City of Tukwila

Comprehensive Sanitary Sewer Plan

UPDATE

Project Number: 10-SW02

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May 2013

Comprehensive Sanitary Sewer Plan

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City of Tukwila

COMPREHENSIVE SANITARY SEWER PLAN

FINAL

February 2014

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CITY OF TUKWILA

COMPREHENSIVE SANITARY SEWER PLAN

2014

This plan was prepared under the direction of the following registered professional engineers.

3/4/14

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City of Tukwila

Comprehensive Sanitary Sewer Plan

TABLE OF CONTENTS

Page No.

APPENDICES

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AACE	American Association of Cost Estimators
AC	asbestos cement
ADD	average day demand
ADWF	average dry weather flow
APWA	American Public Works Association
BF	base flow
BNSF RR	Burlington Northern Santa Fe Railroad
CBD	Central Business District
CCTV	closed-circuit television
CDBG	Community Development Block Grant
CDF	
CERB	Community Economic Revitalization Board
CEU	continuing education requirements
CIP	Capital Improvement Plan
CIPP	cured in-place pipe
City	City of Tukwila
DNS	determination of non-significance
DOH	Washington State Department of Health
DU	dwelling unit
Ecology	Washington State Department of Ecology
ENR CCI	Engineering News-Record Construction Cost Index
EPA	Environmental Protection Agency
ERU	equivalent residential unit
FTE	full time employee
GIS	Geographic Information Systems
gpad	gallons per acre per day
gpd	gallons per day
HDPE	high density polyethylene
hp	horse power

I	Interstate
I/I	inflow and infiltration
IACC	Infrastructure Assistance Coordinating Council
KCAS	King County Aerial Survey
KCWD	King County Water District
kW	kilowatt
LS	lift station
MFR	multi-family residential
MHI	median household income
MMWWF	maximum month wet weather flow
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Agency
O&M	operations & maintenance
PDAF	peak day average flow
PDF	peak day flow
PIF	peak instantaneous flows
Plan	Comprehensive Sanitary Sewer Plan
PS&E	
PSE	Puget Sound Energy
psi	pounds per square inch
PVC	polyvinyl chloride
PWTF	Public Works Trust Fund
R&R	replace & repair
RCW	Revised code of Washington
RTU	remote telemetry unit
RUL	remaining useful life
RWSA	retail water service area
SCADA	Supervisory Control and Data Acquisition

SDR	Standard Dimension Ratio
SEPA	State Environmental Protection Act
SFR	single-family residential
SOP	standard operating procedure
SR	state route
SSES	Sanitary System Evaluation Surveys
UGB	Urban Growth Boundary
USEDA	United States Economic Development Administration
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation
WTD	wastewater treatment division
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

The City of Tukwila (City) is located in the central Puget Sound region, 12 miles south of the City of Seattle, 17 miles north of the City of Tacoma, and directly east of the Seattle-Tacoma International Airport. The City collects wastewater from the residential, commercial, institutional, and industrial dischargers within the service area and has an agreement with King County wastewater treatment division (WTD) for conveyance and treatment of it's wastewater. The City's wastewater infrastructure includes over 38.5 miles of pipelines raging in diameter from 4- to 24-inches, and 10 lift stations (LS).

ES.1. PROJECT OBJECTIVES

The primary goal of conducting this Comprehensive Sanitary Sewer Plan Update (Plan) is to develop a logical and thorough path forward for the City of Tukwila's collection system for the next twenty years to accommodate projected growth in the sewer service area. Key elements addressed in the Plan include:

- Develop a basis for planning for the overall system plan by establishing the service area goals and policies and by identifying the existing and future study area boundaries.
- Develop a demographic analysis summarizing the population, employment, and land use projections for the City.
- Develop accurate flow projections for the sanitary system to forecast future expansion needs.
- Describe and inventory the City's wastewater collection system.
- Assess the existing system's ability to meet the needs of the existing and forecasted population in the City's sewer service area.
- Summarize the system improvements identified through the system analysis.
- Develop the recommended Capital Improvement Plan (CIP) for the City.
- Develop a funding strategy that will provide financial strength and viability of the City to implement the schedule of capital improvements.
- Support the City with the State Environmental Protection Act (SEPA) process.

ES.2. SEWER SERVICE AREA

Sewer service within the Urban Growth Boundary (UGB) is provided by City of Tukwila, Valley View Sewer District, and City of Renton. A map of sewer service area through the planning period is presented in Figure ES.1. There are new future areas within three sewer basins that the City is planning on including in the Sewer Service Area. A description of these areas is provided in Chapter 2.

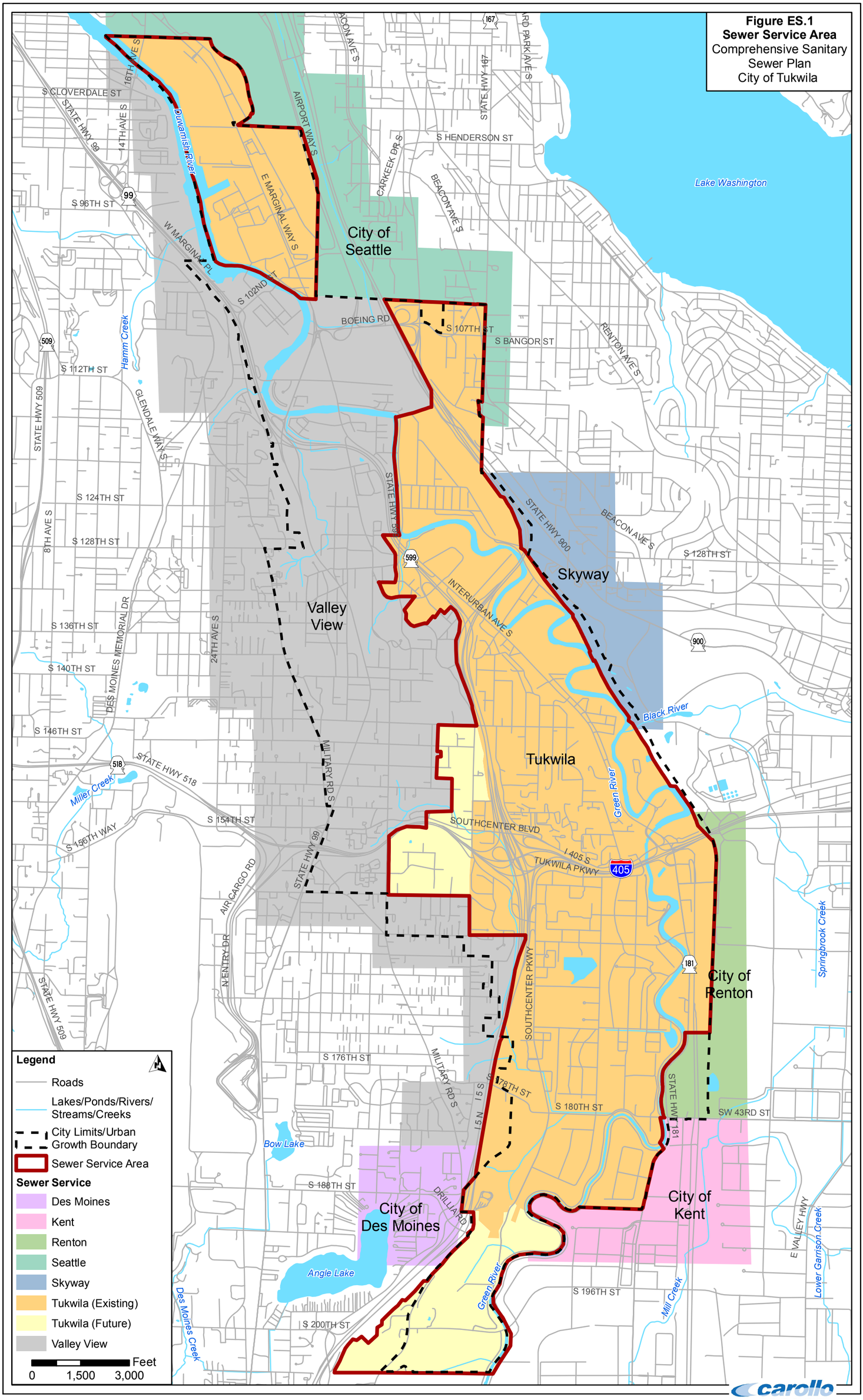
Figure ES.1
Sewer Service Area
Comprehensive Sanitary Sewer Plan
City of Tukwila
Legend
Roads
Lakes/Ponds/Rivers/ Streams/Creeks
City Limits/Urban Growth Boundary
Sewer Service Area
Sewer Service
Des Moines
Kent
Renton
Seattle
Skyway
Tukwila (Existing)
Tukwila (Future)
Valley View
0 1,500 3,000 Feet
City of Seattle
Skyway
Valley View
Tukwila
City of Renton
City of Kent
City of Des Moines
Lake Washington
Duwamish River
Hamm Creek
Miller Creek
Bow Lake
Angle Lake
Green River
Black River
Springbrook Creek
Mill Creek
Lower Garrison Creek
Des Moines Creek
S CLOVERDALE ST
STATE HWY 99
16TH AVE S
14TH AVE S
S 96TH ST
W MARGINAL PL
E MARGINAL WAY S
AIRPORT WAY S
S 102ND ST
BOEING RD
CARKEEK DR S
BEACON AVE S
S HENDERSON ST
STATE HWY 167
RD PARK AVE S
S 107TH ST
S BANGOR ST
RENTON AVE S
S 112TH ST
STATE HWY 509
GLENDALE WAY S
S 124TH ST
8TH AVE S
S 128TH ST
STATE HWY 900
INTERURBAN AVE S
S 136TH ST
24TH AVE S
DES MOINES MEMORIAL DR
S 140TH ST
S 146TH ST
MILITARY RD S
STATE HWY 518
S 154TH ST
S 156TH WAY
AIR CARGO RD
N ENTRY DR
SOUTHCENTER BLVD
I-405 S
TUKWILA PKWY
SOUTHCENTER PKWY
S 176TH ST
I-5 N
I-5 S
S 178TH ST
S 180TH ST
SW 43RD ST
STATE HWY 181
S 188TH ST
DRILLIARD
S 196TH ST
S 200TH ST
E VALLEY HWY
99
509
599
900
518
405
181
167

ES.3. CURRENT AND FUTURE SEWER SERVICE AREA CUSTOMERS

The City currently does not monitor sewer flow rates within the service area. Existing and future sewer flow rates were determined based on the existing water consumption data and estimated number of water customers as determined through water demand projections, respectively.

Current Sewer Service Area Customers

The current water demand in the sewer service area is determined based on the historical connections and water use from 2005 to 2009. The water demand of each customer class was then expressed in terms of equivalent residential units (ERUs) for forecasting and planning purposes. One ERU is defined as the average quantity of water beneficially used by one average, full-time, single-family residence per day. The quantity of water used by other customer classes, and by the whole system, can be expressed in terms of ERUs. Based on the analysis for the Comprehensive Water Plan, an ERU planning value for a single-family residence of 160 gallons per day (gpd) is used for this analysis. Table ES.1 presents current customers in the sewer service area.

Table ES.1 Current Customers in the Sewer Service Area

Customer Class	Number of Connections	Unit ERU Value	ERUs
Single-family/Duplex	1,077	1.0	1,077
Multi-family	147	9.2	1,351
Commercial	647	10.3	6,632
Total	**1,871**	**-**	**9,059**

Future Sewer Service Area Customers

Growth projections were prepared by the City Planning and Engineering staff. Most of the growth is planned for Tukwila South and the Urban Center, which includes the Segale area planned to be served by the City. There will also be residential infill and fluctuation on Boeing employment. The growth projections were categorized by customer classification, which included single-family, multi-family, and commercial (combined regular and high demand). The City is projecting 17,550 new jobs that may come from both commercial customer classes and are represented in the projected increase in commercial accounts. The future sewer service area customers for the planning period are presented in Table ES.2.

Table ES.2 Projected ERUs for Each Customer Classification			
Customer Class	**2016**	**2020**	**2030**
Single-family	1,542	1,679	2,004
Multi-family	5,522	6,754	9,673
Commercial	12,203	13,746	17,767
Total	**19,266**	**22,179**	**29,444**

ES.4. BASE SANITARY SEWER FLOWS AND RECOMMENDED I/I

Base Sanitary Sewer Flows

The sewer base flow projections over the planning period were developed based on the percent of the projected water demand expected to reach the sewer system since the City does not monitor sewer flows.

The sewer base flow was estimated by analyzing City's water sales by customer class to determine how much water is used year-round for "base use" compared to how much water is used during peak season for "peak excess use." Peak excess use is the extra water used during the summer months, most of which is utilized for irrigation. It is assumed that all the base use water reaches the sewer system, while the peak excess use does not. Based on the water sales data, it was estimated that 91 percent of the water consumed by residential customers reaches the sewer system, while 75 percent of the water consumed by commercial and industrial customers is estimated to be captured in the sewer system. These percentages were applied to the estimated quantity of water used per ERU in order to determine the base sanitary flows. For example, current base sanitary flow of 156,000 gpd was calculated as 1,077 (current ERUs) X 160 gpd/ERU X 0.91. The current and projected flows are presented in Table ES.3.

Table ES.3 Current and Projected Base Sanitary Sewer Flows, gpd				
Customer Class	**2009**	**2016**	**2020**	**2030**
Single-family	156,000	223,400	243,300	290,500
Multi-family	195,800	800,200	978,800	1,401,800
Commercial	797,900	1,468,800	1,654,500	2,138,550
Total	**1,149,700**	**2,492,400**	**2,876,600**	**3,830,800**

Inflow and Infiltration (I/I)

Peak flows in a wastewater system are caused by rainfall dependent I/I. The I/I rate used in this Plan is determined based on the analysis of historical pump run time data at LS 12 which serves Drainage Basins 4 and 8. I/I rate in gallons per acre per day (gpad) was derived by calculating the difference between the base flow and peak flow experienced at LS 12 and dividing it by the developed acreage the served by the LS. The resulting I/I rate was approximately 1,950 gpad.

Based on the limited data available, The I/I determined for this area is extrapolated and used for the remainder of the service area.

The City has an aggressive I/I program. Every four years, the City investigates the entire sanitary sewer system using cameras to search for leaks and piping problems. It is recommended that the City continue with their current aggressive I/I Reduction Program.

Reclaimed Water

The City has a contract to send all of its sewage to the King County Metro sewer system, placing prime responsibility to future wastewater reuse opportunities with the County, which is the final manager of the sewage.

Reclaimed water usage provides the City an opportunity to address future regulatory requirements, reduce potable water demand during peak use periods, reduce water quality impacts of treated effluent, offset irrigation withdrawal demands, and provide augmentation of groundwater resources. The City currently produces reclaimed water for Starfire at an average flow of 8,332 annual gpd.

Wastewater reuse will further the City's environmental sustainability initiatives and reduce the discharge of treated effluent. The City has several potential end users for reclaimed water including golf courses, cemeteries, and parks. Specifically, two new customers are identified and more details are included in Chapter 3.

ES.5. EXISTING SYSTEM

The sewer system within the City's sewer service area is owned, maintained, and operated by the City. The system currently consists of ten LSs and 20 drainage basins. The City maintains a total of 25 connections with King County WTD trunk lines. Wastewater from the City is conveyed to King County trunk lines to ultimately be treated at King County's South Wastewater Treatment Plant (WWTP). The City also discharges to Seattle system that is eventually conveyed to the King County system. The existing sewer system, including the pipelines, LSs, King County connections, and drainage basins are presented in Figure ES.2.

ES.6. SYSTEM ANALYSIS

A system analysis was conducted for the City's pumping and wastewater gravity collection systems to identify existing condition issues and capacity deficiencies associated with current and projected future use, and recommend improvements to alleviate any identified concerns.

Lift Station Analysis

Table ES.4 presents the condition assessment results for the City's LSs. The assessment were based on discussions with City staff and an evaluation of the LS age, type, back-up power availability, and overflow alarms.

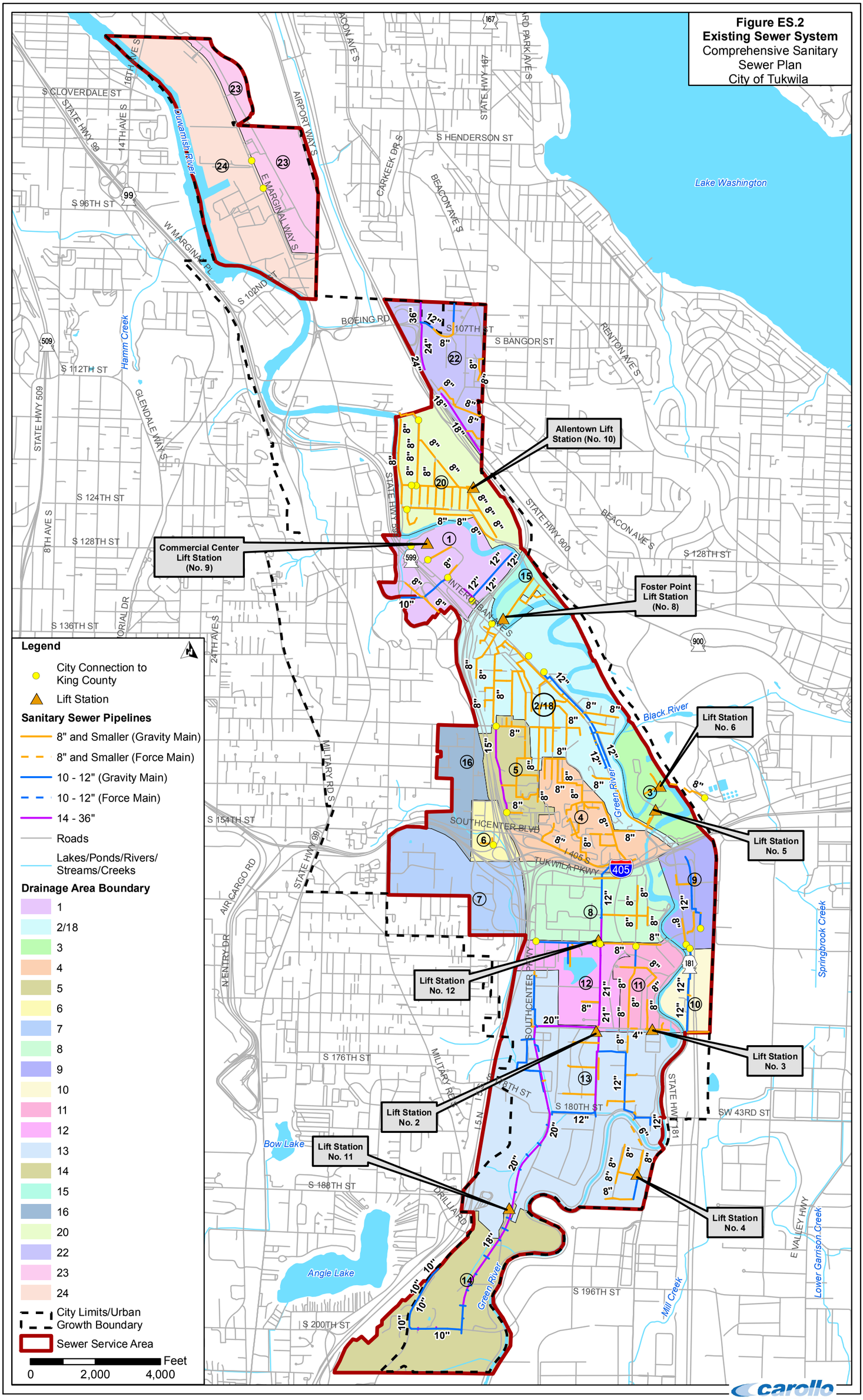
Figure ES.2
Existing Sewer System
Comprehensive Sanitary Sewer Plan
City of Tukwila
Legend
City Connection to King County
Lift Station
Sanitary Sewer Pipelines
8" and Smaller (Gravity Main)
8" and Smaller (Force Main)
10 - 12" (Gravity Main)
10 - 12" (Force Main)
14 - 36"
Roads
Lakes/Ponds/Rivers/ Streams/Creeks
Drainage Area Boundary
1
2/18
3
4
5
6
7
8
9
10
11
12
13
14
15
16
20
22
23
24
City Limits/Urban Growth Boundary
Sewer Service Area
Feet
0
2,000
4,000
Allentown Lift Station (No. 10)
Commercial Center Lift Station (No. 9)
Foster Point Lift Station (No. 8)
Lift Station No. 6
Lift Station No. 5
Lift Station No. 12
Lift Station No. 3
Lift Station No. 2
Lift Station No. 11
Lift Station No. 4
Lake Washington
Duwamish River
Hamm Creek
Black River
Green River
Springbrook Creek
Bow Lake
Angle Lake
Mill Creek
Lower Garrison Creek
S CLOVERDALE ST
S 96TH ST
S 102ND
BOEING RD
S 107TH ST
S BANGOR ST
S HENDERSON ST
S 112TH ST
S 124TH ST
S 128TH ST
S 136TH ST
S 154TH ST
S 176TH ST
S 180TH ST
S 188TH ST
S 196TH ST
S 200TH ST
SW 43RD ST
W MARGINAL PL
E MARGINAL WAY S
AIRPORT WAY S
BEACON AVE S
RENTON AVE S
STATE HWY 99
STATE HWY 509
STATE HWY 900
STATE HWY 167
STATE HWY 181
14TH AVE S
16TH AVE S
8TH AVE S
24TH AVE S
GLENDALE WAY S
INTERURBAN AVE S
SOUTHCENTER BLVD
TUKWILA PKWY
I-405
MILITARY RD S
AIR CARGO RD
N ENTRY DR
DRILLIARD
E VALLEY HWY
CARKEEK DR S

Table ES.4 Lift Station General Condition

LS	Age	Type	Power	Overflow Alarm	Overall Condition
2	1987	Wet/dry pit	On-site (needs new generator)	Yes	Fair
3	1972, new pumps in 2009	Wet/dry pit	Plug-in	Yes	Fair
4	1976, new pumps and motors in 2009	Wet/dry pit	Plug-in	Yes	Fair
5	1975, new pumps in 2002	Wet/dry pit	On-site	Yes	Fair
6	1975, new pumps in 1999	Wet/dry pit	On-site	Yes	Fair
8	2007	Submersible	On-site	Yes	Good
9	1980	Wet/dry pit	Plug-in	Yes	Good
10	2007	Submersible	On-site	Yes	Good
11	2011	Submersible	On-site	Yes	New
12	1972, new pumps in 2003	Wet/dry pit	On-site	Yes	Good

In addition to the general condition assessment, a capacity assessment was performed by estimating the LS peak instantaneous flows (PIF) for current (2009) and future (2030) conditions. The existing flows were compared to actual measured base flows and peak flows at the LSs for calibration. Future LS flows were estimated by using land use flow factors to calculate base flows and then adding peak day flow (PDF) I/I estimate and multiplying that PDF value by the PIF peaking factor. Table ES.5 presents current and future flows for each LS as a result of this analysis.

Table ES.5 Lift Station Current and Future Flows

LS	Total Capacity, gpm	Firm Capacity, gpm	Current Predicted Flow, gpm	2030 Predicted Flow, gpm	Build out Flow, gpm	2030 Capacity Deficit?
2	2400	1600	800	1,839(1)	2,300	Yes
3	200	100	91	121	282	Yes
4	500	250	138	200	249	No
5	240	120	36	48	151	No
6	300	150	89	89	175	No
8	220	110	52	59	96	No
9	800	400	30	41	166	No
10	280	140	48	58	206	No
11	2300	1150	--	513	706	No
12	4000	2000	690	781(2)	781	No

Notes:
(1) 2030 flows include the new Segale area in sewer basin 14.
(2) Capped 2030 flows at buildout level LS 12.

Table ES.6 presents a summary of LS recommendations based on the condition and capacity assessment.

Table ES.6 Lift Station Recommendations

LS	Condition	2030 Capacity Deficit?	Recommendations
2	Fair	Yes	Replace and expand LS when basin 14 is brought online.
3	Fair	Yes	Replace and expand capacity.
4	Fair	No	Pumps reach useful life in 2029. Evaluate facility and pump condition at that time.
5	Fair	No	Pumps reach useful life in 2022. Evaluate facility and pump condition at that time.
6	Fair	No	Pumps reach useful life in 2019. Evaluate facility and pump condition at that time.
8	Good	No	Pumps reach useful life in 2027. Evaluate pump condition at that time.
9	Good	No	Pumps reached useful life in 2000. City wishes to abandon this LS and connect to adjacent King County gravity sewer.

Table ES.6 Lift Station Recommendations			
LS	**Condition**	**2030 Capacity Deficit?**	**Recommendations**
10	Good	No	Pumps reach useful life in 2027. Evaluate pump condition at that time.
11	New	No	No improvements proposed.
12	Good	No	Pumps reach useful life in 2023. Evaluate pump condition at that time.

Collection System Analysis

An analysis of existing condition of the pipes was conducted based on identifying remaining useful life (RUL), known roots and sags in the system, basin sewer flow analysis, and summary of evaluation on providing sewer service to Drainage Basin 4.

RUL is defined as the length of time that a pipe is anticipated to remain functional, commonly called the useful life, depends largely on the pipe material. Beyond the useful life, the increasing costs of maintenance associated with a failing pipe will likely warrant replacement. The age and type of material are used to determine the RUL of the City's sewers. Table ES.7 presents this analysis. The table is sorted according to the total length of pipe to the year installed and material. The cells of the table are color-coded to show the RUL of pipes in that category. For example, the lengths of pipe in the red cells have all reached the end of their useful life, and have a remaining useful life of zero.

The City has approximately 113,990 lineal feet of pipe that will reach their RUL within 10 years and approximately 19,810 lineal feet of pipe that will reach their RUL within 10 to 20 years.

In addition to the RUL analysis, the City has reported sag issues. These have also been included in the near-term replacement program.

Table ES.7 RUL Analysis

Material Type	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	Total
Asbestos Cement (AC)				13,670	3,477				17,147
Cast Iron					8,277				8,277
Concrete				76,825	17,999	2,541			97,365
Ductile Iron	132	145	683	95	15,723	1,882	2,232	561	21,453
High Density Polyethylene (HDPE)								127	127
Polyvinyl Chloride (PVC)						9,403	14,646	23,694	47,743
Steel						62	40		102
Unknown					10,680	1,719			12,399
Grand Total	132	145	683	90,990	55,756	15,607	16,918	24,378	204,613

Legend:

	Over 20 years of RUL	short-term	Between 0 and 10 years of RUL
long-term	Between 10 and 20 years of RUL	short-term	0 years of RUL

Similar to the LS capacity analysis, collection system capacity was estimated based on the anticipated drainage basin sewer flows calculated using the same method used for LS analysis. The flows are anticipated to increase for the current and future basins by between 25 percent and 100 percent, at an average of 57 percent. Based on the results of the capacity of the previous plan, the system had more than 60 percent capacity available. However, since hydraulic modeling analysis was not performed for the collection system evaluation under this planning effort, it is recommended that the hydraulic model should be updated in the next five years to evaluate the collection system capacity for the long-term (through 2030).

ES.7. OPERATION AND MAINTENANCE

Chapter 6 provides an overview of the City's Sanitary Sewer Utility organization and operational procedures. The purpose of this documentation is to identify areas where improvements or changes could enhance existing system operation.

The Public Works Department sewer operations and maintenance staff appear to possess or be able to access all of the equipment and supplies required to adequately perform the responsibilities assigned. However, the lack of sufficient labor to adequately address the many responsibilities of sewer operations and maintenance was a recurring issue during past years. Based on the analysis of the adequacy of existing staffing levels in Sewer Operations and Maintenance work programs, the City determined that an additional two (2) full time employee (FTE) is required for sewer maintenance and operations activities. A portion of additional staff time would be devoted to implementing a grease interceptor inspection program.

ES.8. CAPITAL PROJECT COSTS

The purpose of this CIP is to provide the City with a guideline for planning and budgeting of its wastewater system. Planning-level cost estimates were developed for each of the recommended projects in 2011 dollars and are based on an Engineering News-Record Construction Cost Index (ENR CCI) 20-City Average of 9,116 (September 2011). To estimate the construction costs, the following mark-ups were applied to the direct costs: 30 percent for contingency, 10 percent for general conditions, 15 percent for contractor overhead and profit, and 9.5 percent for sales tax. Project costs include an additional 30 percent for engineering, legal, and administration costs. Design and construction for all projects was assumed to occur within one year except when noted. Table ES.8 and Figure ES.3 provides a summary of the recommended CIP.

ES.9. FINANCIAL ANALYSIS

The City has a six-year financial planning model and capital improvement program that is updated annually. The six-year outlook allows the City to plan ahead to avoid drastic impacts on ratepayers and meet the state's requirement for a six-year financing plan. The most recent 2013 to 2018 plan was reviewed and compared for development of the financial analysis.

The City's financial plan anticipates rate increases of 20 percent in 2013 and 2014, 10 percent and 15 percent increases in 2015 through 2018. The City will continue to monitor the debt repayment schedule and consider adjusting rates and managing additional debt as necessary.

