (is outside of) the very southeast corner of the City's water service area. The water system purchases water from PUD and maintains two groundwater wells for emergency supply. It serves 60 people on 21 of 48 approved connections. All parcels utilize onsite septic systems for waste disposal.

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3 Land Use and Population

3.1 INTRODUCTION

The City of Arlington (City) *Comprehensive Plan*, first completed in 1995 and updated in 2005, was updated once again in 2015. The recent update was adopted by the City Council in June 2015. The plan was developed to meet the requirements of the State of Washington Growth Management Act (GMA). The GMA requires, among other things, consistency between land use and utility plans and their implementation.

This Comprehensive Wastewater Plan (CWP) update has been developed concurrent with the citywide comprehensive planning process. This chapter demonstrates the compatibility of this CWP with the City Comprehensive Plan and with other plans, identifies the designated land uses within the existing and future service area, and identifies population projections within the City's planning area.

3.2 COMPATIBILITY WITH OTHER PLANS

3.2.1 Introduction

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

- Growth Management Act (GMA)
- City of Arlington 2015 Comprehensive Plan
- Snohomish County General Policy Plan
- North Snohomish County Coordinated Water System Plan (2010)

3.2.2 Growth Management Act

The State of Washington Growth Management Act, as amended, defines four goals relevant to this CWP.

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

Urban Growth Area

The GMA requires that Snohomish County (County) and the City cooperate in designating an Urban Growth Area (UGA). As part of the development of its own *2005 Comprehensive Plan Update*, the County designated an UGA that would accommodate the City's projected population growth and provide resource conservation. The City filed a petition on the County's 2014 docket for expansion of the UGA west of I-5 in an area that is located within the Rural Urban Transition Area (RUTA) designated by the County. The County tabled the petition until after completion of County's and City's comprehensive plans, and is expected to rule on the petition in 2016. Meanwhile, the County completed its *2015 Comprehensive Plan Update*, which was adopted by the County Council in June 2015. This CWP update anticipates County approval of its petition for UGA expansion, and allocates growth to the expansion area. However, the expansion area is identified and tracked separately from the existing UGA in text, tables, and maps for evaluation of its effects on wastewater collection and treatment infrastructure. This CWP utilizes the UGA, including the expansion area, as its wastewater service area.

Consistency

The GMA requires planning consistency from two perspectives. First, it requires consistency of plans among jurisdictions. This means that plans and policies of the City and the County must be consistent (RCW 36.70A.100). Second, the GMA requires the implementation of the CWP be consistent with the City's *Comprehensive Plan* (RCW 36.70A.120). While this CWP and the City's *2015 Comprehensive Plan* were in development, Snohomish County was also updating its *Comprehensive Plan*. Both were completed and adopted in June 2015. The City's Planning staff and its Public Works staff worked with their counterparts in Snohomish County Planning and Development Services (PDS) to assure the City's service levels, capital development needs, and planning proposals, including expansion west of I-5, were anticipated in all County planning documents and at all levels of PDS staff. In addition, the Public Works Department coordinated with the City's Community and Economic Development Department to assure this CWP utilized the same growth projections, the same focus areas for residential and commercial/industrial growth, and other assumptions as were used in the City's *2015 Comprehensive Plan*.

Concurrency

Concurrency means that adequate public facilities and services must be provided at the time growth occurs, which is defined as being within a six-year time frame. For example, growth should not occur where schools, roads and other public facilities are overloaded. Concurrency ensures that public dollars are used efficiently and that quality of life is preserved. To achieve this objective, the GMA directs growth to areas already served or readily served by public facilities and services (RCW 36.70A.110). It also requires that when public facilities and services cannot be maintained at an acceptable level of service, the new development should be prohibited (RCW 36.70A.100).

Critical Areas

The GMA requires that critical areas be designated and protected. Critical areas include fish and wildlife habitat, flood zones, aquifer recharge areas, streams, creeks, rivers, lakes, wetlands and other surface water, and geologic hazard areas such as steep slopes and liquefaction zones. Designated critical areas within the City's UGA and wastewater service area are shown in **Figure 3-2. Appendix G** contains a SEPA checklist that addresses other environmental concerns.

3.2.3 City of Arlington Comprehensive Plan

The Land Use Element of the City of Arlington's 2015 *Comprehensive Plan* is the City's vision of how growth and development should occur over a 20-year horizon. It articulates many of the same goals and concerns of the GMA. Like the GMA, the Land Use Element seeks to accommodate growth while preserving the City's character and protecting the environmentally sensitive areas. It seeks to promote a strong local economy and vital commercial, industrial and airport industrial districts by focusing on economic development within them and establishing development guidelines. The Utilities Element ensures that new development will be adequately serviced without compromising existing levels of service, similar to the principal of concurrency as defined in the GMA.

While the Land Use Element goals and policies set forth general standards for locating land uses, the *Comprehensive Plan*'s Land Use Map indicates geographically where certain types of uses may be appropriate. The Land Use Map is a blueprint for development of an area, whereas the zoning code is the regulatory means for implementing it. Preferred zoning designations identified in April 2014 for the development of the City's 2015 update of the *Comprehensive Plan* are used in this update of the CWP. The City's 2015 zoning designations are shown in **Figure 3-1**, Land Use.

3.2.4 Snohomish County General Policy Plan

Snohomish County Council (Council) adopted the *Snohomish County General Policy Plan* (Policy Plan) on June 28, 1995. The Policy Plan was effective on July 10, 1995. Since this time, the Policy Plan has been amended numerous times to incorporate UGA, Capital Facility Plan and land use changes with the last amendment occurring on December 21, 2013. The Policy Plan designates

towns and incorporated cities, including Arlington, as subareas and acknowledges these areas as having individual comprehensive plans. Together with these subareas, the County determines adequate growth areas for each subarea. The County's Policy Plan also guides development in rural, unincorporated Snohomish County.

Similar to the City's *Comprehensive Plan*, the County's Policy Plan contains land use goals that "form the basis of the County's land use strategy and:

- provides for a supply and distribution of land use types to accommodate the majority of county population and employment growth within urban growth area;
- reduces development pressures and patterns of sprawl within rural areas;
- conserves agricultural, forest and mineral resource lands of long-term commercial significance; and
- preserves and protects open space, scenic and cultural resources."

3.3 LAND USE

The City limits currently encompass an area of approximately 6,216 acres. The City's UGA encompasses an additional 387 acres outside of the current City limits. As described in Chapter 2, approximately 488 acres of southwest Arlington receive wastewater service from the City of Marysville. The existing wastewater service area therefore contains approximately 7,090 total acres. The addition of 236 acres in the UGA Expansion Area west of I-5 would create a future wastewater service area of 7,326 acres, as shown in **Table 3-1**. The Zoning Map, **Figure 3-1**, displays the zoning that guides—for the purposes of this CWP—development within the City, UGA, and Expanded UGA.

Land use designations in the existing wastewater service area are summarized in **Table 3-1**. Approximately 3,130 acres (44 percent) is designated for residential use. Of the remaining area, commercial, industrial, and all other uses occupy approximately 1,398 acres (20 percent), 1,108 acres (16 percent), and 1,454 acres (20 percent) of land, respectively.

The Expanded UGA would create a future wastewater service area totaling 7,326 acres. Residential zoning would increase by 224 acres to 3,354 acres (46 percent), and the land area of all other zoning classes would decrease by a fraction of one percentage point (**Table 3-1**).

Table 3-1. Current and Future Land Use Zoning Allocations in the Wastewater Service Area

Land Use Type	Area (Acres)					
	City	Less Smokey Point *	Plus Existing UGA	Existing Wastewater Service Area	Expanded UGA West of I-5	Future Wastewater Service Area
Airport	737	0	0	737	0	737
Business Park	155	0	11	166	0	166
Commercial	1,088	276	34	1,398	12	1,410
Industrial	1,108	0	0	1,108	0	1,108
Medical	20	0	0	20	0	20
Public	450	0	81	531	0	531
Residential	2,657	212	261	3,130	224	3,354
Total	6,216	488	387	7,090	236	7,326

* Served by City of Marysville

3.4 POPULATION

3.4.1 Household Trends

The City is a residential community comprised of a full range of housing types. In 2013, the Office of Financial Management (OFM) estimated that two-thirds of 7,053 housing units (4,695) within the City limits were single family detached homes. Approximately one-fourth of the residences (1,773) had two or more units. The remaining 585 units (8 percent) were in mobile homes and special housing.

According to the U.S. Census Bureau, the average household size in the City was 2.70 persons per household in 2010, down slightly from 2.72 in 2000, but still above 2.51 in 1990. The average household size in all of Snohomish County was 2.65 persons per household in 2000, dropping slightly to 2.62 in 2010. The 2005 *Comprehensive Plan* anticipated that the average household size for Arlington would decrease to approximately 2.50 persons per household by the year 2020. The average number of people per household in 2000 was 2.82 for owner-occupied housing units and 2.54 for renter-occupied units. The densities by housing type and the anticipated future trending could not be located in the 2010 census data at the time of this writing. For the purposes of this CWP, all dwelling units were assumed to house 2.70 persons.

3.4.2 Existing and Future Population

The County has experienced rapid population growth and extensive physical developments since 1990. The County's population increased by more than 25 percent in the 1990s, and remained high

at 17.7 percent from 2000 to 2010. It increased another 2.4 percent by 2013, totaling 730,500 people.

Including annexations, the City's population increased by approximately 82 percent during the 1990s, and another 62.5 percent from 2000 to 2010. It increased another 2.4 percent by 2014, totaling 18,360 people. **Table 3-2** illustrates the City's historical population growth since 1990.

Future population growth is established by county and regional planners under the direction of GMA. Snohomish County established a target population in the year 2035 of 24,937 for the City of Arlington and its UGA. As a basis for projecting water demand and wastewater loading, the City assumed linear annual residential growth of 313 persons per year (or 4.76 percent per year) in order to increase by an additional 6,577 persons, from 18,360 in 2014 to 24,937 in 2035 (21 years). **Table 3-2** illustrates the City's historical population growth since 1990, and projected future growth within the City limits and the wastewater service area.

The actual population served within the wastewater service area differs from the population that resides within the City limits. The City's existing and future population is modified by adding and subtracting various other population values to the annual series of City population described above. The City's Smokey Point and Country Manor neighborhoods obtain wastewater service for their combined 861 lots directly from the City of Marysville. Other facilities in the City (primarily residences) have their waste treated via onsite septic systems, such as the 38 lots in Arlington Terrace. The populations of these areas, as estimated by City planning staff[1], are subtracted from the City population values. The City also provides wastewater service to a limited number of customers outside the City limits but within its UGA, such as the 35 residences under Snohomish County jurisdiction in The Eagles neighborhood. The populations of these services, as estimated by City planning staff [2], are added to the City population values. The actual population served by the wastewater system in 2014 was 16,116. The population served in 2035 is projected to be 22,693, as shown in **Table 3-2**. Note that the population served by the wastewater utility apparently decreases from 2013 to 2014 because of a modification of (increase in) the estimated number of Arlington citizens residing in the Smokey Point area that is served by the City of Marysville. The estimate increased the assumed built-out population of the Smokey Point and Country Manor neighborhoods by 606 persons, from 1,633 to 2,239.

[1] Smokey Point and Country Manor estimated as 861 lots times a density of 2.6 persons per household, or 2,239 total persons. Arlington Terrace estimated as 37 occupied lots times a density of 2.7 persons per household, or 100 total persons. Both estimates are assumed to reflect built-out conditions under existing land use classifications, and therefore do not increase into the future.

[2] Service population in The Eagles is estimated for existing conditions as 35 served parcels times 2.7/HH, or 95 total persons. As there are no remaining vacant parcels in The Eagles, this estimate is understood to reflect built-out conditions, and therefore do not increase into the future.

Table 3-2. City Population Trends and Projections

Year	Population	
	City Limits	Wastewater System
Historical		
1990	4,037	3,977
1991	4,397	4,330
1992	4,614	4,545
1993	4,863	4,792
1994	5,167	5,094
1995	5,692	5,617
1996	6,019	5,942
1997	6,514	6,435
1998	7,188	7,107
1999	8,054	7,971
2000	11,927	11,842
2001	12,912	12,825
2002	13,676	12,185
2003	14,431	12,852
2004	14,838	13,219
2005	15,173	13,523
2006	15,693	13,964
2007	17,094	15,457
2008	17,527	15,889
2009	17,711	16,073
2010	17,926	16,288
2011	17,930	16,292
2012	17,970	16,332
2013	18,270	16,632
2014	18,360	16,116
Projected		
2020 (+6 years)	20,239	17,995
2024 (+10 years)	21,492	19,247
2034 (+20 years)	24,624	22,379
2035 (+21 years)	24,937	22,693

3.5 POPULATION PLACEMENT

Infill within the city is estimated to assume only one-third of total residential growth. In addition, commercial and industrial growth associated with increased employment will create land use changes with the potential for significant effects on the City's wastewater system. Therefore, six general areas within the wastewater service area. where concentrated growth and its associated impacts to the wastewater system are expected, have been defined to facilitate discussion. The six areas are shown in **Figure 3-3** and characterized in **Table 3-3**. Descriptions of the six areas follow.

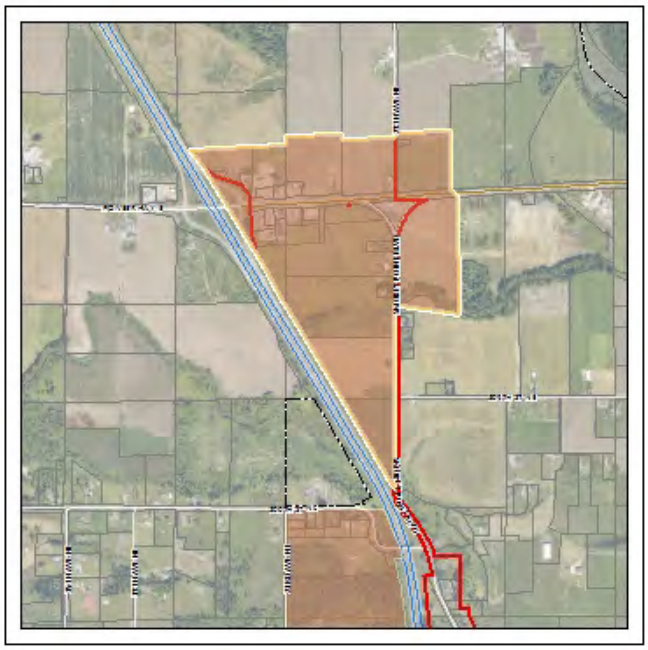
Table 3-3. Growth Center Attributes and Assumptions

Focus Area	Area	Zoning Type[1]			Occupancy by Zoning		
		Residential	Commercial	Industrial	Residential[1]	Commercial[2]	Industrial[2]
	(acres)	(Percent)			(Persons)	(Facility Area, sq. ft.)	(Facility Area, sq. ft.)
Island Crossing	157	0%	100%	0%	0	2,735,568	0
UGA Expansion Area	235	95%	5%	0%	2,474	209,088	0
AP Business Park	188	0%	95%	0%	0	3,118,896	0
MIC--South of 172nd	348	0%	57%	43%	0	3,484,800	3,223,440
SR9/SR531	227	65%	33%	0%	2,286	1,306,800	0
Central Industrial	343	8%	24%	68%	949	1,428,768	5,096,520

[1] City of Arlington data

[2] AWWA Commercial and Institutional End uses of Water indicate 40% and 50% of parcel areas are developed for water consumption in commercial and industrial facilities, respectively

Island Crossing



The Island Crossing focus area is situated at the northwest corner of the City, immediately west of I-5 and entirely on the Stillaguamish River floodplain. It contains 157 acres of city and county land that is primarily in commercial and agricultural use. Current zoning anticipates that land use in 2035 will be 100 percent commercial. For planning purposes, this CWP update assumes 40 percent of the total area—about 2.7 million square feet—contributes to wastewater loading. Capital projects within this focus area are assumed to occur in the second decade of the 20-year planning horizon.

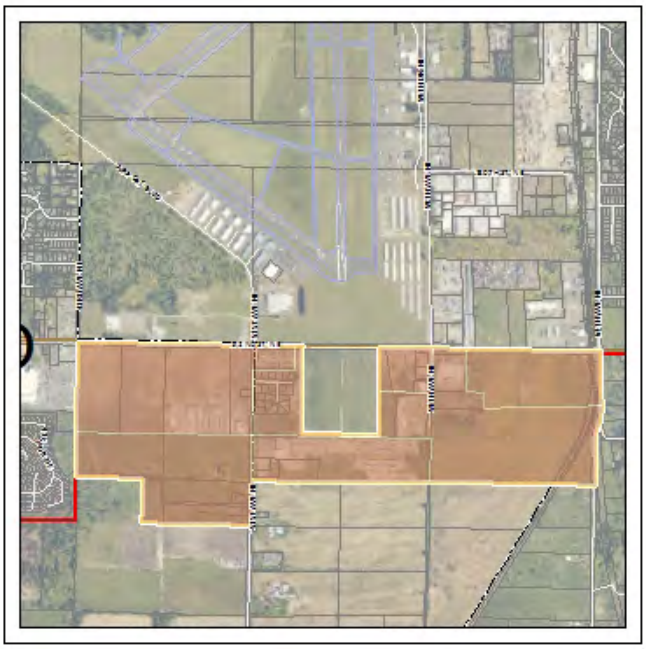
The county land included in this growth center (located east of Smokey Point Boulevard) is entirely within the City's water service area and is owned in part by the Stillaguamish Tribe. The Tribe has approached the City regarding utility service to these parcels, and although development approval is outside of the City's jurisdiction, the City assumes it will develop within the foreseeable future. These parcels are outside of the City's UGA, however, and the City will need to enter into a special use agreement with the Tribe in order to provide wastewater service.

UGA Expansion Area West of I5

The UGA expansion area includes 236 acres situated on uplands located west of I-5. The City anticipates predominately residential growth, but this CWP Update assumes minor commercial growth will occur as well. The area is anticipated to house 2,474 persons and provide an estimated 209,088 sq. ft. of retail space. Capital projects within this focus area are assumed to occur in the second decade of the 20-year planning horizon.

Airport Business Park

The Airport Business Park includes parcels formally zoned as a business park southwest of the airport, and north of 172nd Street (SR 531) and west of Airport Blvd. It also contains additional commercially-zoned parcels further north along Airport Blvd toward 188th St. Nearly the entire area is zoned for commercial and light industrial use. About 5 percent is zoned for open space within the Airport Flightline. It is estimated that the area will contain about 3.1 million sq. ft. of facilities contributing to wastewater loading in 2035. Capital projects within this focus area are assumed to occur in the first decade of the 20-year planning horizon.



Manufacturing Industrial Center (MIC)

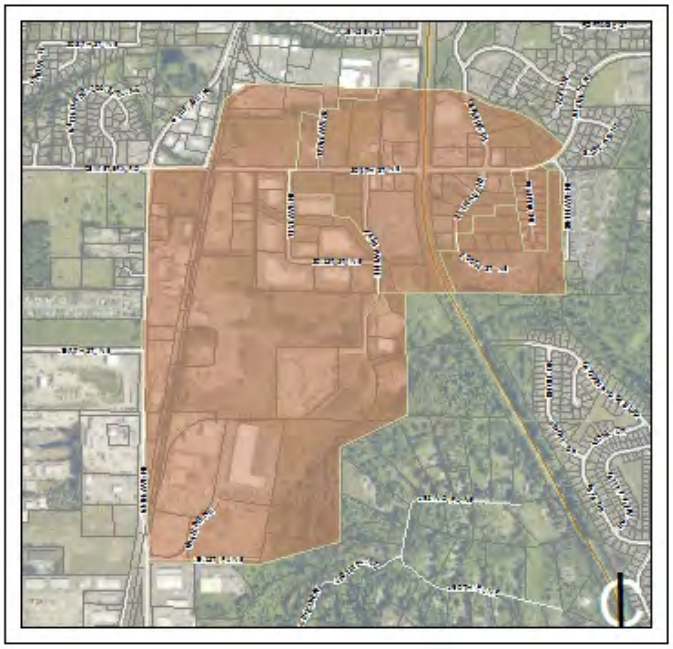
Arlington City Council and Community & Economic Development goals for the City include emphasis on the development of a Manufacturing and Industrial Center (MIC) with the City of Marysville. The City is pursuing Puget Sound Regional Council (PSRC) recognition of the MIC as a regional employment center for family-wage jobs. The MIC would develop primarily on areas zoned as General and Light Industrial across the airport.

The MIC area needing intensive development of City utilities is situated south of 172nd St. Here the MIC would contain about 57 percent commercial area, and 43 percent industrial area. For planning purposes, this CWP update assumes 40 percent of the commercial area contributes to wastewater loading, or about 3.5 million square feet. Another 3.2 million square feet of industrial facilities would develop and discharge wastewater to the City. Capital projects within this focus area are assumed to occur in the second decade of the 20-year planning horizon.

Vicinity of the SR9/SR531 Roundabout

In addition to infill in existing lots across the City, one of two centers for greater residential development is on 227 acres within existing City limits—the vicinity of the intersection of SR 9 and 172nd Street (SR 531). Nearly two-thirds of this area is zoned for residential use at high and suburban densities. This area is also slated for mixed use with about one-third of the area zoned for General and Highway Commercial land use. It is as estimated that it will provide housing for approximately 2,286 persons. In addition, the area may accommodate up to 1.3 million square feet of commercial retail facilities. Capital

projects within this focus area are assumed to occur in the first decade of the 20-year planning horizon.