Table ES.8 Capital Improvement Plan

ID	2013	2014	2015	2016	2017	2018	2019	Short-Term	Long-Term
Lift Station Projects									
L-1	$250,000							$250,000	$702,000
L-2									$490,000
L-3									$490,000
L-4									$409,500
L-5									$409,500
L-6									$117,000
L-7									$605,000
L-8									$117,000
L-9									$4,400,000
L-10	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$70,000	$110,000
Pipeline Projects									
P-1	$1,490,000	$1,490,000	$1,490,000	$1,490,000	$1,490,000	$1,490,000	$1,490,000	$10,430,000	$16,390,000
P-2a									$940,000
P-2b	$1,000,000							$1,000,000	
P-2c		$458,000	$1,756,000	$1,757,000				$3,971,000	
P-3	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$525,000	$825,000
P-4									$150,000
General Projects									
G-1					$225,000			$225,000	
G-2					$200,000			$200,000	$400,000
G-3									$605,000
Total	**$2,825,000**	**$2,033,000**	**$3,331,000**	**$3,332,000**	**$2,000,000**	**$1,575,000**	**$1,575,000**	**$16,671,000**	**$27,160,000**

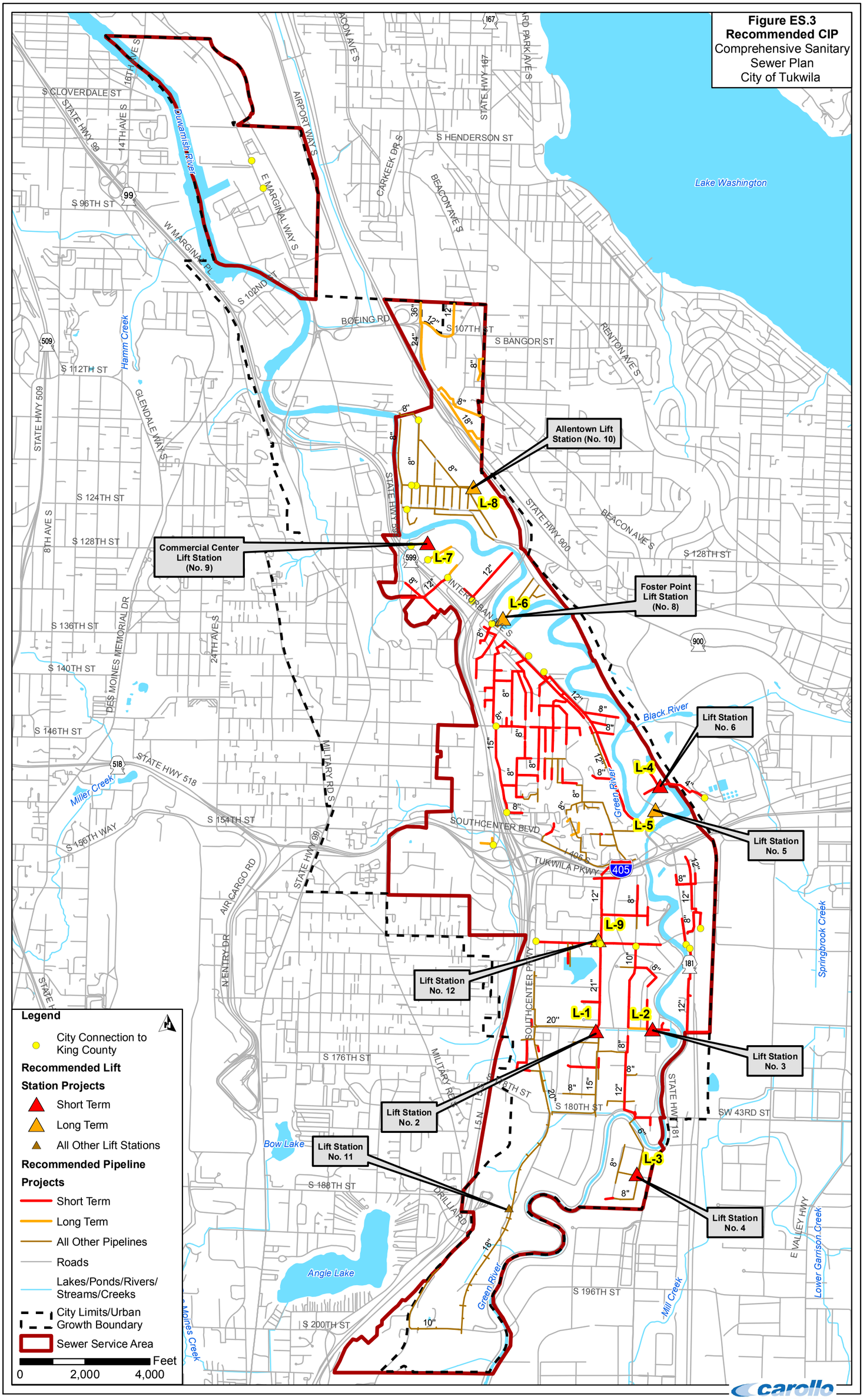
Figure ES.3
Recommended CIP
Comprehensive Sanitary Sewer Plan
City of Tukwila
Allentown Lift Station (No. 10)
Commercial Center Lift Station (No. 9)
Foster Point Lift Station (No. 8)
Lift Station No. 6
Lift Station No. 5
Lift Station No. 12
Lift Station No. 3
Lift Station No. 2
Lift Station No. 11
Lift Station No. 4
L-8
L-7
L-6
L-4
L-5
L-9
L-1
L-2
L-3
Lake Washington
Duwamish River
Green River
Black River
Springbrook Creek
Mill Creek
Lower Garrison Creek
Hamm Creek
Miller Creek
Bow Lake
Angle Lake
Des Moines Creek
S CLOVERDALE ST
S 96TH ST
S 102ND
BOEING RD
S 107TH ST
S BANGOR ST
S HENDERSON ST
S 112TH ST
S 124TH ST
S 128TH ST
S 136TH ST
S 140TH ST
S 146TH ST
S 154TH ST
S 156TH WAY
S 176TH ST
S 180TH ST
S 188TH ST
S 196TH ST
S 200TH ST
SW 43RD ST
SOUTHCENTER BLVD
TUKWILA PKWY
INTERURBAN AVE S
MILITARY RD S
AIRPORT WAY S
E MARGINAL WAY S
W MARGINAL PL
BEACON AVE S
RENTON AVE S
CARKEEK DR S
AIR CARGO RD
N ENTRY DR
SOUTHCENTER PKWY
DRILLIARD
E VALLEY HWY
STATE HWY 99
STATE HWY 509
STATE HWY 518
STATE HWY 900
STATE HWY 167
STATE HWY 181
14TH AVE S
16TH AVE S
8TH AVE S
24TH AVE S
GLENDALE WAY S
DES MOINES MEMORIAL DR
Legend
City Connection to King County
Recommended Lift Station Projects
Short Term
Long Term
All Other Lift Stations
Recommended Pipeline Projects
Short Term
Long Term
All Other Pipelines
Roads
Lakes/Ponds/Rivers/ Streams/Creeks
City Limits/Urban Growth Boundary
Sewer Service Area
Feet
0
2,000
4,000
carollo

CHAPTER 1

INTRODUCTION

The City prepared this Plan to document the status and analyze the future needs of the sanitary sewer system. The Plan will be used as a guide to plan for maintenance and improvements to the system in the next 20 years in order to provide the City with an effective, safe, and reliable sewer system. This Plan is inspired by the need to provide constant evaluation of the City's sewer system and operating policies in order to meet the needs of the customers and to ensure compatibility with the City and County's comprehensive plans. This updated plan is prepared in conformance with Chapter 173-240 of the State of Washington Administrative Code (WAC).

The City decided to update the Sanitary Sewer Plan at the same time as it updated the Water System Plan. A well-developed Plan will be a living document and tool that the City staff can use to anticipate the capacity, the timing, and the cost of improvements necessary to accommodate growth. An integrated plan will provide staff with the tools to quickly and knowledgeably answer questions from the Council and the public about the costs of growth and how to pay for it.

The Plan results from an evaluation of the existing sanitary sewer system and recommendations to resolve existing deficiencies and concerns, and to accommodate growth. The improvements identified in this Plan are based on the requirements of the Washington State Department of Ecology (Ecology), Washington State Department of Health (DOH), King County Comprehensive Plan, and City Comprehensive Plan.

1.1 AUTHORIZATION

Recognizing the importance of planning, developing, and financing sanitary system facilities to provide reliable service for the existing customers and to serve anticipated growth, the City initiated the preparation of this Plan. In 2010, the City selected the Carollo Engineers' team to prepare the updated Plan in accordance with applicable rules and regulations governing planning for sanitary sewer utility systems.

1.2 OBJECTIVE

This Plan has been prepared to serve as a guide for planning and designing future sanitary system facilities and to assist the City in using its existing system in the most efficient manner possible. Identified in this Plan are system improvements intended to meet the expanding and changing needs of the City. Specific objectives of this Plan are addressed by individual chapters presented herein and include the following:

- Develop a basis for planning for the overall system plan by establishing the service area goals and policies and by identifying the existing and future study area boundaries.
- Develop a demographic analysis summarizing the population, employment, and land use projections for the City.
- Develop accurate flow projections for the sanitary system to forecast future expansion needs.

- Describe and inventory the City's wastewater collection system.
- Assess the existing system's ability to meet the needs of the existing and forecasted population in the City's sewer service area.
- Summarize the system improvements identified through the system analysis.
- Develop the recommended CIP for the City.
- Develop a funding strategy that will provide financial strength and viability of the City to implement the schedule of capital improvements.
- Support the City with the SEPA process.

1.3 LOCATION

The City encompasses 8.9 miles of sewer and is located in the central Puget Sound region, 12 miles south of the City of Seattle, 17 miles north of the City of Tacoma, and directly east of the Seattle-Tacoma International Airport. Figure 1.1 shows the vicinity map for the City.

1.4 HISTORY OF THE CITY

The City of Tukwila was incorporated in 1908 and at that time had an area of 418 acres. By 1959, through a series of major annexations, the City's area had increased to 1,739 acres. By 1988 the area had grown to 2,880 acres, again through annexations.

In 1991, another wave of annexations increased the City's area to 5,176 acres. These annexations included the neighborhoods known as Riverton, Foster, Thorndyke, and Cascade View, as well as the area served by Fire District No. 1. At the time of the annexations, sewer service was provided in these areas by several entities – the City of Seattle, Valley View Sewer District, Rainier Vista Sewer District, King County, and the City of Tukwila itself. The location of the Riverton, Foster, Thorndyke, and Cascade View neighborhood areas, and others within the current City boundaries, are shown in Figure 1.2.

The annexations brought with them significant population growth. From a population of 800 in 1950, the City grew to a population of 3,160 in 1978 and to 10,793 in 1989. By 1991, this figure had increased to 14,631. The population when the 1999 Addendum was prepared was approximately 15,000 and rose to 17,000 when the plan was updated in 2005.

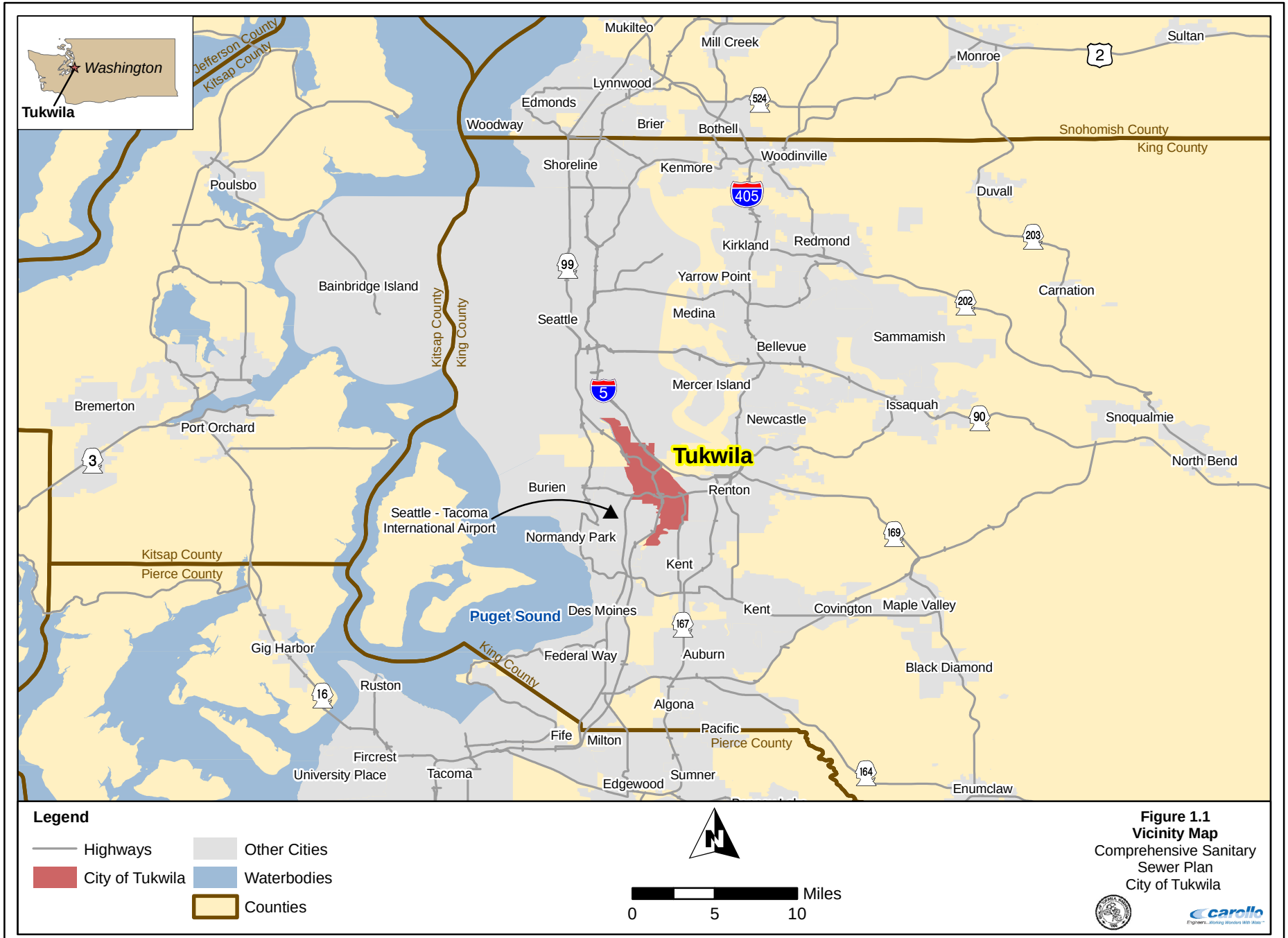

Figure 1.1
Vicinity Map
Comprehensive Sanitary Sewer Plan
City of Tukwila

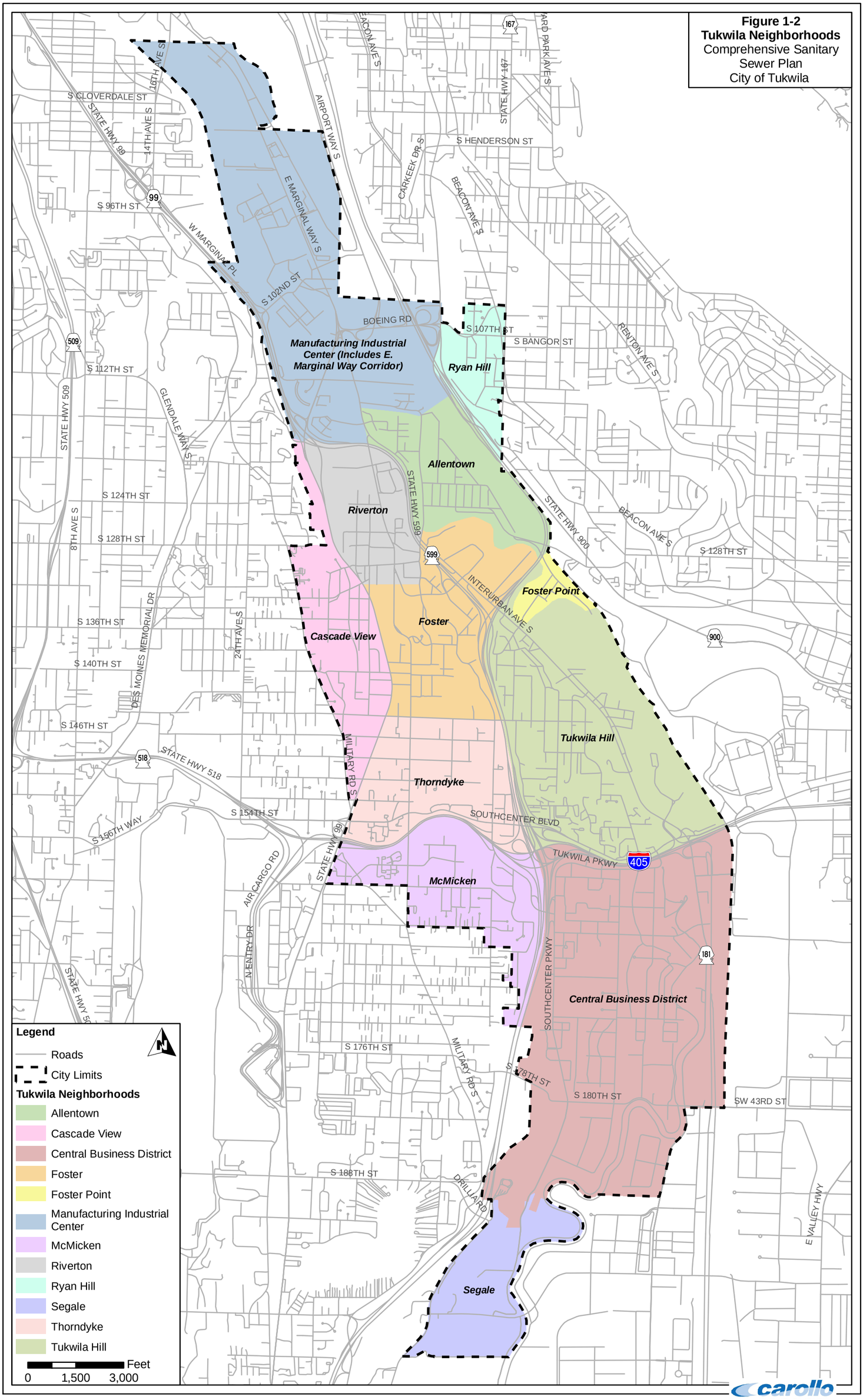
Figure 1-2
Tukwila Neighborhoods
Comprehensive Sanitary Sewer Plan
City of Tukwila
Manufacturing Industrial Center (Includes E. Marginal Way Corridor)
Ryan Hill
Allentown
Riverton
Foster
Foster Point
Cascade View
Tukwila Hill
Thorndyke
McMicken
Central Business District
Segale
S CLOVERDALE ST
STATE HWY 99
16TH AVE S
14TH AVE S
S 96TH ST
W MARGINAL PL
E MARGINAL WAY S
AIRPORT WAY S
S 102ND ST
BOEING RD
CARKEEK DR S
BEACON AVE S
STATE HWY 167
S HENDERSON ST
S 107TH ST
S BANGOR ST
RENTON AVE S
S 112TH ST
STATE HWY 509
GLENDALE WAY S
S 124TH ST
8TH AVE S
S 128TH ST
STATE HWY 599
STATE HWY 900
INTERURBAN AVE S
S 136TH ST
DES MOINES MEMORIAL DR
24TH AVE S
S 140TH ST
S 146TH ST
STATE HWY 518
MILITARY RD S
S 154TH ST
SOUTHCENTER BLVD
S 156TH WAY
AIR CARGO RD
TUKWILA PKWY
405
N ENTRY DR
SOUTHCENTER PKWY
181
S 176TH ST
S 178TH ST
S 180TH ST
SW 43RD ST
DRILLIARD
E VALLEY HWY
Legend
Roads
City Limits
Tukwila Neighborhoods
Allentown
Cascade View
Central Business District
Foster
Foster Point
Manufacturing Industrial Center
McMicken
Riverton
Ryan Hill
Segale
Thorndyke
Tukwila Hill
Feet
0
1,500
3,000
carollo

In 1995 and 1996, respectively, the City of Seattle transferred sewer facilities in the East Marginal Way corridor and Ryan Hill service areas to the City. In 1997, the City of Tukwila constructed sewers in the previously unsewered areas of Allentown. The Boeing Field area (part of the Manufacturing Industrial Center, Figure 1.1) was also incorporated into the City's system. Sewer service was extended to Foster Point and some of the Foster neighborhood in 2006. The City annexed the southern Segale area in 2010. Some of the annexed areas that were previously served by other sewer service providers continued to be served through the original providers.

Except for increases due to the annexations, Tukwila's growth has closely paralleled that of the adjacent communities of Kent, Renton, and Auburn. The construction of Westfield Southcenter Retail Centers and several industrial parks has also affected population increases.

1.5 OWNERSHIP AND MANAGEMENT

The City owns their sewer system. The sanitary sewer system is operated and maintained by the Department of Public Works which is managed by the Public Works Director.

Contact information for the Public Works Director is presented below:

Public Works Director: Bob Giberson
Address: 6300 Southcenter Boulevard
Tukwila, WA 98188
Phone:(206) 433-0179

1.6 POLICIES AND CRITERIA

The policies that govern the City's sewer system are based on City policies as defined in the City of Tukwila Comprehensive Plan (2008) and the sanitary sewer design criteria are defined by the City. The policies and criteria relevant to the City's sanitary sewer system are summarized below and are organized according to the following categories:

- Service policies.
- General design criteria.
- Pipeline design criteria.
- Manhole design criteria.
- Lift station and force main design criteria.
- Financial policies.

Table 1.1 Service Policies

	Subject	Policy	Source
1.1	Policies for City Managed Utilities -- Service Extension and Level of Service	• Use adopted level-of-service standards to meet public health and safety requirements, address deficiencies, and assure quality of service. • Ensure that the City of Tukwila utility functional plans and operations meet applicable federal, state, regional, and county requirements and regulations. • Require the use of Tukwila's adopted level-of-service standards in the design and construction of all utility service extensions. • Base the extension and sizing of utility system components on the Comprehensive Plan land use element for the area.	Comprehensive Plan (2008), Policies 12.1.1 – 12.1.4
1.2	Policies for City Managed Utilities – Coordination of Service Providers	• Coordinate with other jurisdictions and agencies in planning and implementing utility operations, facility additions, and improvements located in or affecting multiple jurisdictions. • Participate in the regulation of all water, sewer, and surface water utility services within the City's eventual boundaries. • Consider annexing water and sewer providers when requests of or within the Districts occur, or to achieve efficiencies and minimum levels of service for customers of the Districts. • Coordinate and allow utility service outside City limits only when the need is caused by adjustments of City limits or when temporary service is necessary because of an emergency. • Establish and maintain franchises and working agreements with sewer and water utilities currently operating within the City limits to ensure that the level of service provided is consistent with the City's requirements and neighborhood revitalization plans. • Allow special-purpose sewer and water districts to continue to operate and serve Tukwila residents and businesses, when appropriate.	Comprehensive Plan (2008), Policies 12.1.8– 12.1.13
1.3	Policies for City Managed Utilities – Concurrency and Implications for Growth	• Schedule and phase utility extensions to occur concurrently with expected growth and development. • Approve development only if adequate utilities are available when a need is created for those facilities, or within a reasonable period as approved by the City.	Comprehensive Plan (2008), Policies 12.1.14– 12.1.15

Table 1.1 Service Policies

	Subject	Policy	Source
1.1.4	Policies for City Managed Utilities – Env Responsibility	• Balance environmentally sound operations with cost effective methods in water, sewer, and surface water management utilities operations.	Comprehensive Plan (2008), Policies 12.1.16– 12.1.18, 12.1.20
1.1.5	Policies for City Managed Utilities – Facility Impact	Design, construct, and maintain facilities so as to minimize their impact on adjacent neighborhoods and businesses.	Comprehensive Plan (2008), Policy 12.1.21
1.1.6	Policies for City Managed Utilities – Sewer Utility	Serve all existing and potential residences and businesses with a sewer utility.	Comprehensive Plan (2008), Policy 12.1.24
1.1.7	Policies for Non-City Owned Utilities	• Actively coordinate project implementation with individual utilities based upon Tukwila's Comprehensive Plan and development regulations. • Require utilities operating in the right-of-way to obtain a franchise that includes service levels and requirements meeting Comprehensive Plan forecasts and other applicable City regulations. • Encourage utilities to consolidate facilities and minimize visual impacts of facilities where technically feasible. • Encourage communication among the City of Tukwila, the Washington Utilities and Transportation Commission, and the utilities regarding cost distribution and rate-setting for existing and proposed facilities and services.	Comprehensive Plan (2008), Policy 12.1.33 – 12.1.36
1.1.8	Annexation – Annexation Area Policies	• Work with King County and other local jurisdictions to coordinate services to identified areas. • Consider the annexation boundary as the extent of Tukwila's annexation area.	Comprehensive Plan (2008), Policy 6.1.2 – 6.1.3
1.1.9	Annexation – Public Services Policy	Ensure annexations do not detract from adopted level of service standards.	Comprehensive Plan (2008), Policy 6.1.5

Table 1.1 Service Policies

	Subject	Policy	Source
1.1.10	Annexation – Planning and Zoning Policy	Ensure that zoning proposed for an annexation area is consistent with Tukwila's adopted Comprehensive Plan and other land use requirements.	Comprehensive Plan (2008), Policy 6.1.6
1.1.11	Annexation – Interjuridictional Policies	• Establish appropriate interlocal agreements that provide solutions to regional concerns, including but not limited to water, wastewater, storm and surface water drainage, transportation, parks and open space, development review, and public safety. • Allow existing public services for utilities outside City limits when there is a need created by boundary adjustments between Tukwila and adjacent jurisdictions or when such temporary service is necessary because of an emergency.	Comprehensive Plan (2008), Policy 6.1.7 – 6.1.8

Table 1.2 General Design Criteria			
	Subject	**Policy**	**Source**
1.2.1	Reference Datum	The reference datum for the City's sanitary sewer infrastructure is based on the King County Aerial Survey (KCAS), which is equal to the NGVD 1988 datum.	Sewer System Plan Update (2005); 5.1.2
1.2.2	Sewer Location	• Wherever possible, trunk and interceptor sewers are located in public rights of way. • Under some topographic conditions, sewers may be located in easements across private property. • Where a sewer line conflicts with other utilities, it must be designed to pass under the other utilities and have a minimum vertical separation of 3 feet. • If the elevation of the sewer prevents it from passing under the other utilities, special construction techniques must be used per the City's direction.	Sewer System Plan Update (2005); 5.1.3
1.2.3	Separation of Water and Sewer Pipelines	• Sewer mains must be laid at least 10 feet horizontally, measured edge to edge, from any existing or proposed water supply line. A reduction to 5 feet of separation may be allowed provided the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. • All sanitary sewer crossings under water mains must be installed such that the top of the sewer pipe is at least 18 inches below the bottom of the water main. An 18-foot section of sewer pipe must be located at the crossing so the joints will be as far from the water supply main as possible. This installation may require special structural support for both the water and sewer pipes.	Sewer System Plan Update (2005); 5.1.4
1.2.4	Separation of Wells and Sewer Pipelines	No sanitary sewers can be constructed within 100 feet of a well.	Sewer System Plan Update (2005); 5.1.5
1.2.5	Sanitary Sewer Connections -- Industrial	Special considerations must be given to sanitary sewer design and connections for industrial users. The potential for pretreatment requirements, excessive wastewater flows, special flow metering, or sampling requirements prior to industrial sewer collection or treatment system design must be considered.	Sewer System Plan Update (2005); 5.1.6

Table 1.2 General Design Criteria

	Subject	Policy	Source
1.2.6	Sanitary Sewer Connections - - Developer	Side sewer connections to King County Wastewater Treatment Division (WTD) interceptor sewer lines are rarely allowed and only by written permission from King County. The City is the agency through which permits are obtained for such connections. The permittee is responsible for all coordination with King County WTD for necessary inspections and approvals.	Sewer System Plan Update (2005); 5.1.6
1.2.7	General Sizing Criteria	• Sanitary side sewers must be sized to carry all sanitary wastewater and waste fluids of any kind from the buildings served. All toilets, sinks, stationary wash stands, floor drains, or any other piece of equipment having waste fluids must be connected to the sanitary sewer system. Commercial minimum sewer diameter is 6-inches. • New sewer systems, except one-lot, single-family residences, are designed based on per capita flows or other methods approved by the City and Ecology. The City requires detailed design calculations and service area maps for the system design, stamped, signed, and dated by a Washington State registered professional engineer.	Sewer System Plan Update (2005); 5.1.7
1.2.8	Grease Interceptors	The City requires grease interceptors on all buildings where food preparation occurs and at locations determined by the City as necessary for the proper handling of liquid wastes. Grease interceptors must comply with Chapter 10 of the Uniform Plumbing Code and the following criteria: • Provide a double baffle type interceptor with 6-inch lines and details referenced to related plumbing sheets. • For sizing, consider the meals per hour as equal to a restaurant's seating capacity. • Locate the vault outside the building, between 5 feet and 25 feet from the building foundation. • Install the interceptor so that gray water from sinks, floor drains, drains under garbage compactors, is routed through the interceptor. DO NOT route dishwashers through the grease interceptor. NOTE: Route ONLY gray water through the interceptor. • Every three months the owner must completely pump out the interceptor. Businesses that generate small amounts of grease may, with the City's approval, pump the interceptor on a 6-month schedule. At any time, the City may inspect the interceptor and require more frequent service.	Sewer System Plan Update (2005); 5.4

Table 1.2 General Design Criteria

	Subject	Policy	Source
1.2.9	Groundwater protection	The City will implement measures to protect groundwater within the City from degradation related to City actions, facilities or programs	Suggested
1.2.10	Overflows	The City will implement programs to ensure that there are no overflows in the existing system, and will adopt standards requiring all new construction to convey peak flows and storm events without overflowing the sewer system	Suggested
1.2.11	Infiltration and inflow	• The City shall control and reduce infiltration and inflow (I/I) of storm and groundwater to the sanitary sewer system. • The City shall adopt, and enforce through vigorous inspection, specifications on sewer construction standards to reduce future I/I. • The City shall continue to administer and financially invest in the I/I reduction measures outlined in the I/I Reduction Program.	Suggested

Table 1.3 Pipeline Design Criteria

	Subject	Policy	Source
1.3.1	Sanitary Sewer Main – Size Configuration and Installation	• Minimum pipe diameter is 8 inches. • Side (lateral) sewers minimum pipe diameter is 6 inches. • Mains must be designed for a mean velocity of 2.0 feet per second when flowing full using Manning's equation with a roughness coefficient, 'n', of 0.013. • For sewers in the street, the minimum depth of cover is four feet. • For sewers located in easements, the minimum depth of cover is three feet. • Sewers must be designed to service the lowest fixtures in the area served. • Sewers are to be designed on straight alignments between manholes. • Sewers are to be designed with a uniform slope between manholes. • City-approved concrete anchors must be used on sewers having a slope equal to or greater than 15 percent.	Sewer System Plan Update (2005); 5.2.1
1.3.2	Sanitary Sewer Main – Overflows	No overflows or overflow structures are allowed.	Sewer System Plan Update (2005); 5.2.1
1.3.3	Sanitary Sewer Main – Minimum Slopes	• 4 - 6 inch sewer (side sewer only) minimum slope = 2 feet per 100 feet • 8 inch sewer minimum slope = 0.40 feet per 100 feet • 10 inch sewer minimum slope = 0.28 feet per 100 feet • 12 inch sewer minimum slope = 0.22 feet per 100 feet • 14 inch sewer minimum slope = 0.17 feet per 100 feet • 15 inch sewer minimum slope = 0.15 feet per 100 feet • 16 inch sewer minimum slope = 0.14feet per 100 feet • 18 inch sewer minimum slope = 0.12 feet per 100 feet • 21 inch sewer minimum slope = 0.10 feet per 100 feet • 24 inch sewer minimum slope = 0.08 feet per 100 feet • 27 inch sewer minimum slope = 0.07 feet per 100 feet • 30 inch sewer minimum slope = 0.06 feet per 100 feet • 36 inch sewer minimum slope = 0.05 feet per 100 feet	Sewer System Plan Update (2005); 5.2.1

Table 1.3 Pipeline Design Criteria

	Subject	Policy	Source
1.3.4	Sanitary Sewer Main – Materials	Materials used for sanitary sewers must be new, undamaged, inspected and approved by the City prior to installation and, in addition, meet the following requirements: • Materials: Materials must conform to the applicable APWA/WSDOT standards. The pipe must be legibly and permanently marked with type, class and/or thickness. • Pipe: Ductile iron Class 50 minimum; PVC minimum SDR 35; or HDPE where its use is justified due to scouring velocities or soil problems. • Fittings: Same materials as the pipe or as specified by the pipe manufacturer.	Sewer System Plan Update (2005); 5.2.1
1.3.5	Sanitary Side Sewers – General Requirements	• Buildings must be connected within 250 feet of the sanitary sewer line. • Only one commercial building connection per side sewer is allowed by the City. • The location and depth of the stubs shown on as-builts must be verified. • Street cuts must be repaired per City standards. • A minimum diameter of 6 inches is allowed within the City right-of-way. Residential side sewers may be reduced to a minimum diameter of 4 inches from the right-of-way to the house. • A sewer cleanout and test tee must be provided at the property line. • A sewer cleanout must be provided at the building. • Two single-family homes may be connected to a 6-inch side sewer.	Sewer System Plan Update (2005); 5.2.2
1.3.6	Sanitary Side Sewers – Materials	• Pipe material: Ductile iron Class 50 minimum; PVC minimum SDR 35; or welded HDPE where its use is justified due to scouring velocities or soil problems. • Pipe encasement: CDF, steel sleeve, PVC. Polyethylene for ductile iron pipe placed in peat areas or areas of potential corrosion.	Sewer System Plan Update (2005); 5.2.2

Table 1.3 Pipeline Design Criteria

	Subject	Policy	Source
1.3.7	Sanitary Side Sewers – Installation	• Side sewers must be installed on a slope greater than two percent but less than 1 vertical: 2 horizontal. • Anchors must be used for pipe having slopes over 15%. • Ductile iron pipe placed in peat areas or areas of potential corrosion must be encased with a polyethylene sleeve. • Install the side sewer not less than 5 feet from any building, except where the sewer enters the building. If the sewer is below the building foundation, for every one foot of depth, the side sewer shall be one foot greater horizontally from the foundation. • Provide clean outs at 100 foot intervals along the sewer lines, at property lines, at the building, and at all vertical or horizontal bends of ninety degrees (90º) or greater. • Outside the right-of-way, side sewers shall have at least 2 feet of cover. • Install a manhole on a side sewer that is 150 feet or farther from the sewer main.	Sewer System Plan Update (2005); 5.2.2
1.3.8	Inverted Siphons	Inverted siphons are not permitted.	Sewer System Plan Update (2005); 5.6

Table 1.4 Manhole Design Criteria

	Subject	Policy	Source
1.4.1	Materials and Standards	• Manholes must be precast with geo-liners. • Minimum diameter is 48 inches. • Sizes up to 96 inches are allowed.	Sewer System Plan Update (2005); 5.3.1
1.4.2	Installation	• Sanitary sewer manholes are required at the following locations: - The end of all sewer mains. - A change in slope or alignment. - A change in pipe diameter. - At the intersection of sewers 8 inches and larger (including side sewers). - At the intersection of sewer mains. - Every 500 feet on sewer mains. - On a side sewer 150-feet or longer. • When the City requires it, a spread foundation or other measure must be installed to prevent differential settlement. In addition, an outside drop connection is required for an invert separation of 24 inches or more, measured at the manhole wall. Inside drop connections require the City's approval. • Manholes must be fully channeled to the sewer crown. • Manholes must be installed so that the invert of the downstream pipe is at least 0.1 foot below all incoming invert elevations. Channelization methods include prefabricated fiberglass/PVC channels.	Sewer System Plan Update (2005); 5.3.2

Table 1.5 Lift Station and Force Main Design Criteria

	Subject	Policy	Source
1.5.1	Lift Station - Location	• Wastewater lift stations must be located to provide the minimum amount of nuisance to local or proposed residential or commercial development. • Lift station design must take into account noise control, odor control and station architectural design. Space for future expansion should be provided as necessary. • If possible, lift stations must be located at elevations above the 100-year flood. • If it is not feasible to locate above the 100-year flood plain, stations must be protected such that a 100-year flood does not damage the facility. • All lift stations must be designed to operate during the 25-year flood.	Sewer System Plan Update (2005); 5.5.1
1.5.2	Lift Station – Pumping Rate and Number of Units	• Each lift station must have a minimum of two pumps. • Each lift station must have the capability of pumping the design flow with the largest pump in the station out of service.	Sewer System Plan Update (2005); 5.5.1
1.5.3	Pumps	• Wastewater pumps must have the capability of passing a 3-inch diameter sphere. • Pump suction and discharge openings must be a minimum of 4 inches in diameter. • All pumps shall operate under a positive suction head. • The pumps must operate with the use of an approved control system that senses the water level in the wet well and must automatically alternate the pump in use. • Each lift station must be equipped with either a standby generator or must have the required connections to allow the use of a portable generator. • For lift stations that utilize portable generators, an emergency overflow connection must be provided of sufficient capacity as required by the Tukwila Director of Public Works. • An alarm system is required for each lift station and must signal a power failure, low water level, high water level, and pump overload or failure, generator failure, generator run, communications failure, and intrusion.	Sewer System Plan Update (2005); 5.5.2

Table 1.5 Lift Station and Force Main Design Criteria

	Subject	Policy	Source
1.5.4	Wet Wells	• Lift stations must have a properly sized wet well to minimize wear and tear on the pumps. The wet well must have a capacity that will provide a holding time not to exceed 10 minutes for the design average flow. • Pump controls must be adjusted such that the pump will run a minimum of 5 minutes and will be off for a minimum of 2 minutes at peak design flow. • Trash racks and bar screens will be provided as required to protect the pumps. • All Lift Stations are equipped with Supervisory Control and Data Acquisition (SCADA) systems which monitor functions of the Lift Stations and notify staff of any problems via cell phone to prevent overflows. • Reliable back-up power is provided to all new Lift Stations, preferably diesel. • All wet wells will be equipped with backup float with timer for pump station operation due to computer failure.	Sewer System Plan Update (2005); 5.5.3
1.5.5	Force mains	• Pipe materials are to be approved by the City Engineer. Minimum pressure class is 200 pounds per square inch (psi).	Sewer System Plan Update (2005); 5.5.4

Table 1.6 Financial Policies

1.6.1	Capital Facilities – General Government Policies	• Ensure that capital facilities are provided within six years of the occurrence of impacts that degrade standards. • Update the six-year financial planning model annually to review and reassess growth, revenue, and cost totals and forecasts. • Review capital facilities needs every three years. • Continue to target a minimum of 33 percent of total sales tax proceeds to pay for capital projects. • Balance infrastructure investment between the residential and commercial sectors. • Support policies and practices that will maintain an A-1 bond rating or better for the City by sound governmental budgeting and accounting principals, revenue diversity, and promoting the economic well-being of the City. • Allow issuance of bonds for facilities if repayment can be made from revenue allocations. • Consider projects identified in the Capital Improvement Plan for general operating revenues if substantial funding from grants, developers, other jurisdictions, or other funding sources becomes available. • Include a dedicated facility fund and allocation for future building needs in the financial planning model. • Consider City funding for preliminary engineering and design of commercial street projects if the City determines that the public's health, safety, and welfare will be benefited. • Use a mitigation-based fee system for each affected City function as determined in the State Environmental Policy Act evaluation of individual development applications. • Continue to pay for and improve residential area local access streets and collector arterials in accordance with the prioritized list of residential street projects, and provide interfund loans or transfers for neighborhood water and sewer deficiencies. • To provide a more timely option for residential street improvements, property owners may form local improvement districts and the City may pay for the design, preliminary engineering, construction engineering, and local improvement district formation costs. Residents will pay the other costs such as, undergrounding utilities in the street and undergrounding from the street to their house, for the actual construction, and for any improvements on private property such as rockeries, paved driveways, or roadside plantings.	Comprehensive Plan (2008), Policies 14.1.1 – 14.1.13

Table 1.6 Financial Policies			
1.6.2	Capital Facilities – Enterprise Fund Policies	• Structure utility rates and charges for services to ensure adequate infrastructure development in addition to operation and maintenance requirements. • Maintain adequate reserved working capital balances for each enterprise fund's annual expenditures. • Provide sewers to all residential and commercial areas in the City as a safety and health issue by using a combination of operating revenues, grants, loans, bonds, voluntary local improvement district formations, and interfund loans. • Use bonded indebtedness as a funding alternative when there is a general long-term benefit to the respective enterprise fund. • Continue to fund the correction of single-family residential neighborhood infrastructure deficiencies.	Comprehensive Plan (2008), Policies 14.1.16 – 14.1.20

1.7 APPROVAL PROCESS

This Plan is required to meet state, county, and local requirements. It complies with the requirements of Ecology, the DOH, and the Revised Code of Washington (RCW) as shown in Table 1.7. Additionally, the Plan is in compliance with any adopted water quality management plan under the Federal water Pollution Control act as amended. A SEPA Checklist and determination of non-significance (DNS) has been prepared for this Plan. The City anticipates this Plan does not have probable significant adverse impacts on the environment in accordance with the DNS. Many of the projects proposed within the Plan will require subsequent project specific environmental review and SEPA checklists as part of their preliminary and final design process. The SEPA Checklist and DNS are included in Appendix A

The City will submit this plan to Department of Ecology, King County, adjacent utilities, and local governments for review. Comment letters will be attached in Appendix B. The Adopting Resolution will be included in Appendix C (to be inserted later), upon Plan approval by the City Council.

Table 1.7 WAC 173-240-050 Sewer Plan Requirements

Requirement	Location
Purpose and need for the proposed plan	Chapter 1
A discussion of who will own, operate and maintain the system	Chapter 1
The existing and proposed service boundaries	Chapter 2
Layout map including:	
• Boundaries: The boundary lines of the municipality or special district to be sewered, including a vicinity map.	Chapter 1
• Existing sewers: The location, size, slope, capacity, direction of flow of all existing trunk sewers, and the boundaries of the areas to be served by each.	Chapter 4
• Proposed sewers: The location, size, slope, capacity, direction of flow of all proposed trunk sewers, and the boundaries of the areas to be served by each.	Chapter 5
• Existing and proposed pump stations and force mains. The location of all existing and proposed pumping stations and force mains, designated to distinguish between those existing and proposed.	Chapter 4, 5
• Topography and elevations. Topography showing pertinent ground elevations and surface drainage must be included as well as proposed and exiting streets.	Chapter 2
• Streams, lakes and other bodies of water. The location, direction of flow of major streams, the high and low elevations of water surfaces at sewer outlets, and controlled overflows, if any. All existing and potential discharge locations should be noted.	Chapter 2
• Water systems. The location of wells or other sources of water supply, water storage reservoirs and treatment plants, and water transmission facilities.	Chapter 2

Table 1.7 WAC 173-240-050 Sewer Plan Requirements	
Requirement	**Location**
Population trend as indicated by available records, and the estimated future population for the stated design period. Briefly describe the method used to determine future population trends and the concurrence of any applicable local or regional planning agencies.	Chapter 2
Any existing domestic or industrial wastewater treatment facilities within twenty miles of the general plan area and within the same topographical drainage basin containing the general plan area.	Chapter 4
A discussion of infiltration and inflow problems and a discussion of actions that will alleviate these problems in the future.	Chapter 3
A statement regarding provisions for treatment and discussion of the adequacy of the treatment.	Chapter 4
A list of establishments producing industrial wastewater, the quantity of wastewater and periods of production, and the character of the industrial wastewater insofar as it may affect the sewer system or treatment plant. Consideration must be given to future industrial expansion.	Chapter 3
Discussion of the location of all existing private and public wells, or other sources of water supply, and distribution structures as they are related to both existing and proposed domestic wastewater treatment facilities.	Chapter 2
A discussion of the various alternatives evaluated, and a determination of the alternative chosen, if applicable.	Chapter 5
A discussion, including table, that shows the cost per service in terms of both debt service and operation and maintenance costs, of all facilities (existing and proposed) during the planning period.	Chapter 8
A statement regarding compliance with any adopted water quality management plan under the Federal water Pollution Control act as amended.	Chapter 1.9
A statement regarding compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA), if applicable.	Appendix A

1.8 ACKNOWLEDGEMENTS

This Plan was developed by Carollo Engineers in coordination with Katy Isakson and Associates. The Carollo Engineers team wishes to acknowledge and thank the following individuals for their efforts and assistance in completing this Plan.

- Mike Cusick, PE, Utility Engineer.
- Pat Brodin, Operations Manager.
- John Howat, Sewer Superintendant

CHAPTER 2

DEMOGRAPHIC ANALYSIS

2.1 INTRODUCTION

The purpose of this chapter is to present the demographic analysis pertaining to the existing and future sewer service area. This involves defining planning data, future land use and estimating current and future customers in the sewer service area so that the City can adequately plan to accommodate its sewer needs.

2.2 LAND USE

Land use designations and regulations provide important information in evaluating existing sewer system capacity. Land use determines the area available for various types of development including both single-family and multi-family residential development, as well as commercial and other types of land use that provide the economic base necessary to support residential development.

The City of Tukwila's Comprehensive Land Use Plan (December 2008) provides a broad statement of community goals and policies that direct the orderly and coordinated physical developments of the City into the future. This Plan is consistent with the policies in Tukwila's Comprehensive Plan. A map of existing zoning in the City for the future sewer service area is provided in Figure 2.1. No major zoning changes were assumed for the next 20 years.

The zoning for land within the City of Tukwila is defined in Title 18 Zoning of the City Municipal Code. Table 2.1 presents a description of the zoning designations.

Figure 2.1
Zoning Map
Comprehensive Sanitary Sewer Plan
City of Tukwila

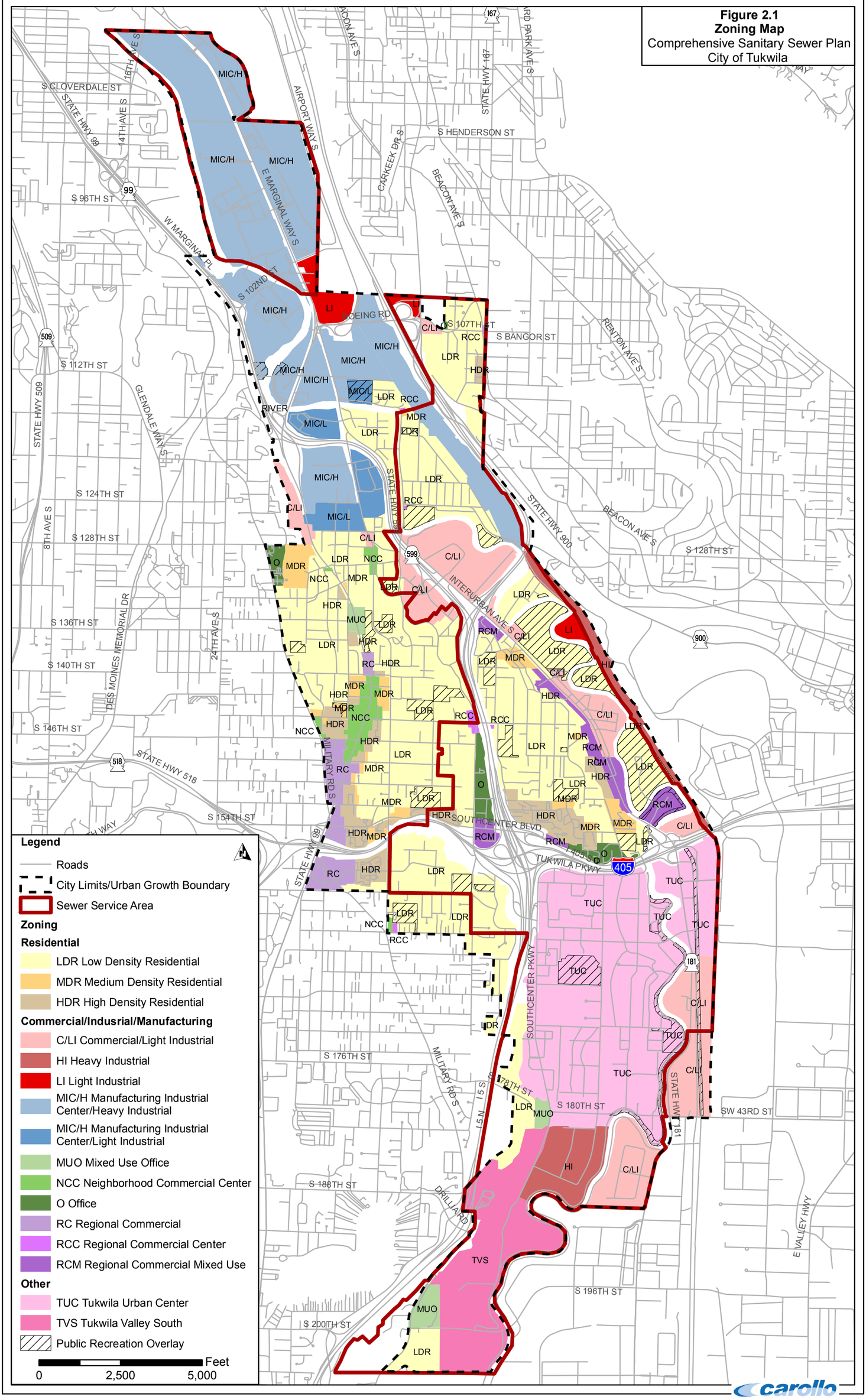

Table 2.1 City Zoning Designations

#	Code	Name	Description
1	C/LI	Commercial / Light Industrial	Areas characterized by a mix of commercial, office or light industrial uses.
2	HDR	High Density Residential	Areas characterized by multi-family buildings; 15-21.8 units per net acre, with senior citizen housing allowed up to 60 units per net acre.
3	HI	Heavy Industrial	Areas characterized by heavy or bulk manufacturing uses and distributive and light manufacturing uses, with supportive commercial and offices uses.
4	LDR	Low Density Residential	Areas characterized by detached single-family residential structures; 0 to 6.7 units per net acre.
5	LI	Light Industrial	Areas characterized by distributive and light manufacturing uses, with supportive commercial and office uses.
6	MDR	Medium Density Residential	Areas characterized by residential duplexes, triplexes, and four-plexes; 6.8 to 14.5 units per net acre.
7	MIC/H	Manufacturing Industrial Center / Heavy	A major employment area containing distributive, light manufacturing and heavy manufacturing uses, with supportive commercial and office uses.
8	MIC/L	Manufacturing Industrial Center / Light	A major employment area containing distributive, light manufacturing, and limited office uses, with supportive commercial and office uses.
9	MUO	Mixed Use Office	Areas characterized by professional and commercial office structures, mixed with certain complementary retail, and residential uses and senior citizen housing allowed up to 60 units per net acre.
10	NCC	Neighborhood Commercial Center	Pedestrian-friendly areas characterized and scaled to serve multiple residential areas with a diverse mix of uses. Uses include certain commercial uses mixed with residential at second story or above (senior citizen housing allowed up to 60 units per net acre); retail; service; office; and recreational and community facilities, generally along a transportation corridor.
11	O	Office	Areas characterized by professional and commercial office structures mixed with certain complementary retail.

Table 2.1 City Zoning Designations			
#	**Code**	**Name**	**Description**
12	RC	Regional Commercial	Areas characterized by commercial services, offices, lodging, entertainment, and retail activities with associated warehousing and accessory light industrial uses, along a transportation corridor and intended for high-intensity regional uses. Residential uses are also allowed in appropriate areas off of the principle arterial with a maximum density determined by code standards and design review criteria.
13	RCC	Residential Commercial Center	Pedestrian-friendly areas characterized and scaled to serve a local neighborhood, with a diverse mix of uses. Uses include certain commercial uses mixed with residential at second story or above, with a maximum density of 14.5 units per acre; retail; service; office; and recreational and community facilities.
14	RCM	Regional Commercial Mixed Use	Areas characterized by commercial services, offices, lodging, entertainment, and retail activities with associated warehousing and accessory light industrial uses. Residential uses mixed with certain commercial uses are allowed, at the second story or above, subject to special design standards, and a maximum density of up to 14.5 units per acre (senior citizen housing allowed up to 60 units per net acre).
15	TUC	Tukwila Urban Center	A specific area characterized by high-intensity regional uses that include commercial services, offices, light industry, warehousing and retail uses, with a portion covered by the TUC Urban Center Mixed Use Residential Overlay.
16	TVS	Tukwila Valley South	A specific area characterized by distributive and light manufacturing uses, with supportive commercial and office uses.

2.3 SEWER SERVICE AREA

The City was incorporated in 1908 and is bounded by the City of SeaTac on the west, the City of Seattle on the north, the City of Renton on the east, and the City of Kent on the south. Based on the discussions with the City staff, the urban growth area for the City is the City limits. Some of the sanitary sewer service areas within the City Limits/Urban Growth Boundary are unsewered or partially sewered. Most of these areas were the result of annexations and are served by septic tanks. Sewer service has been extended to many of the unsewered or partially sewered areas since the mid 1990's. Currently, all of the areas within the city boundary are served by City of Tukwila, Valley View Sewer District, and City of Renton. Additionally, the City also serves a small portion of City of Seattle in the north by S 107th Street based on the topography and piping system. In the south, the City serves City of

SeaTac at approximately S 178th Street and Interstate 5 North. A map of existing sewer service area is presented in Figure 2.2.

There are three new areas the City would like to extend Sewer Service into in the future. Table 2.2 identifies the future areas of service for the City. The location of these areas are presented in Figure 2.2.

The areas west of I-5 by Sounthcenter Boulevard in the UGB as identified on the map is currently served by the Valley View Sewer District. This area is in City's Drainage Basin 7 and 16 (discussed in Chapter 4). The City desires to annex this area into its sewer service.

Additionally, the City annexed Tukwila South area generally from South 180th Street to the City limits at S 204th Street in 2010. A portion of this area is part of unincorporated King County. Currently, public sewer lines do not extend into the area south of 180th Street and west side of the Green River. The is constructing a lift station to serve the area.

The City would also like to serve the area between I-5 and S Orillia Road, which is currently in City of SeaTac city limits and outside the UGB. The City will need to coordinate with the City of SeaTac to provide sewer service in the area.

Table 2.2 Future Service Areas

Drainage Basin	Existing Service Provider	Existing Tukwila Sewer Service Areas	Tukwila Sewer Service Area through Planning Period
16 (East of Tukwila International Boulevard)	Valley View	Valley View currently serves all of Basin 16	East of 46th Avenue S in Basin 16
7	Tukwila Valley View	Klickitat Dr area in Basin 7	East of 42nd Avenue S and north of S 164th St
14	None	None	Area in SeaTac between the City boundary and I-5 up 178th Hill (Segale area) was annexed in 2010.

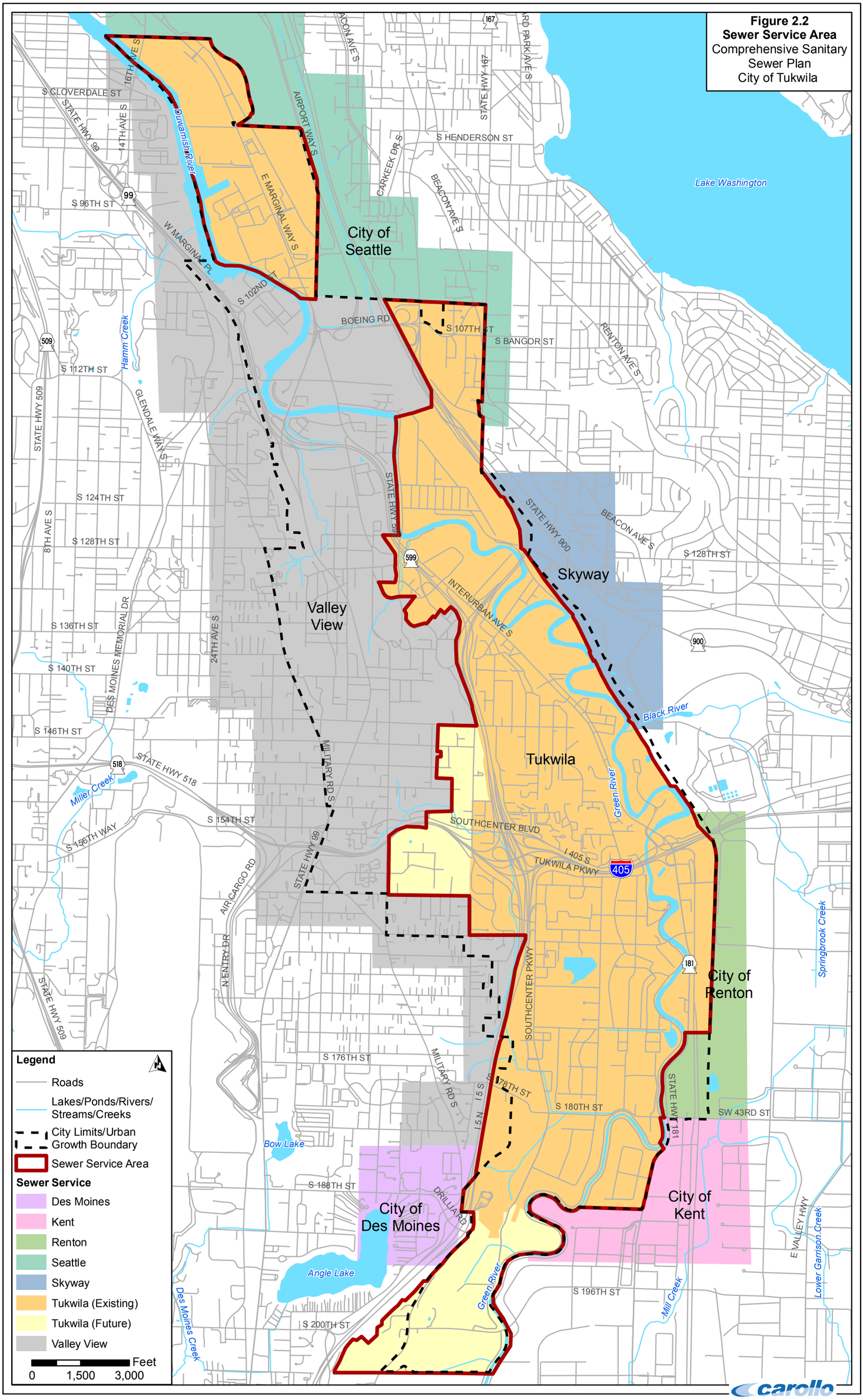
Figure 2.2
Sewer Service Area
Comprehensive Sanitary Sewer Plan
City of Tukwila
Legend
Roads
Lakes/Ponds/Rivers/ Streams/Creeks
City Limits/Urban Growth Boundary
Sewer Service Area
Sewer Service
Des Moines
Kent
Renton
Seattle
Skyway
Tukwila (Existing)
Tukwila (Future)
Valley View
Feet
0
1,500
3,000
City of Seattle
Skyway
Valley View
Tukwila
City of Renton
City of Kent
City of Des Moines
Lake Washington
Duwamish River
Hamm Creek
Miller Creek
Bow Lake
Angle Lake
Green River
Black River
Springbrook Creek
Mill Creek
Lower Garrison Creek
Des Moines Creek
S CLOVERDALE ST
S 96TH ST
S 102ND ST
BOEING RD
S 107TH ST
S BANGOR ST
S HENDERSON ST
S 112TH ST
S 124TH ST
S 128TH ST
S 136TH ST
S 140TH ST
S 146TH ST
S 154TH ST
S 156TH WAY
S 176TH ST
S 178TH ST
S 180TH ST
S 188TH ST
S 196TH ST
S 200TH ST
SW 43RD ST
SOUTHCENTER BLVD
TUKWILA PKWY
I-405 S
INTERURBAN AVE S
BEACON AVE S
RENTON AVE S
E MARGINAL WAY S
W MARGINAL PL
AIRPORT WAY S
CARKEEK DR S
GLENDALE WAY S
DES MOINES MEMORIAL DR
MILITARY RD S
AIR CARGO RD
N ENTRY DR
SOUTHCENTER PKWY
DRILLIARD
E VALLEY HWY
16TH AVE S
14TH AVE S
8TH AVE S
24TH AVE S
STATE HWY 99
STATE HWY 509
STATE HWY 518
STATE HWY 900
STATE HWY 167
STATE HWY 181
I 5 N
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405
99
509
518
599
900
167
181

2.4 SEWER SERVICE AREA CUSTOMERS

The sewer flow rates within the service are determined based on the water consumption data for the sewer customers, as the City does not meter sewer flows. This section presents the estimated number of sewer customers based on the number of water customers as determined through water demand. The estimated sewer flows are presented in Chapter 3.

2.4.1 Current Sewer Service Area Customers

The current water demand in the sewer service area is determined based on the historical connections and water use from 2005 to 2009 as presented in Chapter 2: Demographic Analysis and Demand Projections, Comprehensive Water Plan. Table 2.3 presents the total number of connections by customer class from 2005 through 2009 for the Retail Water Service Area (RWSA).

Table 2.3 Historical Number of Connections in RWSA by Customer Class

Customer Class	2005	2006	2007	2008	2009
Single-family/Duplex	1,236	1,159	1,181	1,265	1,267
Multi-family	182	172	173	173	173
Commercial - Regular	873	864	877	849	751
Commercial - High Demand	10	10	10	10	10
Total	**2,301**	**2,205**	**2,241**	**2,297**	**2,201**

Since the RWSA and the sewer service area are different, the number of connections in the sewer service area was determined by overlaying both service areas to identify which portions of the sewer service areas are within the City's RWSA. For any sewer service areas that are not fully in the City's RWSA, the number of connections in that area are assigned based on the percent of the sewer service area within the RWSA, reviews of aerial photos, and zoning maps.

The demand of each customer class can then be expressed in terms of ERUs for forecasting and planning purposes. One ERU is defined as the average quantity of water beneficially used by one average, full-time, single-family residence per day. The quantity of water used by other customer classes, and by the whole system, can be expressed in terms of ERUs. Based on the analysis for the Comprehensive Water Plan, an ERU planning value for a single-family residence of 160 gpd is used for this analysis. Table 2.4 presents current customers in the sewer service area.

Table 2.4 Current Customers in the Sewer Service Area

Customer Class	Number of Connections	Unit ERU Value	ERUs
Single-family/Duplex	1,077	1.0	1,077
Multi-family	147	9.2	1,351
Commercial	647	10.3	6,632
Total	**1,871**	**-**	**9,059**

2.4.2 Future Sewer Service Area Customers

Many factors influence growth. The state of the economy, interest rates, annexation of adjacent areas, and up-zoning all influence new development and population growth. Growth management policies, along with coordination between local governments, should make development more predictable and growth projections more accurate than they have been historically. However, significant changes to the regional economy will continue to affect growth timing and patterns. It is not uncommon for actual growth rates within the City to vary from those predicted. In addition, growth rates will vary between different parts of the City based on the availability of services and the costs to develop the land for the zoned use. Although these factors were considered in developing the information included within this Plan, it should be noted that the rates of future growth will likely vary from those included within the Plan due to the shifting of growth between areas within the City and between the City and adjoining jurisdictions.

Growth projections were prepared by the City Planning and Engineering staff. Most of the growth is planned for Tukwila South and the Urban Center which includes the Segale area planned to be served by the City. There will also be residential infill and fluctuation on Boeing employment. The growth projections were categorized by customer classification, which included: Single-family, Multi-family, and Commercial (combined regular and high demand). The City is projecting 17,550 new jobs that may come from both commercial customer classes and are represented in the projected increase in commercial accounts. The projections for the sewer service are during the planning period are shown in Table 2.5.

Table 2.5 Classification/Customer Projections for the Sewer Service Area

Customer Class	2016	2020	2030
Single-family	1,542	1,679	2,004
Multi-family	601	735	1,053
Commercial	1,191	1,341	1,733
Total	**3,333**	**3,755**	**4,791**

The future sewer service area customers were estimated by applying the same growth rate as the water RWSA customers. Table 2.6 shows the existing and projected ERUs for the City over the planning period.

Table 2.6 Projected ERUs for Each Customer Classification

Customer Class	2016	2020	2030
Single-family	1,542	1,679	2,004
Multi-family	5,522	6,754	9,673
Commercial	12,203	13,746	17,767
Total	**19,266**	**22,179**	**29,444**

CHAPTER 3

FLOW PROJECTIONS

3.1 INTRODUCTION

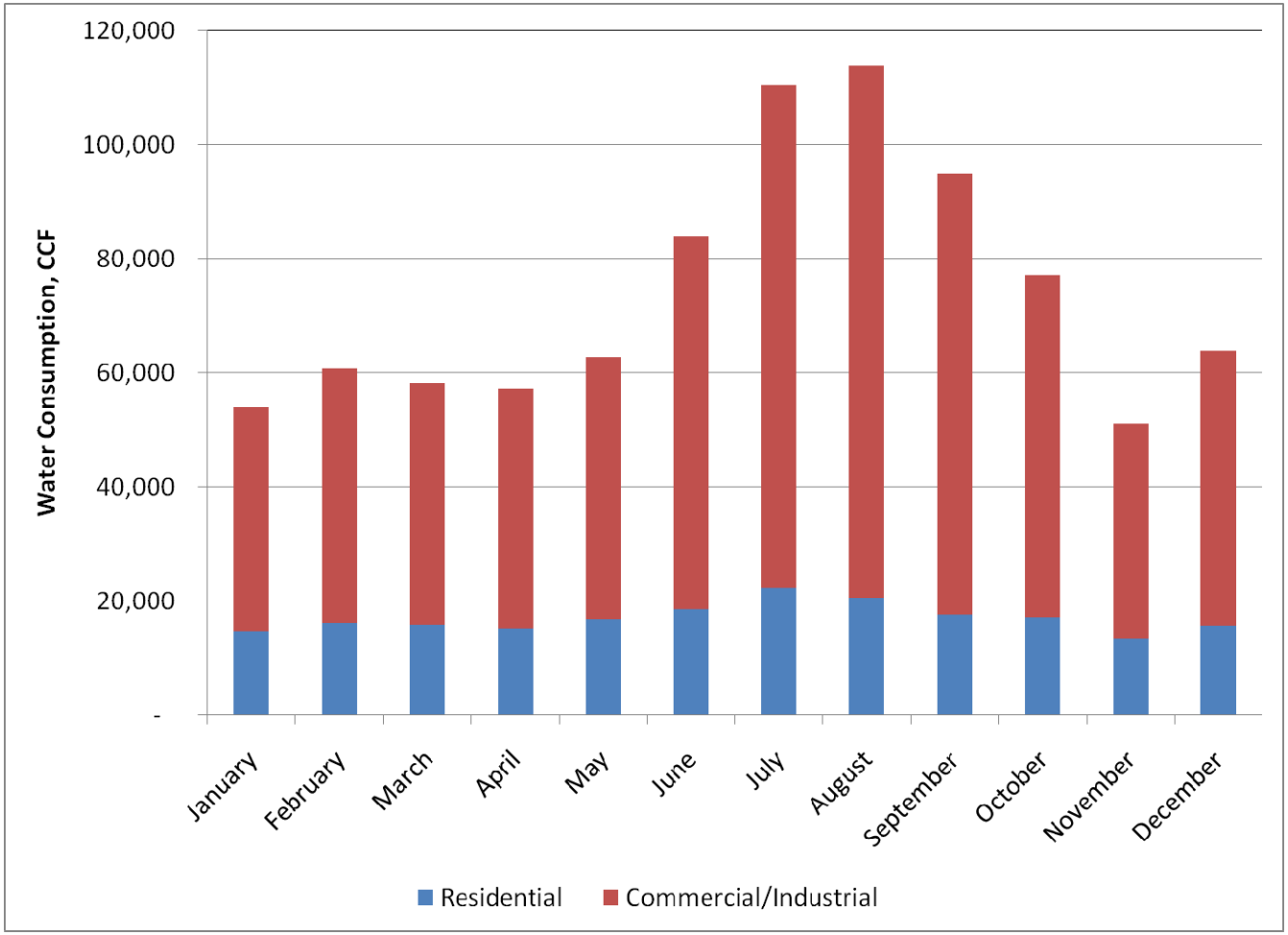
This chapter presents the sewer base flow projections based on projected water demand within the sewer service area, I/I projections, and presents the existing and projected reclaimed water usage for the anticipated growth based on population and land use.