Central Industrial Area in the Vicinity of Arlington Valley Road

This growth center is located in and adjacent to the existing central industrial area currently housed in Jensen Business Park. It also includes the former Northwest Hardwoods site and other parcels east of 67th Avenue which are accessed from 191st Street NE. The area is anticipated to grow with access provided by construction of the Arlington Valley Rd. Capital projects within this focus area are assumed to occur in the first decade of the 20-year planning horizon.

The area is zoned to accommodate more than two-thirds industrial land use in 2035, along with about one-quarter in commercial use, and another eight percent in residential land use. These developments will increase wastewater loading through residential dwellings for 949 persons, industrial facilities totaling 5.1 million square feet, and another 1.4 million square feet in commercial facilities.

4 Flow Analysis

4.1 INTRODUCTION

A detailed analysis of flow and loading in a sewer system is crucial to the planning efforts of a sewer service provider. When analyzing a sewer system, the first step is to identify current flow and load values to determine if the existing system can effectively provide adequate service to its customers under the most crucial conditions, in accordance with federal and state laws. A future sewer system analysis identifies projected flow and load to determine where the system will need to be improved in order to satisfy future growth and continue to meet federal and state laws.

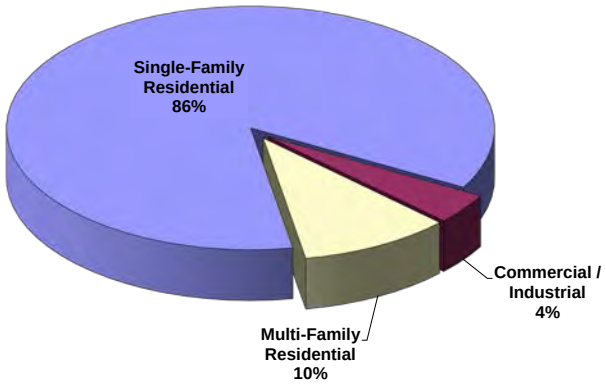
Flow and load values in a sewer system are used to determine the size of gravity collection piping, lift station facilities, force main piping, and size and type of treatment facilities needed. Several different flow scenarios were analyzed and are addressed in this chapter, including average day flow, peak flow, and projected future flows. The loading information and analysis for the City of Arlington's (City) water reclamation facility (WRF) is addressed in "City of Arlington, Washington Wastewater Treatment Plant Evaluation" (Kennedy/Jenks Consultants 2007).

4.2 CURRENT POPULATION AND SERVICE CONNECTIONS

The 2014 city population is estimated at 18,360 people, and the 2014 population served by the wastewater system is estimated at 16,116 people. As of December 2014, there were approximately 5,170 sewer service connections throughout the City's sewer system. Of those connections, 4,440

were single-family residential services, 210 were multi-family residential services, and 520 were commercial/industrial. The 210 multi-family residential connections serve approximately 1,431 multi-family units. **Chart 4-1** shows the December 2014 system connections broken down by customer class.

Chart 4-1. 2014 Sewer Service Connections by Customer Class



4.3 EXISTING WASTEWATER FLOW RATES

The City's sewer collection system can be broken down into 14 distinct sewer drainage basins, as shown in **Figure 2-3**. For the most part, the City's existing collection system flow rates were estimated using 2013 lift station flow records and WRF flow data. 2014 lift station flow data was not used since a full year was not available. The 2013 lift station flow rates are shown in **Table 4-1**. The flow rate for Lift Station 6 is estimated from 2014 flow data because there was a leak in the Lift Station 6 sewer drainage basin that was partially collected and returned through Lift Station 6 in 2013, which caused the flow measured through Lift Station 6 to be greater than the flow measured through Lift Station 5 in 2013. The 2009 to 2014 WRF flow data is shown in **Table 4-2**. Additional lift station information is provided in **Appendix A**.

It is important to note that Lift Station 4 includes flow from Lift Stations 5, 6, 11, and 12; Lift Station 5 includes flow from Lift Stations 6 and 11; and Lift Station 6 includes flow from Lift Station 11. As such, the actual flow from each sewer drainage basin is not directly represented by the recorded lift station flow rate. The estimated existing flow rate for the sewer drainage basins served by Lift Stations 4, 5, and 6 were calculated by subtracting the flow from the upstream lift station.

Pumping information for the Lift Station 1 sewer drainage basin is not available; therefore, the pumping information from the previous Comprehensive Sewer System Plan (Plan) was used for the Lift Station 1 sewer drainage basin. Pumping information for the Lift Station 6 sewer drainage

basin (Rest Area) is not complete for 2013; therefore, the pumping information for 2014 was utilized for the Lift Station 6 sewer drainage basin. Lift Station 13 is a small facility serving a few homes and is included within the Lift Station 2 sewer drainage basin.

There are three remaining sewer drainage basins for which there is limited specific flow information: Old Town, Gleneagle, and the Primary Interceptor. A few weeks' worth of flow data was collected in 2000 and additional flow data was collected from 2007 through 2014 at several locations in the City's sewer system, including some in the Primary Interceptor. This information was reviewed and used to the extent possible in this evaluation. It is recommended that the City continue to obtain additional flow data from these sewer drainage basins in order to accurately evaluate future capacity issues and plan for appropriate improvements.

For the purposes of this Plan, total flow from these three sewer drainage basins has been estimated by subtracting the total recorded lift station flows from the recorded WRF flows. This remaining flow was then allocated to each of the three sewer drainage basins based on the estimated size of the service area, age of pipes, site conditions, historical operation, and judgment. Based on this analysis and discussion of flow rates with the City, Old Town was allocated approximately 63 percent of the remaining flow, Gleneagle was allocated approximately 33 percent of the remaining flow, and the Primary Interceptor was allocated the remaining approximately 5 percent. This is very similar to the previous Plan, which allocated approximately 65 percent of the remaining flow to Old Town, approximately 30 percent of the remaining flow to Gleneagle, and the remaining approximately 5 percent to the Primary Interceptor. The recent development near the intersection of SR531 and SR9 may account for the slight shift in flow from Old Town to Gleneagle.

The resulting average daily flow and estimated peak hour flows for the various sewer drainage basins are illustrated in **Figure 2-3**.

Table 4-1. Existing Average Day Flow Rates at Lift Stations

Lift Station	2013 Existing Average Day Flow (GPD)
LS-1[1]	7,100
LS-2	219,390
LS-3	17,170
LS-4	179,985
LS-5	156,585
LS-6[2]	92,040
LS-7	69,090
LS-8	49,160
LS-9	38,770
LS-11	14,670
LS-12	10,860
LS-13	1,400

Notes:
-Average day flows shown in this table are rounded and approximate.
1 - Historical flow data for LS-1 is not available; the average day flow from the previous General Sewer Plan is presented.
2 - 2014 flow data for LS-6 is presented since the 2013 flow data for LS-6 is not complete.

Table 4-2. Existing Average Day Flow Rates at the Water Reclamation Facility

Year	Average Day Flow (GPD)
2009[1]	1,213,056
2010	1,068,001
2011[2]	1,109,340
2012	1,195,760
2013	1,108,791
2014	1,115,778

Notes:
1 - The influent flow for January 8, 2009, of 3.021 MG was omitted because it exceeds the capacity of the influent flow meter at the WRF and appears to be atypical of the maximum day flows observed at the WRF.
2 - There are 9 days of data in 2011 that are missing for the influent flow at the WRF.

4.4 INFILTRATION AND INFLOW

A sanitary sewer system must be able to carry the domestic wastewater generated by utility customers and the extraneous infiltration/inflow (I/I) that is a part of every sewer collection system. Groundwater that seeps into sewer pipes through holes, cracks, joint failures, and faulty connections on a seasonal or even year-round basis is referred to as infiltration. Stormwater and other water sources with direction connections and rapid response discharges to sanitary sewers on an ephemeral basis is called inflow. Common examples of inflow include roof drain downspouts, foundation drains, storm drain cross-connections, and holes in manhole covers.

The United States Environmental Protection Agency (EPA) published a report in May 1985, *Infiltration/Inflow, I/I Analysis and Project Certification,* that developed guidelines to help determine what amount of I/I is considered to be "excessive" and what amount can be cost-effectively removed. The report established I/I flow rates that were considered normal or acceptable, based on surveys and statistical evaluations of data from hundreds of cities across the nation.

4.4.1 Inflow

The EPA report gives guidelines for determining whether inflow can be classified as non-excessive. Inflow is considered to be non-excessive if the average daily flow during periods of heavy rainfall or spring thaw (i.e. any event that creates surface ponding and surface runoff) does not exceed 275 gallons per capita per day (gpcd). The peak recorded flow day in the last several years (2009 through 2014) of record for the City was 3.02 MGD (million gallons per day), which occurred on January 8, 2009. This day was recorded as having 0.4 inches of precipitation. However, this day was also preceded by several days with heavier precipitation and near-freezing temperatures, so some snow melt may have occurred on this day. This peak inflow event equates to a 188 gpcd flow rate, which is well below the EPA maximum of 275 gpcd. Therefore, the amount of inflow would be considered non-excessive and may be difficult to cost-effectively remove. The influent flow for January 8, 2009, was omitted from the other analyses presented in this Plan because it exceeds the capacity of the influent flow meter at the WRF and appears to be atypical of the maximum day flows observed at the WRF.

The second peak recorded flow day in the last several years of record for the City was 2.47 MGD on November 23, 2011. This day was recorded as having 0.6 inches of precipitation. However, this day was also preceded by several days with heavier precipitation, including the previous day which had the heaviest precipitation from 2009 through 2014 in the amount of 3.0 inches, and near-freezing temperatures, so some snow melt may have occurred on this day. This peak inflow event equates to a 152 gpcd flow rate. The third peak recorded flow day in the last several years of record for the City was 2.41 MGD on January 7, 2009. This day was recorded as a day of moderate precipitation in the amount of 1.2 inches. In addition, this day was also preceded by several days of precipitation and near-freezing temperatures, so some snow melt may have occurred on this day. This peak inflow event equates to a 150 gpcd flow rate. The inflow evaluation

data is included in **Appendix E**. All of these high inflow days are below the EPA maximum of 275 gpcd and are considered non-excessive.

4.4.2 Infiltration

The determination of non-excessive infiltration was based on the national average for dry-weather flow of 120 gpcd. In order for the amount of infiltration to be considered non-excessive, the average daily flow must be less than 120 gpcd (i.e. a 7 to 14 day average measured during periods of seasonal high groundwater). Although it can be difficult to determine how much of the flow is due to I/I, peak inflow will generally occur immediately during or just after a significant rain event, while peak infiltration will occur during the high groundwater period that follows prolonged precipitation events. In addition, it is difficult to find a 7 to 14 day period without rain in the winter in the Pacific Northwest. Therefore, periods were chosen that include negligible or small amounts of rain. The peak week in the last several years (2009 through 2014) of record for the City, occurring after heavy rains, was the week of January 11, 2009. This yielded an average flow rate of 1.88 MGD, which equates to 117 gpcd, which is within the EPA maximum of 120 gpcd. Therefore, the amount of infiltration would be considered non-excessive and difficult to cost-effectively remove.

The second peak week in the last several years of record for the City, occurring after heavy rains, was the week of April 6, 2011, yielding an average flow rate of 1.77 MGD, which equates to 109 gpcd. The third peak week in the last several years of record for the City, occurring after heavy rains, was the week of January 31, 2013, yielding an average flow rate of 1.73 MGD, which equates to 104 gpcd. The infiltration evaluation data is included in **Appendix E**. All of these high infiltration days are below the EPA maximum of 120 gpcd and are considered non-excessive.

4.4.3 Further Investigation/Remedial Work

The City performed an I/I study in 1974, and another in 1991. Copies of these studies are in the Wastewater Department archives. Both studies revealed many sources of direct inflow into the system and identified some areas where the heaviest infiltration was thought to occur. The majority of the direct inflow was identified as primarily coming from roof drains connected to the sewer main along West Avenue, and along the alleyway between MacLeod and Olympic Avenue in the older downtown area of the City. Direct inflow was estimated at rates upwards of 250,000 gallons per day (gpd) during heavy rainfall periods.

The City has not completed any other I/I studies since the last one in 1991. However, City staff regularly monitor flows from neighborhood to neighborhood to detect sewer mains that may be approaching their capacity. Since 2013, the primary focus has been the various mains draining to Lift Station 2. Consistent with the guidelines defined in Chapter C-1 of the Washington State Department of Ecology's (Ecology) *Criteria for Sewage Works Design*, summer and winter flows are being compared to evaluate I/I in this basin. Recent anomalies in the data have prompted additional monitoring through 2015, including precipitation monitoring. A comprehensive

evaluation is anticipated to result in a report containing corrective measures, which may be implemented beginning in 2016.

Any I/I studies that are conducted in the future should follow the guidelines defined in Chapter C-1 of Ecology's *Criteria for Sewage Works Design*. In addition, the King County Department of Natural Resources has published a technical memorandum concerning I/I called *Regional Inflow and Infiltration Program*. This memorandum provides useful information which should be utilized to assist with the I/I study currently being conducted and in future I/I studies conducted on the sewer collection system.

4.5 PEAKING FACTORS

Once existing flow rates are measured and defined, projected flow rates can be developed. Projected flows are used to further analyze how well the existing system will perform in the future, and to determine improvements required to maintain or improve system function. In order to establish projected flow scenarios for a sewer system, peaking factors need to be determined for the existing system, which can then be applied to future flow rates. Peaking factors are the ratio of higher flows, such as maximum day flow, to the average annual flow. **Table 4-3** presents flow rates and peaking factors measured at the WRF.

Table 4-3. Summary of Existing Flows and Peaking Factors for the Water Reclamation Facility

Flow Scenario	Flow (MGD)	Peaking Factor (in terms of AAF)
2009 Average Annual Flow[1]	1.21	1.00
2009 Max Month Flow[1]	1.66	1.37
2009 Max Day Flow[1]	2.41	1.98
2010 Average Annual Flow	1.07	1.00
2010 Max Month Flow	1.34	1.25
2010 Max Day Flow	1.73	1.62
2011 Average Annual Flow	1.11	1.00
2011 Max Month Flow	1.55	1.40
2011 Max Day Flow	2.47	2.23
2012 Average Annual Flow	1.20	1.00
2012 Max Month Flow	1.59	1.33
2012 Max Day Flow	2.26	1.89
2013 Average Annual Flow	1.11	1.00
2013 Max Month Flow	1.49	1.35
2013 Max Day Flow	2.16	1.95
2014 Average Annual Flow	1.12	1.00
2014 Max Month Flow	1.42	1.27
2014 Max Day Flow	1.85	1.66

Note:
1 - The influent flow for January 8, 2009, of 3.021 MG was omitted because it exceeds the capacity of the influent flow meter at the WRF and appears to be atypical of the maximum day flows observed at the WRF.

As shown in **Table 4-3**, the average annual flow at the WRF has remained around 1.1 to 1.2 MGD over the last 6 years. The maximum month and maximum day peaking factors have also remained fairly consistent over the same time span.

Peaking factors for collection system pipes and lift stations are typically based on peak hour flow rates. Peaking factors in the collection system are often greater than those experienced at the WRF due to the smaller size of the sewer drainage basin feeding the particular collector or lift station.

The City is not able to retrieve direct measurements of peak hour flows into the WRF, so this value could not be obtained for comparison. Peak hour flow rates have been measured in the system at the lift stations; the peak hour flow peaking factor for the lift stations are presented later in this chapter in **Table 4-5**. The average of the peaking factors (peak hour flow to average annual flow) for the lift stations is approximately four. (This average excludes Lift Station 13, which only serves

approximately four residences and is located on the outer boundaries of the sewer service area.) The average is consistent with the peaking factor curves provided in Figure C1-1 in Ecology's *Criteria for Sewage Works Design*. For the purposes of this Plan, therefore, peak hour flow will be estimated using a peaking factor of four times the Average Annual Flow (AAF).

4.6 PROJECTED WASTEWATER FLOW RATES

Future flow rates were calculated for the 2024 (10-year) and 2035 (21-year) planning horizons. Population projections, as shown in **Table 3-2** in **Chapter 3**, were used to calculate the projected flow rates. A population increase was established over the projected period, which was in turn applied to the estimated existing flow rate for each sewer drainage basin. Information regarding expected future development and areas where growth is projected was obtained from the City (**Figure 3-3**) and used to develop population and flow distributions for the 2024 and 2035 planning horizons.

The projected flows at the WRF and the flow distribution to the various sewer drainage basins were developed using the following assumptions.

- The existing flow rate for the current population will remain the same as in recent years. This assumes that existing users of the City's sewer system will continue to discharge wastewater at the same rate they currently do.
- Although the current average flow rate is approximately 70 gpcd, average day flow rates for the new growth portion of the future flow were projected based on 100 gpcd, in accordance with Ecology's sewer system design guidelines.
- The projected flows for sewer drainage basins where commercial and industrial development is expected were estimated assuming an average annual water demand rate of 26 gallons per square foot of building space per year, which is in accordance with the American Water Works Association's (AWWA) Commercial and Institutional End Users of Water design guidelines, 30 percent of the available land would be developed to building space, and 90 percent of the water demand would be conveyed into the City's sewer system. Development in these growth center areas is discussed further in **Chapter 3**.
- The estimated existing and projected peak hour influent flows for each of the lift stations were assessed by assuming that all upstream lift stations were pumping at firm capacity at the same time the peak hour flows occurred (**Table 4-5**). The firm capacity is the capacity of the lift station with the largest pump out of service.

Table 4-4 presents the existing and projected flow rates for the sewer drainage basins and WRF based on the population projections and the assumptions above. **Chapter 3** should be referenced for more information regarding both population and growth scenarios.

Table 4-4. Projected Sewer Drainage Basin Average Day and Peak Hour Flow Rates

Sewer Drainage Basin	2013 Existing		Projected 2024		Projected 2035	
	ADF (GPD)	PHF (GPM)[1]	ADF (GPD)	PHF (GPM)[1]	ADF (GPD)	PHF (GPM)[1]
Primary Interceptor	26,405	75	50,455	140	76,905	215
Old Town (A & B)	330,080	915	344,350	955	360,050	1,000
Gleneagle	171,640	475	258,340	720	353,710	985
Lift Station 1	7,100	20	7,235	20	7,385	20
Lift Station 2	219,390	610	337,455	935	467,330	1,300
Lift Station 3	17,170	50	19,220	55	21,475	60
Lift Station 4 (Airport)	12,540	35	21,380	60	31,110	85
Lift Station 5	64,545	180	106,070	295	151,750	420
Lift Station 6 (Rest Area)	77,370	215	81,810	225	86,690	240
Lift Station 7 (Highclover)	69,090	190	76,640	215	84,945	235
Lift Station 8 (Highland View)	49,160	135	72,070	200	97,270	270
Lift Station 9	38,770	110	39,780	110	40,890	115
Lift Station 11 (Island Crossing)	14,670	40	34,435	95	56,180	155
Lift Station 12 (Crown Park)	10,860	30	87,075	240	170,905	475
Lift Station 14 (Smokey Point)	---	---	14,615	40	30,695	85
Lift Station 15 (UGA Expansion)	---	---	109,095	305	229,105	635
Treatment Plant (ADF)	**1.11 MGD**		**1.66 MGD**		**2.27 MGD**	
Treatment Plant (MMF)	**1.49 MGD**		**2.32 MGD**		**3.17 MGD**	

Notes:
-Average day flows and peak hour flows shown in this table are rounded off and approximate.
-Highlighted flow exceeds current wastewater treatment plant capacity.
1 - Peak hour flows for each sewer drainage basin were estimated based on the average day flow and a peaking factor of four.

The City's current National Pollutant Discharge Elimination System (NPDES) permit allows a maximum month average influent flow (MMF) of 2.67 MGD at the WRF. As shown in **Table 4-4**, the regulatory flow capacity of the WRF will be exceeded within the 21-year planning period. At 85 percent of the design MMF, planning will need to begin for the membrane upgrades at the WRF. The City's Capital Improvement Plan (CIP) includes the planning and construction of the membrane upgrades for the WRF. Capacity upgrades to the WRF will be necessary to handle future flows. The numbers presented in **Table 4-4** are projected estimates based on current flow information. The City should closely monitor influent flow on a yearly basis to verify population and flow trends.

Current pumping capacity and flow rate projections for the lift stations are provided in **Table 4-5**. The existing lift station capacities presented in **Table 4-5** are the capacities of each lift station with the largest pump out of service. The projections in **Tables 4-4** and **4-5** include the following projects that are anticipated to be completed by 2024:

- Construct Lift Station 14 (Smokey Point) and Lift Station 15 (Urban Growth Area (UGA) Expansion). Lift Station 15 will be conveyed to Lift Station 14.
- Reroute wastewater flows from Lift Station 6 (Rest Area) and Lift Station 11 (Island Crossing) to Lift Station 14 (Smokey Point). Rerouting the flow from Lift Station 6 will alleviate the flows on the Primary Interceptor.

- The wastewater from Lift Station 14 (Smokey Point) will be conveyed to Lift Station 7 (High Clover).

These improvements are discussed further in **Chapter 7**. No improvements are discussed in **Chapter 7** for re-routing wastewater flows from Lift Station 6 to Lift Station 14 because the City has indicated that the existing force main will be re-used. Lift Station 11 will be evaluated during the design of Lift Station 14.