3.2 SEWER BASE FLOW PROJECTIONS

The sewer base flow projections over the planning period are developed in this section. Estimating sewer flows is important for understanding the current and future capacity requirements of the wastewater collection system, for targeting improvements projects towards areas with high infiltration and inflow, and for projecting flows to King County's South WWTP.

Since the City does not meter wastewater flows, the existing and projected wastewater generated were calculated based on the percent of the projected water demand (section 2.4) expected to reach the sewer system. This was estimated by analyzing City's water sales by customer class to determine how much water is used year-round for "base use" compared to how much water is used during peak season for "peak excess use." Peak excess use is the extra water used during the summer months, most of which is utilized for irrigation. It is assumed that all the base use water reaches the sewer system, while the peak excess use does not. Figure 3.1 shows the monthly water consumption by customer class for the year 2009. Based on Figure 3.1, the peak season for the City is June through October. Table 3.1 presents a summary of this analysis for the year 2009.

As illustrated on Table 3.1, it is estimate that 91 percent of the water consumed by residential customers reaches the sewer system, while only 75 percent of the water consumed by commercial and industrial customers is estimated to be captured in the sewer system. These percentages were applied to the projected average day demand (ADD) presented in section 2.4.2 of Chapter 2. The resulting base sanitary sewer flows are presented in Table 3.2.



WATER DEMAND FLUCTUATION IN YEAR 2009

FIGURE 3.1

CITY OF TUKWILA
COMPREHENSIVE SANITARY SEWER PLAN

Table 3.1 Water Demand Base Use Compared to Peak Excess Use			
Description	**Residential[(1)], CCF[(2)]**	**Commercial/ Industrial, CCF**	**Total, CCF**
Non Peak Season (Nov-May)	107,891	300,192	408,083
Peak Season (June-Oct)	96,314	383,881	480,195
Total	204,205	684,073	888,278
Average Non-Peak Month	15,413	42,885	58,298
Average Peak Month	19,263	76,776	96,039
Excess during Peak Month	3,850	33,892	37,741
Annual Base Use	184,956	514,615	699,571
Annual Peak Excess Use	19,249	169,458	188,707
Annual Total	204,205	684,073	888,278
Base Use as % of Total	0.91	0.75	0.79

Notes:
(1) Residential category includes single-family and multi-family.
(2) One CCF is 100 cubic feet.

Table 3.2 Projected Base Sanitary Sewer Flows for the Planning Period				
Customer Class	**2009**	**2016**	**2020**	**2030**
Single-family	156,044	223,412	243,317	290,462
Multi-family	195,756	800,195	978,779	1,401,771
Commercial	797,916	1,468,782	1,654,523	2,138,548
Total	**1,149,716**	**2,492,389**	**2,876,618**	**3,830,781**

3.3 INFILTRATION AND INFLOW

Peak flows in a wastewater system are caused by rainfall dependent I/I. I/I is extraneous flow that enters into the collection system through offset pipe joints, cracks in sewer pipes, or direct storm drain connections. Peak flows can result in flows more than ten times the base flow, causing utilities to construct high-capacity infrastructure to convey and treat these flows. This section describes the current I/I rates in the City's service area based on the analysis of historical pump runtime data at Lift Station 12 which serves Drainage Basins 4 and 8. This analysis was extrapolated and used to determine I/I flows from the remainder of the drainage basins. In addition, this section also describes the City's current I/I program and outlines a program for identifying and reducing I/I. The peak flows developed herein were used to evaluate the capacity of the City's existing infrastructure, and to make recommendations for improvements.

3.3.1 I/I Estimation

This plan uses flow rate per acre method to estimate I/I within the City's service area. In order to estimate the flow rate per acre between the base flow and peak flow, the historical run time data at Lift Station 12 was analyzed. Lift Station 12 serves Drainage Basins 4 and 8.

3.3.1.1 Existing Flows Lift Station 12

Base Flow. The City collects pump runtime data every three to four days. Daily runtime data was extrapolated by dividing the number of hours of pump runtime and the number of days between the readings. The adjusted daily runtimes were then multiplied by the design pump flow rate to determine daily flows experienced. Year 2009 data was used in this analysis. Figure 3.2 presents the average daily flow for January through December for the Year 2009.

The base flow for Lift Station 12 was determined by averaging flows during the months of June through October, which amounts to 151,250 gpd.

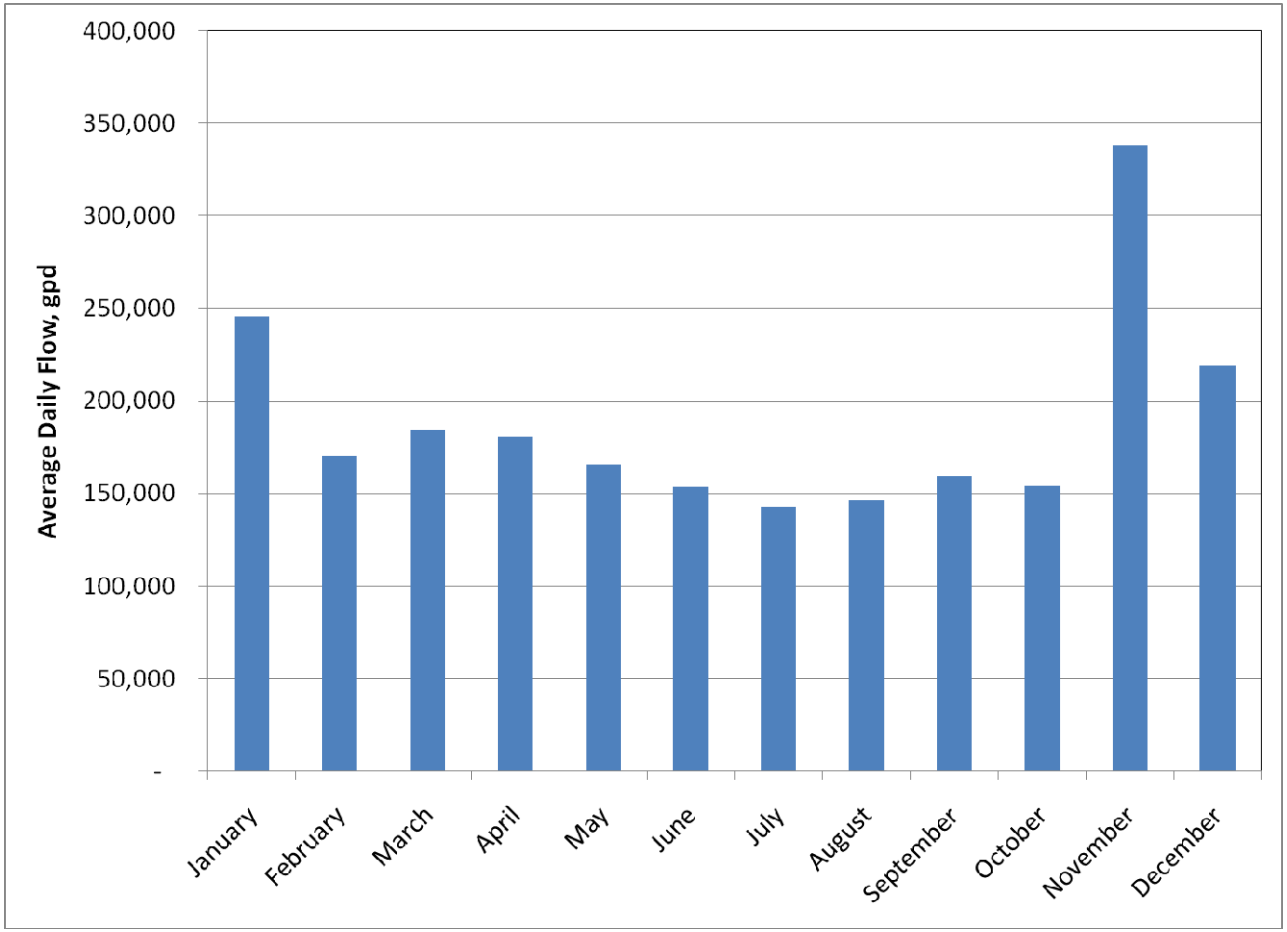
Average Annual Flow. The average annual flow is defined as the daily influent flow that a lift station experiences. It is derived by averaging the flows through the year. For Lift Station 12, the average annual flow calculation results in 187,630 gpd.

Peak Flows. The method used for determining peak flows at the Lift Station 12 is described below.

The first step was to determine the Maximum Month Wet Weather Flow (MMWWF) by plotting the monthly average flow (gpd) for each typical weather month in 2009 against total rainfall accumulation for that month. An equation correlating flow and rainfall is determined from a line of best fit. From the NOAA Seattle-Tacoma Climatic Data for 1971 through 2000, a 5-year maximum month rainfall was determined as 7.12 inches (occurring in January). Given this rainfall accumulation, the 5-year MMWWF is determined by where 7.12 inches intercepts the line of best fit as shown in Figure 3.3, resulting in a MMWWF of 308,960 gpd.

Next peak day average flow (PDAF) was determined by plotting available storm events from November through May against daily rainfall. Again, an equation correlating peak flows with high rain events is determined from a line of best fit. Using the US Department of Commerce Technical Paper No. 49, Figure 13 Isopluvials for Washington, a 2-day 5-year 24-hour storm event in Tukwila produces approximately 3 inches of rainfall per day. The PDAF is determined by where the 3 inches intercepts the best fit line, resulting in a PDAF of 724,240 gpd. Figure 3.4 presents the graph for the PDAF determination.

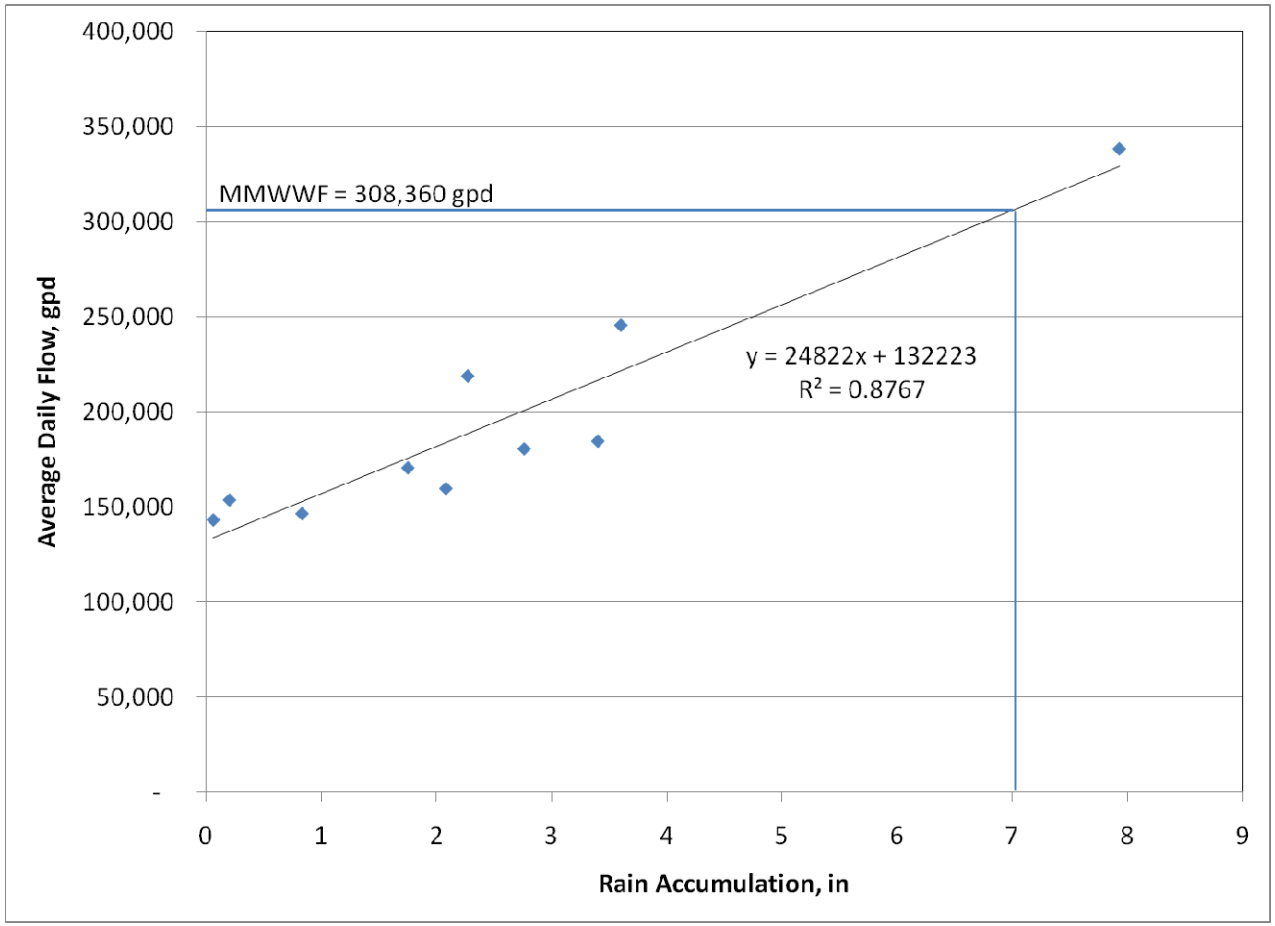
Finally, the PIF is determined using a best fit line based on the Average Annual Flow, MMWWF, and PDAF. Figure 3.5 plots these flows against the probabilities of these each occurring on a log graph. For example, the average annual flow has a 50 percent probability of occurring, considering it is the annual average. Using a line of best fit, the PIF can be determined assuming it has a 0.011 percent (1 hour in 8760 hours/year) probability of occurring, resulting in a PIF of 1,176,270 gpd. The graph and regression equation for the PIF determination is shown in Figure 3.5. A summary of the Lift Station 12 analysis is presented in Table 3.3.



AVERAGE DAILY FLOW IN YEAR 2009 FOR LIFT STATION 12

FIGURE 3.2

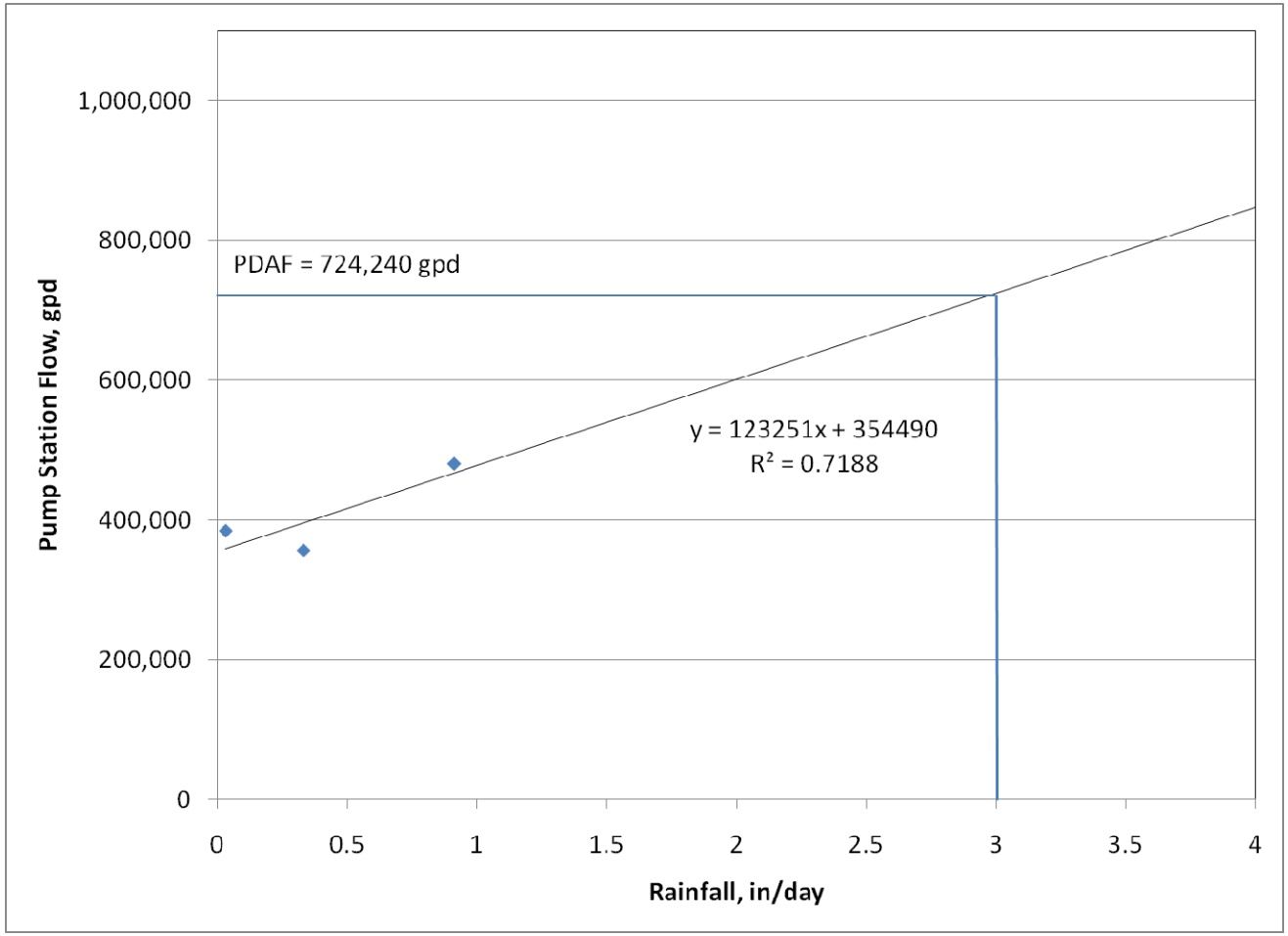
CITY OF TUKWILA
COMPREHENSIVE SANITARY SEWER PLAN



MMWWF DETERMINATION FOR LIFT STATION 12 (2009 DATA)

FIGURE 3.3

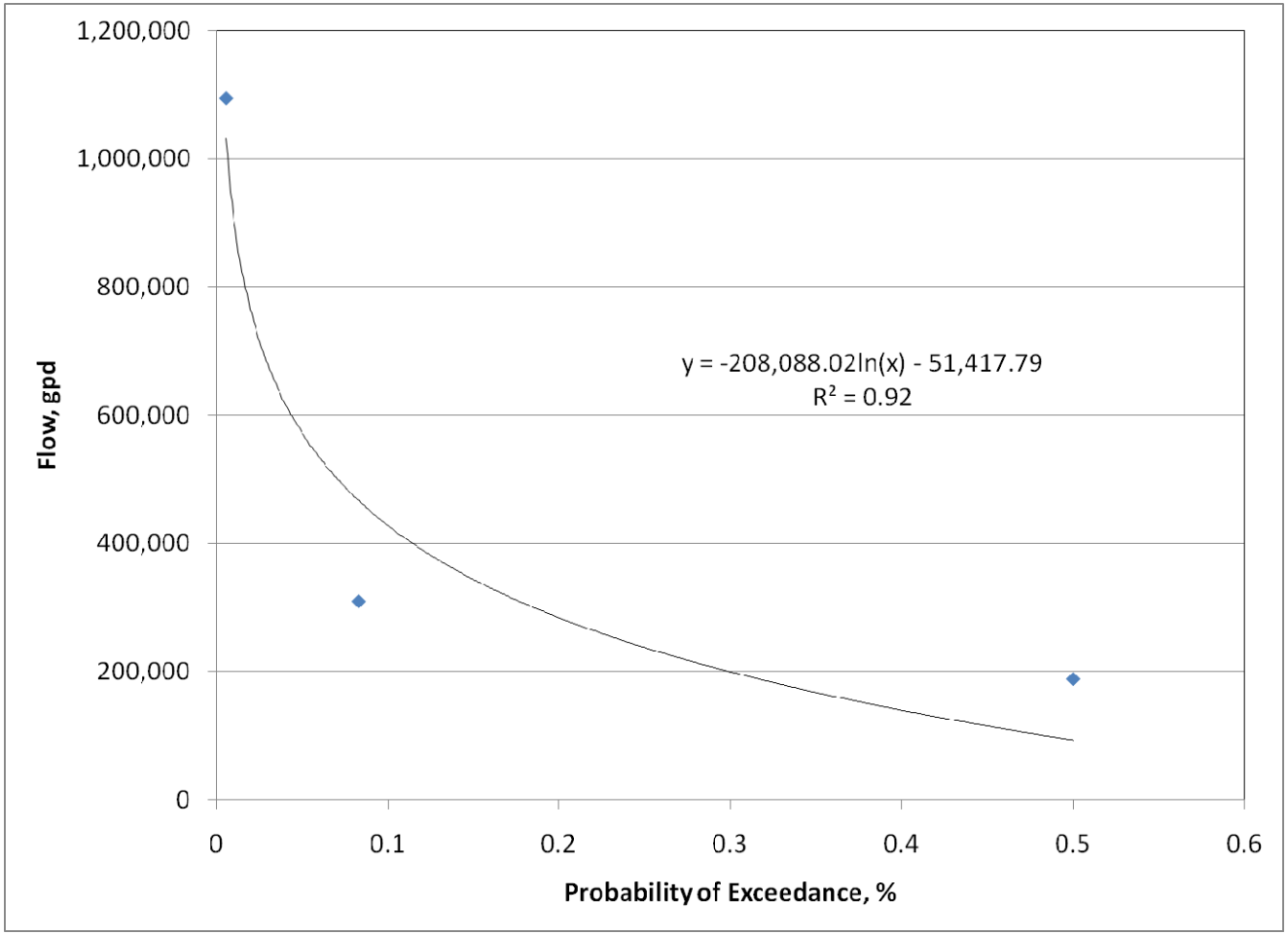
CITY OF TUKWILA
COMPREHENSIVE SANITARY SEWER PLAN



PDAF DETERMINATION FOR LIFT STATION 12 (2009 DATA)

FIGURE 3.4

CITY OF TUKWILA
COMPREHENSIVE SANITARY SEWER PLAN



PIF DETERMINATION FOR LIFT STATION 12 (2009 DATA)

FIGURE 3.5

CITY OF TUKWILA
COMPREHENSIVE SANITARY SEWER PLAN

Table 3.3 Summary of Existing Flows at Lift Station 12		
Flow Parameter	**Flow (gpd)**	**Peaking Factor**
Base Flow (June through October)	151,250	-
Average Annual Flow	187,630	1.2
Maximum Month Wet Weather Flow	308,960	2.0
Peak Daily Average Flow	724,240	4.8
Peak Instantaneous Flow	1,176,270	7.8

3.3.1.2 Recommended Service Area I/I Rate

The difference between the PDAF and base flow essentially equates to the additional infiltration and inflow experienced by each lift station's conveyance system during wet weather months. Based on the results of the Lift Station 12 analysis presented above, this amounts to 572,900 gpd. This I/I rate was divided by the service area of the Lift Station 12, excluding undeveloped parcels, resulting in an I/I per acre of approximately 1,950 gallons per acre per day (gpad). In comparison, the previous plan used 1,100 gpad to project peak flows in the Central Business District.

Based on the results of this analysis, it is recommended that an I/I contribution of 1,950 gpad be used to derive the PDAF within the sewer service area. PIF were calculated by multiplying the PDAF for each sewer basin by the ratio of the PIF to PDAF shown in Table 3.3. The peak flows derived are used in the conveyance system analysis presented in Chapter 5.

3.3.2 I/I Reduction Methods

Reduction of I/I in wastewater systems can be a difficult and costly task to undertake. Identifying specific sources, developing metrics for tracking the effectiveness of reduction measures, and balancing the cost against capacity projects are all major challenges.

Little data exists on the effectiveness of reducing I/I in terms of cost/benefit. One of the best sources of I/I data in the northwest is a study by King County, Washington, which began a Regional I/I Control Program in 1999. The program began with pilot-tests of I/I reduction techniques in nine sample basins. The results of their ongoing study provide useful information to wastewater agencies in the northwest. The following sections describe I/I reduction methods, which are largely based on the latest results of the King County I/I study.

3.3.2.1 Source Identification

The first step in I/I reduction is to identify the sources as closely as possible. As discussed above, I/I has many causes such as connected foundation drains, downspouts, leaking pipes, and leaking manholes. Identifying the causes of I/I entails narrowing down the probable location of occurrence. This effort begins at the basin level, and through inspection techniques, can be narrowed down to specific neighborhoods. Inspection techniques commonly include the following:

- Mainline closed-circuit television (CCTV) inspection.
- Smoke testing.

- Lateral/side sewer CCTV inspection.
- Visual inspection of manholes.

King County created and employed Sanitary System Evaluation Surveys (SSES) as encompassing surveys and data review for employing these techniques to identify causes of I/I in specific locations. A similar approach is recommended for the City in identifying sources of I/I.

After completing nine pilot projects focusing on I/I reduction, King County publicized the following results (*Regional Infiltration and Inflow Control Program Pilot Project Report*, King County, Washington, October 2004, p. 1-8):

- Sources and volumes of I/I can be identified through comprehensive wet-weather flow monitoring.
- Sewer system evaluation surveys (specifically CCTV inspections) are most effective when done in the wet-weather season.
- A high percentage of I/I tends to originate in side sewers and laterals.

3.3.2.2 Reduction Methods

Methods for reducing I/I include the following:

- Direct Disconnects: This includes disconnecting roof downspouts, yard drains, foundation drains, stormwater catch basins, and/or any connection to the wastewater system causing inflow. Disconnection of these items may require additional provisions for stormwater drainage.
- Replacement or Repair (R&R) of Pipes: This includes replacing or repairing public wastewater pipes, typically due to poor condition, root intrusion, and disconnected joints. Options for replacing pipes include open-cut trench construction or using trenchless technologies, such as pipe bursting or cured in-place pipe (CIPP). These options need to be assessed for local conditions, such pipe condition, adjacent utilities, and soil type.
- R&R of Manholes: Several options exist for sealing manholes and preventing infiltration through faulty joints and cracks. Alternatives include grouting, coating, installing a liner, and/or applying an external sealant.
- R&R of Laterals and Side Sewers: This includes replacing or repairing laterals and side sewers due to poor condition and the presence of infiltration. Faulty side sewers and laterals are often large contributors of I/I. Identifying and repairing multiple faulty laterals and side sewers on private property can be more difficult and expensive than repairing a public wastewater pipe. Because of their location on private properties, replacing or repairing side sewers involves the cooperation of property owners. Methods for repairing or replacing laterals and side sewers are similar to those described for public pipes. Trenchless technologies, which are far less obtrusive than open-cut trenches are effective for replacing laterals and side sewers while minimizing impacts to landscaping, yards, and driveways.

3.3.2.3 Evaluation of Methods

After completing nine pilot projects focusing on I/I reduction, King County publicized the following results:

- I/I can be reduced through sewer rehabilitation.
- Very little I/I reduction will likely result from manhole rehabilitation alone. For this reason, replacing or improving manholes is not recommended as a cost-effective method for I/I reduction and is not included in the recommendations that follow.
- Success of I/I control projects depends on a high level of cooperation with local agencies and private property owners.
- Rehabilitating sewer mains at the same time that side sewers and laterals are rehabilitated may be done for a relatively small increase in cost.

King County used the results of the Regional I/I Control Program Pilot Project to develop a Benefit/Cost Analysis Report, in which the effectiveness of specific I/I reduction techniques (or combinations thereof) were summarized. Table 3.4 presents the percent I/I reduction assumed for each of these techniques given the percent of the basin rehabilitated. As seen in the table, focusing on private property side sewers (with some direct disconnects) resulted in more I/I reduction than rehabilitating public sewers.

Table 3.4 Percent I/I Reduction for Specific Techniques[1]

Technique	% Basin Rehabilitated	% I/I Reduction
1. Direct disconnects	4%	10%
2. Replace everything and direct disconnects	95% Sewer Mains 95% Manholes 95% Laterals & Side Sewers 4% Direct Disconnects	80%
3. Replace public sewers and direct disconnects	50% Sewer Mains 50% Manholes 50% Laterals 4% Direct Disconnects	40%
4. Replace private property and some laterals and direct disconnects	50% Laterals & Side Sewers 45% Side Sewers only 4% Direct Disconnects	60%

Notes:

1. Source: King County Regional I/I Control Program Benefit/Cost Analysis Report, Earth Tech Team, November 2005, p. 3-30.

3.3.2.4 Flow Monitoring

Evaluating the effectiveness of I/I techniques requires flow monitoring data that can show the reduction in peak flows before and after a method is implemented. The quantity of I/I reduced can be compared to the cost of the employed I/I reduction technique to evaluate its cost-effectiveness. It is best to collect flow monitoring data in the wet weather period before and after an I/I reduction technique has been implemented.

Permanent and temporary flow meters can be used. Permanent flow meters typically provide more accuracy than temporary meters, due to differences in the type of meter and installation techniques. Temporary meters are more prone to move, causing changes in flow readings. Temporary meters are sometimes installed twice, before and after the I/I reduction technique has been implemented, when the meter is needed elsewhere. Slight changes in the first and second installations can compound the differences in before and after flow readings. However, temporary flow monitoring may be applicable when targeting I/I reduction in smaller sub-basins.

3.3.3 On-Going Collection System Improvements

The City has an aggressive I/I program. Every four years, the City investigates the entire sanitary sewer system using cameras to search for leaks and piping problems. The City commits $75,000 in the annual capital improvements program to repair leaks found during the investigation. Table 3.5 presents a summary of completed collection system projects since the last sewer system plan update.

Table 3.5 Summary of Completed I/I Projects

2005	Removed a leaking and broken manhole at 15315 64th Avenue South. Installed a new manhole with inside drop at this location.
2006	The City had Michels Pipe Services pressure grout 4 manholes that were leaking at 14116 55th Avenue South, Interurban Avenue South east of Pacific Pride Gas Station, 56th Place South and South 139th, and 56th Avenue South and South 147th street.
2007	The City had Nordic Construction install a 2 flap check valves in manholes on Andover Park West at Strander Blvd. to prevent flows from King County Sewers coming back into City owned sewer lines. Michels Pipe Services provided 3 point repairs on the sewer line in Industry Drive.
2008	The City had Michels Pipe Services pressure grout a leaking manhole in Baker Blvd. and remove a protruding tap at near Manhole #1012.
2009	The City had Brike Excavating and Underground pressure grout MH # 12 near 116644 44th Avenue South, coat the inside of manhole #390410 near 13735 Interurban Avenue South with Supercoat 2000 and install new ladder, coat the inside of manhole # 390411 near 13735 Interurban Avenue South with Supercoat 2000 and install a new ladder, coat the inside of manhole 39049 near 13735 with Supercoat 2000, install a new ladder and a in side drop. Michels Pipe Services pressure grout MH T-10 near 11835 44th Avenue South.
2010	The city had Green River Construction repair a sanitary sewer trench sinking near 13050 48th Avenue South, Green Earthworks Construction pressure grout a manhole near 17405 Southcenter Parkway and Michels Pipe Services pressure grout a leaking manhole at the end of South Wallace Street.

3.3.3.1 I/I Reduction Recommendation

It is recommended that the City continue with their current aggressive I/I Reduction Program. It is anticipated that this program will extend for many years. Costs for this program are provided in Chapter 7 – Capital Improvements Plan.

3.4 RECLAIMED WATER

The City has a contract to send all of its sewage to the King County Metro sewer system, placing prime responsibility to future wastewater reuse opportunities with the County, which is the final manager of the sewage.

Reclaimed water usage provides the City an opportunity to address future regulatory requirements, reduce potable water demand during peak use periods, reduce water quality impacts of treated effluent, offset irrigation withdrawal demands, and provide augmentation of groundwater resources. Wastewater reuse will further the City's environmental sustainability initiatives and reduce the discharge of treated effluent. The City has several potential end users for reclaimed water including golf courses, cemeteries, and parks.

This section presents a summary of reclaimed water usage by the City and projected reclaimed water usage for the City.

3.4.1 Reclaimed Water Purchases and Sales

The six most recent years of reclaimed water purchases from King County are shown in Table 3.6. Purchases have ranged from a low of 2,429 gpd in 2008 to a high of 10,731 gpd in 2006. In year 2008, Starfire did not irrigate their ballfields due to construction activities for expansion. Since the year 2008 is an outlier compared to the rest of the years, the average of shown in the table is calculated without including that data. This average is used for demand forecasting.

Table 3.6 Reclaimed Water Purchases 2005-2010, gpd

Month	2005	2006	2007	2008	2009	2010	Average[(1)]
January	45	-	-	-	-	-	9
February	-	-	-	-	4	-	1
March	-	-	-	-	-	139	28
April	12	150	109	105	381	232	177
May	8	685	619	527	506	492	462
June	1,463	1,506	2,209	207	1,922	670	1,554
July	1,908	2,092	1,752	14	1,705	1,172	1,726
August	2,338	3,703	2,058	-	1,154	1,670	2,185
September	2,519	2,187	1,400	2	689	1,539	1,667
October	1,160	387	8	47	531	445	506
November	-	20	-	-	-	64	17
December	6	-	-	1,527	-	-	1
Annual Average	**9,460**	**10,731**	**8,155**	**2,429**	**6,892**	**6,423**	**8,332**

Notes
(1) Does not include 2008 data.

The average monthly distribution of reclaimed water is presented in Figure 3.6. Reclaimed water is purchased almost exclusively for irrigation of ballfields at the Starfire sports complex. Therefore, the purchases are centered on the summer months, with little or no purchases in the non-summer months. Within the summer months, reclaimed water purchases form a bell curve that peaks in August.

Reclaimed water sales are nearly identical to reclaimed water purchases. There is essentially no non-revenue water for the reclaimed water system. This is not unexpected as the system infrastructure is new and the types of uses that make up non-revenue water, such as water system flushing and leaks, are not common in a new reclaimed water system.

3.4.2 Projected Reclaimed Water Usage

The existing and potential reclaimed water customers are presented in Figure 3.7. Reclaimed water demand was projected by estimating that the new customers will grow at the same rate as the City's commercial customers and two new customers are assumed to be served by year 2016. The two new customers are:

- ***Seattle Rendering Plant*:** The plant is currently served by potable water from the King County Water District (KCWD) 125. Billing records from KCWD125 show the demand from this customer to be 59,573 gpd on an average annual basis.
- ***Foster Golf Course:*** The golf course is currently irrigated using the existing water right on Green River. City staff generated an estimate of 99,438 gpd average annual demand, or 167,000 gpd during the main irrigation season of April to October, for the golf course.

Table 3.7 presents a summary of reclaimed water projections for the City.

Currently, the City has infrastructure in place to supply both Seattle Rendering plant and Foster Golf Course. There is no cost anticipated in conveying the reclaimed water. Long term, the City would like investigate opportunities west of Fort Dent Park (Starfire) and Foster Golf Course and south of I-405 as presented in Figure 3.7.

Table 3.7 Reclaimed Water Projections, gpd

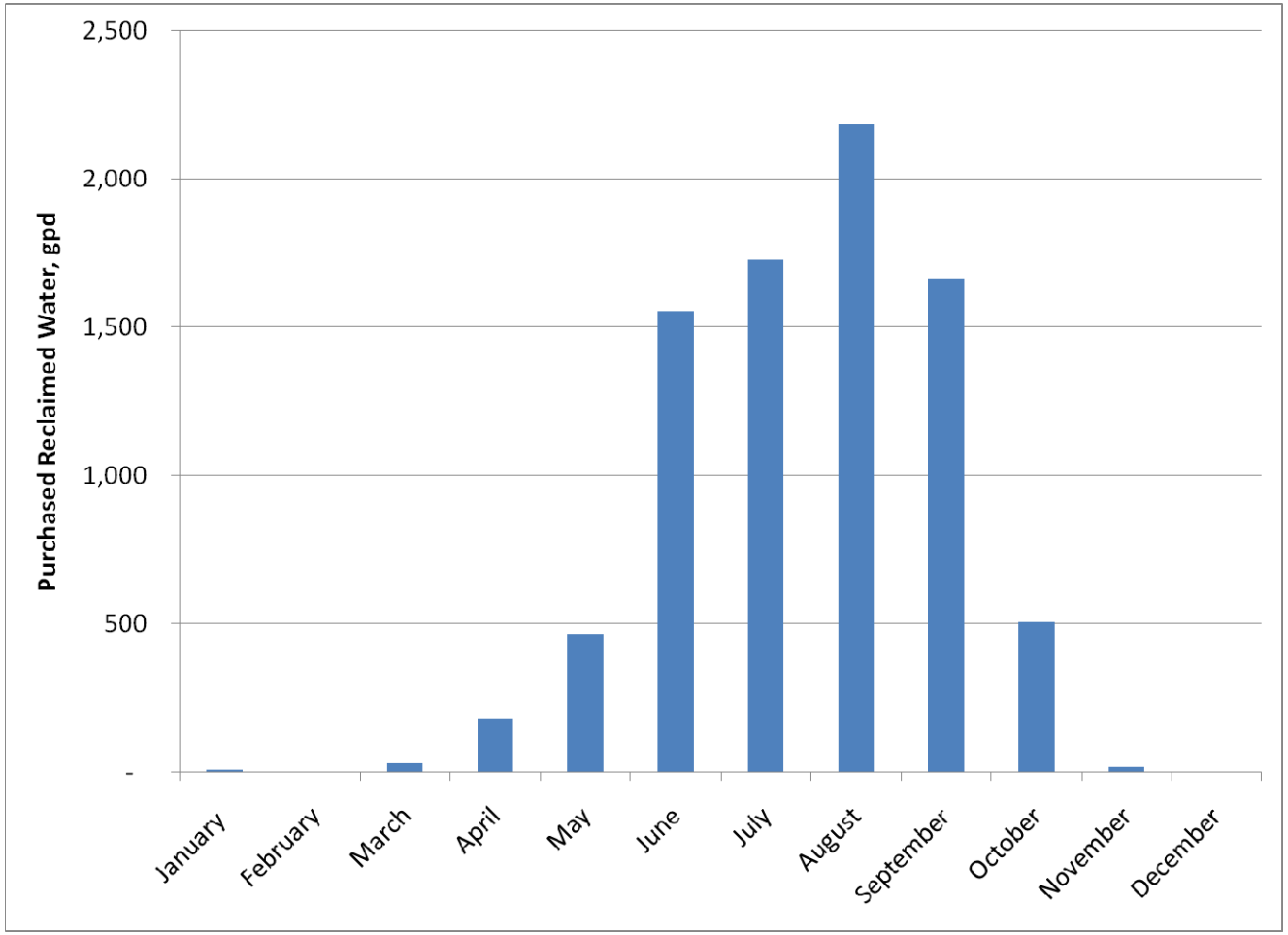
Reclaimed Water Usage	2011	2012	2013	2014	2015	2016	2020	2030
Reclaimed Water Usage Increase based on % Increase in Commercial Customer Class	7,092	7,756	8,417	9,009	9,589	10,155	10,989	12,845
Seattle Rendering Plant	-	-	-	-	-	59,573	59,573	59,573
Foster Golf Course	-	-	-	-	-	99,438	99,438	99,438
Total Reclaimed Water Usage	**7,092**	**7,756**	**8,417**	**9,009**	**9,589**	**169,166**	**170,000**	**171,856**

3.5 Flow Projections with Water Use Efficiency Savings

In 2008, Cascade Water, which is the major supply source for the City, adopted a six-year conservation savings goal (2008-2013) of one million gallons per day. For the City, this water use efficiency (WUE) goal for conservation translated to achieve a savings of 52,000 gallons of water per day on an average annual basis compared to the current usage by December 31, 2013. Beyond year 2013, the City goal is to achieve an annual one percent reduction in water demand through the planning period. Reductions in water use will decrease the base sanitary sewer flows. However, WUE is not expected to affect I/I, which can contribute up to 7.8 times more flow than the base flow. Base sanitary flows were projected considering reduced water use in line with the WUE program goals using the methodology described in Section 3.2. The projected base sanitary flows are presented in Table 3.8.

Table 3.8 Projected Base Sanitary Sewer Flows for the Planning Period with Water Use Efficiency

Customer Class	2009	2016	2020	2030
Single-family	156,044	214,476	223,852	238,179
Multi-family	195,756	768,187	900,477	1,149,452
Commercial	797,916	1,410,031	1,522,161	1,753,609
Total	**1,149,716**	**2,392,693**	**2,646,489**	**3,141,240**



MONTHLY DISTRIBUTION OF RECLAIMED WATER

FIGURE 3.6

CITY OF TUKWILA
COMPREHENSIVE SANITARY SEWER PLAN

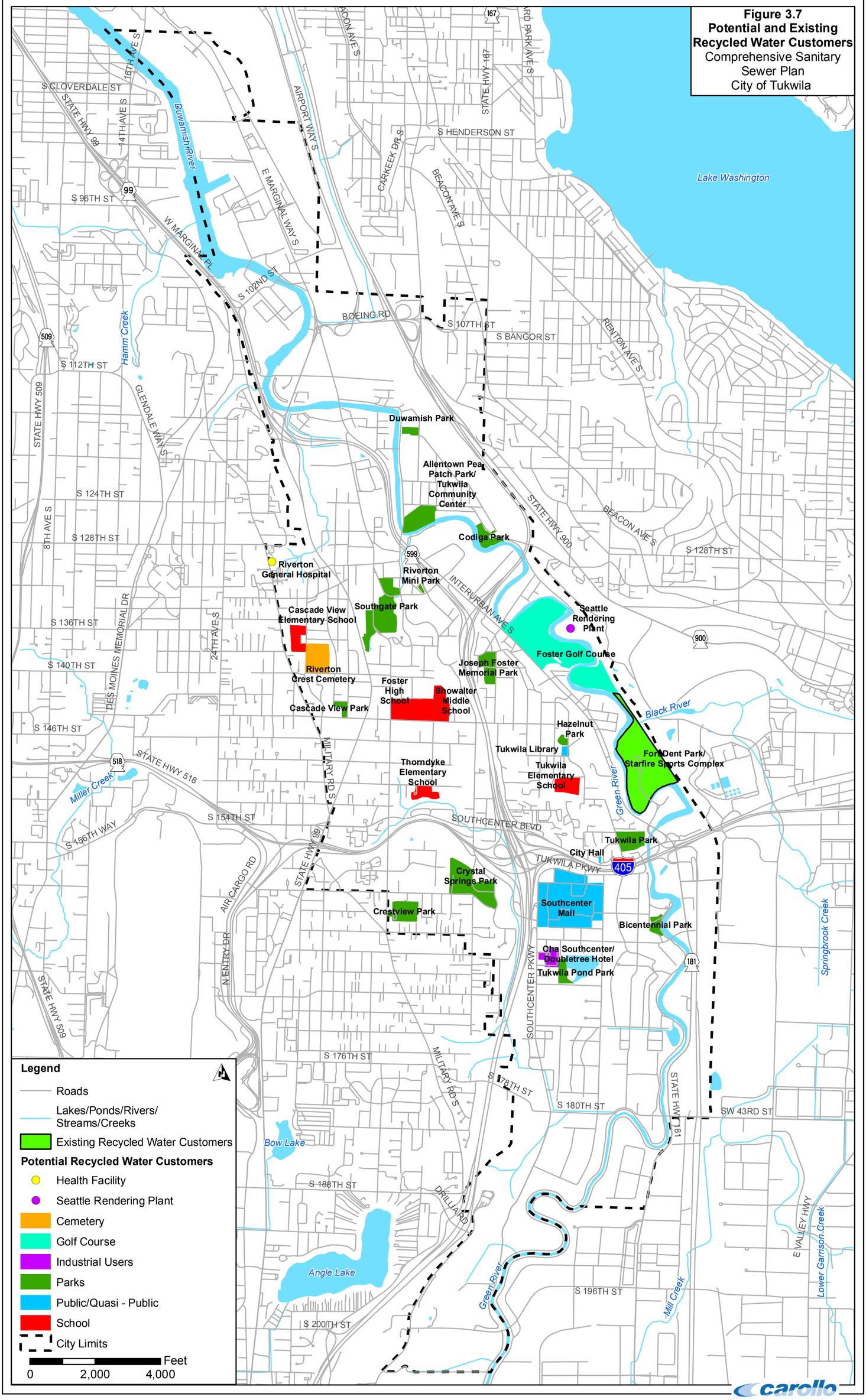


Figure 3.7
Potential and Existing
Recycled Water Customers
Comprehensive Sanitary
Sewer Plan
City of Tukwila
Lake Washington
Duwamish River
Hamm Creek
Miller Creek
Black River
Green River
Springbrook Creek
Mill Creek
Lower Garrison Creek
Bow Lake
Angle Lake
S CLOVERDALE ST
S 96TH ST
S 102ND ST
BOEING RD
S 107TH ST
S BANGOR ST
S HENDERSON ST
S 112TH ST
S 124TH ST
S 128TH ST
S 136TH ST
S 140TH ST
S 146TH ST
S 154TH ST
S 156TH WAY
S 176TH ST
S 178TH ST
S 180TH ST
S 188TH ST
S 196TH ST
S 200TH ST
SW 43RD ST
SOUTHCENTER BLVD
TUKWILA PKWY
SOUTHCENTER PKWY
W MARGINAL PL
E MARGINAL WAY S
AIRPORT WAY S
CARKEEK DR S
BEACON AVE S
RENTON AVE S
STATE HWY 99
STATE HWY 167
STATE HWY 509
STATE HWY 518
STATE HWY 900
STATE HWY 181
16TH AVE S
14TH AVE S
8TH AVE S
GLENDALE WAY S
DES MOINES MEMORIAL DR
24TH AVE S
INTERURBAN AVE S
MILITARY RD S
AIR CARGO RD
N ENTRY DR
DRILLIARD RD
E VALLEY HWY
Duwamish Park
Allentown Pea Patch Park/ Tukwila Community Center
Codiga Park
Riverton General Hospital
Riverton Mini Park
Cascade View Elementary School
Southgate Park
Riverton Crest Cemetery
Cascade View Park
Foster High School
Showalter Middle School
Joseph Foster Memorial Park
Seattle Rendering Plant
Foster Golf Course
Hazelnut Park
Tukwila Library
Tukwila Elementary School
Thorndyke Elementary School
Fort Dent Park/ Starfire Sports Complex
Tukwila Park
City Hall
Crystal Springs Park
Crestview Park
Southcenter Mall
Bicentennial Park
Cha Southcenter/ Doubletree Hotel
Tukwila Pond Park
Legend
Roads
Lakes/Ponds/Rivers/ Streams/Creeks
Existing Recycled Water Customers
Potential Recycled Water Customers
Health Facility
Seattle Rendering Plant
Cemetery
Golf Course
Industrial Users
Parks
Public/Quasi - Public
School
City Limits
Feet
0
2,000
4,000
carollo

CHAPTER 4

EXISTING SYSTEM

4.1 INTRODUCTION

This chapter presents an overview of the City's existing sewer system and summarize the inventory of piping and pump stations in the City's current collection system. This chapter also presents a brief discussion on selected administrative and planning issues related to operations and future expansion which this Comprehensive Sanitary Sewer Plan has been prepared. This chapter relies on the information provided by the City staff and the City's 2005 Sewer System Plan Update completed by HDR Engineering.

The Tukwila sewer system is owned and operated by the City. The system currently consists of ten lift stations in the City served 20 drainage basins. The City maintains a total of 25 connections with King County WTD trunk lines. The City also discharged to Seattle system that is ultimately conveyed to the King County system. The City has an agreement with King County WTD for conveyance and treatment of the City's wastewater at the South Wastewater Treatment Plant per agreement in Appendix D.

4.2 KING COUNTY WTD FACILITIES AND CITY CONNECTIONS

Major King County WTD facilities within the City's existing sewer service area include gravity and force mains of various diameters, and the Interurban Pumping Station as shown in Figure 4.1. King County WTD's South WWTP is located outside of the service area just to the east of Drainage Basin No. 3.

One major (42-inch diameter) gravity trunk line enters the City's service area at its northern boundary with the City of Seattle and runs along East Marginal Way and Puget Sound Energy's right of way to the Green River. From there, wastewater is pumped via two, parallel 12-inch force mains that cross the City and then run generally along the eastern city limits to King County WTD's South WWTP.

A second major trunk line begins as a 48-inch pipe just north of South 118th Street (in the Burlington Northern Santa Fe Railroad [BNSF RR] right of way) and runs south to and across the Green River where it changes to a 54-inch diameter pipe. From there it runs adjacent to Interurban Avenue to the Interurban Pumping Station located at the intersection of Interurban Avenue and 57th Avenue South. Two 24-inch force mains transport wastewater from the pumping station along Interurban Avenue and under the Green River to the King County's South WWTP.

The City has numerous connections with King County WTD trunk lines. The City has an agreement with King County WTD for conveyance and treatment of the City's wastewater at the South Plant per agreement in Appendix D.

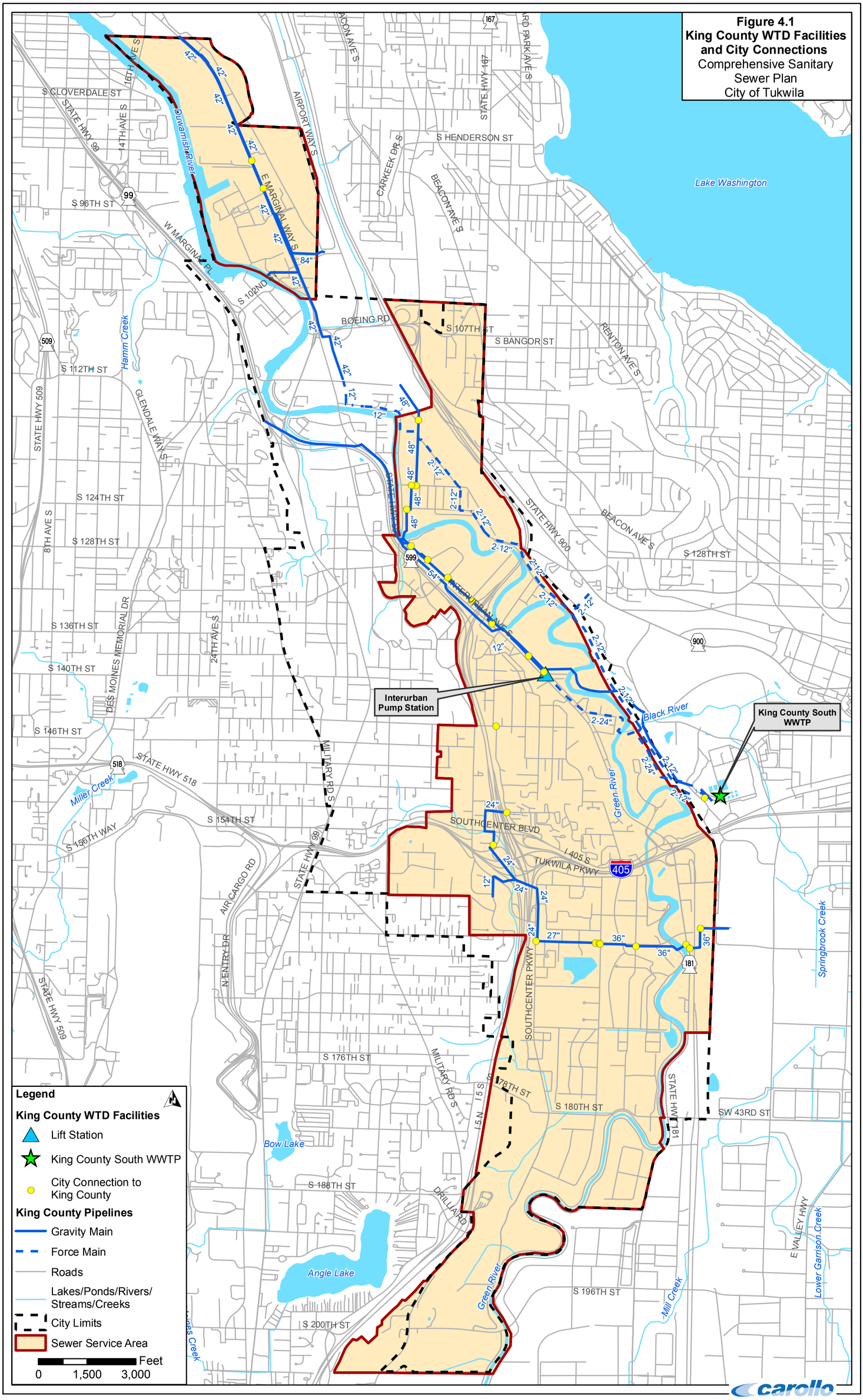


Figure 4.1
King County WTD Facilities and City Connections
Comprehensive Sanitary Sewer Plan
City of Tukwila
Lake Washington
Duwamish River
Hamm Creek
Miller Creek
Bow Lake
Angle Lake
Black River
Green River
Springbrook Creek
Lower Garrison Creek
Mill Creek
Interurban Pump Station
King County South WWTP
S CLOVERDALE ST
S 96TH ST
S 102ND
BOEING RD
S 107TH ST
S BANGOR ST
S HENDERSON ST
S 112TH ST
S 124TH ST
S 128TH ST
S 136TH ST
S 140TH ST
S 146TH ST
S 154TH ST
S 156TH WAY
S 176TH ST
S 178TH ST
S 180TH ST
S 188TH ST
S 196TH ST
S 200TH ST
SW 43RD ST
SOUTHCENTER BLVD
TUKWILA PKWY
I-405 S
INTERURBAN AVE S
MILITARY RD S
STATE HWY 99
STATE HWY 509
STATE HWY 518
STATE HWY 900
STATE HWY 181
AIRPORT WAY S
E MARGINAL WAY S
W MARGINAL PL
BEACON AVE S
RENTON AVE S
GLENDALE WAY S
DES MOINES MEMORIAL DR
AIR CARGO RD
N ENTRY DR
SOUTHCENTER PKWY
DRILLIARD
E VALLEY HWY
Legend
King County WTD Facilities
Lift Station
King County South WWTP
City Connection to King County
King County Pipelines
Gravity Main
Force Main
Roads
Lakes/Ponds/Rivers/ Streams/Creeks
City Limits
Sewer Service Area
Feet
0
1,500
3,000
carollo

4.3 DRAINAGE BASINS

Because of the many annexations that have occurred in the past, the assumption of sewer service from other providers, the topographic challenges for sewer system design and construction, as well as development pressures, the existing sewer system is particularly complex. The City's sanitary sewer service area is composed of 20 separate drainage basins, delineated as shown in Figure 4.2. Figure 4.2 also presents the lift stations in the drainage basins. The basin numbers are from the 2005 Plan remain and the basins not served by the City in the future service area have been removed from the plan. The figure also presents a simplified system map with major piping and lift stations from each basin to illustrate wastewater flow to the King County WTD facilities.

A full size system map with detailed piping is presented in Appendix E.

Table 4.1 presents a summary of the drainage basins including neighborhood, area, demographics, lift stations and King County connections.

A general description of each basin is presented in this section.

4.3.1 Drainage Basin No. 1

Drainage Basin No. 1 is in the vicinity of the Gateway Drive area in the north central part of the City. Its northerly and easterly boundaries follow the 1988 city limits. Its southerly boundary is in the vicinity of 48th Avenue South. A portion of the drainage area is west of Interurban Avenue South.

Land use in Basin No. 1 is largely commercial. The area is mostly served by gravity and flows west into the King County WTD trunk lines via connections. The basin also receives wastewater from a portion of Drainage Basin No. 20 via a 4-inch force main from the BNSF RR pump station located across the Green River.

Pump Station No. 9 serves the Tukwila Commercial Park development and discharges directly to the King County WTD trunk line via a 6-inch force main.

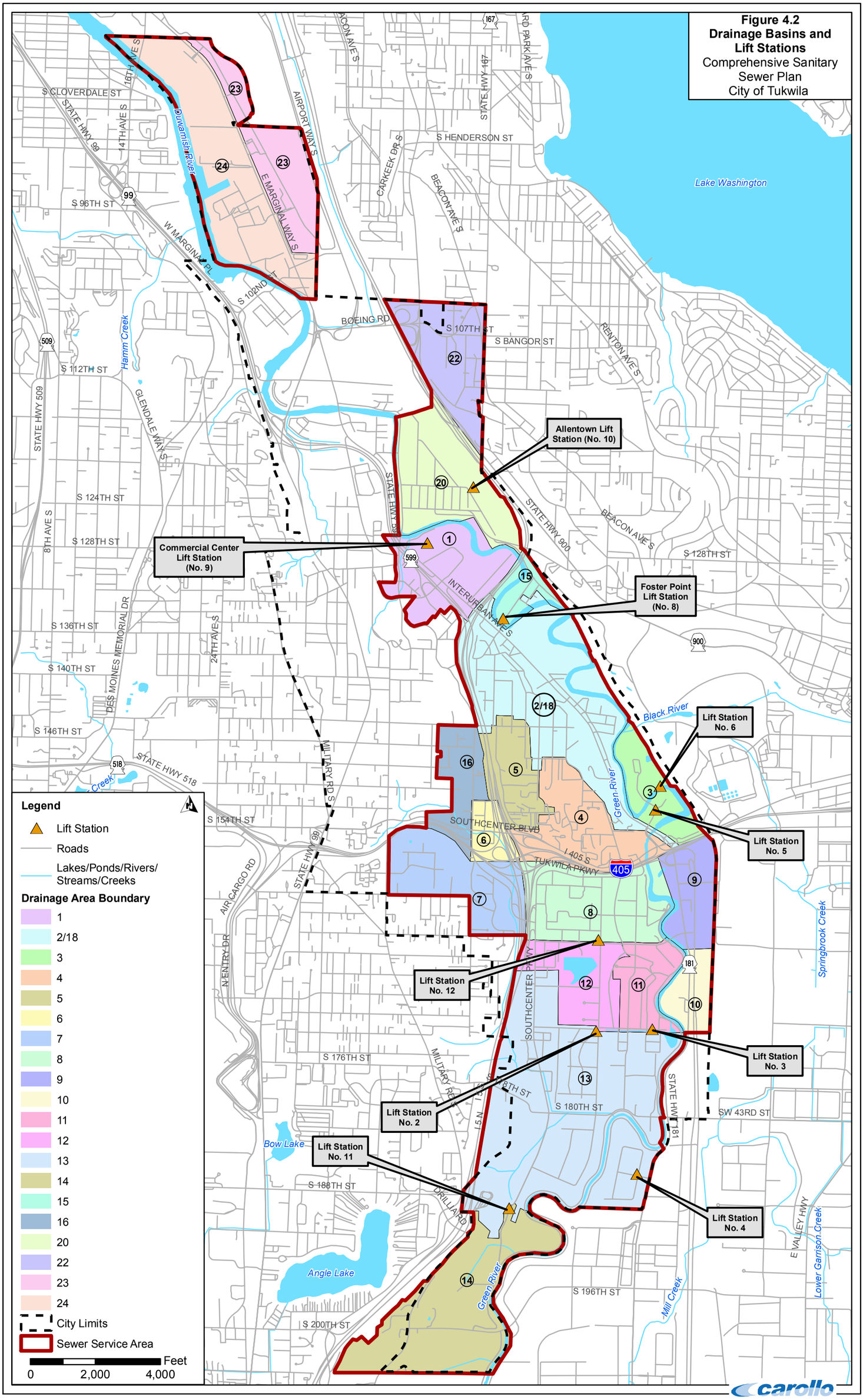


Figure 4.2
Drainage Basins and Lift Stations
Comprehensive Sanitary Sewer Plan
City of Tukwila
Lake Washington
Duwamish River
Hamm Creek
Black River
Green River
Springbrook Creek
Mill Creek
Lower Garrison Creek
Bow Lake
Angle Lake
Allentown Lift Station (No. 10)
Commercial Center Lift Station (No. 9)
Foster Point Lift Station (No. 8)
Lift Station No. 6
Lift Station No. 5
Lift Station No. 12
Lift Station No. 3
Lift Station No. 2
Lift Station No. 11
Lift Station No. 4
S CLOVERDALE ST
S 96TH ST
S 102ND
BOEING RD
S 107TH ST
S BANGOR ST
S HENDERSON ST
S 112TH ST
S 124TH ST
S 128TH ST
S 136TH ST
S 140TH ST
S 146TH ST
S 154TH ST
S 176TH ST
S 180TH ST
S 188TH ST
S 196TH ST
S 200TH ST
SW 43RD ST
SOUTHCENTER BLVD
TUKWILA PKWY
I-405 S
INTERURBAN AVE S
BEACON AVE S
RENTON AVE S
E MARGINAL WAY S
W MARGINAL PL
AIRPORT WAY S
CARKEEK DR S
GLENDALE WAY S
8TH AVE S
14TH AVE S
16TH AVE S
24TH AVE S
DES MOINES MEMORIAL DR
MILITARY RD S
AIR CARGO RD
N ENTRY DR
DRILLIARD
E VALLEY HWY
STATE HWY 99
STATE HWY 509
STATE HWY 518
STATE HWY 900
STATE HWY 167
STATE HWY 181
Legend
Lift Station
Roads
Lakes/Ponds/Rivers/ Streams/Creeks
Drainage Area Boundary
1
2/18
3
4
5
6
7
8
9
10
11
12
13
14
15
16
20
22
23
24
City Limits
Sewer Service Area
Feet
0
2,000
4,000
carollo

Table 4.1 Drainage Basins

Drainage Basins	Neighborhood	Area, acres	Primary Land Use	Pump Stations	King County Connections	Miles of Sewers	Sewer Service Provider
1	Foster	189	Commercial	9	4	1.02	Tukwila
2/18	Tukwila Hill	381	Residential	7	3	7.04	Tukwila
3	Tukwila Hill	94	Residential	5, 6	-	0.78	Tukwila
4	Tukwila Hill	160	Residential	-	-	3.20	Tukwila
5	Tukwila Hill	89	Residential	-	3	1.29	Tukwila
6	Thorndyke	23	Residential	-	1	0.11	Tukwila
7	McMicken	235	Residential	-	-	0.00	Valley View
8	Central Business District (CBD)	180	Commercial	12	-	2.35	Tukwila
9	CBD	83	Commercial	-	3	1.02	Tukwila
10	CBD	134	Commercial	-	-	0.52	Tukwila and Renton
11	CBD	96	Commercial	3	1	1.51	Tukwila
12	CBD	133	Commercial	-	4	1.24	Tukwila
13	CBD	673	Commercial	2, 4	-	5.27	Tukwila
14	Segale	363	Residential	-	-	0.00	No service
15	Foster Point	55	Residential	8	-	0.57	Tukwila
16	Thorndyke & Cascade View	425	Residential	-	-	0.00	Valley View
20	Allentown	223	Residential	-	4	4.14	Tukwila
22	Ryan Hill	116	Residential	-	-	0.97	Tukwila
23	Manufacturing Industrial Center	169	Commercial	-	2	0.00	Tukwila
24	Manufacturing Industrial Center	373	Commercial	10	-	0.02	Tukwila

4.3.2 Drainage Basin No. 2/18

Drainage Basin No. 2/18 is also in the north central part of the City. It is bounded on the north and east by the Green River and on the south by South 154th Street. The westerly boundary is irregular, generally following 55th Avenue South, 57th Avenue South, South 147th Street and the easterly boundary of I-5 in the northern most reach. The basin is mostly residential with some commercial uses.