Table 4-5 Projected Lift Station Average Day and Peak Hour Flow Rates

Name	Existing Firm Capacity (GPM)[4]	2013 Existing				Projected 2024		Projected 2035	
		ADF (GPD)	Estimated PHF (GPM)[1]	Measured PHF (GPM)	Measured PHF Peaking Factor	ADF (GPD)	PHF (GPM)[1]	ADF (GPD)	PHF (GPM)[1]
LS-1[2]	200	7,100	20	20	4.06	7,235	20	7,385	20
LS-2	500	219,390	**705**	445	2.92	337,455	**1,035**	467,330	**1,395**
LS-3	200	17,170	50	60	4.88	19,220	55	21,475	60
LS-4 (Airport)	400	179,985	**735**	**555**	4.43	214,525	**760**	353,760	**1,010**
LS-5	450	156,585	**680**	270	2.48	106,070	295	151,750	420
LS-6 (Rest Area)[3]	500	92,040	330	195	3.08	81,810	225	86,690	240
LS-7 (Highclover)	176	69,090	**190**	130	2.71	316,595	**1,640**	**487,615**	**1,660**
LS-8 (Highland View)	225	49,160	135	135	3.92	72,070	200	97,270	**270**
LS-9	225	38,770	110	90	3.26	39,780	110	40,890	115
LS-11 (Island Crossing)	115	14,670	40	55	5.53	34,435	95	56,180	**155**
LS-12 (Crown Park)	250	10,860	30	55	7.31	87,075	240	170,905	**475**
LS-13	100	1,400	5	15	14.29	1,400	5	1,400	5
LS-14 (Smokey Point)	---	---	---	---	---	239,955	1,305	402,670	1,410
LS-15 (UGA Expansion)	---	---	---	---	---	109,095	305	229,105	635

Notes:
-Average day flows and peak hour flows shown in this table are rounded-off and approximate.
-Highlighted flows exceeds current pump capacity.
1 - Peak hour flows for each lift station were estimated based on the average day flow and a peaking factor of four.
2 - No historical flow data is available for LS-1 so the average day flow and peak hour flow from the previous Plan was utilitzed for LS-1.
3 - 2014 flow data for LS-6 was utilitzed since the 2013 flow data for LS-6 is not complete.
4 - The existing firm capacities are the capacities of each lift station with the largest pump out of service.

Some of the peak hour flow data points from each of the lift stations were omitted from these analyses because they appear to be atypical of the peak hour flows observed at the respective lift station. The lift station flow data used for these analyses is presented in **Appendix D**.

The following assumptions were made for the estimated 2013 existing peak hour flow analysis.

- The incoming flow for Lift Station 2 is based on the following:
    - Estimated 2013 existing peak hour flow from the Lift Station 2 sewage drainage basin, excluding the peak hour flow from the area served by Lift Station 13, and
    - Existing capacity of 100 gallons per minute (gpm) for Lift Station 13.
- The incoming flow for Lift Station 4 (Airport) is based on the following:
    - Estimated 2013 existing peak hour flow from the Lift Station 4 sewage drainage basin,
    - Existing capacity of 450 gpm for Lift Station 5, and
    - Existing capacity of 250 gpm for Lift Station 12.
- The incoming flow for Lift Station 5 is based on the following:

  - Estimated 2013 existing peak hour flow from the Lift Station 5 sewage drainage basin, and
  - Existing capacity of 500 gpm for Lift Station 6.
- The incoming flow for Lift Station 6 (Rest Area) is based on the following:
  - Estimated 2013 existing peak hour flow from the Lift Station 6 sewage drainage basin, and
  - Existing capacity of 115 gpm for Lift Station 11.

The following assumptions were made for the 2024 peak hour flow analysis.

- The incoming flow for Lift Station 2 is based on the following:
  - Projected 2024 peak hour flow from the Lift Station 2 sewage drainage basin, excluding the peak hour flow from the area served by Lift Station 13, and
  - Existing capacity of 100 gpm for Lift Station 13.
- The incoming flow for Lift Station 4 (Airport) is based on the following:
  - Projected 2024 peak hour flow from the Lift Station 4 sewage drainage basin,
  - Existing capacity of 450 gpm for Lift Station 5, and
  - Existing capacity of 250 gpm for Lift Station 12.
- The incoming flow for Lift Station 7 (High Clover) is based on the following:
  - Projected 2024 peak hour flow from the Lift Station 7 sewage drainage basin, and
  - Estimated future capacity of 1,425 gpm for Lift Station 14.
- The incoming flow for Lift Station 14 (Smokey Point) is based on the following:
  - Projected 2024 peak hour flow from the Lift Station 14 sewage drainage basin,
  - Existing capacity of 500 gpm for Lift Station 6,
  - Existing capacity of 115 gpm for Lift Station 11, and
  - Estimated future capacity of 650 gpm for Lift Station 15.

The following assumptions were made for the 2035 peak hour flow analysis.

- The incoming flow for Lift Station 2 is based on the following:
  - Projected 2035 peak hour flow from the Lift Station 2 sewage drainage basin, excluding the peak hour flow from the area served by Lift Station 13, and
  - Existing capacity of 100 gpm for Lift Station 13.
- The incoming flow for Lift Station 4 (Airport) is based on the following:

  - Projected 2035 peak hour flow from the Lift Station 4 sewage drainage basin,
  - Existing capacity of 450 gpm for Lift Station 5, and
  - Estimated future capacity of 475 gpm for Lift Station 12.
- The incoming flow for Lift Station 7 (High Clover) is based on the following:
  - Projected 2035 peak hour flow from the Lift Station 7 sewage drainage basin, and
  - Estimated future capacity of 1,425 gpm for Lift Station 14.
- The incoming flow for Lift Station 14 (Smokey Point) is based on the following:
  - Projected 2035 peak hour flow from the Lift Station 14 sewage drainage basin,
  - Existing capacity of 500 gpm for Lift Station 6,
  - Estimated future capacity of 175 gpm for Lift Station 11, and
  - Estimated future capacity of 650 gpm for Lift Station 15.

As indicated in **Table 4-5**, Lift Station 4 (Airport) is estimated to be at or near capacity at this time and Lift Station 2 is estimated to be near capacity at this time. Lift Stations 7 (High Clover) and 12 (Crown Park) will be at capacity prior to 2024 and Lift Station 11 (Island Crossing) will be at capacity prior to 2035, as shown in **Table 4-5**. Capacity upgrades to Lift Stations 2, 4, 7, 11, and 12 will be necessary to handle future flows. The future capacity of these lift stations were based on 2035 peak hour flows. These improvements are discussed further in **Chapter 7**.

4.7 SUMMARY

Table 4-6 includes a summary of the population and flow information presented in this chapter.

The City's current NPDES Permit allows a MMF of 2.67 MGD at the WRF. The WRF will reach capacity based on flow within the 21-year planning period. Assuming linear growth in the MMF, influent will reach permitted flow during 2028. The City is required to begin planning for membrane upgrades at 85 percent of design MMF, or about 2.27 MMF. Linear growth model assumes planning would begin in about 2023.

The projected flows presented in **Table 4-6** were estimated using current flow rates and assuming a future average annual influent flow rate per capita of 100 gpcd, which is in accordance with Ecology's sewer system design guidelines. In addition, the projected flows for sewer drainage basins where commercial and industrial development is expected were estimated assuming an average annual water demand rate of 26 gallons per square foot of building space per year, which is in accordance with the AWWA's Commercial and Institutional End Users of Water design guidelines, 30 percent of the available land would be developed to building space, and 90 percent of the water demand would be conveyed into the City's sewer system. Based on the flow analysis and using Ecology's recommended guidelines, the WRF will reach capacity based on flow. The WRF has the capability to be expanded for additional capacity, which is discussed further in the

"City of Arlington, Washington Wastewater Treatment Plant Evaluation" report prepared by Kennedy/Jenks Consultants. The planning and construction of the membrane upgrades at the WRF are included in **Chapter 7** and the City's CIP.

The City's average annual influent flow rate per capita has been below 100 gpcd since at least 2009. Future sewer flow rates for commercial and industrial developments are difficult to estimate without specific information about the proposed developments. If the average annual gallons per capita day remains below Ecology's recommended guideline of 100 gpcd, it is likely that the WRF will not reach capacity in the 21-year planning period based on flow. Therefore, the City should closely monitor influent flow on a yearly basis to see if the average annual influent flow rate per capita continues to remain lower than the guidelines presented in Ecology's Orange Book.

Table 4-6. Flow Analysis Summary

Description	2013 Existing	2024 Projected	2035 Projected
Population Data			
Service Area Population	16,632	19,247	22,693
Increase from Base Year 2013		2,615	6,061
Flow Basis Data (gal/day/capita)			
Residential Average Day Flow Per Capita	---	74	78
Commercial and Industrial Average Day Flow Per Capita	---	12	22
Total Average Day Flow Per Capita	67	86	100
Water Reclamation Facility Flow (MGD)			
Average Annual WRF Flow	1.11	1.66	2.27
Max Month WRF Flow	1.49	2.32	3.17

5 Policies and Design Criteria

5.1 INTRODUCTION

The City of Arlington (City) operates and plans wastewater service for the City and associated wastewater service area residents and businesses according to the design criteria, laws and policies that originate from the United States Environmental Protection Agency (EPA) and the Washington State Department of Ecology (DOE).

These laws, design criteria and policies guide the City's operation and maintenance of the wastewater utility on a daily basis, and it's planning for growth and improvements. The overall objective is to ensure that the City provides high quality sewer service at a fair and reasonable cost to its customers. They also set the standards the City must meet to ensure that the sewer system is adequate to meet existing and future flows. The system's ability to handle these flows is detailed in **Chapter 6**, and the recommended improvements are identified in **Chapter 7**.

The Arlington City Council cannot adopt regulations and policies that are less stringent or in conflict with those established by the U.S. and State governments. The City's policies take the form of ordinances, memoranda and operational procedures, many of which are summarized in this chapter.

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

- Regulations
- Customer Service
- Collection Systems
- Lift Stations
- Treatment
- Operational
- Reclaimed Water Reuse
- Financial
- Organizational

5.2 REGULATIONS

5.2.1 National Pollutant Discharge Elimination System Permit and Reclaimed Water Permit

The State of Washington regulates the federal effluent limitations with the National Pollutant Discharge Elimination System (NPDES) program. Wastewater discharge into the waters of the state shall have an NPDES permit from the Department of Ecology. The City of Arlington's permit allows 2.67 MGD for the average flow during the maximum month. The permit also contains influent and effluent quality standards, collection system requirements, pretreatment requirements, and system maintenance requirements.

Beginning with the permit effective March 1, 2014, reclaimed water is permitted for reuse according to the specific conditions included within the NPDES permit. These "R" conditions require treatment to Class A reclaimed water standards, and treatment and operational and maintenance procedures which assure reliability and redundancy for public health protection. This initial permit limits reuse to the irrigation of the City's constructed treatment wetland, located just west of the WRF across SR 9, for the maintenance of wetland functions.

A copy of the NPDES and Reclaimed Water permits is included in **Appendix I**.

5.2.2 Other Regulations and Required Permits

The City also holds permits and is regulated by the Puget Sound Clean Air Agency (Registration No. 11058), State of Washington Department of Natural Resources Aquatic Lands Outfall Easement (No. 51-070281) and the General Permit for Biosolids Management (issued 2015).

5.3 CUSTOMER SERVICE POLICIES

5.3.1 Sewer Service and Connection

- The City will strive to provide sewer service to the properties within the City's wastewater service area, provided all policies related to service can be met.
- All proposed developments within the City's wastewater service area shall connect directly to the City's sewer system, unless deemed unfeasible by the City at the time of the request.
- Sewer system extensions required to provide sewer service to proposed developments shall be approved by the Department of Public Works and must conform to the City's adopted design criteria and construction standards and specifications, as shown in the City's most current Design and Construction Standards and Specifications. All costs of the extension shall be borne by the developer or applicant. The sanitary sewer section (Section 3) from the City's draft 2015 Design and Construction Standards and Specifications is included in **Appendix H**.
- Sewer service can be extended outside of the City limits and within the UGA only if the project is in compliance with the City's utility regulations, standards and policies.
- Sewer service cannot be extended outside of the City's UGA, except for certain exceptions identified in City Code.
- Sewer extensions shall be given based on system capacity using the following priorities.
    1. Extensions shall first be given to applicants within the City limits.
    2. Second priority shall be given to those applicants within the UGA.
    3. Extensions may be given higher priority where existing environmental problems make extension necessary.
- For sewer service applications within the City limits, the City will review the availability for wastewater service at the time of land use permitting, site development permit review and building permit. During the land use permitting process, the City will determine if sewer collection and treatment capacity is available for the site and will issue its determination in a certificate of wastewater service availability. During the site development permit review, the City will address the sizing and location of the sewer extension. The formal sewer service application begins at the time of building permit when service sizing is evaluated.
- For sewer service applications outside of the City limits, the applicant must first obtain a wastewater utility service agreement from the City. The City will review the agreement and determine the availability of sewer
- Sewer collection system, lift station and treatment plant capacity will be considered when providing sewer availability to applicants.

- In the absence of a connection, wastewater service availability at a site shall expire at the time that the associated permit expires (i.e. land use, site development or building permit).
- Time extensions in regards to sewer availability shall be granted in accordance with the associated permit requirements. When extensions are denied, the disputes are handled through the rules guiding the associated permit process. Disputes can be brought to the City Council for discussion.

5.3.2 Septic Systems

- Existing single-family homes with septic systems in good working condition, per the Snohomish County Health Department, may continue to be used. All septic systems in the City shall be monitored per WAC 246-272A-0270 and the Snohomish County Health Department's regulations. The City will provide periodic reminders to property owners regarding their responsibilities for onsite sewage disposal.
- Property owners within city limits with a failing septic system, as documented by the Snohomish County Health Department, shall connect to the sewer system, consistent with AMC 20.60.120. The presence of an available reserve drain field area is not adequate reason for an exemption from this requirement.
- Septic systems are not typically allowed for new developments. Exceptions may be granted: 1) where connection to the sewer within 500 feet is not available, 2) to single-family residences, 3) on 5-acre platted lots, 4) when located outside of recognized aquifer protection areas (in the City's comprehensive plan). See AMC 20.60.120 for further reference.

5.3.3 Annexations

- Areas annexed will be served by the City of Arlington sewer utility at the customer's expense unless accepted by City Council and must meet the City of Arlington sewer standards.
- Provision of sewer service will be provided per the adopted utility policy. The City of Arlington will follow State guidelines in the assumption of facilities in annexation areas.

5.4 COLLECTION SYSTEM POLICIES AND DESIGN CRITERIA

5.4.1 Sanitary Sewer Design Criteria

- All sewer lines within the City shall be designed in accordance with good engineering practice by a professional engineer with the minimum design criteria presented in the *Criteria for Sewerage Works Design*, prepared by the State of Washington Department of Ecology (DOE), December 1998, or as superseded by subsequent updates. Chapter C1 of this document includes standards and guidelines for design considerations (minimum pipe sizes, pipe slopes and wastewater velocities), maintenance considerations, estimating wastewater flow rates, manhole locations, leak testing and separation from other

underground utilities. These criteria have been established to ensure that the sanitary sewers convey the sewage and protect the public health and environment. The sewer lines shall also conform to the latest regulatory requirements relating to design.

- Sewers shall be designed and constructed in accordance with the City of Arlington's most current Design and Construction Standards and Specifications.

5.4.2 Gravity Sewer Design Criteria

- Gravity sewers are sized to provide capacity for peak, wet-weather flows. The smallest diameter sewer allowed is 8 inches.
- All sewers will be laid on a grade to produce a mean velocity of at least 2 feet per second when flowing half-full.
- Manholes shall be at least 48 inches in diameter and will be spaced at intervals not to exceed 400 feet.
- Manholes shall also be located at changes in grade, flow direction, and sewer pipe size.

5.4.3 Design Flow Rates

- Sanitary sewer system flows are composed of residential, institutional, business, commercial, and industrial wastewater, along with infiltration and stormwater inflow. Sanitary sewer systems must be capable of conveying the ultimate peak flows of these wastewater sources.
- No overflows will be permitted.

5.4.4 Gravity Pipe Material and Roughness

- Allowable gravity sewer pipe material shall include ductile iron, high density polyethylene (HDPE) or polyvinyl chloride (PVC). For normal depth, PVC is generally preferable. All materials shall be in accordance with the City of Arlington's most current Design and Construction Standards and Specifications.
- The Manning equation is used to design and analyze wastewater flow characteristics of the sanitary sewers. The Manning roughness coefficient "n" varies depending on the pipe material. However, an "n" value of 0.013 shall be used for design regardless of material used.

5.4.5 Separation between Sanitary Sewer and Other Utilities

- A minimum horizontal separation of 5 feet between sanitary sewer and other utilities shall be maintained (edge to edge).
- Wherever possible, a horizontal separation of 10 feet is required between sewer and water lines (edge to edge).

- The guidelines provided in DOE's *Criteria for Sewage Works Design* should be followed for difficult spacing or other situations.

5.4.6 Design Period

- The design period is the length of time that a given facility will provide safe, adequate and reliable service. The design period selected is based on the economic life of a given facility, which is determined by the structural integrity of the facility, the rate of degradation, the replacement cost, the cost of increasing the capacity of the facility and the projected population growth rate serviced by the facility.
- Collection and interceptor sewers are designed for the peak development of a contributing area.
- The life expectancy for new sanitary sewers, using current design practices, is in excess of 50 years.

5.4.7 Force Main Design Criteria

- All force mains within the City shall be designed in accordance with good engineering practice by a professional engineer with the minimum design criteria presented in the *Criteria for Sewerage Works Design*, prepared by the State of Washington Department of Ecology, December 1998, or as superseded by subsequent updates. Chapter C2 of this document contains design considerations for force mains.
- Force mains shall not be less than 4 inches in diameter.
- A minimum scouring velocity of 2 feet per second should be maintained. Velocities should not exceed 8 feet per second.
- All force mains should be constructed of ductile iron. Alternative materials, if any, will be specified in the City's *Engineering Standards* (**Appendix H**)

5.4.8 Side Sewer Design Criteria

- City jurisdiction and responsibility for side sewers ends at the right-of-way boundary. On the homeowners' side, sewers are governed by the City's adopted versions of the International Plumbing Code and the Uniform Building Code.
- Side sewers shall provide single service. Each individual single family, duplex and triplex unit shall have its own side sewer. Four-plex and larger multi-family buildings, as well as other non-residential buildings shall have one side sewer per building.
- Side sewers shall be installed in accordance with the City of Arlington's most current Design and Construction Standards and Specifications.

5.5 LIFT STATION POLICIES AND DESIGN CRITERIA

- Lift stations shall be designed in accordance with the City of Arlington's most current Design and Construction Standards and Specifications.
- Lift stations shall be designed for peak design flow with the largest pump out of service.
- Lift stations should be designed for a 20-year design life.
- All existing and future lift stations will be modified/constructed to comply with the following minimum standards.
    1. All structures will be non-combustible, where practical.
    2. All buildings will have adequate heating, cooling, ventilation, insulation, lighting and work spaces necessary for on-site operation and repair.
    3. Sites will be fenced to reduce vandalism and City liability.
    4. Each station will be equipped with a flow meter and all necessary instrumentation to assist personnel in operating and troubleshooting the facility.
    5. Emergency power capability will be provided at all lift stations.
- Pumps will be operated automatically, with flexibility in pump start/stop settings.
- Stations will be operated with the provision for at least two methods of control to minimize system vulnerability.

5.6 TREATMENT POLICIES

5.6.1 Treatment Facilities

Consistent with the selection of membrane filtration and biological nutrient removal treatment technologies in the 2006-2011 upgrade to a water reclamation facility, the City's future treatment decisions will consider and prefer approaches which:

- Require a smaller footprint (providing greater expansion opportunities in the future),
- Require fewer unit processes (less demand on operations staff),
- Have more consistent performance (less fluctuation in effluent quality),
- Produce higher quality effluent, which will reduce disinfection requirements and may yield some removal of constituents that could be regulated in the future,
- Are considered "best available technology" for cost-effective treatment of municipal wastewater, and
- Demonstrate the City's ongoing commitment as a good steward of the environment.

- The City will initiate planning for expansion and upgrade of treatment facilities when influent rates reach 80% of the design capacity, or as required by state law.

5.6.2 Environmental Responsibility

- The wastewater utility will implement procedures, and modifications to procedures, when it is demonstrated that such procedures, as part of an integrated watershed management plan involving other utilities and land uses in the Stillaguamish and Quilceda basins, would result in net environmental benefits at a reasonable cost to the utility.
- The wastewater utility will manage its operations and discharges with consideration for parameters known to cause, or which potentially could cause, impairments to water quality in the Stillaguamish River. As of this plan, parameters of primary concern include: water temperature, phosphorus and other nutrients, and copper and zinc.
- The wastewater utility will maintain lists of viable alternatives for adaptive management planning in the event that changes in effluent or receiving water quality require the consideration or implementation of such procedures.

5.7 OPERATIONAL POLICIES

5.7.1 Maintenance

- With regard to all wastewater utility infrastructure, equipment, and operational procedures, the utility will work proactively, not reactively, to maintaining its assets. Assets will not be simply built and operated, but managed for the following objectives: extending asset life; optimizing maintenance and renewal schedules; developing accurate long-term funding strategies; and sustaining long term performance.
- Detailed asset inventories and maintenance scheduling will be maintained in an asset management program. The wastewater utility currently employs Cartegraph for this purpose.
- Equipment breakdown is given highest maintenance priority, and repairs should be made as soon as possible.
- Equipment should be replaced when it becomes obsolete.
- Worn parts should be repaired, replaced or rebuilt before they represent a high failure probability.
- Equipment that is out of service should be returned to service as soon as possible.
- A preventive maintenance schedule shall be established for all facilities, equipment and processes.
- Spare parts shall be stocked for all equipment items whose failure will impact the ability to meet other policy standards.

- Tools shall be obtained and maintained to repair all items whose failure will impact the ability to meet other policy standards.
- Dry, heated shop space shall be available to all maintenance personnel to maintain facilities.
- All maintenance personnel shall be trained in the procedures and techniques necessary to efficiently perform their job descriptions.
- Work orders, maintenance records, labor and expense tracking, and summary reports will be maintained on each facility and item of equipment using Public Works' asset management program (Cartegraph).