Most of the basin is served by 8-inch gravity mains. The south end sewers drain to Tukwila's Lift Station No. 7 located north of South 147th Street and adjacent to Interurban Avenue South. Lift Station No. 7 discharges via a 6-inch force main to an 8-inch gravity main located in Interurban Avenue South, where it flows to King County WTD's 54-inch trunk line and subsequently to King County WTD's Interurban Pumping Station. This station will be abandoned in 2011.

A 12-inch gravity main also serves the south end of Basin No. 2/18. This line runs east of and parallel to Interurban Avenue South. It ultimately discharges to the King County WTD trunk line below the Interurban Pumping Station. The remainder of Basin No. 2/18 drains by gravity directly to the King County WTD trunk line and the Interurban Pumping Station.

4.3.3 Drainage Basin No. 3

Basin No. 3 includes Fort Dent Park and the low-lying green belt areas along the Green River. Its boundaries are highly irregular, but generally are as follows: The southern and easterly boundaries are Interstate 405 (I-405) and the city limits, respectively. The Green River bounds the northern most reach of the drainage area and Interurban Avenue South bounds a small reach in the southwest section of the basin between I-405 and the Green River. There is a small meander of the Green River in the southern part of the drainage area.

The area within the Green River meander drains by gravity to the City's Lift Station No. 6. From there it is pumped via a 4-inch force main across the river to an 8-inch gravity main where it then flows by gravity to the treatment plant connection.

Lift Station No. 5 pumps wastewater via a 4-inch force main to an 8-inch gravity in Drainage Basin 2/18.

4.3.4 Drainage Basin No. 4

Drainage Basin No. 4 is bounded generally by South 147th Street on the north, 57th Avenue South on the west, I-405 on the south and on the east by the irregular boundary between I-405 and South 147th Street, as described for Drainage Basin No. 2/18. The basin includes single-and multi-family units as well as the Tukwila City Hall and several restaurants and office buildings.

Conveyance in Basin No. 4 is provided largely by 8-inch gravity mains. Wastewater is conveyed by gravity to Southcenter Boulevard and across I-405 via a 12-inch pipe to Drainage Basin No. 8. The City is exploring to add an additional lift station to eliminate this 12-inch pipe under I-405 due to maintenance issues.

4.3.5 Drainage Basin No. 5

This drainage basin is located generally adjacent to Basin No. 4. It is bounded on the north by South 144th Street, on the south by I-405, on the west by I-5 and on the east by 56th and 57th Avenues South. The basin is in a residential area. Wastewater is conveyed by 8-inch gravity mains to the King County WTD line along Macadam Road South.

4.3.6 Drainage Basin No. 6

Basin No. 6 is a small basin just to the west of I-5 and north of State Route (SR) 518. It is bounded on the west by 51st Avenue south and on the north by South 151st Street. Sanitary sewer service consists of 8-inch pipelines that discharge directly to King County WTD lines located within the basin.

4.3.7 Drainage Basin No. 7

Basin No. 7 is just south of SR 518 and west of I-5. Tukwila International Boulevard forms its short, most westerly boundary and its southern boundary traverses South 160th Street, South 164th Street and South 168th Street. Service to this drainage area is provided by Valley View Sewer District. However, a significant area within the basin is on septic tanks and will potentially be sewered by the City.

4.3.8 Drainage Basin No. 8

Basin No. 8 covers the Southcenter Shopping Center. It is bounded on the north by I-405, on the west by I-5, on the south by Strander Boulevard and on the east by the Green River. Generally, wastewater is conveyed by 8-, 12- and 14-inch gravity pipelines to Tukwila's Lift Station No. 12 located at the intersection of Strander Boulevard and Andover Park West. A private lift station discharges into the City's conveyance system in the northwest corner of the basin. Lift Station Number 12 discharges into the King County WTD interceptor at the Strander Boulevard intersection.

4.3.9 Drainage Basin No. 9

This basin is east of Basin No. 8, across the Green River. It is bounded generally by the river on the west, the city limits on the east and I-405 on the north. The south boundary is just south of Strander Boulevard. The basin serves light industrial customers. Wastewater flows by gravity via 8-and 12-inch pipelines directly to King County WTD's 36-inch interceptor that leads to its East Plant.

4.3.10 Drainage Basin No. 10

Drainage Basin No. 10 is east of the Green River. It is bounded generally by the southern boundary of Basin No. 9 (extension of Strander Boulevard) on the north, the river on the west, South 180th Street on the south and the city limits (BNSF RR right of way) on the east. It is comprised of light industrial uses. Sewer service consists primarily of a 12-inch pipeline that flows by gravity from the extension of Minkler Boulevard (Costco Boulevard) to the 36-inch King County WTD interceptor along Strander Boulevard.

The lower portion of this drainage (below the extension of Minkler Boulevard) is currently served by the City of Renton.

4.3.11 Drainage Basin No. 11

This basin is located southeast of the Southcenter Shopping Center. It is bounded by Strander Boulevard on the north, the Green River on the east and Minkler Boulevard on the South. The western boundary is roughly halfway between Andover Park West and Andover Park East. Basin No. 11 is made up of largely commercial and light industrial uses.

Wastewater from customers in the southeast corner of the basin is conveyed by 8-inch gravity mains to the City's Lift Station No. 3 located near the City Shops. Lift Station No. 3 pumps wastewater via a 4-inch force main to an 8-inch gravity line in Andover Park East that then flows north to a 10-inch main and hence to the King County WTD interceptor on Strander Boulevard.

4.3.12 Drainage Basin No. 12

This basin is located directly south of the Southcenter Shopping Center, between Strander and Minkler Boulevards. On the east, Basin No. 12 is adjacent to Basin No. 11. The western boundary of Basin No. 12 starts at a point on Minkler Boulevard that is about 1,200 feet west of Andover Park West. From this point the boundary line extends north for a distance of about 1,400 feet, where it then turns west to I-5. The basin consists of office buildings and commercial and light industrial development. It is served by 8-, 12- and 21-inch sewers. Wastewater generated in the area flows by gravity to the King County WTD interceptor on Strander Boulevard.

4.3.13 Drainage Basin No. 13

Basin No. 13 is the largest in the City's sanitary sewer system. It serves all of the southern area of the City below Minkler Boulevard to the Green River on the east and to the vicinity of South Glacier Street on the south. The western boundary is I-5. Uses in the area include commercial, light industrial, and heavy industrial. The Shasta Bottling Plant and Costco Food Plant are located in this basin.

Conveyance in Basin No. 13 consists of 8-, 10-, 12-, 15- and 18-inch pipelines. Lift Station No. 4 collects wastewater from the southeast corner of the basin and pumps it north across the Green River via a 6-inch force main to the gravity sewer system on South 180th Street.

Most of the sewers in Basin No. 13 flow by gravity to the City's Lift Station No. 2 located at the intersection of Minkler Boulevard and Andover Park West. Lift Station No. 2 pumps wastewater to the 21-inch gravity sewer along Andover Park West in Drainage Area No. 12 that eventually flows to the King County WTD interceptor in Strander Boulevard.

The area south of South 178th Street and west of Southcenter Parkway was recently sewered since the last master plan as part of the Tukwila Valley South Project. The wastewater flow generated in this area is pumped via Lift Station No. 4 to the existing 12-inch gravity line within the basin and ultimately to the King County WTD interceptor in Strander Boulevard.

4.3.14 Drainage Basin No. 14

Drainage Basin No. 14 is at the very south end of the city and is bounded by the Green River on the east, I-5 on the west, and generally South 188th and 204th Streets on the north and south, respectively.

The area is currently under development by Segale Properties. As a part of this development a gravity sewer, is being constructed from the vicinity of 200th Street north connect with the existing system at the corner of Minkler Boulevard. and Southcenter Parkway. A lift station will be located approximately at the mid point of this gravity sewer to prevent excessive depths, flat sewer slopes or both. This lift station will discharge wastewater to the Lift Station No. 2.

4.3.15 Drainage Basin No. 15

This is a small basin that consists largely of the Foster Point area. This area was sewered in 2007 and mostly consists of 8-inch sewers. The sewers drain to Tukwila's Lift Station No. 8 located on 56th Avenue South. The Lift Station No. 8 discharges via a 4-inch force main to the King County WTD interceptor.

4.3.16 Drainage Basin No. 16

Drainage Basin No. 16 is served entirely served by Valley View Sewer District.

A small area in the eastern sector of the new drainage, between 51st Avenue South and I-5, remains on septic systems. The City plans serve this area as shown in Figure 2.2 (Chapter 2).

4.3.17 Drainage Basin No. 20

Basin No. 20 consists largely of the Allentown area of the City. It is bounded by South 116th Street on the north, I-5 on the east, and the Green River on the west and south. The area is largely residential.

A 48-inch King County WTD interceptor runs north-south through the basin from South 116th Street to a siphon crossing on the Green River, where it connects to King County WTD's 54 inch trunk line in Drainage Basin No. 1. Eight-inch gravity pipelines in the basin also flow to connections with the King County WTD line. A new lift station, No. 10, was constructed in 2007. The Lift Station No. 10 discharges via a 4-inch force main to the King County WTD interceptor.

4.3.18 Drainage Basin No. 22

Drainage Basin No. 22 serves the residential area of Ryan Hill, bounded generally by I-5 on the west and south and the city limits on the north and east. Much of the basin is unsewered.

Existing service in those portions of the basin that are sewered consists of 8- and 12-inch gravity lines in several locations. These gravity lines drain to the two connections to existing 18- and 24-inch Seattle system that ultimately conveys to the King County system WTD mains located in Martin Luther King Way.

4.3.19 Drainage Basins Nos. 23 and 24

Basins Nos. 23 and 24 are located on the east and west side of East Marginal Way, respectively, northwest of Basin No. 21. Most of the industrial and commercial customers in these basins are served directly by King County WTD's 42-inch trunk line in East Marginal Way.

4.4 LIFT STATIONS

The City owns and operates ten lift stations within the drainage basins described in Section 4.3. An additional lift station is planned for the future in the Tukwila South area (Drainage Basin No. 14). Table 4.2 summarizes the location and key features of each station.

4.5 EXISTING SEWERS

The City has approximately 38.8 miles of sewer lines. Pipe diameters range from 4 to 36 inches, and the pipe materials include mostly concrete. An inventory of the existing sewers in the City's system, excluding private laterals, is provided in Table 4.3. This inventory is based on the 2009 Sewer Plant and Equipment List provided by the City with additional pipe information from the recently completed Lift Station 11 project.

4.6 EXISTING DOMESTIC OR INDUSTRIAL WASTEWATER TREATMENT FACULTIES

The City and surrounding area contains existing domestic or industrial wastewater treatment facilities that have the potential to discharge into the City system or nearby King County interceptors. Table 4.4 lists existing domestic or industrial wastewater treatment facilities located within twenty miles of the general plan area and within the same topographic drainage basin containing the general plan area. The table provides the facility name, identification number, facility type and receiving sewer authority. As shown in the Table, the majority of treatment facilities discharge into the City of Tukwila system.

Table 4.2 Lift Stations

Lift Station	Drainage Basin	Pump No.	HP	Rated Capacity (gpm)	TDH (feet)	Firm Capacity (gpm)	Pump Model	Pump Manufacturer	Year Constructed/ Rehabilitated	Emergency Power	Location
2	13	1 2 3	10 10 10	800 800 800	25	1600	6NHTA VFB	Cornell	1987	Yes On-Site	1105 Andover Park West
3	11	1 2	4 4	100 100	21	100	4NWTLH M3-8	Cornell	Moved Lift Station 5 pumps in 2005	Yes Plug-In	550 Minkler Boulevard.
4	13	1 2	7.5 7.5	250 250	42	250	4NNDH-RH UM 7-1/2-6	Cornell	New pumps and motors in 2009	Yes Plug-In	6790 Todd Boulevard.
5	3	1 2	3 3	120 120	26	120	4NMTL HUM 3-6	Cornell	New pumps in 2002	Yes On-Site	6830 Fort Dent Way
6	3	1 2	5 5	150 150	30	150	4NMTR HUM 3-6	Cornell	New pumps in 1999	Yes On-Site	6820 Fort Dent Way
7	Abandoned										
8	15	1 2	2 2	110 110	29	110	130-4095-1	Grundfos	2007	Yes On-Site	13359 56th Ave South
9	1	1 2	5 5	400 400	28	400	4B2A	Smith and Loveless	1980	Yes Plug-In	12638 Interurban Avenue South
10	20	1 2	3 3	140 140	25	140	130-4095-10	Grundfos	2007	Yes On-Site	12218 51st Place South
11	14	1 2 3	10 10 10	1,150 1,150 1,150	25	2,300	NP3127-421	ITT Flygt	2011	Yes On-Site (50kW)	Southcenter Parkway
12	8	1 2	40 40	2000 2000	46	2000	K254T-CG-5325	Pumpx	New pumps in 2003	Yes On-Site	255 Andover Park West

Table 4.3 Existing Pipe Lengths by Diameter and Material[1]

Diameter	Length, ft								Percentage (%)
	Concrete	Polyvinyl Chloride (PVC)	Ductile Iron	Asbestos Cement (AC)	Cast Iron	High Density Polyethylene (HDPE)	Steel	Total	
4-inch			459					459	0.2%
6-inch		6,748	3,155					9,903	4.9%
8-inch	67,396	33,294	7,845	13,578	8,277			130,390	64.7%
10-inch	2,610	379	212					3,201	1.6%
12-inch	23,025	5,368	7,749	2,905				39,047	19.1%
15-inch	2,135		1,895					4,030	2.0%
16-inch			676					676	0.3%
18-inch	9,486	30	57	664		127		10,364	5.1%
20-inch		1,924	4,517					4,517	3.2%
24-inch							62	62	0.0%
36-inch							40	40	0.0%
Total	**104,652**	**47,743**	**26,565**	**17,147**	**8,277**	**127**	**102**	**204,613**	**100.0%**
Percentage (%)	**51.2%**	**23.3%**	**13.0%**	**8.4%**	**4.1%**	**0.1%**	**0.1%**	**100.0%**	**-**

Notes:
(1) Source: 2009 Sewer Plant and Equipment List. Includes recently completed construction for Lift Station 11.

Table 4.4 Domestic or Industrial Wastewater Treatment Facilities

Company	Number	Authori-zation	Type	Date Issued	Expiration Date	Address	City	Discharge To	Zip	Receiving Authority
CMX Corp.	4059-02	Major Discharge	General	9/2/2008	9/1/2013	6601 S. Glacier Street	Tukwila	South Treatment Plant	98188	City Of Tukwila
Container Properties LLC	4167-01	Major Discharge	Groundwater Remediation - Organics	2/18/2009	2/17/2014	9229 East Marginal Way South	Tukwila	West Point	98118	Seattle Public Utilities
Costco Optical Lab No. 190	772-02	Minor Discharge	Manufacturing - Misc	11/1/2011	10/31/2016	441 Costco Drive	Tukwila	South Treatment Plant	98188	City Of Tukwila
Group Health Cooperative - Medical Laboratory	400041-01	No Control Document Required	Laboratory	4/5/2013		12400 E. Marginal Way S.	Tukwila	South Treatment Plant	98168	Valley View Sewer District
Hartung Glass Industries	697-03	Minor Discharge	Glass Manufacturing	5/9/2011	5/8/2016	17830 West Valley Highway	Tukwila	South Treatment Plant	98188	City Of Tukwila
Husky Trucks LLC	50231-01	Verbal	Vehicle Washing	11/18/2010	11/17/2015	11222 E. Marginal Way S.	Tukwila	South Treatment Plant	98168	Valley View Sewer District
Industrial Revolution	400029-01	No Control Document Required	General Type	7/9/2012		5835 Segal Point Drive C	Tukwila	South Treatment Plant	98188	City Of Tukwila
King County SWD - Bow Lake Transfer Station	4162-01	Major Discharge	Solid Waste - Transfer Fac.	12/8/2008	12/7/2013	18800 Orillia Road South	Tukwila	South Treatment Plant	98188	City Of Tukwila
King County SWD - Bow Lake Transfer Station	4165-01	Major Discharge	Construction Dewatering	12/8/2008	12/7/2013	18800 Orillia Road South	Tukwila	South Treatment Plant	98188	Valley View Sewer District
King County SWD - Bow Lake Transfer Station	7882-01	Permit	Solid Waste - Transfer Fac	6/18/2012	6/17/2017	18800 Orillia Road South	Tukwila	South Treatment Plant	98188	City Of Tukwila

Table 4.4 Domestic or Industrial Wastewater Treatment Facilities

Company	Number	Authori-zation	Type	Date Issued	Expiration Date	Address	City	Discharge To	Zip	Receiving Authority
Madrona Specialty Foods LLC	791-01	Minor Discharge	Food Processing	8/18/2008	8/17/2013	18475 Olympic Avenue S.	Tukwila	South Treatment Plant	98188	City Of Tukwila
Metro Transit South Base	4238-01	Major Discharge	Transportation Facility	12/3/2012	12/2/2017	12100 E Marginal Way South	Tukwila	South Treatment Plant	98168	Valley View Sewer District
Metro Transit South Base Facilities Maintenance	288-04	Major Discharge	Transportation Facility	5/18/2011	5/17/2016	11911 E Marginal Way South	Tukwila	South Treatment Plant	98168	Valley View Sewer District
NC Machinery Co.	675-03	Minor Discharge	Vehicle Washing	3/14/2011	3/13/2016	17025 West Valley Highway	Tukwila	South Treatment Plant	98188	City Of Tukwila
NC Power Systems Co.	674-03	Minor Discharge	Vehicle Washing	3/13/2011	3/12/2016	16711 West Valley Highway	Tukwila	South Treatment Plant	98188	City Of Tukwila
PacWest Energy, LLC - DBA Jacksons Food Stores	400017-01	No Control Document Required	General Type	11/30/2011		13138 Interurban Avenue South	Tukwila	South Treatment Plant	98032	City Of Tukwila
Pacific Strapping, Inc.	400002-01	No Control Document Required	General Type	4/5/2011		2922 South 112th Street	Tukwila	South Treatment Plant	98168	City Of Tukwila
Petschl's Quality Meats	639-04	Minor Discharge	Food Processing-Meats	4/14/2013	4/13/2018	1150 Andover Park East	Tukwila	South Treatment Plant	98188	City Of Tukwila
Rainier Industries Ltd.	803-01	Minor Discharge	Manufacturing -Misc	7/16/2009	7/15/2014	18375 Olympic Avenue South	Tukwila	South Treatment Plant	98188	City Of Tukwila
Reischling Press, Inc.	50238-01	Verbal	Printing	1/31/2011	1/30/2016	3325 South 116th Street, Suite 161	Tukwila	South Treatment Plant	98168	Valley View Sewer District

Table 4.4 Domestic or Industrial Wastewater Treatment Facilities

Company	Number	Authori-zation	Type	Date Issued	Expiration Date	Address	City	Discharge To	Zip	Receiving Authority
Seattle Industrial Motor and Machine Co (SIMMCO)	50239-01	Verbal	Pressure Washing	2/2/2011	2/1/2016	10831 E Marginal Way S	Tukwila	South Treatment Plant	98168	Valley View Sewer District
Shasta Beverages	7881-01	Permit	Food Processing-Soft Drinks	7/14/2012	7/13/2017	1227 Andover Park East	Tukwila	South Treatment Plant	98188	City Of Tukwila
United Parcel Service - Tukwila	715-03	Minor Discharge	Vehicle Washing	6/19/2012	6/18/2017	550 Andover Park West	Tukwila	South Treatment Plant	98188	City Of Tukwila

Notes:

a. Existing domestic or industrial wastewater treatment facilities located within twenty miles of the general plan area and within the same topographic drainage basin containing the general plan area.
b. All facilities are treated by the South Treatment Plant, except Container Properties LLC that is treated by the West Point Treatment Plant.

CHAPTER 5

CONVEYANCE SYSTEM ANALYSIS

5.1 INTRODUCTION

This chapter presents an analysis of the City's wastewater gravity collection and pumping system and identities projects that correct capacity deficiencies and serve future users. This chapter includes an analysis to determine if the existing system LS have the capacity to convey the projected quantities of sewage and I/I, a summary of City's reported condition problems for root intrusions and sags, and identification of sewer improvement projects based on pipe material and age.

5.2 LIFT STATION ANALYSIS

The City has 10 LS located throughout the City as shown in Chapter 4, Figure 4.3. The LS were evaluated for overall general condition and hydraulic capacity.

5.2.1 General Condition

A general condition review of the LS was conducted to identify major facility deficiencies and incorporates information from City staff. The information gathered during the review will be used to evaluate LS upgrades and improvements. All LS in the City's collection system annunciate the following: Power failure, Generator on, Generator off, Generator fail (fail to start), dry well flooding (where applicable), Intrusion alarm, Pump fail (fail to start), High level and Low level.

The pumps in all of the LS are driven by reduced voltage starters. Upon a pump fail-to-start, the fault is automatically reset unless a high amp draw is measured. The City uses Citect for monitoring all of the sewer LS, which relies on radio telemetry information sent through the Rugid control panel units at each LS. The LS overflows are piped to connect to the sanitary sewer system. The City's collection system is built such that in the event of a LS failure, the system surcharges to a level where it overflows to a gravity system downstream of the LS. The City has standardized their lift station equipment and keeps a inventory of the following supplies for each new facility: pump control panel, radio antenna, high-level float, and submersible pressure transducer.

The City's LSs were evaluated based on the following criteria:

- **Age**: the economic and design life for a LS is 20 years. The age of each LS is summarized in Table 5.1.
- **Type**: The dry pits for the existing wet pit/dry pit LS are considered a confined space and require extra precautions for entry. LSs 3, 4, 5, 6, and 9 are all side-by-side wet pit/dry pit pump stations, constructed of concrete, and similar in layout.
- **Power**: Back up power or a plug-in for a backup generator should be provided at each facility so that the City can maintain service in the event of power failure.
- **Overflow Alarm:** Each LS should have an overflow alarm to alert maintenance personnel of overflow conditions such as a high wet well or station flood condition. All the City's LS have overflow alarms.

These criteria were used to establish a general condition of each LS which are summarized in Table 5.1. In addition to the conditions summarized in Table 5.1 the City noted the following general concerns:

- **Grease:** There currently is no enforcement on the pretreatment program for maintenance of grease traps.
- **Electrical Gear Location:** Location of electrical gear is important and is coupled with the new ventilation codes. In LS where mechanical supply and mechanical exhaust do not both exist and the electrical gear is located in an underground facility, this area is considered classified by the National Electric Code (classification level is identified within NFPA 820).

Table 5.1 LS General Condition

LS	Age	Type	Power	Overflow Alarm	Overall Condition
2	1987	Wet/dry pit	On-site (needs new generator)	Yes	Fair
3	1972, new pumps in 2009	Wet/dry pit	Plug-in	Yes	Fair
4	1976, new pumps and motors in 2009	Wet/dry pit	Plug-in	Yes	Fair
5	1975, new pumps in 2002	Wet/dry pit	On-site	Yes	Fair
6	1975, new pumps in 1999	Wet/dry pit	On-site	Yes	Fair
8	2007	Submersible	On-site	Yes	Good
9	1980	Wet/dry pit	Plug-in	Yes	Good
10	2007	Submersible	On-site	Yes	Good
11	2011	Submersible	On-site	Yes	New
12	1972, new pumps in 2003	Wet/dry pit	On-site	Yes	Good

5.2.2 Capacity Analysis

This section presents the capacity analysis of the LS to reliably meet the current and future flows. Ensuring that LS have adequate capacity to convey peak flows is important for preventing unwanted wastewater overflows at LS. The current capacity of each LS is presented in Chapter 4. For this analysis, it is assumed that all pumps are able to operate at the rated design capacity. The LS were evaluated against the standards and guidelines as detailed in Chapter 1, Table 1.5.

The LS PIF for current (2009) and future (2030) conditions were predicted by estimating the base flow (BF) for the LS areas, adding to that the PDF I/I estimate and multiplying that PDF value by the PIF peak factor.

BF for each LS was calculated by first estimating the number of single-family residential (SFR), multi-family residential (MFR) and commercial ERUs within each LS basin. Two methods were

used to estimate the number of ERUs depending on the size of the LS basin as summarized below:

- For LS serving entire sewer basins, the number of SFR, MFR and commercial ERUs was estimated based on the proportion of the total area zoned for each use multiplied by the total number of SFR, MFR and commercial ERUs described in Chapter 2. For the City, the LS serving entire sewer basins include LS 2 which serves sewer service basins 13 and 14, LS 4 which serves the entire C/LI portion of sewer service basin 13, future LS 8 which will serve sewer basin 14 and LS 12 which serves sewer service basins 4 and 8. The commercial ERU factor (the number of ERUs assumed for each commercial connection) was adjusted to match the measured BFs at each LS.
- For LS serving partial basins, the number of ERUs was estimated by counting the number of served connections based on areal maps. The commercial ERU factor (the number of ERUs assumed for each commercial connection) was adjusted to match the measured BF at each LS.

BF was predicted for each LS, by multiplying the number of SFR and MFR ERUs by 145.6 gpd/ERU (160 gpd/ERU * 0.91) and multiplying the number of commercial ERUs by 120 gpd/ERU (160 gpd/ERU * 0.75). The measured and predicted BFs for each LS are summarized in Table 5.2.

As shown in Table 5.2 the commercial ERU factor ranged from 4.6 to 15. Two of the LSs (2 and 3) had calculated commercial ERU factors less than the overall City value of 10.3 determined in Chapter 2, three of the LS had commercial ERU factors equal to 10.3 (LSs 4, 10 and 12) and three of the LS had calculated commercial ERU factors greater than 10.3. LS 8 had no commercial properties.

The LS current PDF I/I was calculated by multiplying the LS basin area by an I/I factor. The PIF was then calculated by multiplying that PDF by the PIF to PDF peak factor determined in Chapter 3. The I/I factors were adjusted to match as closely as possible the PIF calculated from the pump run time data for each LS. Since King County recommends a new system I/I factor of 1,500 gpad, the I/I rate was not adjusted below this value. As shown in Table 5.2, the adjusted I/I rate ranged from 1,500 gpad for LSs 4, 5, 6, 8 and 10 to a high of 4,000 gpad for LS 4. The predicted PIF for LS 6, 8 and 10 significantly exceeds the measured flows and I/I factors would need to be decreased well below the King County minimum recommended rate of 1,500 gpad to match these flows. To be conservative, the higher predicted flows will be assumed for the LS analysis. If these higher flows result in predictions of insufficient capacity, the City should measure the LS flows to confirm estimated PIFs.

Table 5.2 Lift Station Current Flow Calculations

Lift Station	BF, gpm		PIF, gpm		I/I Rate, gpad
	Measured[(1)]	Predicted	Measured[(2)]	Predicted	
2	109	108	795	800	2,750
3	11	11	92	91	2,500
4	19	18	140	138	4,000
5	6	5	20	36	1,500
6	1.3	1.3	40	89	1,500
8	1.9	2.2	20	48	1,500
9	4	4	30	30	2,000
10	0.5	6	6	48	1,500
12	102	107	730	690	1,950

Notes:
(1) Measured BF equals the minimum three-month average flow for the year 2009 calculated from the pump run-time data.
(2) Measured PIF calculated by multiplying the average dry weather flow (ADWF) (June through October) by the PIF/ADWF peak factor determined in Chapter 3.

PIFs for the year 2030 were projected by increasing the SFR, MFR, and commercial ERUs by the growth rates for each customer class defined in Chapter 2. It was assumed that the commercial accounts in 2030 will resemble the current commercial accounts in each LS basin and thus the adjusted commercial ERU factors were used for the 2030 projections. It was assumed that the LS basins would not change in size and thus the adjusted I/I rates for each LS basin were used for projections by applying King County's recommended 7percent I/I degradation rate per decade. Since LS 11 will be all new development, the I/I rate for this LS was assumed to be 1,500 gpad. The projected 2030 PIFs for each LS are summarized in Table 5.3.

The projected 2030 PIFs were then compared to the buildout PIFs for each LS to ensure that the projected flows did not exceed the capacity of the LS. The LS buildout PIFs were estimated based on Land Use Flow Factors. The Land Use Flow Factors provide the means to transform a land use category from acreage into wastewater flow. The Land Use Flow Factors are multiplied by the total acres of associated land use in each LS service area to develop buildout BFs. Flow factors are commonly expressed in gpad or gallons per day per dwelling unit (gpd/DU) for residential properties. Customized flow factors for the City were estimated by evaluating the measured and calculated total average day flow at the LS in Drainage Basins 1, 2/18, 3, 4, 8, 11, and 13 for year 2009. The resulting Land Use Flow Factors are presented in Table 5.4. Buildout PIFs for the LSs were developed by adding the I/I factor described in Table 5.2 to the buildout BFs.

Table 5.3 compares the projected 2030 flows to the firm LS capacity. As shown in Table 5.3, the only two LS with projected PIFs exceeding capacity in 2030 are LSs 2 and 3. LS 2 is projected to experience a large increase in flow as this LS will pump the entire new Sewer Service Basin 14. LS 3 is nearly out of capacity now and is projected to exceed capacity by the year 2030. It is recommended that pump run times are closely watched at both of these LS to ensure that the LSs are expanded when they reach capacity.

Table 5.3 Lift Station Current and Future Flows

Lift Station	Total Capacity, gpm	Firm Capacity, gpm	Current Predicted Flow, gpm	2030 Predicted Flow, gpm	Build out Flow, gpm	2030 Capacity Deficit?
2	2400	1600	800	1,839(1)	2,300	Yes
3	200	100	91	121	282	Yes
4	500	250	138	200	249	No
5	240	120	36	48	151	No
6	300	150	89	89	175	No
8	220	110	52	59	96	No
9	800	400	30	41	166	No
10	280	140	48	58	206	No
11	2300	1150	--	513	706	No
12	4000	2000	690	781(2)	781	No

Notes:
(1) 2030 flows include the new Segale area in sewer basin 14.
(2) Capped 2030 flows at buildout level lift station 12.

Table 5.4 Land Use Flow Factors

Land Use Category		Land Use Flow Factor	Units
C/LI	Commercial / Light Industrial	500	gpd/acre
HDR	High Density Residential	400	gpd/acre
HI	Heavy Industrial	800	gpad/taxlot
LDR	Low Density Residential	146	gpd/du
LI	Light Industrial	500	gpd/acre
MDR	Medium Density Residential	250	gpd/acre
MIC/H	Manufacturing Industrial Center / Heavy	1500	gpad/taxlot
MIC/L	Manufacturing Industrial Center / Light	1200	gpd/acre
MUO	Mixed Use Office	500	gpd/acre
NCC	Neighborhood Commercial Center	350	gpd/acre
O	Office	500	gpd/acre
RC	Regional Commercial	350	gpd/acre
RCC	Residential Commercial Center	350	gpd/acre
RCM	Regional Commercial Mixed Use	350	gpd/acre
TUC	Tukwila Urban Center	350	gpd/acre
TVS	Tukwila Valley South	800	gpad/acre

5.2.3 Summary of Lift Station Capacity and General Condition Review

Table 5.5 presents a summary of condition and capacity ratings and the analysis recommendations.

Table 5.5 Lift Station Recommendations

LS	Condition	2030 Capacity Deficit?	Recommendations
2	Fair	Yes	Replace and expand LS when basin 14 is brought online.
3	Fair	Yes	Replace and expand capacity.
4	Fair	No	Pumps reach useful life in 2029. Evaluate facility and pump condition at that time.
5	Fair	No	Pumps reach useful life in 2022. Evaluate facility and pump condition at that time.
6	Fair	No	Pumps reach useful life in 2019. Evaluate facility and pump condition at that time.
8	Good	No	Pumps reach useful life in 2027. Evaluate pump condition at that time.
9	Good	No	Pumps reached useful life in 2000. City wishes to abandon this LS and connect to adjacent King County gravity sewer.
10	Good	No	Pumps reach useful life in 2027. Evaluate pump condition at that time.
11	New	No	No improvements proposed.
12	Good	No	Pumps reach useful life in 2023. Evaluate pump condition at that time.

5.3 COLLECTION SYSTEM ANALYSIS

The City collection system is divided into 20 sub-basins forming the current and future service areas. The total area within the sewer service area is 3,440 acres, although the system currently serves approximately 3,165 acres. There are nearly 202,690 linear feet of sewer pipe in service, ranging in size from 4 to 24 inches in diameter. The drainage basin piping and LS in the service area are explained in detail in Chapter 4 – Existing System.

This section presents the existing condition of the pipes and an analysis of remaining useful life of the existing sewers, known roots and sags in the system, basin sewer flow analysis, and a summary of evaluation on providing sewer service to Drainage Basin 4. In addition, this section also presents cost of annual replacement of pipes that reached their useful life. This information will be incorporated in the capital improvement plan (Chapter 7).

5.3.1 Collection System Condition Assessment

This section provides a review of the pipeline age, type, and pipeline replacement program based on the City's conveyance piping maps and replacement history. In addition, reported condition problems for root intrusions and sags will be summarized. Data from the City's 2009 Sewer Plant and Equipment List was used with additional information from the recently completed Lift Station 11 project. The total pipe length listed in the 2009 Inventory is greater than the total pipe length modeled in GIS. To be conservative, the pipe information from the 2009 Inventory was used to plan for future pipeline replacement projects.

5.3.1.1 Pipe Age

The City was incorporated in 1908 as a small community near the Duwamish River and operated a sewage lagoon system located in the Southcenter area until 1965. When Metro opened the Renton South Wastewater Treatment Plant in 1965 the lagoon system was abandoned and the sewer system was connected to the Metro system for treatment. A map of City's connections to Metro system is provided in Chapter 4.

The City's sanitary sewer system was largely built by the formation of Local Improvement Districts (LIDs) which began in 1961. Throughout the 1960's, Tukwila experienced rapid expansion by the use of LIDs and developer extension agreements. Table 5.6 presents the City's pipe age by decade. Figure 5.1 presents the pipe age by decade for the entire system, including the proposed LS 11 and associated piping.

Table 5.6 Pipe Age

Decade	Pipe Length, feet
1930s	132
1940s	145
1950s	683
1960s	90,990
1970s	55,756
1980s	15,607
1990s	16,918
2000s	24,384
Grand Total	**204,613**

5.3.1.2 Pipe Type

The existing collection system pipe type and length is presented in Table 5.7. Figure 5.2 presents this information graphically.

As shown below, there are approximately 17,150 feet of AC pipe in the collection system. Almost all of the AC pipe exists in the CBD which comprises of Drainage Basins 8, 11, 12, and 13. The current pipeline repair program includes primarily the AC pipe due to the poor condition of the pipe.

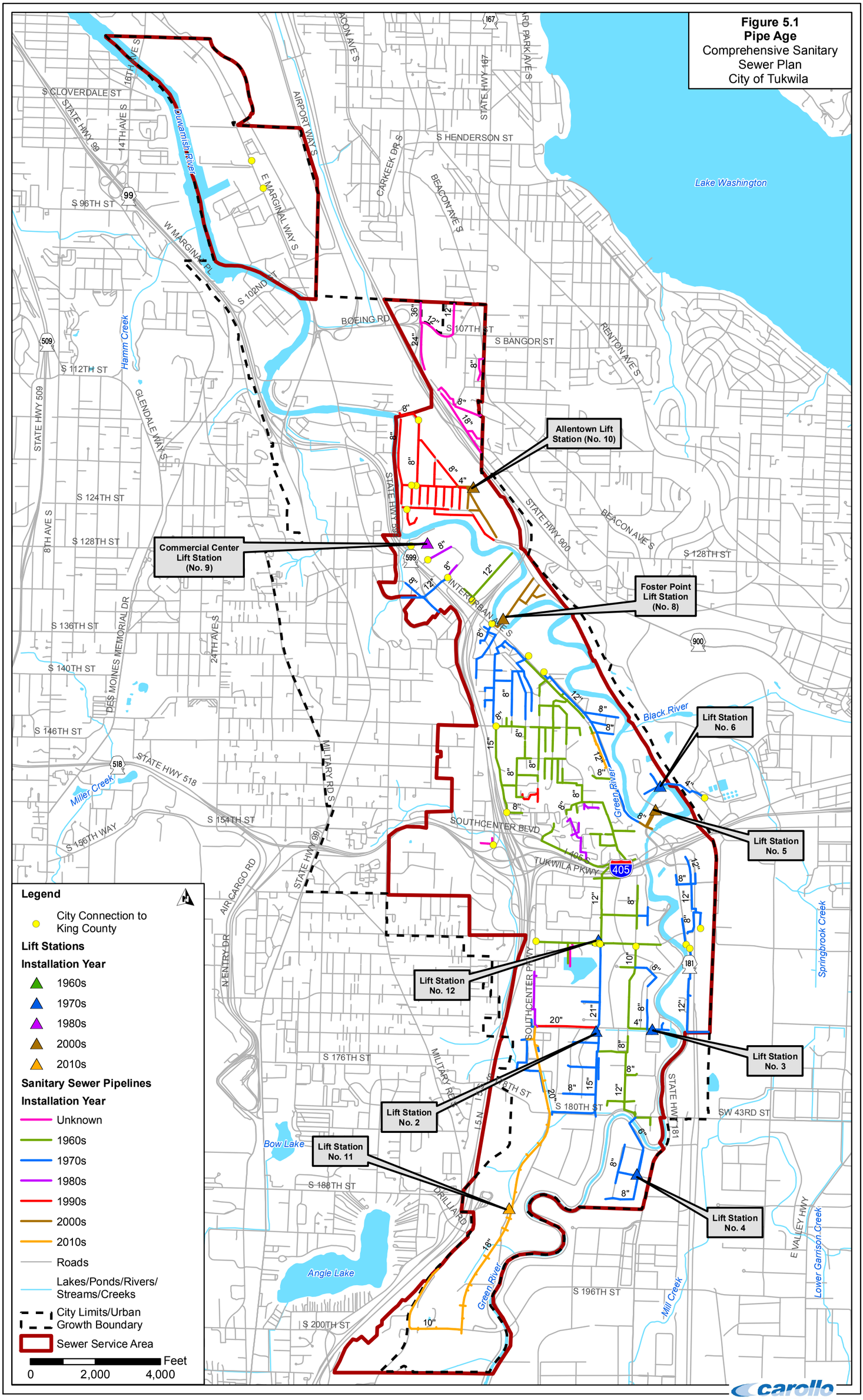


Figure 5.1
Pipe Age
Comprehensive Sanitary Sewer Plan
City of Tukwila
Allentown Lift Station (No. 10)
Commercial Center Lift Station (No. 9)
Foster Point Lift Station (No. 8)
Lift Station No. 6
Lift Station No. 5
Lift Station No. 12
Lift Station No. 3
Lift Station No. 2
Lift Station No. 11
Lift Station No. 4
Lake Washington
Duwamish River
Hamm Creek
Miller Creek
Black River
Green River
Springbrook Creek
Bow Lake
Angle Lake
Mill Creek
Lower Garrison Creek
S CLOVERDALE ST
S 96TH ST
S 102ND
BOEING RD
S 107TH ST
S BANGOR ST
S HENDERSON ST
S 112TH ST
S 124TH ST
S 128TH ST
S 136TH ST
S 140TH ST
S 146TH ST
S 154TH ST
S 156TH WAY
S 176TH ST
S 180TH ST
S 188TH ST
S 196TH ST
S 200TH ST
SW 43RD ST
TUKWILA PKWY
SOUTHCENTER BLVD
INTERURBAN AVE S
STATE HWY 99
STATE HWY 509
STATE HWY 518
STATE HWY 900
STATE HWY 167
STATE HWY 181
AIRPORT WAY S
E MARGINAL WAY S
W MARGINAL PL
BEACON AVE S
RENTON AVE S
CARKEEK DR S
GLENDALE WAY S
DES MOINES MEMORIAL DR
MILITARY RD S
AIR CARGO RD
N ENTRY DR
SOUTHCENTER PKWY
E VALLEY HWY
DRILLIARD
Legend
City Connection to King County
Lift Stations
Installation Year
1960s
1970s
1980s
2000s
2010s
Sanitary Sewer Pipelines
Installation Year
Unknown
1960s
1970s
1980s
1990s
2000s
2010s
Roads
Lakes/Ponds/Rivers/ Streams/Creeks
City Limits/Urban Growth Boundary
Sewer Service Area
Feet
0
2,000
4,000
carollo

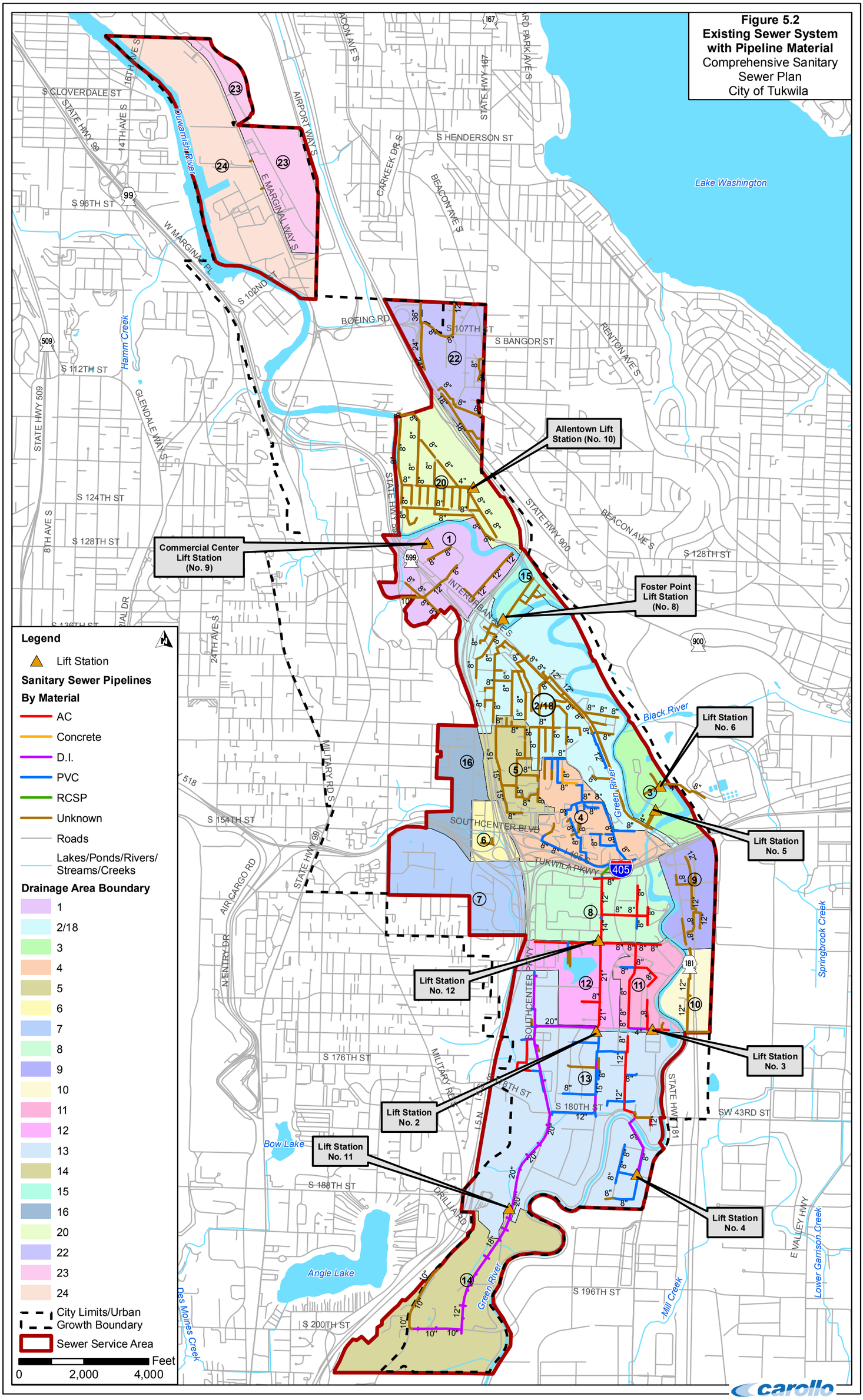


Figure 5.2
Existing Sewer System with Pipeline Material
Comprehensive Sanitary Sewer Plan
City of Tukwila
Allentown Lift Station (No. 10)
Commercial Center Lift Station (No. 9)
Foster Point Lift Station (No. 8)
Lift Station No. 6
Lift Station No. 5
Lift Station No. 12
Lift Station No. 3
Lift Station No. 2
Lift Station No. 11
Lift Station No. 4
Legend
Lift Station
Sanitary Sewer Pipelines By Material
AC
Concrete
D.I.
PVC
RCSP
Unknown
Roads
Lakes/Ponds/Rivers/ Streams/Creeks
Drainage Area Boundary
1
2/18
3
4
5
6
7
8
9
10
11
12
13
14
15
16
20
22
23
24
City Limits/Urban Growth Boundary
Sewer Service Area
Feet
0
2,000
4,000
Lake Washington
Duwamish River
Green River
Black River
Springbrook Creek
Hamm Creek
Bow Lake
Angle Lake
Des Moines Creek
Mill Creek
Lower Garrison Creek
S CLOVERDALE ST
S 96TH ST
S 102ND
BOEING RD
S 107TH ST
S BANGOR ST
S HENDERSON ST
S 112TH ST
S 124TH ST
S 128TH ST
S 136TH ST
S 154TH ST
S 176TH ST
S 180TH ST
S 188TH ST
S 196TH ST
S 200TH ST
SW 43RD ST
SOUTHCENTER BLVD
TUKWILA PKWY
INTERURBAN AVE S
STATE HWY 99
STATE HWY 509
STATE HWY 900
STATE HWY 167
STATE HWY 181
AIRPORT WAY S
E MARGINAL WAY S
W MARGINAL PL
BEACON AVE S
RENTON AVE S
CARKEEK DR S
GLENDALE WAY S
14TH AVE S
16TH AVE S
8TH AVE S
24TH AVE S
MILITARY RD S
AIR CARGO RD
N ENTRY DR
SOUTHCENTER PKWY
I-5 N
I-405
E VALLEY HWY
DRILLIARD
carollo

Table 5.7 Pipe Type	
Decade	**Pipe Length, feet**
Asbestos Cement (AC)	17,147
Cast Iron	8,277
Concrete	97,365
Ductile Iron	21,453
High Density Polyethylene (HDPE)	127
Polyvinyl Chloride (PVC)	47,743
Steel	102
Unknown	12,399
Grand Total	**204,613**

5.3.1.3 Remaining Useful Life

The City's pipeline replacement program was focused on identifying the RUL. RUL is defined as the length of time that a pipe is anticipated to remain functional, commonly called the useful life, depends largely on the pipe material. Beyond the useful life, the increasing costs of maintenance associated with a failing pipe will likely warrant replacement. Table 5.8 presents the estimated useful lives of various types of pipe materials. As seen in the table, materials such as PVC, HDPE, and Ductile Iron have longer useful lives than other pipe materials, such as cast iron. Unknown pipe materials were assumed to have a useful life of 50 years.

Table 5.8 Useful Life of Pipes	
Pipe Material	**Useful Life Assumption (yrs)**
Asbestos Cement (AC)	40
Cast Iron	40
Concrete Pipe	60
Ductile Iron	70
High Density Polyethylene (HDPE)	70
Polyvinyl Chloride (PVC)	70
Steel	25-35
Unknown	50

The age and type of material presented in the previous section were used to determine the RUL of the City's sewers. Table 5.9 presents the total length of pipe according to the year installed and material. The cells of the table are color-coded to show the RUL of pipes in that category. For example, the lengths of pipe in the red cells have all reached the end of their useful life, and have a remaining useful life of zero.

Table 5.9 Sewer Pipe Length by Decade Installed and Material Type

Material Type	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	Total
Asbestos Cement (AC)				13,670	3,477				17,147
Cast Iron					8,277				8,277
Concrete				76,825	17,999	2,541			97,365
Ductile Iron	132	145	683	95	15,723	1,882	2,232	561	21,453
High Density Polyethylene (HDPE)								127	127
Polyvinyl Chloride (PVC)						9,403	14,646	23,694	47,743
Steel						62	40		102
Unknown					10,680	1,719			12,399
Grand Total	132	145	683	90,990	55,756	15,607	16,918	24,378	204,613

Legend:

	Over 20 years of RUL	short-term	Between 0 and 10 years of RUL
long-term	Between 10 and 20 years of RUL	short-term	0 years of RUL

Based on this analysis, approximately 25,760 lineal feet of pipe has reached its useful life. The City will need to address this issue by expanding the pipeline replacement program to include aging pipes in addition to the AC pipelines. A portion of these pipes are already included in the City's pipeline replacement program as replacement of AC pipe. Besides the pipe that has reached its useful life, the City also needs to consider pipe that has 0 to 10 years of RUL in the short-term pipeline replacement program. This includes 88,230 lineal feel of pipe. The total length of replacing pipe that has reached its useful life and pipe that has zero to ten years of useful life is 113,990 lineal feet. The pipeline unit costs are shown in Table 5.10 were used to estimate the total cost of replacement. These unit costs assume open-trench construction in improved areas. Costs include pavement cutting, excavation, hauling, shoring, pipe materials and installation, backfill material and installation, and pavement replacement.

Table 5.10 Pipeline Construction Unit Costs

Pipe Size (inches)	Pipeline Unit Cost ($/Linear Foot)
4	$ 97
6	$ 129
8	$ 172
10	$ 215
12	$ 258
15	$ 322
18	$ 367
20	$ 428
24	$ 489

Based on the unit costs outlined in Table 5.9, the total cost of replacement of pipe in the short-term replacement program is $25,563,000 over ten years. This results in a total annual replacement cost of approximately $2,563,000 per year for short-term.

Additionally, the City has approximately 19,810 lineal feet of pipe that will reach their RUL within 10 to 20 years. The total cost of replacement for these "long-term" pipes is approximately $5,106,000. The annual cost of replacement of the long-term pipes is $511,000.

5.3.1.4 Root Intrusion, Sag and Other Condition Issues

Root intrusion and sags can cause sewer backups. Roots growth into sewers is a common problem, especially in older concrete and clay pipes that were not constructed with watertight joints. Once roots seek out a water source in sewer pipes, they continue to thrive and grow. This results in cracked pipes and sewer backups when debris is not able to pass through the roots. The City currently does not have any reported issues with roots.

Sewers with sags or low spots reduce the ability of debris to flow and allow a place for settlement in the pipe, which has the potential to result in sewer backups. Side sewers

should be constructed with at least minimum fall to avoid pipe sags and allow wastewater to flow via gravity through the pipe without any deposits of debris.

The City reported the following sag issues within its collection system:

1. Approximately 1500 feet of 8-inch sewer in Interurban Avenue from The Golden Nugget at 14025 Interurban Avenue South to the Foster Green Apartments at 13735 Interurban Avenue South has sags and is currently undersized.
2. Approximately 865 feet of 12-inch sewer and 3 manholes between Andover Park East and Andover Park West have severe sags. Similar to the Interurban Avenue South sag above, this piping is also included in the RUL short-term pipeline replacement program.
3. Approximately 500 feet of 12-inch line under I-405 from North Hill and Andover Park West.

Figure 5.3 shows the location of the existing pipelines with sag issues. These pipes will be included in the Capital Improvement Plan (Chapter 7). Both the Andover Park East and Andover Park West improvement projects are included in the RUL short-term pipeline replacement program and the Interurban Avenue South improvement was included in the long-term pipeline replacement program.

The 12-inch line under I-405 currently conveys flow from Drainage Basin 4 across I-405 and drains to Drainage Basin 8. However, due to a widening project and significant damage to the existing pipe, the City is considering replacing the pipe section under I-405. The project memorandum presented in Appendix F provides an analysis of alternatives to serve Drainage Basin 4 customers. A summary of the recommendation will be provided subsequent to its completion.

Additional condition issues that the City is aware of include the sewer line from Lift Station 12 to the King County Metro line at Andover Park West. The City has indicated that this line will need to be repaired.

5.3.2 Collection System Capacity Analysis

The anticipated drainage basin sewer flows were calculated using the same method as described in Section 5.2.2 and are summarized in Table 5.10. As shown in the Table 5.11 the PIF in the drainage basins is anticipated to increase by between 25 percent for basin 20 and 100 percent for basin 4. The basins that generally experienced the highest growth rates were those basins that had the highest proportion of MFR as the City is anticipating a high growth rate for MFR housing. Drainage Basin 14 and a portion of Drainage Basin 16 are anticipated to be within the sewer service area for the year 2030.

A hydraulic modeling analysis was not performed for the collection system evaluation under this planning effort. The previous Plan performed a hydraulic model for the CBD and found that all pipes were at less than 60 percent of capacity for both the current and future (2024) conditions. Based on the results of the previous Plan, the collection system capacity is assumed to be sufficient in the near-term (through 2020). However, it is recommended that the City update the hydraulic model and perform a full geographical information system (GIS) study to identify inverts in the next 5 years to evaluate the collection system capacity for the long-term (through 2030).

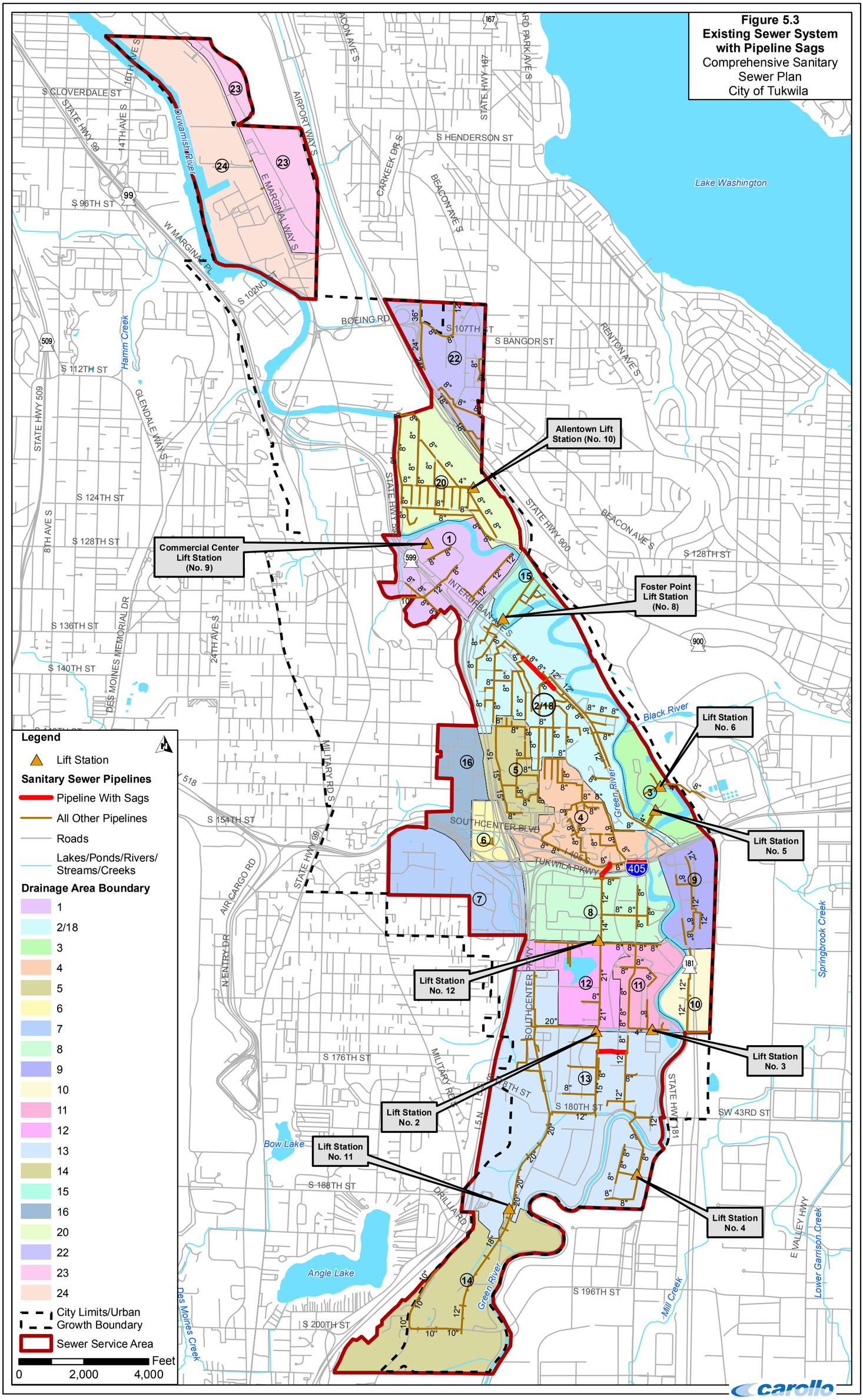


Figure 5.3
Existing Sewer System with Pipeline Sags
Comprehensive Sanitary Sewer Plan
City of Tukwila
Allentown Lift Station (No. 10)
Commercial Center Lift Station (No. 9)
Foster Point Lift Station (No. 8)
Lift Station No. 6
Lift Station No. 5
Lift Station No. 12
Lift Station No. 3
Lift Station No. 2
Lift Station No. 11
Lift Station No. 4
Lake Washington
Duwamish River
Green River
Black River
Springbrook Creek
Hamm Creek
Bow Lake
Angle Lake
Mill Creek
Lower Garrison Creek
Des Moines Creek
S 96TH ST
S 102ND
BOEING RD
S 107TH ST
S BANGOR ST
S HENDERSON ST
S 112TH ST
S 124TH ST
S 128TH ST
S 136TH ST
S 140TH ST
S 154TH ST
S 176TH ST
S 180TH ST
S 188TH ST
S 196TH ST
S 200TH ST
SW 43RD ST
SOUTHCENTER BLVD
TUKWILA PKWY
INTERURBAN AVE S
MILITARY RD S
STATE HWY 99
STATE HWY 509
STATE HWY 900
STATE HWY 181
STATE HWY 167
AIRPORT WAY S
E MARGINAL WAY S
W MARGINAL PL
BEACON AVE S
RENTON AVE S
GLENDALE WAY S
DES MOINES MEMORIAL DR
AIR CARGO RD
N ENTRY DR
DRILLIARD RD
E VALLEY HWY
Legend
Lift Station
Sanitary Sewer Pipelines
Pipeline With Sags
All Other Pipelines
Roads
Lakes/Ponds/Rivers/ Streams/Creeks
Drainage Area Boundary
1
2/18
3
4
5
6
7
8
9
10
11
12
13
14
15
16
20
22
23
24
City Limits/Urban Growth Boundary
Sewer Service Area
Feet
0
2,000
4,000
carollo

Table 5.11 Estimated Current and Year 2030 Flows from Drainage Basins			
Drainage Basin	**Current PIF, gallons per minute (gpm)**	**Year 2030 PIF Flow, gpm**	**Flow Increase, %**
1	325	523	61%
2/18	1,497	2,139	43%
3	99	173	74%
4	452	773	71%
5	256	513	100%
6	89	148	66%
7	NA (served by Valley View)	244	-
8	231	381	65%
9	217	358	65%
10	62	102	66%
11	150	204	36%
12	69	114	66%
13	796	1,172	47%
14	Future Basin	474	-
15	129	163	26%
16	NA (served by Valley View)	470	-
20	949	1,190	25%
22	649	932	44%
23	38	63	66%
24	163	266	63%

CHAPTER 6

OPERATIONS AND MAINTENANCE

6.1 INTRODUCTION

This chapter provides an overview of the City's Sanitary Sewer Utility organization and operation. The purpose of the chapter is to document existing procedures and to identify areas where improvements or changes could enhance system operation.

6.2 RESPONSIBILITY, AUTHORITY, AND ORGANIZATION STRUCTURE

6.2.1 Mission Statement

The mission statement of the City's Utility Sanitary Sewer department is to provide for the efficient, environmentally sound and safe management of the existing and future sewer system within Tukwila's service area.

6.2.2 Department Organization

The City of Tukwila Public Works Department is responsible for water, sewer, drainage, construction, engineering, construction inspection, fleet and facilities and street functions. The Tukwila Sanitary Sewer Utility operates under the direction of the Public Works Director. The Public Works Operations Manager oversees the supervisory responsibilities for the Sanitary Sewer Utility's operation and maintenance as well as water and surface water. Day to day activities are conducted by the Sanitary Sewer System Superintendent who reports to the Public Works Operations Manager. The Public Works Engineer covers budgeting, new or upgraded system design, operations analysis, and the construction of capital improvements as outlined in the Sanitary Sewer Comprehensive Plan. Figure 6.1 shows the organizational structure for sanitary sewer operations.

6.2.3 Tasks and Responsibilities

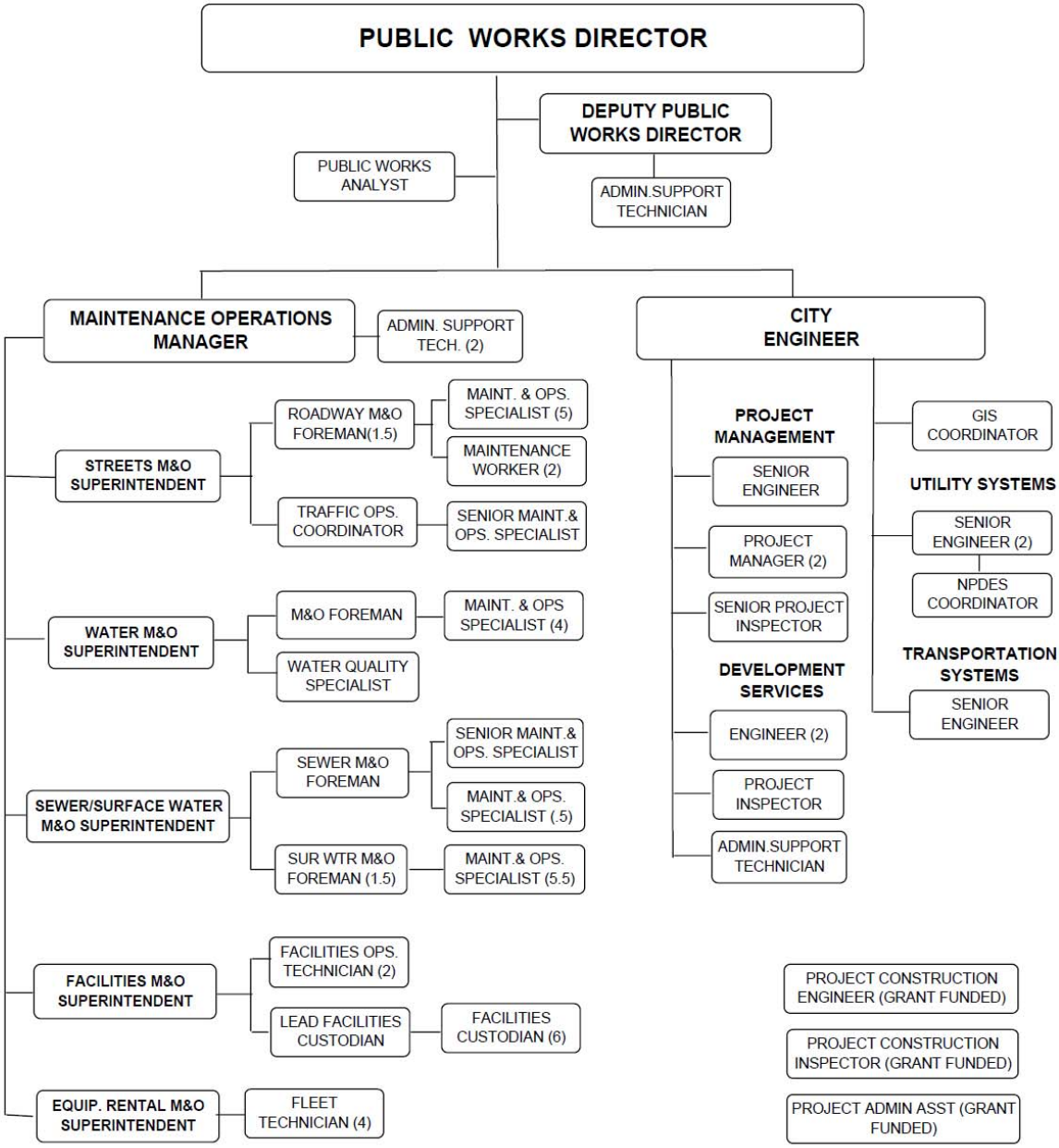
6.2.3.1 Director of Public Works

The Director of Public Works directs all activities and programs within the Public Works Department including the City's services for sewer system.