5.7.2 Temporary and Emergency Services

- Compliance construction standards (not quality standards) may be deferred for temporary sewer service.
- Compliance with Construction Standards may be deferred for emergency wastewater service.
- Once an emergency has been identified by City staff and the threat to public health and the environment has been abated, City Staff will notify the Department of Ecology and City Administrator about the emergency; the cause, the remedy, and plans to prevent it from reoccurring.

5.7.3 Reliability

- The City shall ensure that the wastewater utility is constructed, operated and maintained to protect against failures of power supply, treatment process, equipment or structure with appropriate backup facilities.

5.8 RECLAIMED WATER REUSE POLICIES

- The City considers the newly available production of reclaimed water to be a resource with potential economic and environmental benefits. The potential for distribution and/or reuse of reclaimed water shall be a consideration in all utilities, road, and land use projects.
- Reclaimed water may have a significant role in the City's integrated water resources management program.
- The City will advocate for the development of rules and regulations at the state level which will recognize the City's right to consumptive and non-consumptive use of reclaimed water it produces.
- The City will develop and implement a Reclaimed Water Reuse marketing plan to guide the development of a reclaimed water market.

- The City will develop rate structures for potable water, reclaimed water, and wastewater services that encourage consideration of reclaimed water reuse. Preliminarily, reclaimed water rates should consider recovering approximately 80% of the cost to distribute it, and 20% should be borne by potable water and wastewater rates with the understanding that these are costs that would otherwise be borne by utilities for expansion of their treatment and pipe infrastructure.

5.9 ORGANIZATIONAL POLICIES

5.9.1 Structure

- The Public Works Director or his/her designee is responsible for overall sewer utility financial planning and management.
- The Wastewater Utility Supervisor is responsible for the day-to-day operations of the wastewater systems, including pretreatment, collections, treatment, composting, disposal, and reuse, as well as system operation and maintenance, personnel staffing and management, and reporting requirements.
- The wastewater utility is responsible for adequate system operation and maintenance.
- Planning, design, operations and maintenance, and construction will be accomplished or overseen by the Public Works Department.

5.9.2 Staffing

- The wastewater utility staffing levels are established by the City Council based on the financial resources of the City and needs of the wastewater utility.
- Personnel certification and training will comply with State established standards.

5.9.3 Relationship with Other Departments

- The Finance Department works in conjunction with the Utilities Division Staff Accountant. The Staff Accountant and Public Works Director or designee coordinate all sewer-related financing requirements. The Finance Department is responsible for customer billing and payment collection, and the Utility Division collects connection fees and oversees project cost accounting.
- The Human Resources Department is responsible for employee records, union labor negotiations and salary schedules.
- The Fire Department is responsible for emergency responses to hazardous events at wastewater utility facilities.
- The Police Department and/or Sewer Department are responsible for enforcing violations of the City's wastewater ordinances.

- The Water Department is responsible for shutting off water service if a customer does not pay their wastewater bill.
- The Wastewater Department will participate in the implementation of the Water Department's Water Use Efficiency and Cross-Connection Control Programs.

5.10 FINANCIAL POLICIES

General financial policies are summarized in this section, detailed information regarding these and other wastewater utility financial policies is included in **Chapter 9**.

5.10.1 General

- The City will set rates that comply with State regulations.
- Rates and additional charges established for the City should:
    1. Be cost-based rates that recover historical, current and future costs associated with the City's wastewater utility and its services;
    2. Be equitable charges to recover costs from wastewater customers commensurate with the service demands, including the total volume of water used, peak rates of use, and other factors;
    3. Be an adequate and stable source of funds to cover the current and future annual cash needs of the wastewater utility; and
    4. Not subsidize the operation of other City departments.
- The City's existing customers will pay the direct and indirect costs of operating and maintaining the wastewater facilities through user rates. In addition, the user rates will include debt service incurred to finance the capital assets of the utility.
- New customers seeking to connect to the sewer system will be required to pay a connection charge for an equitable share of the cost of the system's current and planned infrastructure. This revenue will be used to finance the CIP, in conjunction with rate revenue.
- New and existing customers will be charged for extra services through a separate ancillary charge based on the cost to provide the service. The charges should be reviewed regularly and updated based on the cost of providing the service. In between cost studies, charges may be increased annually based on increases in the Consumer Price Index for the City area. Revenue from ancillary charges will be used to finance annual operations and maintenance.
- The City will maintain information systems that provide sufficient financial and statistical information to ensure conformance with rate-setting policies and objectives.
- The user charges must be sufficient to provide cash for the expenses of operating and maintaining the utility. To ensure the fiscal and physical integrity of the utility, an amount

should be set aside each year for capital expenditures from rates. That is, an amount should be set aside to cover some portion of the depreciation of the physical plant. The amount may be transferred from the operating fund to the capital fund for general or specific purposes.

- Rate Stabilization Fund - For this Financial Plan, a rate stabilization reserve will be set to phase in up to 5% of rate revenue by the end of the 10-year forecast.
- System Reinvestment Funding - It is recommended to annually fund from rates an amount equal to annual depreciation expense net of annual debt principal payments. However, due to the current debt load for the Wastewater Utility, no incremental funding for system reinvestment is forecasted during the 10-year time period. As debt service is paid down, system reinvestment funding is projected to begin in year 2029.
- Debt Management – The Wastewater Utility will strive to manage debt consistent with industry best practice, that is to maintain a debt to fixed asset ratio of no more than 60% debt to 40% fixed assets (current ratio for the Wastewater Utility is 32% debt to 68% fixed assets).
- Operational Reserve - The City's current policy is to maintain a minimum balance in the operating account equal to 3 months of operating reserves (90 days), industry practice is to maintain a reserve range of 30 to 45 days of O&M expenses. The City will adjust its policy to maintain a reserve equivalent to 60 days of O&M expenses for the short term. This policy can be adjusted in the future if other recommendations, such as the Rate Stabilization Account, provide financial stability in the Sewer O&M fund.
- Bond Reserve – It is typical industry practice, and often required by lenders and underwriters, for utilities to establish a restricted cash reserve equivalent to one year's debt service payment (principal and interest) for each bond issue or loan. The Wastewater Utility has such a fund for its one outstanding revenue bond due to mature in 2017. Additional reserve monies are held in the fund as a requirement for the utility's two Department of Ecology State Revolving Fund loans.
- Capital Contingency Reserve – A Capital Contingency Reserve will be maintained to cover unanticipated emergencies and capital cost overruns. The current practice is to maintain a $1,000,000.00 reserve which is about 1.7% of current fixed assets, this is consistent with industry standards of maintaining a capital reserve balance equal to 1% to 2% of the original cost of plant in service.
- The City's fees and charges should be calculated for the wastewater service area as a whole. Rates will be the same regardless of service location for existing customers. Rates charged in annexed areas will be evaluated on an individual basis.

5.10.2 Connection Charges

The owners of properties that have not been assessed, charged or have not borne an equitable share of the cost of the sewer collection and sewer treatment facilities shall pay one or more of the following connection charges prior to connection to a sewer main. Additional details regarding connection charges can be found in Chapter 9.

1. Latecomers Fees: Latecomers Fees are negotiated with developers and property owners for the reimbursement of a pro rata portion of the original costs of sewer system extensions and facilities and is documented in a Recovery Contract.
2. Connection Charge: The connection charge shall be assessed against any property connecting to the sewer system. This charge is for the major facilities that deliver the sewage to a treatment facility and for the facilities to treat and dispose of the sewage. This charge is for reimbursement of customers who have paid for the facilities described and for building capacity to accommodate growth.
3. Developer Extension Charges: These charges are for the administration, review and inspection of a developer extension project.
4. Developer Funded Improvements: These are costs incurred by a developer to upgrade and increase capacity in the sewer system to accommodate the increase in flow from the proposed development.

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6 Wastewater Collection Evaluation

6.1 *INTRODUCTION*

The City of Arlington (City) will require improvements to its collection system to accommodate in-City growth, collection system expansions, and to repair damaged and deteriorating facilities. This chapter presents the evaluation of the City's existing sewer collection system. Individual sewer system components were analyzed to determine their ability to meet policies and design criteria under both existing and future flow conditions. The policies and design criteria are presented in **Chapter 5**, and the sewer system flow analysis is presented in **Chapter 4**. A description of the existing sewer system facilities and current operation is presented in **Chapter 2**.

6.2 *DRAINAGE BASINS*

The City's collection system can be broken into 14 sewer drainage basins, as shown in **Figure 2-3**. Three of the drainage basins are able to gravity flow to the treatment plant. The remaining basins gravity flow to lift stations, where they are pumped into gravity sewer interceptors, which in turn flow by gravity to the treatment plant.

6.3 *HYDRAULIC MODEL DESCRIPTION*

6.3.1 Background

A computer-based hydraulic model of the existing sewer system was created using version 8i (SELECT series 3) of the SewerCAD program, developed by Bentley Systems, Inc. The entire sewer collection system, including gravity mains, force mains, and sewer lift stations was modeled. The hydraulic model was updated since the previous Comprehensive Sewer System Plan (Plan) using information provided by the City, including construction as-built drawings and geographic information system (GIS) data. Pipe location, length, diameter, and material were input based on as-built drawings and various system maps acquired from the City. Manhole invert and rim elevation data was used, when available, and the remaining elevation data was extracted from

Snohomish County topographic and United States Geological Survey (USGS) data when other information was not available.

6.3.2 Model Limitations

Due to the lack of diameter, material, or invert elevation information in some areas, the results of the modeling should be further investigated through field surveys or similar methods in the vicinity of the proposed improvements prior to design and construction. If it is found that the input information differs significantly from actual conditions, then the model should be updated accordingly and rerun to confirm the original results.

The modeling was performed using a steady-state analysis, which shows all flows reaching all downstream points simultaneously. This is conservative and not truly representative of conditions that occur since it takes some time for wastewater to travel downstream through the sewer system. Steady-state modeling is a good planning-level tool to conduct capacity analyses and sizing of pipes in planning-level documents like sewer system plans.

6.3.3 Flow Data

Existing and proposed flow rates for the basins and lift stations were developed in **Chapter 4**. Average day flow and peak hour flow, based on a peaking factor of four, were developed for each basin in **Table 4-4** and for the lift stations in **Table 4-5**. This information was used in the modeling scenarios.

6.3.4 Facilities

The hydraulic model of the existing system contains all active existing system facilities. Available information for each lift station, such as pump capacity, total dynamic head (TDH), horsepower, wet well diameter, wet well depth, and force main diameter is included in the model. For simplicity, the pump stations are modeled as constant-discharge pumps so that they produce a constant discharge regardless of TDH conditions.

6.4 *HYDRAULIC ANALYSIS RESULTS*

Hydraulic analyses were performed assuming a peaking factor of average day flow to peak hour flow of four. In the evaluation, the criteria for listing a sewer pipe as deficient is that the peak hour flow exceeds 80 percent of the pipe flow capacity in terms of depth to diameter (d/D). The results of the hydraulic analyses are presented in **Appendix B**, in a Google Earth KMZ file.

Hydraulic analyses were performed based on the existing flow rates, as well as future flow rates for the 2024 (10-year) and 2035 (20-year) projections. **Figure 7-1** highlights current system deficiencies. **Figure 7-2** provides capacity deficiencies for projected 2024 conditions. **Figure 7-3** provides capacity deficiencies for the population projection for 2035.

6.4.1 Pipe Capacity Analysis

Existing System

Based on discussions with the system operators, there are a few deficiencies along the primary interceptor which occur during storm events. Based on the analysis of the existing system, it appears that a significant portion of the lower primary interceptor is currently at or near capacity. The primary interceptor is a current pipe segment of interest in the City's ongoing flow monitoring program. It is recommended that monitoring continue to determine what the actual peak flows are in the system and whether the primary interceptor is at capacity. Flow monitoring is included in the City's capital improvement program (CIP).

In addition, the hydraulic modeling indicated that there may be some pipe segments that are near or at capacity along West Avenue between E 1st Street to E 3rd Street. This City has elected to conduct flow monitoring along West Avenue before scheduling this improvement (CIP P3 in **Chapter 7**). This information is presented in **Table 6-1**, along with the linear feet (LF) of pipe that has been identified.

Table 6-1. Existing Collection System Deficiencies

Sewage Drainage Basin	Location	Existing Diameter of Main (in.)	Proposed Diameter of Main (in.)	Length of Main (LF)
Primary Interceptor	67th Avenue NE	12	15	1,710
		12	24	2,810
	West Avenue	24	36	605
		24	42	155

Population 2024

Based on the analysis of the system using projected flow rates for 2024, a significant portion of the upper end of the primary interceptor and several pipe sections in the Gleneagle sewage drainage basin will need to be upsized. This information, in addition to other areas that need to be upsized, are presented in **Table 6-2**.

Most of the flow increases will occur due to the six growth center areas (discussed in **Chapter 3**). A considerable amount of collection pipe will be required in the following sewage drainage basins to accommodate this growth: Island Crossing (LS-11), Urban Growth Area (UGA) Expansion (west of I-5 and the Rest Area sewage drainage basin), Lift Station 12 (Crown Park), Gleneagle (south of SR531 and east of SR9), and Lift Station 2. The City has elected to conduct flow monitoring of the primary interceptor deficiencies prior to scheduling improvements (CIP P3 in **Chapter 7**) except for the 1,605 LF of pipe south of 197th Street NE (CIP P5 in **Chapter 7**).

These improvements are shown in **Figure 7-2**. The pipe size upgrades for the 2024 flow projections are scheduled based on capacity of the existing pipes being reached at the 2024 flow rate. However, the proposed size of the pipe is based on the ultimate flow projection for 2035. All of the growth and related improvements for 2024 are necessary to accommodate flow from expected future developments.

Table 6-2. 2024 Collection System Deficiencies

Sewage Drainage Basin	Location	Existing Diameter of Main (in.)	Proposed Diameter of Main (in.)	Length of Main (LF)
Gleneagle	Wedgewood Park	8	12	500
	W Country Club Drive	8	12	2,300
	Cedarbough Loop	8	12	205
Primary Interceptor	South of 197th Street NE	12	15	1,605
	67th Avenue NE	24	30	4,060
		24	36	285
	67th Avenue NE and 204th Street NE	12	15	60
		10	15	60
	West Avenue	24	30	560
	Railroad Street	24	30	280
Lift Station 4 (Airport)	Near 59th Avenue	10	12	120
Lift Station 7 (Highclover)	Cemetery Road and 47th Avenue NE	10	15	110
		8	15	100

Population 2035

Based on the analysis of the system using projected flow rates for 2035 and assuming the 2024 improvements were completed, there are additional pipe sections in the Gleneagle sewage drainage basin (see **Table 6-3**) that will need to be reconstructed to accommodate projected flows from the SR9/SR531 Roundabout growth center area (**Chapter 3**).

Table 6-3. 2035 Collection System Deficiencies

Sewage Drainage Basin	Location	Existing Diameter of Main (in.)	Proposed Diameter of Main (in.)	Length of Main (LF)
Gleneagle	Gleneagle Boulevard	8	12	1,260
	Woodlands Way	8	12	1,815

The majority of the growth and related improvements for 2035 are necessary to accommodate flow from expected future developments. The additional improvements for 2035 are shown in **Figure 7-3**.

6.4.2 Lift Station Capacity Analysis

Existing System

Based on discussions with the system operators, Lift Station 2 has capacity deficiencies during peak flow events. Based on the analysis of the existing system, it appears likely that Lift Stations 2, 4, 5, and 7 (**Table 6-4**) are currently at or near capacity during peak hour events. Review of lift station telemetry data does show that Lift Station 4 exceeds its firm capacity (n-1 pump in operation) during storm events. Capacity analyses is based on estimated peak hour flow with n-1 pumps in operation. The City's lift stations are, and will continue to be, monitored to determine if current inflow during peak events is approaching or exceeding the current pumping capacity.

As part of the 2024 improvements, the discharge for Lift Station 6 will be rerouted away from Lift Station 5 sewage drainage basin and this will significantly reduce the flow to Lift Station 5. The City has indicated that the existing force main for Lift Station 11 will be re-used and therefore, the project to re-route Lift Stations 6 and 11 discharges are not included on the capital improvement plan. Lift station 5 is not planned for an upgrade. In addition, City staff have not observed capacity issues with this lift station during peak hour flow events.

Population 2024

Based on the analysis of the system using projected flow rates, no additional lift station will have capacity deficiencies.

Two new lift stations will need to be constructed: Lift Stations 14 and 15, and they will be located in the northwestern portion of the City's sewer service area (**Figure 7-2**). In addition, the effluent from Lift Station 6 (Rest Area sewage drainage basin) is currently pumped to the Lift Station 5 sewage drainage basin. Lift Station 5 pumps to Lift Station 4 which discharges into the primary interceptor just south of 197th Street NE. The discharge from Lift Station 6 is planned to be rerouted to the proposed Lift Station 14 which will reduce flows to Lift Stations 5 and 4 from the Rest Area sewage drainage basin (Lift Station 6). The discharge from the proposed Lift Station 14 will be conveyed to Lift Station 7. Lift Station 7 discharges to the primary interceptor at 204th Street NE.

Population 2035

Lift Stations 8, 11, and 12 may need to be upgraded for 2035 projected flows as part of the 2035 improvements (**Table 6-4**). The capacity of Lift Station 11 will need to be evaluated further with the construction of Lift Stations 14 and 15 in 2024. It may be possible to divert a portion of the flow away from Lift Station 11 to Lift Station 14 so that Lift Station 11 is not at capacity by 2035. This will need to be evaluated in the future during the design of Lift Station 14.

Table 6-4. Projected Lift Station Peak Hour Flow Rates

Name	Number of Pumps	Existing Capacity (GPM)	Existing Firm Capacity (GPM)[2]	2013		Projected 2024		Projected 2035	
				Estimated PHF (GPM)	% of Firm Capacity[1]	Estimated PHF (GPM)	% of Firm Capacity[1]	Estimated PHF (GPM)	% of Firm Capacity[1]
LS-2	2	500 500	500	705	**141%**	1,035	**207%**	1,395	**279%**
LS-4 (Airport)	2	400 400	400	735	**184%**	760	**190%**	1,010	**253%**
LS-5	2	450 450	450	680	**151%**	295	66%	420	93%
LS-7 (Highclover)	2	176 176	176	190	**108%**	1,640	**932%**	1,660	**943%**
LS-8 (Highland View)	2	225 225	225	135	60%	200	89%	270	**120%**
LS-11 (Island Crossing)	2	115 115	115	40	35%	95	83%	155	**135%**
LS-12 (Crown Park)	2	250 250	250	30	12%	240	96%	475	**190%**
LS-14 (Smokey Point)	2	NA	NA	NA	NA	1,305	NA	1,410	NA
LS-15 (UGA Expansion)	2	NA	NA	NA	NA	305	NA	635	NA

Notes:
1 - The percentages for firm capacity that exceed the capacity of the lift station are highlighted red.
2 - The existing firm capacities are the capacities of each lift station with the largest pump out of service.

7 Wastewater System Improvements

7.1 INTRODUCTION

This chapter presents proposed improvements to the City of Arlington's (City) sewer system that are necessary to resolve existing system deficiencies and plan for the projected growth of sewer customers. The sewer system improvements were identified from an evaluation of the results of the system analyses presented in **Chapter 6**. The existing and projected flow values are presented in **Chapter 4**. The sewer system improvements were sized to meet both the existing and future demand conditions of the system.

A Capital Improvement Program (CIP) project number has been assigned to each improvement. Project numbers were assigned to the improvements as shown in **Figures 7-1** (Existing System Analysis), **7-2** (2024 Projected System Analysis), and **7-3** (2035 Projected System Analysis). The improvements are organized and presented in this chapter according to the following primary categories:

- Existing System Analysis:
  - Pipeline Improvements (P)
  - Facility Improvements (F)
  - Miscellaneous Improvements (M)
- 2024 Projected System Analysis (10-Year):
  - Pipeline Improvements (P)
  - Facility Improvements (F)
  - Miscellaneous Improvements (M)
- 2035 Projected System Analysis (21-Year):

- Pipeline Improvements (P)
- Facility Improvements (F)
- Miscellaneous Improvements (M)

The remainder of this chapter presents the basis for the cost estimates, a brief description of each group of improvements, the criteria for prioritizing, and the implementation schedule. **Table 7-1** also shows the distribution of projects that have been identified for implementation over the next ten years and those that are slated to occur in 2026 and beyond.

For planning purposes, the improvement projects described herein are based on one alternative route or conventional concept for providing the necessary improvement. Other methods of achieving the same result, such as obtaining flow capacity increases by adding one large gravity main versus using multiple gravity pipes, force main/gravity main combinations, or multiple force mains, should be considered during predesign to ensure the best and lowest cost alternative design is selected. Further evaluation should be performed when more information is available regarding when and where new developments will occur in the future.

7.2 ESTIMATING COSTS OF IMPROVEMENTS

Project costs for the proposed improvements were estimated, based on costs of similar, recently-constructed sewer projects in the City and around the Puget Sound area, and are presented in 2014 dollars and do not include future escalation. The costs were developed from a combination of recent bids on construction projects, vendor quotes, cost curves, scale-up and scale-down factors, and size and cost comparisons with similar projects. These project costs are developed for guidance in project evaluation from information available at the time of preparation. No costs are included for extraordinary circumstances, such as potential discovery and remediation of contaminated materials or actions that may be required to address the existence of cultural artifacts.

The unit costs for each pipe size are based on estimates of all construction-related improvements, such as materials and labor for installation, services, manholes, connections to the existing system, trench restoration, asphalt surface restoration, and other work for a complete installation. The unit costs also include a contingency and sales tax. Additional costs were added to some improvements to cover anticipated increased costs related to the project location and degree of difficulty.

The cost estimates include the estimated construction cost of the improvement and indirect costs estimated at 35 percent of the construction cost for engineering preliminary design, final design, construction management services, permitting, and legal and administrative services.

Cost estimates for projects in the CIP are considered to be Class 5 estimates, based on standards established by the American Association of Cost Engineers (AACE). Class 5 estimates are described as generally being prepared with very limited information and subsequently have wide accuracy ranges. The typical accuracy range for this cost estimate class is from -20 percent to -50 percent

on the low side and from +30 percent to +100 percent on the high side. Class 5 estimates are prepared for any number of strategic business planning purposes, including but not limited to, market studies, assessment of initial viability, evaluation of alternate schemes, project screening, project location studies, evaluation of resource needs and budgeting, long-range capital planning, etc. Supporting documentation for all lift station capital improvement items is included in **Appendix H**.

The final cost of the projects will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule, and other variable factors. As a result, the final project costs will likely vary from those presented. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

7.3 DESCRIPTION OF IMPROVEMENTS

This section provides a general description of each group of improvements and an overview of the deficiencies they will resolve. Most improvements will be necessary to serve currently undeveloped areas within city limits and the expanded Urban Growth Area (UGA). The major pipe and facility improvements that will be required when development occurs in those areas are considered to be developer-funded projects. Additional developer-funded projects include localized on-site sewer main improvements that are not associated with the existing overall sewer collection/interceptor system but will be necessary when the property served by the sewer system is redeveloped or expanded. The costs associated with all of these improvements shall be borne by the developers, rather than the existing sewer customers. The locations of improvements in the undeveloped areas are not shown as they will be designed in the future to fit the specific layout of the future developments.

Some projects—particularly those in existing developed areas—target replacement and/or improvement of existing, aging infrastructure. Where these projects clearly provide benefits to existing customers and prospective developers, funding requirements are pro-rated by the benefits provided to the City and to developers. In some areas, projects simply are infrastructure replacements with little or no upgrades to the services provided. In these instances, the entire project will be borne by the City.

7.3.1 Pipeline Improvements

P1: Flow Monitoring Study and Plans (Gleneagle Area)

Deficiency: Based on modeling results, portions of the Gleneagle sewage drainage basin may be at or near capacity as future development occurs within the City's sewer service area. Flow monitoring should be completed to verify existing flow rates at various points in the system in order to determine if any additional capacity is available. Actual infrastructure improvements associated with CIPs P2A and P2B will be dependent on the prior completion of this CIP.

Improvement: Install monitoring equipment in the sewer collection system at multiple locations to determine existing flow rates; use flow data to calibrate model for this basin and run the model to project future flows. If current or future peak flow capacity is at or exceeds 80 percent of the pipeline or pumping capacity, then plans for an expansion and/or upgrade should be implemented.

P2A: Gleneagle Improvements

Deficiency: Portions of the Gleneagle sewage drainage basin collection system will be near or at capacity with the development of SR9 Roundabout Capital Project Improvement Focus Area.

Improvement: Replace approximately 3,005 lineal feet (LF) of existing pipe with 12-inch diameter pipe, per City standards.

P2B: Gleneagle Improvements

Deficiency: Portions of the Gleneagle sewage drainage basin collection system will be near or at capacity with the development of SR9 Roundabout Capital Project Improvement Focus Area.

Improvement: Replace approximately 3,075 LF of existing pipe with 12-inch diameter pipe, per City standards.

P3: Flow Monitoring Study and Plans (Primary Interceptor and Inflow to Lift Stations)

Deficiency: Portions of the Primary Interceptor sewage drainage basin may be at or near capacity as future development occurs within the City's sewer service area. In addition, influent gravity sewer mains in the vicinity of the lift stations may be at or near capacity. Flow monitoring should be completed to verify existing flow rates at various points in the system in order to determine if any additional capacity is available. The hydraulic analysis found deficiencies in Primary Interceptor segments as summarized in **Table 7-1**. In addition, inflows to Lift Stations 2, 4, 5, and 7 may be near capacity now or with future development proposals and warrant additional monitoring.

Table 7-1. Modeled Deficiencies in the Existing Primary Interceptor

Sewage Drainage Basin	Location	Existing Diameter of Main (in.)	Proposed Diameter of Main (in.)	Length of Main (LF)
Primary Interceptor	West Avenue	24	36	605
		24	42	155
	67th Avenue NE	24	30	4,060
		24	36	285
	67th Avenue NE and 204th Street NE	12	15	60
		10	15	60
	West Avenue	24	30	560
	Railroad Street	24	30	280

Improvement: Install monitoring equipment in the sewer collection system at multiple locations to determine existing flow rates. If peak flow capacity is at or exceeds 80 percent of the pipeline or pumping capacity, then plans for an expansion and/or upgrade should be implemented.

P4: Primary Interceptor Improvements

Deficiency: Portions of the Primary Interceptor will be near or at capacity as future development occurs within the City's sewer service area.

Improvement: Replace approximately 1,710 LF of existing pipe with 15-inch diameter pipe and 2,810 LF of existing pipe with 24-inch diameter pipe, per City standards.

P5: Primary Interceptor Sewage Drainage Basin Improvements

Deficiency: Portions of the Primary Interceptor sewage drainage basin will be near or at capacity as future development occurs within the City's sewer service area.

Improvement: Replace approximately 560 LF of existing pipe with 15-inch diameter pipe, per City standards.

P6: Lift Station 4 Sewage Drainage Basin Improvements

Deficiency: Portions of the Lift Station 4 sewage drainage basin will be near or at capacity as future development occurs within the City's sewer service area.

Improvement: Replace approximately 120 LF of existing pipe with 12-inch diameter pipe, per City standards.

P7: Lift Station 7 Sewage Drainage Basin Improvements

Deficiency: Portions of the Lift Station 7 sewage drainage basin will be near or at capacity as future development in the West I-5 Expansion Area and Island Crossing Capital Project Improvement Focus Areas.

Improvement: Replace approximately 220 LF of existing pipe with 15-inch diameter pipe, per City standards.

P8: West of I-5 Collection System

Deficiency: This area was recently included in the City's sewer service area and the area will need to be connected to the municipal sewer system.

Improvement: Extend the gravity sewer to serve the West of I-5 Capital Project Improvement Focus Area, per City standards.

P9: MIC, South of 172nd Improvement Focus Area Collection System

Deficiency: This area was recently included in the City's sewer service area and the area will need to be connected to the municipal sewer system.

Improvement: Extend the gravity sewer to serve the Manufacturing Industrial Center (MIC), South of 172nd Capital Project Improvement Focus Area, per City standards.

7.3.2 Facility Improvements

F1: Lift Station 2 Improvements

Deficiency: Pumping and force main capacity will be exceeded as future development occurs within the City's sewer service area.

Improvement: Construct a new submersible pump station with a variable frequency drive (VFD) with a 1,400 gallons per minute (gpm) capacity and 2,300 LF of force main, per City standards.

F2: Lift Station 4 Improvements

Deficiency: Pumping capacity will be exceeded as future development occurs within the City's sewer service area.

Interim Improvement: Replacement of the impellers and motor, a relatively small investment in 2020, will buy another 5 years before the lift station is permanently replaced (**Table 7-2**).

Permanent Improvement: Construct a new submersible pump station on a VFD with a 1,100 gpm capacity, per City standards.

F3: Lift Station 7 Improvements

Deficiency: Pumping and force main capacity will be exceeded as future development occurs within the City's sewer service area.

Interim Improvement: Replacement of the pumps and motors, a comparatively small investment in 2023, will buy another 3 years before the lift station is permanently upgraded and replaced (**Table 7-2**).

Permanent Improvement: Construct a new submersible pump station on a VFD with a 1,700 gpm capacity and 7,700 LF of force main, per City standards.

F4: Lift Station 8 Improvements

Deficiency: Pumping capacity will be exceeded as future development occurs within the City's sewer service area.

Improvement: Replacement of the pumps and motors with a capacity of 300 gpm.

F5: Lift Station 11 Improvements

Deficiency: Pumping capacity will be exceeded as future development occurs within the City's sewer service area.

Improvement: Construct a new submersible pump station on a VFD with a 200 gpm capacity, per City standards.

F6: Lift Station 12 Improvements

Deficiency: Pumping capacity will be exceeded as future development occurs within the City's sewer service area.

Improvement: Replacement of the pumps and motors with a capacity of 500 gpm.

F7: Lift Station 14 Construction

Deficiency: The Island Crossing Capital Project Improvement Focus Area was recently added to the City's sewer service area and a pump station will be required for the areas that cannot be served by gravity sewer.

Improvement: Construct a new submersible pump station on a VFD with a 1,450 gpm capacity and 9,000 LF of force main, per City standards.

F8: Lift Station 15 Construction

Deficiency: The West of I-5 Capital Project Improvement Focus Area was recently added to the City's sewer service area and a pump station will be required for the areas that cannot be served by gravity sewer.

Improvement: Construct a new submersible pump station on a VFD with a 650 gpm capacity and 2,000 LF of force main, per City standards.

F9: Lift Station 3 Rehabilitation

Deficiency: The existing electrical system, controls, pumps, and wet well are nearly 20 years old and in poor condition.

Improvement: Replace lift station structures and equipment, as required, to bring the lift station to City standards.

F10: Membrane Upgrade for WRF

Deficiency: The existing membrane units will need to be replaced, per the manufacturer's recommendations.

Improvement: Replace membrane units, as needed.

7.3.3 Miscellaneous Improvements

The following miscellaneous improvements are for future planning efforts.

M1: 2024 Sewer Plan Update

Deficiency: The City's Comprehensive Sewer System Plan (Plan) should be updated every ten years.

Improvement: The City will update its Plan every ten years. In addition, the City will perform a check of the Plan at the five-year mark and adjust the projections and improvements, as necessary.

M2: 2035 Sewer Plan Update

Deficiency: The City's Plan should be updated every ten years.

Improvement: The City will update its Plan every ten years. In addition, the City will perform a check of the Plan at the five-year mark and adjust the projections and improvements, as necessary.

7.4 PRIORITIZING IMPROVEMENTS

The existing system improvements were prioritized by the City based on the perceived need for the improvement to be completed prior to projects with fewer deficiencies or less risk of damage due to failure of the system. For planning purposes, a general schedule has been established for the projects; however, the estimated schedule will need to be modified as development occurs.

7.5 SCHEDULE OF IMPROVEMENTS

The results of prioritizing the improvements were used to assist in establishing an implementation schedule that can be used by the City for preparing its ten-year CIP. The implementation schedule for the proposed improvements is shown in **Table 7-1**. The City will identify and schedule the repair/replacement projects during the annual budget process. This provides the City with the flexibility to coordinate these projects with road or other projects within the same area.

7.5.1 Future Project Cost Adjustments

All cost estimates shown in the tables are presented in year 2014 dollars. Therefore, it is recommended that future costs be adjusted to account for the effects of inflation and changing construction market conditions at the actual time of project implementation. Future costs can be estimated using the Engineering News Record Construction Cost Index for the Seattle area or by applying an estimated rate of inflation that reflects the current and anticipated future market conditions.

The CIP presented in **Table 7-1** is based on the information currently available. As the City implements the recommendations, the cost and timing of projects may be revised. The two elements that are most likely to affect the costs and schedule of projects in the CIP table are:

- Condition assessment, particularly of the lift stations, and
- Collection system flow monitoring.

Once these activities are completed or under way, the City can reassess the priority and timing of the projects in the CIP.

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Table 7-2. Proposed Improvements Implementation Schedule

No.	Description	Type	Finance Source	Estimated 2015 Cost	Schedule of Improvements Planned Year of Project and Estimated Cost											
					2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026-2030	2031-2035
Pipeline Improvements																
P1	Flow Monitoring Study and Plans (Gleneagle Area)	Increase Capacity	City Funded	$40K	$20K	$20K										
P2A	Gleneagle Improvements (Replace Existing 8-inch Pipe along Wedgewood Park, W Country Club Drive, and Cedarbough Loop)	Increase Capacity	City Funded	$811K			$243K	$284K	$284K							
P2B	Gleneagle Improvements (Replace Existing 8-inch Pipe along Gleneagle Boulevard and Woodlands Way)	Increase Capacity	City Funded	$306K												$306K
P3	Flow Monitoring Study and Plans (Primary Interceptor and Inflow to Lift Stations)	Increase Capacity	City Funded	$80K	$40K	$40K										
P4	Primary Interceptor Improvements (Replace Existing 12-inch Pipe along 67th Avenue NE)	Increase Capacity	City Funded	$1,567K			$470K	$548K	$548K							
P5	Primary Interceptor Sewer Drainage Basin Improvements (Replace Existing 12-inch Pipe South of 197th Street NE)	Increase Capacity	City Funded	$440K							$440K					
P6	Lift Station 4 Sewer Drainage Basin Improvements (Replace Existing 10-inch Pipe near 59th Avenue)	Increase Capacity	City Funded	$32K				$10K	$22K							
P7	Lift Station 7 Sewer Drainage Basin Improvements (Replace Existing 8-inch and 10-inch Pipe along Cemetery Road and 47th Avenue NE)	Increase Capacity	City Funded	$58K						$17K	$20K	$20K				
P8	West of I-5 Collection System	Expansion	City Funded	$2,228K								$668K	$780K	$780K		
P9	MIC, South of 172nd Improvement Focus Area Collection System	Expansion	City Funded	$3,240K								$972K	$1,134K	$1,134K		
Total Pipeline Improvements				**$8,802K**	**$60K**	**$60K**	**$713K**	**$842K**	**$855K**	**$17K**	**$460K**	**$1,661K**	**$1,914K**	**$1,914K**	**$0K**	**$306K**
Facility Improvements																
F1	Lift Station 2 Improvements	Increase Capacity	City Funded	$1,426K		$100K	$328K	$499K	$499K							
F2	Lift Station 4 Improvements	Increase Capacity	City Funded	$825K					$75K					$750K		
F3	Lift Station 7 Improvements	Increase Capacity	City Funded and Developer Funded	$2,400K								$200K			$2,200K	
F4	Lift Station 8 Improvements	Increase Capacity	City Funded and Developer Funded	$100K												$100K
F5	Lift Station 11 Improvements	Replacement/Expansion	City Funded and Developer Funded	$600K										$600K		
F6	Lift Station 12 Improvements	Increase Capacity	City Funded and Developer Funded	$200K											$200K	
F7	Lift Station 14 Construction	Expansion	City Funded and Developer Funded	$3,780K							$1,134K	$1,323K	$1,323K			
F8	Lift Station 15 Construction	Expansion	City Funded and Developer Funded	$1,621K									$567K	$1,054K		
F9	Lift Station 3 Rehabilitation	Increase Capacity	City Funded and Developer Funded	$50K			$25K	$25K								
F10	Membrane Upgrades for WRF	Increase Capacity	City Funded and Developer Funded	$2,000K										$2,000K		
Total Facility Improvements				**$13,002K**	**$0K**	**$100K**	**$353K**	**$524K**	**$574K**	**$0K**	**$1,134K**	**$1,523K**	**$1,890K**	**$4,404K**	**$2,400K**	**$100K**
Miscellaneous Improvements																
M1	2024 Sewer Plan Update		City Funded	$150K									$150K			
M2	2035 Sewer Plan Update		City Funded	$150K												$150K
Total Miscellaneous Improvements				**$300K**	**$0K**	**$0K**	**$0K**	**$0K**	**$0K**	**$0K**	**$0K**	**$0K**	**$150K**	**$0K**	**$0K**	**$150K**
Total Estimated Project Costs				**$22,104K**	**$60K**	**$160K**	**$1,066K**	**$1,366K**	**$1,429K**	**$17K**	**$1,594K**	**$3,184K**	**$3,954K**	**$6,317K**	**$2,400K**	**$556K**

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8 Operations and Maintenance

8.1 INTRODUCTION

The City of Arlington's (City) wastewater utility operations and maintenance program consists of the following six elements.

1. Normal Operations
2. Emergency Operations
3. Preventive Maintenance
4. Maintenance
5. Development Review
6. Construction Inspection

8.2 NORMAL OPERATIONS

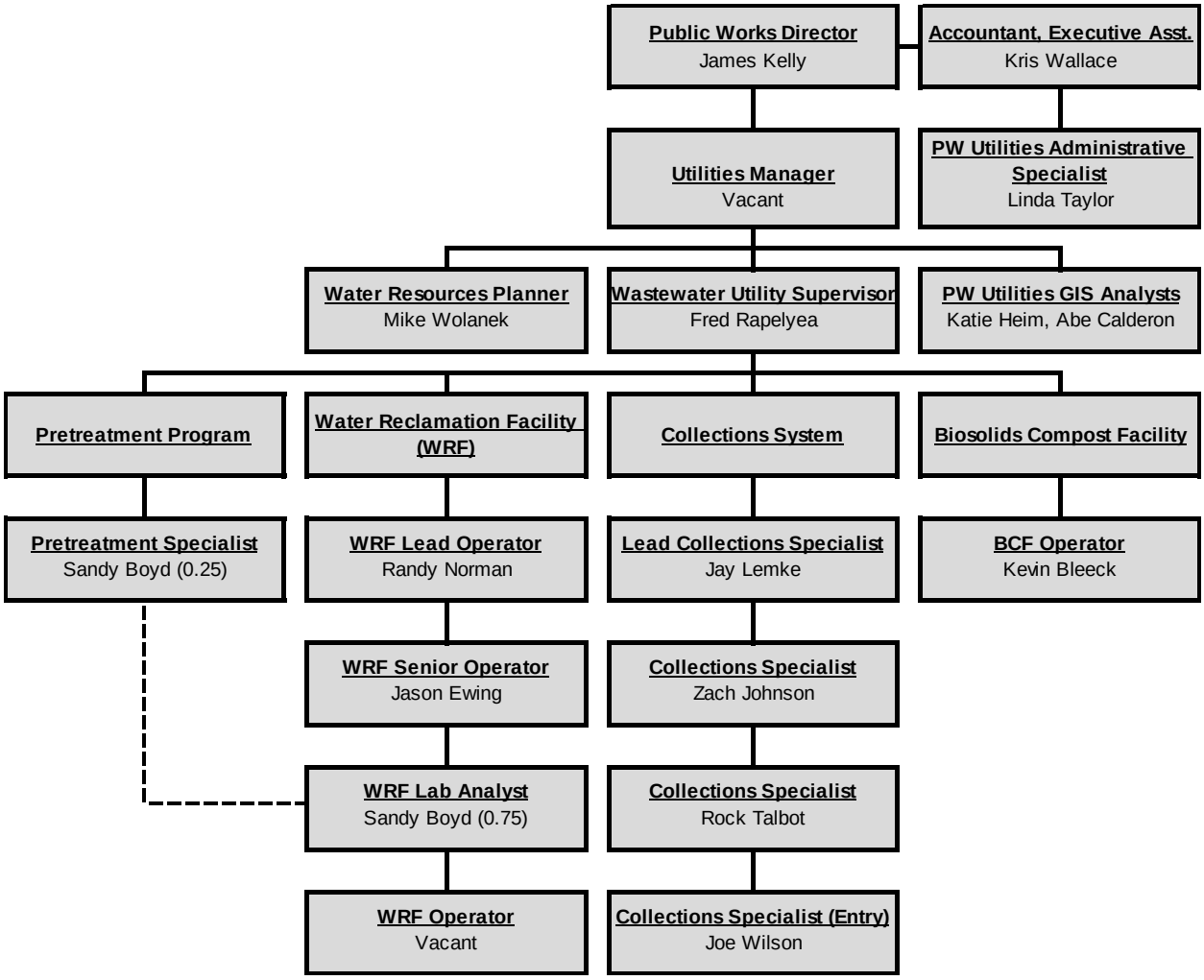
8.2.1 City Personnel

The organizational structure of the wastewater utility is presented in **Chart 8-1**. The City of Arlington Utilities Division operates under the Public Works Department and its Director, Mr. James Kelly, P.E. The Utilities Division functions under the direction of the Utilities Manager, a position also served by the Public Works Director since approximately 2008. The Wastewater Department Supervisor, Mr. Fred Rapelyea, reports to the Utility Manager and is responsible for supervising the daily operations of the wastewater utility. The Water Resources Planner, Mr. Mike Wolanek, assists with the regulatory requirements and planning and implementation of capital improvement projects, and special projects requiring coordination across water, wastewater, and stormwater utilities.

The Wastewater Department is staffed by several operation and maintenance personnel that function under the Wastewater Utility Supervisor (**Chart 8-1**). Tasks that are performed by the operations and maintenance staff include development review, inspection, testing, installation and repair of system facilities, routine operation and preventive maintenance, water quality sampling, regulatory compliance monitoring, recordkeeping, administrative tasks, general clerical work, and corrective or breakdown maintenance required in response to emergencies.

The City allocates funds annually for personnel training, certification and membership in professional organizations. The City believes that the time and money invested in training, certification and professional organizations are repaid many times in improved safety, skills, quality control and employees' job satisfaction.

Chart 8-1. Wastewater Department Organization



8.2.2 Personnel Responsibilities

The key responsibilities of the wastewater operations and maintenance staff are summarized below.

Utilities Manager (1) – Supervises, organizes, directs and performs activities related to the overall operation of the water, wastewater, and stormwater utilities.

Utilities Water Resources Planner (1) – Assists with the planning and implementation of capital improvement projects, and special projects requiring coordination across water, wastewater, and

stormwater utilities. Responsible for regulatory compliance and communications under NPDES and other permits. Monitoring and management of reclaimed water and reuse programs. Organizes and oversees as-built records and filing system.

Utilities Administrative Specialist (1) – Coordinates development and building permit review comments and assures timely submittal of comments. Coordinates the business license review process for utilities. Tracks review processes. Also supports the general administrative duties for all utilities.

Public Works Executive Assistant and Staff Accountant (1) – Administrative support and general accounting duties for all utilities and other Public Works' divisions.

Wastewater Utility Supervisor (1) – Organizes, directs and performs activities related to the operation and maintenance of the City's sewage collection system, water reclamation facility (WRF), and biosolids compost facility.

Lead Wastewater Treatment Plant Operator (1) – Directs and performs skilled routine maintenance activities at the WRF.

Senior Wastewater Treatment Plant Operator (1) – Performs skilled routine maintenance activities at the WRF.

Wastewater Treatment Plant Operator (0) – Performs a variety of skilled tasks to efficiently operate and maintain the City's WRF, compost facility and related facilities.

Lab Analyst/Pre-treatment Specialist (1) – Evaluates samples and analyzes water quality data collected by WRF staff. Assures compliance with applicable State water quality limits, and directs all necessary routine tasks. Performs technical work to perform all regular and non-routine sewer pre-treatment operations, reviews, inspection and laboratory work. Required to be a fully licensed and trained Wastewater Treatment Plant Operator (WWTPO) at the WRF.

Bio-solids Compost Operator (1) – Performs a variety of skilled tasks to efficiently operate and maintain the City's Bio-solids Compost Facility (BCF) and related facilities. Tasks include monitoring, preventive maintenance, sample collection, reporting and compost distribution.

Lead Collection System Specialist (1) – Performs non-routine trouble shooting, maintenance, development review, inspection, installation and repair work for the sanitary sewer collection system, and directs all necessary routine tasks. This position is also required to be a fully licensed and trained WWTPO.

Senior Collection System Specialist (0) – Performs all necessary routine and non-routine activities in the installation, construction, maintenance, repair and testing of the sanitary sewer collection system. This position is also required to be a fully licensed and trained WWTPO.

Collection System Specialist (3) – Performs all necessary routine activities in the installation, construction, maintenance, repair and testing of the sanitary sewer collection system. This position is also required to be a fully licensed and trained WWTPO.

8.2.3 Available Equipment

The wastewater department has several types of equipment available for daily routine operation and maintenance of the utility. If additional equipment is required for specific projects, the City will rent or contract with a local contractor for the services needed. A stock of supplies in sufficient quantities for normal system operation and maintenance and short-term emergencies are stored at the WRF. A list of major equipment and chemicals used in the normal operation of the wastewater utility is shown in **Table 8-1,** Utilities Division Equipment List.

Table 8-1. Wastewater Department Equipment List

Quantity	Description	Size/Special Features
	Equipment Inventory	
1	Dump Truck	10 Yard for Biosolids
1	CAT IT 14G Front Loader	Compost Facility
1	Vactor Truck	Shared by all utilities depts.
1	Forklift	Shared with Water Dept
2	Backhoe	Water and Street Depts
2	Snow Plows	Available via Street Dept
3	Pickup Truck	1/2 Ton
2	Pickup Truck	3/4 Ton
2	Flat Bed Trucks	
1	Van	
1	Utility Trailer	Enclosed
1	O'Brien Series 7040 Hydrojetter	
1	Portable Video Camera System	
1	Portable Pressure Washer	
1	Portable Steam Cleaner	
2	Emergency Generator	5 kW, with Water Dept
1	Emergency Generator	1 kW, with Water Dept
3	Portable Pumps	Water Dept
Varies	Miscellaneous Equipment	
	Chemical Inventory	
Varies	Sodium Hypochlorite	
Varies	Magnesium Hydroxide	
Varies	Polymer	Biosolids belt press
Varies	MARC Citrus Lift Station Maintainer	

The following representatives typically provide the supplies and chemicals to the wastewater utility.

- Collections System supplies: H.D. Fowler, 6016 29th Drive NE, Marysville, WA 98288, (360) 651-2400
- Ferric Chloride, Calcium Hypochlorite: Univar Inc., 8201 S 212th, Kent, WA 98032-1925, (253) 872-5000
- Collections system supplies and vactor services: CUZ Concrete, 19604 67th Avenue NE, Arlington, WA 98223, (360) 435-5531
- Analytical supplies: Hach Company, PO Box 389, Loveland, CO 80539, (800) 227-4224
- Analytical supplies: Scientific Supply and Equipment, Inc., 926 Poplar Place S., Seattle, WA 98144, (206) 324-8550
- Membrane treatment process: Ovivo USA, LLC, 2404 Rutland Drive, Austin, TX 78758, 1-855-OVIVO-MBR

The wastewater department utilizes several different types of communications equipment to ensure a reliable and redundant means of internal communication. Some vehicles are equipped with mobile two-way radios that are capable of communicating with similar base radios at the water utility office. In addition, all Public Works employees are equipped with cell phones that have two-way radio capability. The phones provide the capability for personnel to communicate with other cities and Snohomish County as necessary.

8.2.4 Routine Operations

Routine operations involves the analysis, formulation and implementation of procedures to ensure the facilities are functioning efficiently and meeting demands of the system. The utility's maintenance procedures are good, with repairs being made promptly.

8.2.5 Continuity of Service

As a municipality, the City has the structure, stability, authority and responsibility to ensure that wastewater service will be continuous. For example, changes in the City Council or staff would not have a pronounced effect on the City's customers or quality of service.

8.2.6 Routine Sampling

The Washington State Department of Ecology has adopted federal regulations that specify minimum monitoring requirements for the wastewater utility. The sampling requirements typically depend on the type of treatment provided and site specific conditions. The sampling, testing and reporting requirements are contained in the NPDES and Reclaimed Water permits; copies are included in **Appendix I**.

8.2.7 Operations and Maintenance Records

Facilities Operations and Maintenance Manuals

With the upgrade to the WRF, an operations and maintenance manual has been developed in html format and made available on the City's intranet and internet for staff members' reference. The O&M manual includes summarized procedures, graphics and reference tables, links to as-built drawings, and links to vendors' manuals. Paper copies of these materials are also kept on file at the WRF, compost facility, lift stations, and utilities office as appropriate. The utility intends to maintain its policies of requiring complete operation and maintenance manuals for all new equipment and facilities and making them available electronically.

Mapping and As-Built Drawing Records

Maintenance of infrastructure drawings is essential to maintenance crews, City planners, developers and anyone else needing to know the WRF, and how the sewer collections system is laid out throughout the City. WRF as-builts are available in hardcopy in the wastewater utility office, and electronically from within the online O&M manual. The entire sewer collections system is electronically mapped in an ArcGIS geodatabase. This provides alignment and information on every component of the collections system (gravity sewers, force mains, manholes, lift stations, etc.). Older collections system as-builts are maintained in paper format and are stored in an organized file at the Public Works' Administration office. Staff are actively converting these documents for electronic access through the City's Engineering Library. Links to these documents are also provided through ArcGIS.

Operations and Maintenance Records

Maintenance of the WRF and the collection system is planned and scheduled using Public Works' asset management system (Cartegraph). Work orders are issued and associated with specific assets. Completed work orders track maintenance performed, supplies used, labor, and changes in scheduling. Examples of records are stored electronically in Cartegraph include:

- Pump motor tests
- Wastewater flow records
- Wastewater system maintenance
- Sewer collection notes
- Side sewer connections
- Sewer main cleaning/inspection

Laboratory analyses and reporting are maintained in a bench log, Access database, and in pdf files on the City's server. The inspections and reviews of new developments are maintained in the City's permit tracking database and at the wastewater utility offices. Tracking of customer

complaints is done through the City's web site (maintained by the Executive Department) and in departmental files.

8.2.8 Safety Procedures and Equipment

Safety is the concern and responsibility of all sewer operations and maintenance staff. To maintain the highest level of safety the City actively educates and trains employees as to safe working procedures; safety equipment and other resources are always available to employees. The wastewater utility has a dedicated Safety Coordinator who ensures that safety topics are discussed at the department's weekly meeting and that the shop safety locker is always adequately supplied. Quarterly safety coordination meetings are conducted between the utility manager, each utility supervisor, and each utility safety coordinator. The City is fully dedicated to providing a safe and secure work environment for each of its employees.

The following identifies procedures to be followed for operations and maintenance tasks that involve the most common potential work place hazards in the wastewater utility.

Use of Sodium Hypochlorite and Magnesium Hydroxide

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

Working in Confined Spaces

Standard Procedure – Follow state requirements for confined space entry and the Public Works Department, Utilities Division's Confined Space Program.

Working around Heavy Equipment

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

Working in Traffic Areas

Standard Procedure – Wear proper clothing and provide adequate signage and flagging for work area, follow standard Washington State Department of Transportation and Labor and Industries safety procedures.

Working on or around Tall Structures

Standard Procedure – Follow proper safety harness procedures for working on tall structures and follow standard Labor and Industries safety procedures.

Working in or around Pump Stations

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

Training and Supplies

Wastewater utility personnel are required to take training courses regarding the following topics: confined spaces; fall protection; competent persons; heavy equipment operation; CPR; first aid; traffic flagging; lockout-tagout; and blood-borne pathogens.

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

The Public Works Department follows all appropriate OSHA and WISHA regulations in its day-to-day operations and complies with the following state requirements.

- WAC 296-62-145 to 14529 Part M – Entry into confined spaces.
- WAC 296-155-650 to 66411 Part N – Shoring of open ditches.
- WAC 296-155-429 – Lockout-tagout for work on energized or de-energized equipment or circuits.
- WAC 296-155 Part C1 – Fall restraint for access to pump stations, vaults and manholes.
- MUTCD – Traffic control for work in the public right-of-way.

8.3 EMERGENCY OPERATIONS

The City is well equipped to accommodate short-term system failures and abnormalities. The City's capabilities are as follows.

8.3.1 Emergency Equipment

The City is equipped with the necessary tools to deal with common emergencies. If a more serious emergency should develop, the City will hire a local contractor who has a stock of spare parts necessary to make repairs to alleviate the emergency condition.

8.3.2 Emergency Telephone

The wastewater department has a published "after hours" or emergency phone number that is available for the public to directly contact wastewater personnel. The police or other City departments can also reach staff via direct-connect phones or home contact numbers. Emergency contact information, including cell phones, pagers and home phone numbers, is provided to each City department.

8.3.3 On-Call Personnel

The Wastewater Utility is actively monitored 24 hours per day, 365 days per year. The utility has an On-Call program to ensure monitoring during weekends, holidays, and non-work hours. The On-Call person is equipped with a portable computer from which he can control and monitor every

function of the WRF and lift stations. The On-Call person also has an assigned service vehicle and is required to respond to a call within 45 minutes. A list of emergency telephone numbers is provided to each On-Call employee. New employees are not placed on-call until they are familiar with the systems and maintenance procedures and are properly certified as required.

8.3.4 Material Readiness

Some critical repair parts, tools and equipment are on-hand and kept in fully operational condition. As repair parts are used, they are re-ordered. Inventories are kept current and are adequate for most common emergencies that can reasonably be anticipated. The City has ready access to an inventory of repair parts, including parts required for the repair of each type and size of pipe within the service area. Additionally, the City has been provided with after-hours emergency contact phone numbers for key material suppliers, which gives the City 24-hour access to parts not kept in inventory.

8.4 PREVENTIVE MAINTENANCE

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

Sewer Collection System	
Frequency	***Task or Activity***
Annually or As Needed	Conduct leak survey primarily on force mains.
Every two-to-five years or As Needed	Inspect, clean and evaluate manholes and sewer pipe line condition.

Water Reclamation Facility	
Frequency	***Task or Activity***
Daily	Log and record run hours, motor starts, chemicals used, chemicals added, fuse indicators, flow and loading; visually inspect pumps/blowers; check pump/blower packing; check pump/blower oil

	levels; check all equipment for proper function and operation; check security.
Annually	Check all valves and screens; check control valve settings; re-grease pumps/blowers; change pump/blower oil.
As Needed	Maintain electrical and mechanical equipment; paint structures and piping; equipment calibration; indoor and outdoor facility maintenance and repairs.

Sewage Lift Stations	
Frequency	***Task or Activity***
Daily	Visual and audio inspection; check security; check pump motors for excessive heat and vibration.
Weekly	Observe and record motor current draw (three phases); log and record flow rates and pump motor hours; measure and record discharge pressure; check motor noise, temperature and vibration.
Annually	Change motor oil.
Annually	Take inventory of parts, pumps and motors.
As Needed	Calibrate flow meter; maintain electrical and mechanical equipment; paint structures and piping; routine maintenance of equipment.

Engine Generator Sets	
Frequency	***Task or Activity***
Monthly	Operate to achieve normal operating temperatures; observe output.
As Contracted	Routine maintenance in accordance with manufacturer's recommendations.
As Contracted	Replace fluids and filters in accordance with manufacturer's recommendations (or more frequently depending on amount of use).
As Contracted	Perform tune-up; replace parts as necessary.

Telemetry and Control System	
Frequency	***Task or Activity***
Weekly	Backup program and data.
Monthly	Visually inspect cabinets and panels for damage, dust and debris.
Semi-Annually	Inspect inside of cabinets and panels for damage, dust and debris.
Semi-Annually	Vacuum clean all modules.
Semi-Annually	Test alarm indicator units.
Semi-Annually	Clean and flush all pressure sensitive devices.
Semi-Annually	Visually inspect all meters to coordinate remote stations.
Annually	Check master and remote telemetry units for proper operation; repair as necessary.

Tools and Equipment	
Frequency	***Task or Activity***
Rolling Stock	
Weekly	Check all fluid levels and brakes. Fluid levels and brakes are checked each time the equipment is used if less than weekly.
As Needed	Replace fluids and filters in accordance with manufacturer's recommendations (or more frequently depending on type of use); preventive maintenance per manufacturer's recommendation.
Tools	
As Needed	Clean after each use; lubricate and maintain as necessary; inspect for damage and wear before each use; preventive maintenance performed per manufacturer's recommendation.

8.5 STAFFING

The preventive maintenance procedures, as well as normal and emergency operations of the wastewater utility, are described in the previous sections. The labor and supervision required to effectively implement the work of the maintenance and operations schedules form the basis for determining staffing levels.

The current staff includes management personnel, supervisory personnel, operators, maintenance workers and office personnel engaged in the activities necessary to see to the continuous safe operation and maintenance of a sewer system and sewer utility. There are currently nine full-time wastewater utility employees. An estimate of their time spent on assigned tasks and duties is shown in **Table 8-2**. An analysis completed with the upgrade and expansion of the WRF identified 10 employees would be necessary to fully staff all functions of the utility. The City anticipates adding another operator (WWTPO) at or before the next WRF membrane upgrade.

There is approximately the equivalent of 2.25 management personnel in Public Works Administration supporting the wastewater utility. The Public Works Director, Water Resources Planner, Utilities Administrative Specialist, Utilities Accountant, and utility billing staff support the City's water, wastewater, storm and refuse/recycling utilities; thus, only a portion of their time is available solely for the wastewater utility.

Table 8-2. Current Wastewater Department Staffing

Task/Duty Assignment	Full-time Employees
Distribution of Duties	
Supervisory	1
WRF Operations*	3.75
Collection system	3
Compost Facility	1
Pretreatment Program	0.25
Total Wastewater Department Staff	
Total FTE's	9

* Water Reclamation Facility

8.6 OPERATIONS AND MAINTENANCE IMPROVEMENTS

Since completion of the supervisory control improvements the wastewater department is continuing to enhance wastewater treatment and lift station operations. As the wastewater department collects more data, future optimization of controls and operation is planned. With the addition of an asset management program, a large effort has been placed into connecting the work performed directly to assets in the field. This process has allowed the wastewater department to better prioritize the work performed and the work that is needed. As this program continues we will better understand the future needs of the system as a whole. We are continuing to add optimization parameters such as energy savings amongst the many others to better streamline operations and optimize processes.

8.7 CONSTRUCTION INSPECTION

The wastewater department staff performs inspections and project reviews for new construction. These inspections account for approximately 10% of the operations and maintenance time. Construction inspections are valuable tools to the verification of quality products provided to the City of Arlington and its citizens. They also serve as an invaluable tool for training new personnel and providing quality assurance for the management of the sewer collections system. We will continue to improve this the inspection process in collaboration with Community and Economic Development to further streamline development within the City of Arlington and better serve its citizens.

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9 Financial Plan

9.1 INTRODUCTION

The objective of the financial plan is to identify the total cost of providing utility service and to provide a financial program that allows the utility to remain financially viable during execution of the identified Capital Improvement Program (CIP). This analysis considers the historical financial condition of the utility, the sufficiency of utility revenues to meet current and future financial and policy obligations, and the financial impact of executing the CIP identified in this Comprehensive Wastewater Plan (CWP). Furthermore, the plan provides a review of the utility's rate structure with respect to rate adequacy and customer affordability.

9.2 PAST FINANCIAL PERFORMANCE

This section includes a summary of historical financial performance for the utility (2010-2014), including a summary of Fund Resources and Uses and the schedule of outstanding debt.

9.2.1 Summary of Fund Resources and Uses

Sewer Utility Fund 401

Fund 401 serves as the Wastewater Utility operating account where operating revenues are deposited and operating expenses are paid. Operating revenues consist primarily of service charges (utility bills), and include taxes and fines as well as interfund transfers. Operating expenses include labor and materials for operations and maintenance of collections and treatment facilities, debt payments, transfers to capital funds, and more. During the historical time period, average annual revenues have increased by about $1.3 million, for an overall change of about 29%. Total expenditures (operating, debt service costs, and minor capital) have increased 67% over the same

period, or about $1.1 million, the majority of which represents additional debt service. **Table 9-1** presents the detail of annual revenues, expenditures, and ending cash for the time period 2010 to 2014.

Sewer Utility Fund 406

Fund 406 serves as the Wastewater Utility capital account where capital revenues are deposited and capital expenditures are paid. Examples of capital revenues include connection charges, grant and debt proceeds, and capital transfers from rates. Capital expenditures are investments in the utility through acquisition or upgrade of fixed, physical, non-consumable assets, such as buildings and equipment. During the historical time period, total revenues have varied widely from year to year, ranging from about $160,000 to $1 million, primarily due to the level of annual capital contributions. Similarly, total expenditures over that same period have varied from year to year based on the level of annual capital spending. **Table 9-2** presents the detail of annual revenues, expenditures, and ending cash for the time period 2010 to 2014.

9.2.2 Outstanding Debt Principal

Table 9-3 presents outstanding utility debt as of the end of 2014. The utility currently has six outstanding debt issues, as shown below, totaling $27.6 million.

9.3 AVAILABLE CAPITAL RESOURCES

Feasible long-term capital funding strategies must be defined to ensure that adequate resources are available to fund the CIP identified in this CWP. In addition to the City's internal resources such as accumulated cash reserves, capital revenues, and rate revenues designated for capital purposes, capital needs can be met from outside sources such as grants, low-interest loans, and bond financing. The following is a summary of potential internal and external resources that might be available for funding the CIP.

9.3.1 Internal Utility Resources

Internal utility resources appropriate for funding capital needs include accumulated cash in capital funds, transfers from operating revenues, and capital revenue such as connection charges or local facilities charges. These resources are discussed below.

Table 9-1. Summary of Historical Fund Resources and Uses Arising From Cash Transactions, Sewer Utility Fund 401

Sewer Utility Fund 401	2010	2011	2012	2013	2014
Beginning Net Cash and Investments					
Unspecified	$ -	$ -	$ -	$ -	**$ -**
Reserved	$ -	$ -	$ -	$ -	$ -
Unreserved [A]	$ 1,336,108	$ 1,086,978	$ 1,508,459	$ 1,367,577	$ 1,542,569
Total Beginning Cash Balance	**$ 1,336,108**	**$ 1,086,978**	**$ 1,508,459**	**$ 1,367,577**	**$ 1,542,569**
Revenues and Other Sources:					
Taxes [B]	$ 41,514	$ -	$ -	$ -	$ -
Intergovernmental Revenues	$ 51,574	$ -	$ -	$ -	$ -
Charges For Services	$ 4,237,302	$ 4,651,995	$ 5,195,065	$ 5,440,995	$ 5,549,725
Fines & Forfeitures	$ -	$ 4,117	$ 19,752	$ 35,505	$ 32,447
Miscellaneous Revenues	$ 15,523	$ 4,467	$ 16,438	$ 12,098	$ 30,424
Interfund Transfers	$ -	$ -	$ 48,814	$ -	$ -
Insurance Recoveries	$ -	$ -	$ 2,874	$ -	$ -
Total Revenues and Other Sources	**$ 4,345,913**	**$ 4,660,578**	**$ 5,282,943**	**$ 5,488,598**	**$ 5,612,597**
Total Resources	**$ 5,682,020**	**$ 5,747,556**	**$ 6,791,403**	**$ 6,856,175**	**$ 7,155,166**
Operating Expenditures:					
Sewer Utility	$ 2,478,568	$ 2,543,032	$ 2,635,165	$ 2,647,750	$ 2,629,064
Non Expenditures	$ -	$ -	$ -	$ -	$ 1,500
Total Operating Expenditures	**$ 2,478,568**	**$ 2,543,032**	**$ 2,635,165**	**$ 2,647,750**	**$ 2,630,564**
Debt Services	$ 1,349,303	$ 1,364,303	$ 2,186,443	$ 2,058,407	$ 2,096,123
Interest & Other Debt Svc Costs	$ 230,013	$ 228,478	$ 497,198	$ 604,962	$ 561,720
Capital Expenditures	$ 8,246	$ 1,583	$ 3,319	$ 787	$ -
Total Expenditures	**$ 1,587,563**	**$ 1,594,364**	**$ 2,686,961**	**$ 2,664,156**	**$ 2,657,844**
Other Financing Uses	$ 528,912	$ 101,700	$ 101,700	$ 1,700	$ 201,700
Total Uses	**$ 4,595,042**	**$ 4,239,097**	**$ 5,423,825**	**$ 5,313,606**	**$ 5,490,107**
Excess (Deficit) of Resources Over Uses	$ 1,086,978	$ 1,508,459	$ 1,367,577	$ 1,542,569	$ 1,665,059
Non-Revenues					
Non-Expenditures					
Ending Net Cash and Investments					
Unspecified					
Reserved					
Unreserved	$ 1,086,978	$ 1,508,459	$ 1,367,577	$ 1,542,569	$ 1,665,059
Total	**$ 1,086,978**	**$ 1,508,459**	**$ 1,367,577**	**$ 1,542,569**	**$ 1,665,059**

[A] The beginning fund balance in 2010 was backcalculated by assuming that the ending balance for 2010 is the beginning balance for 2011.

[B] In 2011, taxes began to be included in "Charges for Services"

Table 9-2. Summary of Historical Fund Resources and Uses Arising From Cash Transactions, Sewer Improvement Fund 406

Sewer Improvement Fund (406)	2010	2011	2012	2013	2014
Beginning Net Cash and Investments	2,692,216	2,834,584	2,898,731	3,400,111	3,570,011
Revenues:					
Miscellaneous Revenues	33,188	37,782	35,346	30,471	29,758
Capital Contributions	126,000	478,800	865,200	193,200	109,200
Non Revenues	1,175	3,376	4,026	7,040	1,676
Interfund Transfers	-	100,000	100,000	255,367	200,000
Total Revenues and Other Sources	**160,363**	**619,958**	**1,004,572**	**486,078**	**340,634**
Total Resources	**2,852,579**	**3,454,542**	**3,903,303**	**3,886,189**	**3,910,645**
Operating Expenditures:					
Sewer Utility	7,458	24,058	19,868	8,145	6,444
Non Expenditures	-	4,365	3,992	7,023	1,676
Total Operating Expenditures	**7,458**	**28,423**	**23,860**	**15,168**	**8,120**
Capital Expenditures	10,538	527,388	211,217	16,837	939,805
Total Expenditures	**17,996**	**555,811**	**235,077**	**32,005**	**947,924**
Other Financing Uses	-	-	268,114	284,173	-
Total Uses	**17,996**	**555,811**	**503,192**	**316,178**	**947,924**
Excess (Deficit) of Resources Over Uses	2,834,584	2,898,731	3,400,111	3,570,011	2,962,721
Nonrevenues					
Nonexpenditures					
Ending Net Cash and Investments	**2,834,584**	**2,898,731**	**3,400,111**	**3,570,011**	**2,962,721**

Table 9-3. Summary of Outstanding Debt

Debt Description	Principal Outstanding	Maturity Year
Revenue Bond: Water & Sewer Rev. Ref. Bonds 2007	$ 1,495,000	2017
PWTF Loan: City of Arlington WWTP Upgrade and Expansion	684,211	2027
PWTF Loan: Wwtp Improvements	4,722,562	2026
PWTF Loan: Wwtp Improvements	7,411,765	2028
Department of Ecology Loan: L1000024	5,068,284	2031
Department of Ecology Loan: L1000025	8,249,392	2031
Total	**$ 27,631,213**	

Utility Funds and Cash Reserves

Ongoing user charges (rates) paid by utility customers are operating revenues that are the primary funding source for all utility activities. While capital revenue cannot be used for operating or maintenance expenses, operating revenues can be used for capital investment. Rate revenue can pay for capital projects in two ways: either paying for debt service or directly paying for capital projects. Funding capital costs directly through rates avoids the interest expense associated with issuing new debt. Rate funded capital investment should be designed as a regular transfer from operating revenue each year; otherwise, trying to pay for capital projects with current-year operating revenue can lead to rate volatility. If regular transfers of operating revenue are made into the capital fund, then if capital spending is relatively low in any given year, cash reserves can be accumulated that will offset future capital project costs.

Capital Connection Charges

A connection charge, as provided for by RCW 35.92.025, refers to a one-time charge imposed on new customers as a condition of connection to the utility system. Connection charges are separate from meter installation fees or similar charges for the labor and materials used to make a physical connection. Instead connection charges are intended to recover a proportionate share of existing infrastructure and planned future capital investment that will serve new customers.

Equity is served by providing a vehicle for new customers to share the cost of infrastructure investment. Further, connection charge revenue provides a source of cash flow used to support utility capital needs. Revenue can only be used to fund utility capital projects or to pay debt service incurred to finance those projects; it cannot be used for operating or maintenance costs.

In the absence of a connection charge, growth-related capital costs would be borne in large part by existing customers. In addition, the net investment in the utility already collected from existing customers would be diluted by the addition of new customers, effectively subsidizing new customers with prior customers' payments.

The City currently charges all new utility customers a connection charge of $8,400 per equivalent residential unit, where one unit is equal to 300 gallons of water or sewage per day. A study is currently underway to review and update connection charges.

Local Facilities Charges

While a connection charge is the manner in which new customers pay their share of plant investment costs, local facilities charges is a funding mechanism that is used to pay the costs of local facilities that connect each property to the system's infrastructure. Local facilities funding is often overlooked in rate forecasting because it is funded up-front by either connecting customers, developers, or through an assessment to properties, but never from rates. Although these funding mechanisms do not provide a capital resource toward funding CIP costs, a discussion of these charges is included in this chapter because of their impact on new customers.

A number of mechanisms can be considered toward funding local facilities. One of the following scenarios typically occurs: (a) the utility charges a connection fee based on the cost of the local facilities (under the same authority as the connection charge); (b) a developer funds extension of the system to its development and turns those facilities over to the utility (contributed capital); or (c) a local assessment is set up called a Utility Local Improvement District (ULID/LID) or a Local Utility District (LUD) which collects tax revenue from benefited properties.

A local facilities charge (LFC) is a variation of the connection charge authorized through RCW 35.92.025. It is a city-imposed charge to recover the cost related to service extension to local properties. Often called a front-footage charge and imposed on the basis of footage of the main "fronting" a particular property, it is usually implemented as a reimbursement mechanism to a city for the cost of a local facility that directly serves a property. It is a form of connection charge and thus can accumulate up to 10 years of interest. It typically applies in instances where the city installs the facilities prior to the properties being developed.

A developer extension is a requirement that a developer install onsite and sometimes offsite improvements as a condition of extending service. These are in addition to the connection charge required and must be built to city standards. Part of the agreement between the city and the developer might include a late-comer agreement, resulting in a late-comer charge to other properties later served by the developer-funded extension.

A Latecomer charge is a variation of developer extensions whereby new customers connecting to a developer-installed improvement make a payment to the city based on their share of the developer's cost (RCW 35.91.920). The city passes this charge on to the developer who installed the facilities. Latecomer obligations are recorded on the title of affected properties. No interest is allowed, and the reimbursement agreement is in effect for a period of 20 years, unless a longer duration is approved by the city.

A LID/ULID is another mechanism for funding infrastructure that assesses benefited properties based on the special benefit received by the construction of specific facilities (RCW 35.43.042). Most often used for local facilities, some ULIDs also recover related general facilities costs. Substantial legal and procedural requirements can make this a relatively expensive process, and there are mechanisms by which a ULID can be rejected.

9.3.2 Government Programs & Resources

Historically, federal and state grant programs were available to local utilities for capital funding assistance. However, these assistance programs have been mostly eliminated, substantially reduced in scope and amount, or replaced by loan programs. Remaining miscellaneous grant programs are lightly funded and heavily subscribed. Nonetheless, even the benefit of low-interest loans makes the effort of applying worthwhile. Grants and low-cost loans for Washington State

utilities are available from various Washington State Departments. Several grant and loan programs that the City might be eligible for are described in greater detail below.

Department of Commerce

A September 2014 document from the Department of Commerce summarizes various loan and grant programs available for utility projects. The document titled "Summary of Some Grant and Loan Programs for Drinking Water and Wastewater Projects" can be found at http://www.commerce.wa.gov/Documents/9-2-14_multi-program_funding_program_summary.pdf

A few of those programs are described below:

Community Development Block Grant (CDBG) General Purpose Grant

These grants are made available through a competitive application process to assist small cities, towns and counties in Washington State in carrying out significant community and economic development projects that principally benefit low and moderate income persons.

Eligible applicants are Washington State cities and towns with a population less than 50,000 and counties with a population less than 200,000 that are not participating in a CDBG Entitlement Urban County Consortium.

Eligible projects include public facilities such as water, wastewater, and streets.

Further details are available at:

- http://www.commerce.wa.gov/Programs/Infrastructure/CDBG-Program-Overview/Pages/default.aspx
- http://www.commerce.wa.gov/Documents/2015_CommerceResourceBook.pdf

Community Economic Revitalization Board (CERB)

CERB, a division of the Washington State Department of Commerce, primarily offers low cost loans; grants are made available only to the extent that a loan is not reasonably possible. The CERB targets public facility funding for economically disadvantaged communities, specifically for job creation and retention. Priority criteria include the unemployment rates, number of jobs created and/or retained, wage rates, projected private investment, and estimated state and local revenues generated by the project. According to their website, "CERB funds a variety of projects that create jobs including (but not limited to) domestic and industrial water, storm and sewer water projects, telecommunications and port facilities." Eligible applicants include cities, towns, port districts, special purpose districts, federally recognized Indian tribes and municipal corporations.

Program	Funding Limitations
Committed Private Sector Partner Construction	• $2 million per project loan award limit • Up to $300,000 or 50% of total award, **whichever is less**, may be grant funds. • 20% cash match required (minimum, percent of total project cost)
Prospective Development Construction	Available to rural communities only. • $2 million per project loan award limit • Up to $300,000 or 50% of total award, **whichever is less**, may be grant funds. • 50% cash match required (minimum, percent of total project cost)
Planning/Economic Feasibility Studies	• $50,000 grant per project award limit • 25% cash match required (minimum, percent of total project cost)

Funding details for the 2013 – 2015 Program are as follows per the Washington Commerce website: "$9 million was appropriated to CERB for the 2013-2015 Biennium. By state law, CERB must award 75% of this funding to projects in rural counties. The Board has also allocated $2,182,500 to be available for construction and planning grants on a first-come, first-served basis."

Further details are available at:

http://www.commerce.wa.gov/commissions/CommunityEconomicRevitalizationBoard/

http://www.commerce.wa.gov/Documents/2013-15_Policies.pdf

http://www.commerce.wa.gov/commissions/CommunityEconomicRevitalizationBoard/Pages/CERB-Traditional-Programs.aspx

Public Works Board (PWB) Financial Assistance

The Board's goal is community access to financial and technical resources that help sustain local infrastructure. Cities, towns, counties, and special purpose districts are eligible to receive financial assistance for qualifying projects. When funding is available, the following tools exist:

Construction Loan Program: http://www.pwb.wa.gov/financial-assistance/Construction/Pages/default.aspx

- Funding Cycle: Per the Board website, the Governor's proposed 2015-17 budget offers $69.7M for 19 projects.
- Program Description: Low-interest loans for local governments to finance public infrastructure construction and rehabilitation. Eligible projects must improve public health and safety, respond to environmental issues, promote economic development, or upgrade system performance.
- Terms: For non-distressed communities, a term of five years or less has an interest rate of 1.28% and a term from six to twenty years has an interest rate of 2.55%.

Pre-Construction Loan Program: http://www.pwb.wa.gov/financial-assistance/Pre-Construction/Pages/default.aspx

- Funding Cycle: No funding has been allocated to the Pre-construction loan program for the 2013-15 biennium but the program still exists and could be funded in a future biennium.
- Program Description: Local governments may apply for low interest loans to finance pre-construction activities to prepare a project for construction.
- Terms: Terms are limited to a five year repayment period (the loan term may be converted to 20-years once the project has secured construction funding) with a 1% interest rate.

Emergency Loan Program: http://www.pwb.wa.gov/financial-assistance/Emergency-Loan/Pages/default.aspx

- Funding Cycle: No funding has been allocated to the Emergency loan program for the 2013-15 biennium but the program still exists and could be funded in a future biennium.
- Program Description: The Emergency Loan Program provides funding to address public works emergencies, thereby helping provide immediate restoration of critical public works services and facilities.
- Terms: Funds are limited to $500,000 per jurisdiction per biennium, and come with a 20-year term (or the life of the project), and a 3% interest rate. No local match is required.

Energy and Water Efficiency Loan Program: http://www.pwb.wa.gov/financial-assistance/Energy-Water/Pages/default.aspx

- Funding Cycle: No funding has been allocated to the Energy and Water Efficiency (EWE) loan program for the 2013-15 biennium but the program still exists and could be funded in a future biennium.
- Program Description: The EWE program is designed to encourage energy, water, and efficiency upgrades to existing infrastructure by providing low-cost loans.
- Terms: The maximum loan amount is $1,000,000. The interest rate is dependent upon the term of the loan. Loans less than 5 years receive a 0.50% rate. Loans between 5 and 10 years receive a 1% interest rate. Loans between 11 and 20 years receive a 1.50% interest rate.

Further general resources are available at:

- http://www.pwb.wa.gov/financial-assistance/Pages/default.aspx
- http://www.pwb.wa.gov/Documents/FINAL-MASTER-GUIDELINES.pdf
- http://www.commerce.wa.gov/Documents/9-2-14_multi-program_funding_program_summary.pdf

Department of Ecology

Integrated Water Quality Funding Program

This year, Ecology received 227 applications requesting more than $352 million in assistance. Ecology is proposing grant and loan funding for 165 projects totaling approximately $229 million.

State Water Pollution Control Revolving Fund & Centennial Clean Water Program

- Design projects associated with publicly-owned wastewater and stormwater facilities. The integrated program also funds planning and implementation of nonpoint source pollution control activities. Terms for State Fiscal Year 2016 include either 2.4% interest for 6-20 year term or 1.2% for 5 year term loans. Forgivable loan principal terms are available for distressed communities.
- Further general resources are available at:

  http://www.ecy.wa.gov/programs/wq/funding/cycles/FY2016/index.html

9.3.3 Public Debt Financing

Public debt financing options include General Obligation Bonds and Revenue Bonds.

General Obligation Bonds

General Obligation (G.O.) bonds are bonds secured by the full faith and credit of the issuing agency, committing all available tax and revenue resources to debt repayment. With this high level of commitment, G.O. bonds have relatively low interest rates and few financial restrictions. However, the authority to issue G.O. bonds is restricted in terms of the amount and use of the funds, as defined by Washington constitution and statute. Specifically, the amount of debt that can be issued is linked to assessed valuation.

RCW 39.36.020 states:

> *"(ii) Counties, cities, and towns are limited to an indebtedness amount not exceeding one and one-half percent of the value of the taxable property in such counties, cities, or towns without the assent of three-fifths of the voters therein voting at an election held for that purpose.*
>
> *(b) In cases requiring such assent counties, cities, towns, and public hospital districts are limited to a total indebtedness of two and one-half percent of the value of the taxable property therein."*

While bonding capacity can limit availability of G.O. bonds for utility purposes, these can sometimes play a valuable role in project financing. A rate savings may be realized through two avenues: the lower interest rate and related bond costs; and the extension of repayment obligation

to all tax-paying properties (not just developed properties) through the authorization of an ad valorem property tax levy.

Revenue Bonds

Revenue bonds are commonly used to fund utility capital improvements. The debt is secured by the revenues of the issuing utility. With this limited commitment, revenue bonds typically bear higher interest rates than G.O. bonds and also require security conditions related to the maintenance of dedicated reserves (a bond reserve) and financial performance (added bond debt service coverage). The city agrees to satisfy these requirements by resolution as a condition of bond sale.

Revenue bonds can be issued in Washington without a public vote. There is no bonding limit, except the practical limit of each utility's ability to generate sufficient revenue to repay the debt and provide coverage. In some cases, poor credit might make issuing bonds problematic.

9.3.4 Capital Resource Funding Summary

An ideal capital financing strategy would include the use of grants and low-cost loans when debt issuance is required. However, these resources are very limited and competitive in nature and do not provide a reliable source of funding for planning purposes. It is recommended that the City pursue these funding avenues but assume bond financing to meet needs for which the City's available cash resources are insufficient. G.O. Bonds may be useful for special circumstances, but since bonding capacity limits are most often reserved for non-utility purposes, revenue bonds are a more secure financing mechanism for utility needs. The capital financing strategy developed to fund the CIP identified in this CWP generally follows the funding priority below:

Available grant funds and/or developer contributions

Accumulated capital cash reserves from prior years

Interest earned on capital fund balances and other miscellaneous capital resources

Annual revenue from connection charges

Annual transfers of rate-funded capital or excess cash (above target balances) from the operating account

Revenue bond financing

9.4 FINANCIAL PLAN FRAMEWORK

9.4.1 Overview

The Wastewater Utility is a self-supporting enterprise fund responsible for funding all of its costs. It is not dependent upon general tax revenues or other General Fund resources. The primary source of funding for the utility is service charges. The City controls the level of service charges by ordinance and can adjust them as needed to meet financial objectives.

The financial plan can give assurance of financial feasibility only if it considers the total cost of service – capital and operating. To meet this objective, the following analytical steps were taken:

Capital Funding Plan

The capital funding plan identifies total costs for the 20-year capital planning period, which is 2015 through 2035. The plan then shows how those costs can be paid for by some combination of existing reserves, current rate revenue, connection charges, debt financing and any special resources that may be readily available (e.g. grants, developer contributions, etc.). The capital funding plan impacts the financial forecast in two ways: debt financing results in annual debt service and potential debt service coverage requirements, and any rate revenue used for capital funding increases the rate revenue requirement.

Financial Forecast

The financial forecast, or revenue sufficiency analysis, forecasts the amount of annual rate revenue needed to be generated throughout the short-term planning horizon. To be consistent with the Water System Plan, the short-term planning period is defined as the 10-year period (2015-2025).

The analysis incorporates operating revenues, O&M expenses, debt service payments, rate-funded capital needs, and any other identified revenues or expenses related to utility operations. The objective of the financial forecast is to evaluate the sufficiency of the current level of rates. In addition to annual operating costs, revenue needs are impacted by debt covenants (typically revenue bonds) and specific fiscal policies and financial goals of the utility. For this analysis, two revenue sufficiency tests have been developed to reflect the financial goals and constraints of the City: cash needs must be met, and debt coverage requirements must be realized. In order to operate successfully with respect to these goals, both tests of revenue sufficiency must be met.

Cash Test – The cash flow test identifies all known cash requirements for the utility in each year of the planning period. Typically these include O&M expenses, debt service payments, rate-funded system reinvestment funding or directly funded capital outlays, and any additions to specified reserve balances. The total annual cash needs of the utility are then compared to projected cash revenues using the current rate structure. Any projected revenue shortfalls are identified and the rate increases necessary to make up the shortfalls are established.

Coverage Test – The coverage test is based on a commitment made by the City when issuing revenue bonds and some other forms of long-term debt. For purposes of this analysis, revenue bond debt is assumed for any needed debt issuance. As a security condition of issuance, the City would be required per covenant to agree that the revenue bond debt would have a higher priority for payment (a senior lien) compared to most other expenditures; the only outlays with a higher lien are O&M expenses. Debt service coverage is expressed as a multiplier of the annual revenue bond debt service payment. For example, a 1.0 coverage factor would imply that no additional cushion is required. A 1.25 coverage factor means revenue must be sufficient to pay O&M expenses, annual revenue bond debt service payments, plus an additional 25 percent of annual

revenue bond debt service payments. The excess cash flow derived from the added coverage (if any) can be used for either rate-funded capital expenditures or to build reserves.

The City's current revenue bond debt covenants require a coverage factor of 1.20. Targeting a higher coverage factor can help the City achieve a better credit rating and provide lower interest rates for future debt issues. In addition to existing debt, a standard coverage requirement of 1.25 is applied to forecasted additional revenue bonding needs beginning in the latter part of the 10-year planning period.

In determining the annual revenue requirement, both the cash and coverage sufficiency tests must be met and the test with the greatest deficiency drives the level of needed rate increase in any given year.

Independent Growth Assumptions – The customer growth assumptions in the financial forecast are independent of the long-term population growth assumptions contained in other chapters of this CWP. The reason is that the meaning of the word "conservative" for the purpose of facilities planning is the opposite of "conservative" for the purpose of financial forecasting. In planning capital facilities, a conservative customer and demand forecast will tend to fall on the high side of the reasonable range, because underestimating demand could lead to a capacity shortfall, a more serious problem than would result from overestimated demand. For financial planning, the opposite is true: a conservative growth forecast will tend to fall on the low side of the reasonable range, because assuming too many customers could lead to a revenue shortfall and rate spike, a more serious problem than would result from assuming too few customers.

Financial Forecast Customer Growth Assumptions – To be consistent with average growth over the last five years, customer growth is forecasted at 40 connections, or ERUs, per year over the 20-year planning horizon (averaging 0.60 percent per year).

9.4.2 Fiscal Policies

The City maintains a fund structure and implements financial policies that target management of a financially viable and fiscally responsible wastewater utility. A brief summary of the key financial policies employed by the City, as well as those recommended and incorporated in the financial program are discussed below.

Reserve Policies

Utility reserves serve multiple functions: they can be used to address variability and timing of expenditures and receipts; occasional disruptions in activities, costs or revenues; utility debt obligations; and many other functions. The collective use of individual reserves helps to limit the City's exposure to revenue shortfalls, meet long-term capital obligations, and reduce the potential for bond coverage defaults.

Operating Reserve – An operating reserve is designed to provide a liquidity cushion; it protects a utility from the risk of short-term variation in the timing of revenue collection or payment of expenses. Like other types of reserves, operating reserves also serve another purpose: they help smooth rate increases over time. Target funding levels for an operating reserve are generally expressed as a certain number of days of operating and maintenance (O&M) expenses, with the minimum requirement varying with the expected revenue volatility. Industry practice for utility operating reserves ranges from 30 days (8%) to 120 days (33%) of O&M expenses, with the lower end more appropriate for utilities with stable revenue streams and the higher end of the range more appropriate for utilities with significant seasonal or consumption-based fluctuations.

The City's current policy is to maintain a minimum balance in the operating account equal to 3 months of operating reserves (90 days). While industry practice is to maintain a reserve range of 30 to 45 days of O&M expenses for wastewater utilities, the City will amend its current policy to maintain a reserve equivalent to 60 days of O&M expenses for the short term.

Rate Stabilization Reserve (Account) – A rate stabilization reserve is often required to be established per revenue bond covenants, although the amount of designated funding is not usually stipulated. The purpose of this type of reserve is to avoid unexpected rate increases, while ensuring that debt service payments can be made and coverage requirements will be met if revenue collections fall below normal levels. Per typical bond covenants, reserve amounts used in any given year are allowed to meet coverage requirements. There can be specific rules for the accounting of deposits and withdrawals into a rate stabilization reserve, so care must be taken when administering this reserve. The City may consider funding this reserve in the future if needed. It is recommended that the City confer with a bond advisor prior to funding this reserve.

Capital Contingency Reserve – A capital contingency reserve is the minimum fund balance in a capital fund, set aside for capital needs that are large, urgent, and unexpected. These needs could result from a sudden asset failure, or they could come from capital project cost overruns. There is more than one way to determine an appropriate level for this reserve. For instance, a utility could choose a certain percentage of the total cost of its assets, or it could base the minimum reserve on the cost of replacing a particular highly critical asset, or it could set the capital contingency as a percentage of average capital spending per year. The final target level should balance industry practice with the risk level of the City. The most common method is to set a minimum capital fund balance equal to 1% to 2% of the original cost of plant in service.

The City's current policy is to maintain a minimum balance in the Improvement Fund equal to $1 million (about 1.7% of current fixed assets). There are no changes recommended to this policy.

Restricted Bond Reserve – When issuing revenue bonds, and sometimes other debt instruments, underwriters require that the utility establish a restricted cash reserve, typically equal to one year's debt service payment (principal and interest) for each bond issue or loan. The reserve can be used to fund the last year's debt service payment for each issue. The Wastewater Utility has one

outstanding revenue bond due to mature in 2017. Additional reserve monies are held in the fund as a requirement for the utility's two Department of Ecology State Revolving Fund loans.

System Reinvestment Funding – System reinvestment funding promotes system integrity through reinvestment in the system. Target system reinvestment funding levels are commonly linked to annual depreciation expense as a measure of the decline in asset value associated with routine use of the system. Particularly for utilities that do not already have an explicit system reinvestment policy in place, implementing a funding level based on depreciation expense could significantly impact rates. A common alternative benchmark is annual depreciation expense net of debt principal payments on outstanding debt. This approach recognizes that customers are still paying for certain assets through the debt component of their rate, and intends to avoid simultaneously charging customers for an asset and its future replacement. The specific benchmark used to set system reinvestment funding targets is a matter of policy that must balance various objectives including managing rate impacts, keeping long-term costs down, and promoting "generational equity" (i.e. not excessively burdening current customers with paying for facilities that will serve a larger group of customers in the future).

The City does not have a policy in place for system reinvestment funding. It is recommended to establish a policy to annually fund from rates an amount equal to annual depreciation expense net of annual debt principal payments. Due to the current debt load for the Wastewater Utility, no incremental funding for system reinvestment is forecasted during the 10-year time period. As debt service is paid down, system reinvestment funding is projected to begin in year 2029.

Debt Management – It is prudent to consider policies related to debt management as part of broader utility financial policy structure. Debt management policies should be evaluated and formalized including the level of acceptable outstanding debt, debt repayment, bond coverage and total debt coverage targets.

Industry best practice is to maintain a debt to fixed asset ratio of no more than 60% debt to 40% fixed assets. The current ratio for the Wastewater Utility is 32% debt to 68% fixed assets. As debt is paid off over time at a faster pace than new debt is projected to be issued, this ratio improves to 16% debt to 85% fixed assets within 10 years and to 9% debt to 91% fixed assets within 20 years.

9.5 FINANCIAL PLAN RESULTS

9.5.1 Capital Improvement Program

The CIP developed for this CWP identifies $19.3 million in project costs ($24.4 million inflated) over the 10-year planning horizon (including study year 2015). This includes $8.9 million of developer funded projects and $10.4 million of utility funded projects. The 20-year period totals $22.2 million ($28.8 million inflated). Costs are stated in 2015 dollars and are escalated to the year of planned spending at an annual rate of 3.0% per year.

Table 9-4 summarizes the expected capital expenditures. Approximately 87% (2015 dollars) of the capital costs are included in the 10-year planning period.

Table 9-4. 10-Year and 20-Year CIP

Year	Total Annual Cost (2015 $)	Developer Funded (2015 $)	Utility Funded (2015 $)	Total Annual Cost (Inflated) [a]
Study Year 2015	$ 185,000	$ -	$ 185,000	$ 185,000
2016	60,000	-	60,000	61,800
2017	160,000	-	160,000	169,744
2018	1,041,200	-	1,041,200	1,137,747
2019	1,341,000	-	1,341,000	1,509,307
2020	1,428,800	-	1,428,800	1,656,371
2021	17,400	-	17,400	20,777
2022	1,594,300	567,000	1,027,300	1,960,788
2023	3,183,300	2,351,500	831,800	4,032,509
2024	3,954,350	2,859,175	1,095,175	5,159,530
2025	6,318,000	3,091,000	3,227,000	8,490,864
10- Year Capital Total	**19,283,350**	**8,868,675**	**10,414,675**	**24,384,437**
2026-2035	2,956,000	675,000	2,281,000	4,392,445
20- Year CIP Total	**$ 22,239,350**	**$ 9,543,675**	**$ 12,695,675**	**$ 28,776,882**

[a] Inflated to year of implementation

9.5.2 Capital Funding Plan

A capital funding plan is developed to identify the total resources available to pay for the CIP and determine if new debt financing is required.

The Wastewater Utility began 2015 with $1.4 million in the Operating Fund and $800,000 in the Improvement Fund. Funds in excess of the Operating Fund maximum target of 60 days of O&M expenses are planned to be transferred to the Improvement Fund. Since debt principal payments exceed depreciation expense in the 10-year period, rate-funded system reinvestment is not funded.

The cash resources described above are forecasted to fund 46% of the 10-year CIP and 51% of the 20-year CIP. Escalated developer funded projects total $11.6 million, or 47%, of the 10-year CIP), and $12.6 million, or 44%, of the 20-year CIP. The remaining 6% of the 10-year CIP and 5% of the 20-year CIP are met through the issuance of revenue bonds. **Table 9-5** presents the corresponding 20-year capital financing strategy.

Table 9-5. 20-Year Capital Funding Strategy

Year	Capital Expenditures 2015 $	Capital Expenditures Escalated	Debt Financing	Developer Funding	Cash Funding	Total Financial Resources
2015	$ 185,000	$ 185,000	$ -	$ -	$ 185,000	$ 185,000
2016	60,000	61,800	-	-	61,800	61,800
2017	160,000	169,744	-	-	169,744	169,744
2018	1,041,200	1,137,747	-	-	1,137,747	1,137,747
2019	1,341,000	1,509,307	-	-	1,509,307	1,509,307
2020	1,428,800	1,656,371	-	-	1,656,371	1,656,371
2021	17,400	20,777	-	-	20,777	20,777
2022	1,594,300	1,960,788	-	697,338	1,263,449	1,960,788
2023	3,183,300	4,032,509	-	2,978,810	1,053,699	4,032,509
2024	3,954,350	5,159,530	-	3,730,575	1,428,955	5,159,530
2025	6,318,000	8,490,864	1,567,402	4,154,046	2,769,417	8,490,864
Subtotal	**19,283,350**	**24,384,437**	**1,567,402**	**11,560,769**	**11,256,266**	**24,384,437**
2026-2035	2,956,000	4,392,445	-	997,979	3,394,466	4,392,445
Total	**$ 22,239,350**	**$ 28,776,882**	**$ 1,567,402**	**$ 12,558,748**	**$ 14,650,732**	**$28,776,882**

9.5.3 Financial Forecast

The financial forecast is developed from the 2015 budget documents along with other key factors and assumptions to develop a complete portrayal of the utility's annual financial obligations. The following is a list of the key revenue and expense factors and assumptions used to develop the financial forecast:

Revenue Assumptions

As previously discussed, rate revenues are assumed to grow at about 0.60% per year.

Miscellaneous revenues are forecasted to increase at the customer growth rate, for the most part. Miscellaneous revenues include late penalties, NSF fees, and charges for special services.

Connection charge revenue is budgeted at $168,000 for 2015. Based on the growth forecast, connection charge revenue is assumed at about $175,000 per year over the study period.

Interest earnings initially assume a rate of 0.15% applied to beginning of year cash balances based on existing Local Government Investment Pool rates. The interest rate phases up to 1.0% within five years.

Expenditure Assumptions

O&M expense projections are based on the 2015 budget and are forecasted to increase with general and labor cost inflation of 2.0% and benefit cost inflation of 7.0%.

Utility and state taxes are calculated based on forecasted revenues and prevailing tax rates.

The utility currently has six outstanding debt issues, including one revenue bond, three PWTF loans, and two Department of Ecology loans. Total existing debt service declines from $2.6 million to $2.1 million by the end of the 10-year period.

The capital financial strategy developed for this CWP forecasts the need to issue $1.6 million in new revenue bond debt, resulting in new debt service payments beginning at $132,000 in 2026, and continuing over the 20-year period. Bond terms are assumed at an interest rate of 4.5%, issuance cost of 1%, and a 20-year repayment period.

Any Operating Fund balance above the minimum requirement is assumed to be transferred to the Improvement Fund each year. The 2015 Operating Fund balance is expected to end the year at 60 days of O&M expenses, with the remainder transferred to the Improvement Fund. The Improvement Fund balance is expected to end the year at $1.4 million.

Although the financial plan is completed for a 20-year planning period, the rate strategy focuses on the shorter term horizon, 2015 through 2025. It is recommended that the City revisit the proposed rates annually to ensure that the rate projections developed remain adequate. Any significant changes should be incorporated into the financial plan and future rates should be adjusted as needed.

Table 9-6 summarizes the annual revenue requirement for 2015 through 2025 based on the forecast of revenues, expenditures, fund balances, fiscal policies, and capital funding.

Annual rate adjustments of 2.0% are projected for years 2018 through 2025 to cover projected O&M expenses and debt service, and achieve other stated financial policy objectives.

Table 9-6. 10-Year Financial Forecast

	Study Year	10 Year Forecast									
Revenue Requirement	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Revenues											
Rate Revenues Under Existing Rates	$ 5,546,108	$ 5,581,361	$ 5,621,339	$ 5,661,318	$ 5,701,297	$ 5,741,275	$ 5,781,254	$ 5,821,233	$ 5,861,211	$ 5,901,190	$ 5,941,168
Non-Rate Revenues	38,125	40,802	45,796	46,470	49,835	50,186	50,526	50,897	51,258	51,623	51,976
Total Revenues	**$ 5,584,234**	**$ 5,622,163**	**$ 5,667,135**	**$ 5,707,788**	**$ 5,751,132**	**$ 5,791,461**	**$ 5,831,779**	**$ 5,872,130**	**$ 5,912,469**	**$ 5,952,813**	**$ 5,993,145**
Expenses											
Cash Operating Expenses	$ 2,836,404	$ 2,895,984	$ 2,958,162	$ 3,022,185	$ 3,088,136	$ 3,156,104	$ 3,226,181	$ 3,298,466	$ 3,373,063	$ 3,450,084	$ 3,529,646
Existing Debt Service	2,647,912	2,500,034	2,052,625	2,047,747	2,042,869	2,037,991	2,033,113	2,028,235	2,023,357	2,018,479	2,013,601
New Debt Service	-	-	-	-	-	-	-	-	-	-	-
Rate Funded System Reinvestment	-	-	-	-	-	-	-	-	-	-	-
Total Expenses	**$ 5,484,316**	**$ 5,396,018**	**$ 5,010,787**	**$ 5,069,932**	**$ 5,131,005**	**$ 5,194,095**	**$ 5,259,294**	**$ 5,326,701**	**$ 5,396,420**	**$ 5,468,563**	**$ 5,543,247**
Net Surplus (Deficiency)	**$ 99,917**	**$ 226,145**	**$ 656,348**	**$ 637,856**	**$ 620,126**	**$ 597,366**	**$ 572,486**	**$ 545,429**	**$ 516,049**	**$ 484,250**	**$ 449,898**
Additions to Meet Coverage	-	-	-	-	-	-	-	-	-	-	-
Total Surplus (Deficiency)	**$ 99,917**	**$ 226,145**	**$ 656,348**	**$ 637,856**	**$ 620,126**	**$ 597,366**	**$ 572,486**	**$ 545,429**	**$ 516,049**	**$ 484,250**	**$ 449,898**
Annual Rate Adjustment	0.00%	0.00%	0.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Cumulative Annual Rate Adjustment	0.00%	0.00%	0.00%	2.00%	4.04%	6.12%	8.24%	10.41%	12.62%	14.87%	17.17%
Rate Revenues After Rate Increase	$ 5,546,108	$ 5,581,361	$ 5,621,339	$ 5,774,544	$ 5,931,629	$ 6,092,687	$ 6,257,815	$ 6,427,111	$ 6,600,676	$ 6,778,612	$ 6,961,026
Additional Taxes from Rate Increase	$ -	$ -	$ -	$ 11,355	$ 23,100	$ 35,243	$ 47,794	$ 60,764	$ 74,161	$ 87,997	$ 102,281
Net Cash Flow After Rate Increase	**99,917**	**226,145**	**656,348**	**739,727**	**827,359**	**913,535**	**1,001,252**	**1,090,544**	**1,181,353**	**1,273,675**	**1,367,474**
Coverage After Rate Increases	**4.66**	**4.64**	**6.15**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**25.83**

Table 9-7 shows a summary of the projected ending balances for the Operating Fund, Improvement Fund, and Debt Reserve Fund through 2025.

The combined minimum target balance is based on 45 days of O&M expenses, plus $1 million for the Improvement Fund, plus one year's payment of revenue bonds and department of ecology loans in the Reserve Fund. Funds remain above the targets throughout the forecast.

Table 9-7. Ending Cash Balance Summary

	Study Year	10 Year Forecast									
Ending Fund Balances	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Sewer Utility Fund	$ 466,258	$ 474,751	$ 486,273	$ 496,798	$ 507,639	$ 517,394	$ 530,331	$ 542,214	$ 554,476	$ 565,587	$ 580,216
Sewer Improvement Fund	1,866,209	2,163,623	2,786,717	2,535,496	2,003,091	1,405,561	2,522,186	2,497,650	2,773,047	2,769,417	1,515,570
Sewer Bond Reserve	1,501,946	1,465,229	1,022,698	1,022,698	1,022,698	1,022,698	1,022,698	1,022,698	1,022,698	1,022,698	1,154,658
Total	**$3,834,413**	**$ 4,103,603**	**$ 4,295,688**	**$ 4,054,992**	**$ 3,533,428**	**$ 2,945,653**	**$ 4,075,215**	**$ 4,062,561**	**$ 4,350,221**	**$ 4,357,702**	**$ 3,250,443**
Combined Minimum Target Balance	*2,961,923*	*2,821,293*	*2,387,403*	*2,395,296*	*2,403,427*	*2,410,743*	*2,420,446*	*2,429,358*	*2,438,555*	*2,446,889*	*2,589,820*

9.6 CURRENT AND PROJECTED RATES

9.6.1 Current Rates

The current wastewater rate structure consists of a flat monthly charge for residential customers, and a fixed monthly charge for commercial customers, which includes up to 300 cubic feet of water usage and a volume charge per hundred cubic feet (ccf) of use above the allowance. There are also contract customers who are charged an individual flat rate based on winter water average, and industrial users who are charged a fixed monthly charge and a volume charge based on volume and strength. **Table 9-8** shows the existing rate schedule.

Table 9-8. Existing Schedule of Rates

2015 Sewer Rates	
Monthly Base Rate	
	Current
Residential	$ 70.15
Commercial (includes 3 ccf)	$ 70.15
Commercial Volume Charge (per ccf)	$ 7.25
Contract Customers	by contract
Industrial Users	
Industrial users < 250 mg/l	$ 429.00
Industrial users > 250 mg/l	$ 1,715.00
Industrial flow-based charge (per ccf)	$ 2.051
BOD charge (per pound BOD)	$ 0.645
TSS charge (per pound TSS)	$ 0.431

9.6.2 Projected Rates

Table 9-9 presents the proposed 10-year schedule of sewer rates, incorporating the proposed 2.0 percent annual rate increases, beginning in 2018. For purposes of the Financial Plan, the rate increases are applied uniformly to the existing rate structure. A study is underway to evaluate cost of service and rates by customer class.

Table 9-9. 10-Year Proposed Rates

Across the Board Projected Rate Increases

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Residential	$ 70.15	$ 70.15	$ 70.15	$ 71.55	$ 72.98	$ 74.44	$ 75.93	$ 77.45	$ 79.00	$ 80.58	$ 82.19
Commercial (includes 3 ccf)	$ 70.15	$ 70.15	$ 70.15	$ 71.55	$ 72.98	$ 74.44	$ 75.93	$ 77.45	$ 79.00	$ 80.58	$ 82.19
Commercial Volume Charge (per ccf)	$ 7.25	$ 7.25	$ 7.25	$ 7.40	$ 7.54	$ 7.69	$ 7.85	$ 8.00	$ 8.16	$ 8.33	$ 8.49
Contract Customers	by contract	by contract	by contract	by contract	by contract	by contract	by contract	by contract	by contract	by contract	by contract
Industrial Users											
Industrial users < 250 mg/l	$ 429.00	$ 429.00	$ 429.00	$ 437.58	$ 446.33	$ 455.26	$ 464.36	$ 473.65	$ 483.12	$ 492.79	$ 502.64
Industrial users > 250 mg/l	$ 1,715.00	$ 1,715.00	$ 1,715.00	$ 1,749.30	$ 1,784.29	$ 1,819.97	$ 1,856.37	$ 1,893.50	$ 1,931.37	$ 1,970.00	$ 2,009.40
Industrial flow-based charge (per ccf)	$ 2.051	$ 2.051	$ 2.051	$ 2.092	$ 2.134	$ 2.177	$ 2.220	$ 2.264	$ 2.310	$ 2.356	$ 2.403
BOD charge (per pound BOD)	$ 0.645	$ 0.645	$ 0.645	$ 0.658	$ 0.671	$ 0.684	$ 0.698	$ 0.712	$ 0.726	$ 0.741	$ 0.756
TSS charge (per pound TSS)	$ 0.431	$ 0.431	$ 0.431	$ 0.440	$ 0.448	$ 0.457	$ 0.467	$ 0.476	$ 0.485	$ 0.495	$ 0.505

Table 9-10 shows residential monthly bill comparisons for the proposed annual increases.

Table 9-10. 10-Year Monthly Bills

Residential	Current	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Monthly Bill	$ 70.15	$70.15	$ 70.15	$ 71.55	$ 72.98	$ 74.44	$ 75.93	$ 77.45	$ 79.00	$ 80.58	$ 82.19
% Increase		0.00%	0.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
$ Difference		$0.00	$ -	$ 1.40	$ 1.43	$ 1.46	$ 1.49	$ 1.52	$ 1.55	$ 1.58	$ 1.61

9.7 AFFORDABILITY

The Washington State Department of Health and the State Public Works Board have historically used an affordability index to prioritize low-cost loan awards. The typical threshold looks at whether a system's rates exceed 1.5% to 2.0% of the median household income for the demographic area. As a result, if monthly bills are less than 1.5% of the median household income for the demographic area, they are generally considered affordable.

According to a 2015 Alliance for Housing Affordability report, the median household income for the City of Arlington was $61,817. This figure is escalated for future years based on the assumed 2.0 percent labor cost inflation rate. **Table 9-11** presents the estimated residential sewer bill with the projected increases for the forecast period. The affordability mark (Monthly Bill *12 ÷ Median Income) averages 1.32% throughout the study period, indicating that rates are expected to remain affordable through 2025, remaining below the lower end of the threshold range.

Table 9-11.
Affordability Test

Year	Inflation	Median HH income	2.00% Monthly Threshold	Projected Monthly Bill	% of Median HH Income
2015		$ 61,817	$ 103.03	$ 70.15	1.36%
2016	2.00%	$ 63,053	$ 105.09	$ 70.15	1.34%
2017	2.00%	$ 64,314	$ 107.19	$ 70.15	1.31%
2018	2.00%	$ 65,601	$ 109.33	$ 71.55	1.31%
2019	2.00%	$ 66,913	$ 111.52	$ 72.98	1.31%
2020	2.00%	$ 68,251	$ 113.75	$ 74.44	1.31%
2021	2.00%	$ 69,616	$ 116.03	$ 75.93	1.31%
2022	2.00%	$ 71,008	$ 118.35	$ 77.45	1.31%
2023	2.00%	$ 72,428	$ 120.71	$ 79.00	1.31%
2024	2.00%	$ 73,877	$ 123.13	$ 80.58	1.31%
2025	2.00%	$ 75,355	$ 125.59	$ 82.19	1.31%

9.8 CONCLUSION

The analysis indicates that rate increases are necessary to fund ongoing operating and capital needs and to achieve stated policy objectives. Implementation of the proposed rate increases, beginning in 2018, should provide for continued financial viability while maintaining reasonably affordable rates.

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