6.2.3.2 City Engineer

The City Engineer plans, organizes, staffs, and manages the Engineering Division. Responsibilities involve development of the six-year capital improvement program for the sewer utilities. The City Engineer is also responsible for annual capital projects including development of scopes-of-work and consultant selection.

PUBLIC WORKS DEPARTMENT



ORGANIZATIONAL CHART

FIGURE 6.1

CITY OF TUKWILA
COMPREHENSIVE SANITARY SEWER PLAN

carollo

pw://Carollo/Documents/Client/WA/Tukwila/8472A00/Deliverables/Chapter 6/Fig 6.1

6.2.3.3 Senior Project Engineer

The Senior Project Engineer, under the direction of the City Engineer, is responsible for overseeing assigned annual capital projects. Tasks include development of project schedules, scope-of-work and consultant selection. The Project Engineer also tracks progress through the development of PS&E, coordinates bidding and contract execution, and is tasked with submittal review and approval, progress reports, pay estimates, construction management/inspection and project closeout.

6.2.3.4 Maintenance Operations Manager

The Maintenance Operations Manager oversees maintenance activities within the public works department. For the Sanitary Sewer system, the Maintenance Operations Manager has budgetary responsibility and directs the Sanitary Sewer Maintenance Superintendent in carrying out sewer system maintenance responsibilities.

6.2.3.5 Sewer Superintendent

The Sewer Superintendent is responsible for all day-to-day operation and maintenance activities associated with the sanitary sewer system.

This position is also responsible for developing maintenance work standards, interfacing with the sewer engineer, setting up repairs, reviewing plans for current and future development, design of pump stations, and I/I work planning.

6.2.3.6 Operation and Maintenance Foreman

Operation and Maintenance Foreman, along with the Superintendent, perform all field maintenance and operation functions for the City's sanitary sewer system.

6.2.3.7 Operation and Maintenance Senior Specialist

The Operation and Maintenance Senior Specialist is responsible for the day-to-day maintenance of the City owned lift stations, pump and control system repair and the sewer system jetting program.

6.2.3.8 Operation and Maintenance Specialist

The Operation and Maintenance Specialist is responsible for the day-to-day maintenance of the sanitary sewer system under the direction of the Foreman and Operation and Maintenance Senior Specialist duties include manhole repair, sewer jetting and work as assigned.

6.2.4 Communications System

The City maintains a communications system to contact Sanitary Sewer Utility personnel during normal work hours and after hours. This system is necessary to respond to customer requests, routine maintenance, or emergency situations. Maintenance staff vehicles and other rolling stock are equipped with two-way radios and the personnel carry combination cellular phones and radio units. The staff is equipped with laptop computers that allow staff to

communicate with each other and the lift stations telemetry system. The Sewer Utility also has access to an inventory of portable emergency use radio units should they be required.

The City has a Standby Call-Out Program for weekends to ensure that coverage for after-hours response is assured. One staff member in Maintenance Operations always carries a dedicated, combination cell phone/radio on weekends. Emergency calls for the after-hours calls on weekdays go to the Operation Manager, then 911 and then go to the staff member on call, who determines which staff is required for call out. The initial call from the Standby Person is to the Sewer Maintenance Superintendant. If the initial call-out attempt is unsuccessful, the contact order is as follows: Sewer Utility Foreman, Sewer Senior Specialist, and lastly the Sewer Maintenance Workers. If all of the above contact attempts fail, the Standby Staff member then calls the Maintenance Operation Manager. Once City personnel arrive and assess the issue, they determine if more personnel are required. If it is determined that further staff are required, the Standby Person and other staff from the Maintenance Operations Departments may be called upon. Sewer maintenance staff can be notified of lift station problems via the alarm auto dialer and by the internet with the telemetry system.

6.3 CERTIFICATION, EDUCATION, AND TRAINING

The City is in full compliance with current laws and regulations regarding staff certification and training. Four Tukwila Public Works employees possess Washington Wastewater Collection Personnel Association certifications. Table 6.1 is a summary of personnel certifications and experience in sewer system operations.

Employees are supported and encouraged to meet continuing education (CEU) requirements by attending work related classes, refresher courses, safety training, and regional conferences. To meet the staff educational needs, the City includes a budget line item in the annual Operations and Maintenance (O&M) budget devoted to training.

Table 6.1 Sewer Utility Personnel Certification

Position	Name	Certification
M&O Superintendent , Sewer	John Howat	Wastewater Collection, Level II
M&O Foreman, Sewer	Dave Lawrence	Wastewater Collection, Level III
M&O Senior Specialist	Ernie Ballejos	Wastewater Collection, Level II
M&O Specialist, Sewer	Walley Snover	Wastewater Collection, Level II

6.4 SYSTEM OPERATION

6.4.1 Administrative Duties

The key administrative duty of the City's operation staff is to establish routine operation duties and schedules. Routine operations involve the analysis, formulation, and implementation of procedures to ensure that the sanitary sewer facilities are functioning

efficiently. The utility's maintenance procedures work well. Repairs are made promptly so customers do not experience unnecessary inconvenience.

Additionally, the operations staff establishes emergency operations procedures for operation during such emergencies. The primary objectives of these procedures are to ensure public safety, restore essential services as quickly as possible, and to provide assistance to other areas as required. Emergency operations are described in the following section.

Side sewer maintenance is a major problem within a sanitary sewer system. It is the City's policy that individual property owners are responsible for maintaining their side sewers. If a problem occurs, it is the property owner's responsibility to contact a private plumber to investigate and correct the problem.

6.4.2 Emergency Operations

The City of Tukwila's objective is to provide and support effective planning, disaster management, and education services to enable citizens and employees of Tukwila to prepare for, respond to, and recover from an emergency. The Public Works Department has in place an "Emergency Action Plan" that outlines procedures to protect the City's infrastructure. The Emergency Action Plan identifies potential threats or hazards that may jeopardize the City's sanitary sewer system and is available from the City. Some key features are described below.

6.4.2.1 Emergency Telephone Numbers

The City maintains a sewer emergency response crew on 24-hour call. This crew is available to answer any emergency that may occur within the system and has immediate response responsibility. This would include, but not be limited to, lift station alarms, sewer backups, and force main blockages. The City maintains the following telephone numbers to allow the public to notify the repair crews:

- During Business Hours: (206) 443-1860.
- After Business Hours: 911.

The lift station alarms are monitored by computer in the City's Maintenance Facility during normal working hours. After hours, the alarms are monitored by the sewer computer alarm system. If an alarm is sounded, the system dials the sewer crew at home to respond to the problem. The police dispatch is the last back up on the call out system.

6.4.2.2 System Vulnerability

Tukwila's sewer system is comprised of individual drainage basins that convey wastewater to King County WTD's sewer interceptors. In the event of a natural or manmade disaster, the system has the following vulnerabilities to either loss of service or to pollution of the surrounding environment.

- Treatment and Disposal: The City has an agreement with King County WTD for treatment and disposal of all of the wastewater collected in the system. King County WTD has full responsibility to ensure that the wastewater is properly treated prior to

disposal. An interruption of treatment service would result in discharge of untreated wastewater to Puget Sound.

- Sewer Mains, Trunks, and the King County WTD Interceptors: Any pipeline is subject to clogging, and under certain circumstances, the sewer pipe can break. Clogging of the sewer creates backups in manholes and in severe cases, these backups can progress back to customer properties. Pipe breaks due to settlement, deteriorating pipe or other causes will pollute the groundwater and result in excessive infiltration and inflow.
- Lift Stations: The City operates ten lift stations within the sewer collection system. Failure of a lift station would cause sewer backups in the system in the area of the lift station. The City has recently modified a portion of the lift stations by installing bypass piping connections. These connections allow the City to use their portable pump to lift the wastewater in the event of an emergency.
- Electrical Power: Power is provided to the area by Seattle City Light and by Puget Sound Energy (PSE). PSE has an extensive power distribution grid in the Tukwila area and electrical power can be supplied from many directions. Loss of power would shut down pump and control operations resulting in the conditions described above. Historically, the City has not experienced regular or extended power outages. The City maintains a backup generator in the event of a power failure. All stations that are rebuilt receive onsite generator sets.
- Personnel: Sewer system personnel are available to respond to emergency calls and have the capability to perform minor repairs and emergency operations as required to sustain sewer service.
- Supplies and Spare Parts: The City maintains a small inventory of spare parts that are normal for operations and emergency repairs. In the event of a major catastrophe, the City would have to procure necessary spares from suppliers and reduce the level of service to consumers.
- Communications: The City uses Nextel radiophones to keep in contact with the field crews during normal working hours. After hours, there are maintenance crews on call that can be contacted by the Police Department Dispatcher. A radio system serves as backup to the phones.

6.4.3 Tools and Equipment Cleaning

Smaller commonly used tools and equipment are carried in the employee's trucks or are readily available from the stockroom. Tools and equipment such as pumps, small compressors, portable generators, pressure washers, and power tools are available from the stockroom. Larger, infrequently used items are rented from various equipment rental companies located in Tukwila.

The Public Works Department owns heavy equipment such as dump trucks, rollers, boom truck, front-end loader, forklifts, backhoes, and vactor truck units. If necessary, larger equipment is leased or rented on an as-needed basis from local suppliers. The City's maintenance and construction crews have personnel trained and experience in heavy equipment operation.

6.4.4 Staff Meetings, Conferences and Training

Continuing education opportunities are fundamental elements for staff in the sanitary sewer utility. The sanitary sewer utility training budget is funded so as to support staff in maintaining their technical awareness and skill sets. Seminars and conferences; 1) broaden their knowledge, and; 2) allow them to network with other professionals involved in sewer utility work.

6.5 SYSTEM MAINTENANCE

6.5.1 Inspections, Preventive Maintenance, Repairs and Replacement

The maintenance program is composed of both preventative and corrective maintenance. Preventive maintenance uses planned and scheduled activities to ensure smooth, continuous operations of equipment and facilities. Maintenance schedules, that meet or exceed manufacturer's recommendations, should be established for all critical components in the sanitary system. The City's sewer telemetry system provides automated data collection and record keeping of lift station functions. Physical inspections of the stations are still an important tool in maintaining the system. The preventive maintenance programs include; lift station inspection and maintenance, manhole inspection and maintenance, video inspection root cutting, grease removal, and hydraulic line clearing. Corrective maintenance is that which improves the performance of the existing equipment.

Sewer maintenance staff also responds to customer's questions, odor complaints and sewer overflows.

6.5.2 Lift Station Maintenance

Lift Stations: A regular inspection is made of the lift stations within the system. Running times are monitored and recorded to determine pump life. The pumps are regularly serviced and lubricated per the recommendation of the pump manufacturers.

6.5.3 Manhole Maintenance

The City's personnel inspect all the sanitary sewer manholes each year for the following situations:

- A visual inspection for proper flow to sewage.
- A visual inspection of the manhole frame, cover and ladder.
- Assessment of the state of solids buildup in the manhole and Channel.
- Root intrusion.

6.5.4 Utility Locating Service

Currently the services for sewer utility locates are performed by a designated locator who is under the supervision of the Sewer M&O Superintendant. The locator is responsible for locating sanitary sewer facilities within the public right of way.

6.5.5 Video Inspection

The City has an ongoing CCTV inspection program to identify the problem areas in the system. In past years as much as 20,000 linear feet had been inspected annually. In areas with significant problems identified, the City has repaired the sewer by removal of the existing sewer and construction of a new sewer to serve the area.

6.5.6 Root Cutting

Routine sewer facility inspection commonly identities root intrusion with the public sewer mains. If the problem is within the City right of way, the City will correct the problem and remove the roots.

A hydraulic root cutter is routinely used to remove roots that accumulate within sewer lines creating flow restrictions and blockages. Numerous lines throughout the City have been examined and discovered to have had a history of problems created by roots. These particular lines are rodded more frequently to ensure there is no interruption of flow.

6.5.7 Grease Removal

The City requires grease interceptors on all buildings where food preparation occurs and at locations determined by the City as necessary for the proper handling of liquid wastes. Grease interceptors must comply with the Uniform Plumbing Code and the following criteria:

- Provide a double baffle type interceptor with 6- inch lines and details referenced to related plumbing sheets.
- For sizing, consider the meals per hour as equal to a restaurant's seating capacity.
- Locate the vault outside the building, between 5 feet and 25 feet from the building foundation.
- Install the interceptor so that gray water from sinks, floor drains, drains under garbage compactors, is routed through the interceptor. DO NOT route dishwashers through the grease interceptor. NOTE: Route ONLY gray water through the interceptor.
- Every three months the owner must completely pump out the interceptor. Businesses that generate small amounts of grease may, with the City's approval, pump the interceptor on a 6-month schedule. At any time, the City may inspect the interceptor and require more frequent service.

6.5.8 Hydraulic Line Cleaning

The sewer lines are cleaned with a vacuum-high velocity cleaning /jetting truck, which performs two primary functions: vacuuming and jetting. Jetting a sanitary sewer pipe is the principal means of cleaning the line portions of the sewer of sludge, debris, or obstruction. A hose with a special end fitting is inserted into the pipe and high-pressure water (up to 2.500 pounds per square inch) is sent through the hose. The high-pressure water exits the small hole at the tip of the cone fitting, breaking down the sludge and obstructions. The hose is propelled down the length of the pipe via the numerous other holes found in the end fitting. The hose is inserted through a manhole into the pipe and the line is jetted to the next manhole. The hose is then retracted via a motor driven system, back to the entry manhole.

All of the sludge/debris is scoured toward the entry manhole (because the spraying water forces it that direction) and is vacuumed out as required.

There are a number of lines in the City that have inconsistent grades creating septic conditions within the lines. A part of the maintenance program is to take the vactor truck to flush water through these lines periodically to prevent those conditions from occurring. The vactor truck is the primary equipment used for emergency blockages in the lines is used to assist TV inspection.

All sanitary sewer lines in the city are jetted or flushed each year.

6.5.9 Repair Sewers and Clear Plugs

When problems with the sewer are identified through the preventative maintenance program described above, repairs are made to the infrastructure or clogs are removed. The preventative maintenance program is efficient and typically represents a small part of the maintenance staff time.

6.6 EMERGENCY RESPONSE PROGRAM

The City's objective is to provide and support effective planning, disaster management, and education services to enable citizens and employees of Tukwila to prepare for, respond to, and recover from an emergency.

The Public Works Department has in place an "Emergency Action Plan" that outlines procedures to protect the sanitary sewer system and the city's infrastructure. The Emergency Action Plan identifies potential threats or hazards that may jeopardize the city's sanitary sewer system. The Emergency Action Plan is available from the City and addresses:

- Water Quality Emergencies.
- Earthquake Response.
- Emergency Power Requirements.
- Outside Agency Coordination.
- Specific Emergency Standard Operating Procedures (SOP).
- Floods.
- Terrorism.
- Volcanic Eruption.

6.7 DEPARTMENT COORDINATION

The Sewer Utility utilizes the services of other City departments, according to interdepartmental agreements, to augment the Sewer Utility's expertise. The Finance and Information Technology Departments are responsible for customers billing, payment collection, fund activity reporting, and basic computer needs. The Human Resource Department is responsible for employee records, labor negations, salary schedules and union labor negotiations.

Within the Public Works Department, the Sewer Utility utilizes the service of the Engineering Department for plan review, permit issuance, inspection, project design, and management for Capital Improvement Projects.

6.8 RECORDS DOCUMENTS

The City utilizes an Information and Records Management system. By computer network tracking, the City's Public Works Department has developed a filing system that breaks down the lift stations, collection systems, generators, and other necessary components that make up a service area. The city also involves department heads and supervisors to maintain and track their areas of responsibility. On an annual basis, maintenance records are reviewed for the annual report. In addition, the city has contracted out the maintenance of the SCADA system within the service area. All telemetry maintenance is conducted by sewer department staff and a contractor.

6.8.1 Record Documentation

- The City of Tukwila maintains the following records for efficient management of the sanitary sewer system.
- Customer Accounts: The City maintains records of each sewer account detailing sewer use and any problems or complaints registered.
- King County WTD Records: All reports on wastewater treatment charges and status from King County WTD are kept on file.
- Maps: A Comprehensive Sewer Plan Map of the full system is maintained by the City for informational purposes. This map shows all proposed improvements and upgrades required, all piping, manholes, clean outs, lift stations, force mains and sewer trunk lines.
- As-Built Drawings: The City maintains a comprehensive file of all as-built drawings of the system improvements as they occur. These drawings show the location of side sewers in many cases and locate all other piping as constructed.
- Pump Maintenance Records: The City keeps all lift station pump manufacturer maintenance and technical information on file to include but not be limited to: pump run time records, maintenance schedules, maintenance performed, repairs performed, problems encountered, and any other information noted during the regular maintenance checks of the lift stations.
- All sewer manholes in the central business district are in the GIS System.

6.8.2 Telemetry

The sewer system's SCADA system consists of remote telemetry units (RTUs) located at individual sewer lift stations; linked to a master control computer at the City's Maintenance Facility on Minkler Boulevard. The telemetry control panel serves to display important system status information. This system monitors the wet well water levels and pump motor starts, pump motor amps, generator starts and stops, power failures, pump run time, and some lift station have flow meters to measure pumping rates.

Communication between the RTUs and the master control computer at the Minkler Boulevard shops is via radio. To facilitate communications a radio signal repeater station is

located at the North Hill reservoir. This repeater does have an uninterruptible power supply (battery backup). If a power failure were to occur, loss of the repeater station could limit the ability of the sewer utility (and all of public works) to communicate with other units of the system. Battery backup of critical SCADA and communications elements is a common and desirable feature of modern SCADA systems.

During evenings, and on weekends, an alarm triggers an auto dialer, which alerts sewer utility maintenance personnel by telephone of an alarm condition. The maintenance staff with the internet can access the SCADA system from off-site locations. This feature provides supervisory staff with a more complete picture of the status of the system, reduces the need for unproductive trips to the operations center or remote sites, and promotes better operational control of the system.

6.8.3 Asset Management

The Public Works Department does not have an Asset Management plan at this time. The city is planning to implement an Asset Management plan in the future.

6.9 FUTURE OPERATIONS AND MAINTENANCE NEEDS

The Public Works Department sewer operations and maintenance staff appear to possess or be able to access all of the equipment and supplies required to adequately perform the responsibilities assigned.

The lack of sufficient labor to adequately address the many responsibilities of sewer operations and maintenance was a recurring issue during this analysis.

An analysis of the Sewer Operations and Maintenance work programs of the City of Tukwila Public Works Department was conducted to determine the adequacy of existing staffing levels. The work production rates of existing O&M crews in performing a wide range of specific O&M tasks related to pipeline, manhole and pump station maintenance were quantified. Unit rates of work that can reasonably be accomplished per FTE were developed and used to project the sewer O&M labor requirements of the Public Works Department. Currently there are 3 FTE assigned to the sewer function. The projected requirement is 5 FTE, or an increase of 2 FTE for sewer maintenance and operations activities.

It is recommended that the Public Works Department Sewer Operations and Maintenance staff be augmented by 2 FTE. This additional staff time would be devoted, in part, to implementing a grease interceptor inspection program.

CHAPTER 7

CAPITAL IMPROVEMENTS PLAN

7.1 INTRODUCTION

This chapter presents a summary of all capital projects outlined in the previous chapters and related studies, and creates a cohesive CIP for the City‘s wastewater collection system. The CIP developed includes estimated costs and recommended year of implementation for each of the selected projects. The purpose of this CIP is to provide the City with a guideline for planning and budgeting of its wastewater system. The following sections present the project cost estimating assumptions and the final recommended CIP. Project phasing is developed between 2013 through 2019 (near-term), and 2020 through 2030 (long-term).

7.2 PROJECT COST ASSUMPTIONS

Planning-level cost estimates were developed for each of the recommended projects for budgeting purposes. These direct costs are planning level estimates only and should be refined during pre-design of the projects as final costs of a project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors such as preliminary alignment generation, investigation of alternative routings, and detailed utility and topography surveys. The CIP cost estimates should be periodically reevaluated to account for changes in inflation.

All direct costs are in 2011 dollars, and are based on an ENR CCI 20-City Average of 9,116 (September 2011). Cost estimates were developed using a Class 3 budget estimate, as established by the American Association of Cost Estimators (AACE). This level of estimate is used for budgeting and feasibility studies and assumes a 10 percent to 40 percent level of project definition. The expected accuracy range is -30 percent to +50 percent, meaning the actual cost should fall in the range of 30 percent below the estimate to 50 percent above the estimate.

Construction costs apply the following mark-ups to the direct costs: 30 percent for contingency, 10 percent for general conditions, 15 percent for contractor overhead and profit, and 9.5 percent for sales tax. Project costs include an additional 30 percent for engineering, legal, and administration costs. Design and construction for all projects was assumed to occur within one year except when noted.

7.2.1 Lift Station Costs

The City is moving towards standardizing submersible lift stations within its collection system as the existing wet pit/dry pit stations are considered to be a confined space and require extra precautions for entry. Therefore, Carollo recommended replacing lift stations that have pumps reaching their useful life within the planning period with submersible lift station. Per City’s guidance, the replacement costs for a submersible station were based on the total construction costs incurred for Lift Station 11. However, for lift stations that are substantially different in size as compared to Lift Station 11, costs were estimated based on vendor quotes or recent costs

developed based on projects of similar size completed by Carollo Engineers and experience on other projects.

7.2.2 Pipeline Unit Costs

The City has sewers that range in size from 4-inches to 24-inches in diameter. The pipeline unit costs (as presented in Chapter 5) are shown in Table 7.1. These unit costs were used to estimate the total cost of replacement. The unit costs assume open-trench construction in improved areas. Costs include pavement cutting, excavation, hauling, shoring, pipe materials and installation, backfill material and installation, and pavement replacement.

Table 7.1 Pipeline Construction Unit Costs

Pipe Size (inches)	Pipeline Unit Cost ($/Linear Foot)
4	$ 97
6	$ 129
8	$ 172
10	$ 215
12	$ 258
15	$ 322
18	$ 367
20	$ 428
24	$ 489

7.3 CAPITAL PROJECTS

The capital projects identified can be categorized into lift station (L), pipeline (P), and general (G). Specific projects are described in the sections below.

7.3.1 Lift Station Projects

The City's existing lift stations were reviewed for general condition and hydraulic capacity, as discussed in Chapter 5. The lift stations where the City's criteria for capacity or condition are not met by the year 2030 are summarized below in the following section. Table 7.2 presents a summary of the estimated project costs for lift station improvements projects and Figure 7.1 shows the location of the near-term and long-term lift station projects.

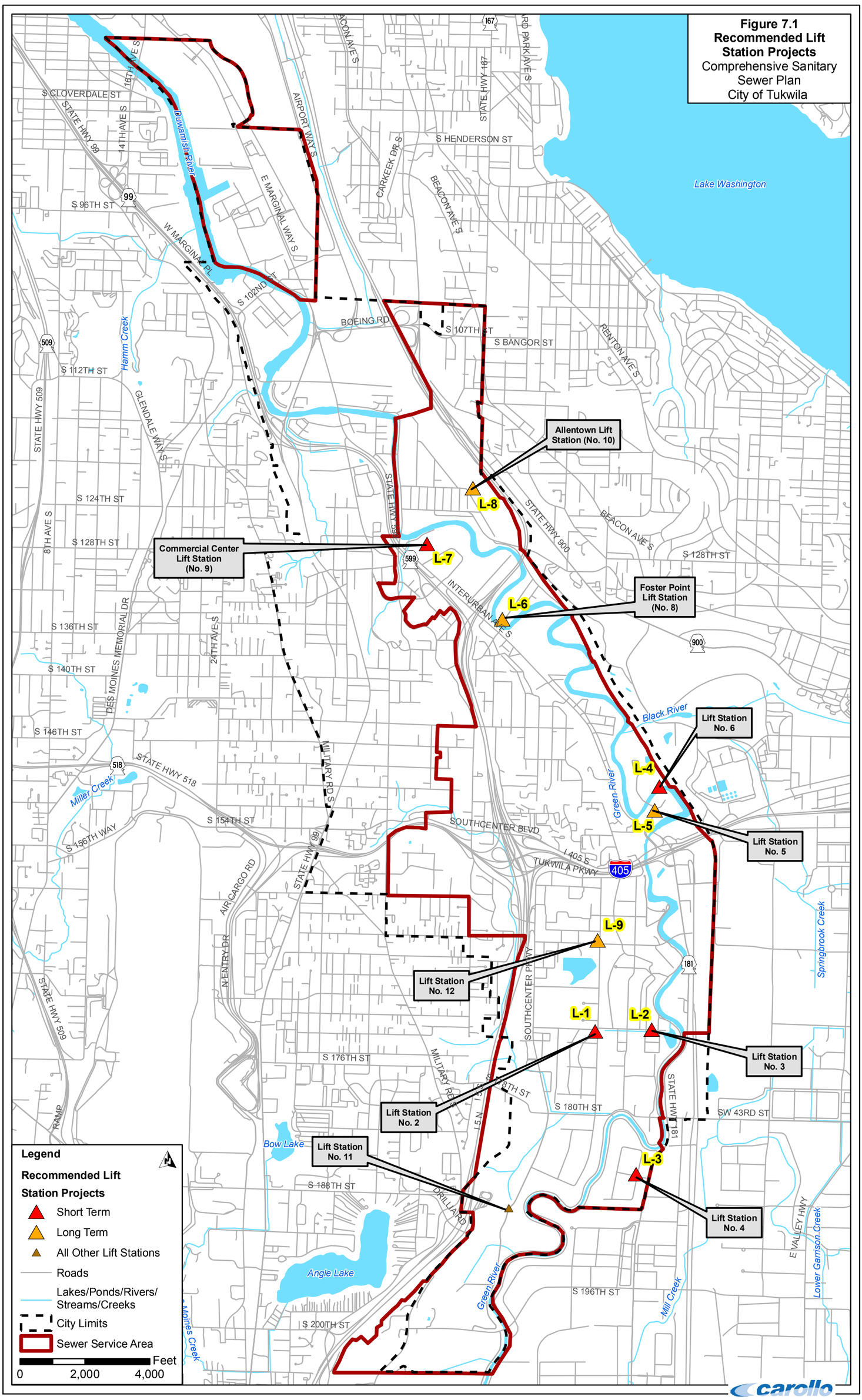


Figure 7.1
Recommended Lift Station Projects
Comprehensive Sanitary Sewer Plan
City of Tukwila
Allentown Lift Station (No. 10)
L-8
Commercial Center Lift Station (No. 9)
L-7
Foster Point Lift Station (No. 8)
L-6
Lift Station No. 6
L-4
L-5
Lift Station No. 5
L-9
Lift Station No. 12
L-1
L-2
Lift Station No. 3
Lift Station No. 2
Lift Station No. 11
L-3
Lift Station No. 4
Lake Washington
Duwamish River
Black River
Green River
Springbrook Creek
Hamm Creek
Miller Creek
Bow Lake
Angle Lake
Mill Creek
Lower Garrison Creek
S CLOVERDALE ST
S 96TH ST
S 102ND ST
BOEING RD
S 107TH ST
S BANGOR ST
S HENDERSON ST
S 112TH ST
S 124TH ST
S 128TH ST
S 136TH ST
S 140TH ST
S 146TH ST
S 154TH ST
S 156TH WAY
S 176TH ST
S 178TH ST
S 180TH ST
S 188TH ST
S 196TH ST
S 200TH ST
SW 43RD ST
SOUTHCENTER BLVD
TUKWILA PKWY
I-405
STATE HWY 99
STATE HWY 509
STATE HWY 518
STATE HWY 900
STATE HWY 181
STATE HWY 167
INTERURBAN AVE S
BEACON AVE S
RENTON AVE S
E MARGINAL WAY S
AIRPORT WAY S
W MARGINAL PL
GLENDALE WAY S
DES MOINES MEMORIAL DR
MILITARY RD S
AIR CARGO RD
N ENTRY DR
SOUTHCENTER PKWY
E VALLEY HWY
Legend
Recommended Lift Station Projects
Short Term
Long Term
All Other Lift Stations
Roads
Lakes/Ponds/Rivers/ Streams/Creeks
City Limits
Sewer Service Area
Feet
0
2,000
4,000
carollo

Table 7.2 Summary of Project Costs for Recommended Lift Station Projects

Project ID	Recommended Year	Short Term (2013-2019)	Long Term (2020-2030)
L-1	–2013, Long-term	$250,000[1]	$702,000
L-2	Long-term		$490,000[1]
L-3	Long-term		$490,000[1]
L-4	Long-term		$409,500
L-5	Long-term		$409,500
L-6	Long-term		$117,000
L-7	Long-term		$605,000[1]
L-8	Long-term		$117,000
L-9	Long-term		$4,400,000[1]
L-10	Annual	$70,000[1]	$110,000[1]
Total		**$320,000**	**$7,850,000**

Notes:
1. Cost estimates provided by City.

7.3.1.1 Replace and Expand Lift Station 2 (L-1)

It is projected that Lift Station 2 will experience a large increase in flow as this station will convey flows from the new Drainage Basin 14 (via Lift Station 11) to the King County sewer system. The City has observed no growth recently for the new area, and thus does not anticipate a large increase in flows within the near-term timeframe.

Lift Station 2 has an on-site generator that has reached the end of its useful life and will need to be replaced within the near-term timeframe. For the purposes of this CIP, it is anticipated that Lift Station 2 will have to be replaced and expanded within the long-term timeframe.

7.3.1.2 Replace and Expand Lift Station 3 (L-2)

Flows to List Station 3 are projected to exceed the lift station capacity by the year 2030. The City has observed minimal growth recently in the flow to Lift Station 3 and does not anticipate that the station's capacity will be exceeded in the near-term. Lift Station 3 has a wet pit/dry pit type of configuration and the lift station structure will reach its useful life in year 2022. Carollo recommends that the City monitor the Lift Station 3 flows and replace this station with a submersible lift station when the capacity is exceeded. For the purposes of this CIP, it is anticipated that Lift Station 3 will need to be replaced and expanded within the long-term timeframe.

7.3.1.3 Replace Lift Station 4 (L-3)

Based on the hydraulic capacity analysis, Lift Station 4 has adequate firm capacity for the year 2030 projected flows. However, the condition of the lift station is fair and may need to be

replaced. Due to these condition concerns, it is recommended that this lift station be replaced with a submersible station within the long-term timeframe.

7.3.1.4 Replace Lift Station 5 (L-4)

Lift Station 5 has adequate capacity for the predicted year 2030 flows. However, based a design life of 20 years, the pumps will reach the end of their useful life in year 2022. In addition, this station was built in 1975 with wet pit/dry pit configuration and the structure is anticipated to reach the end of its useful life by the year 2025. The overall condition of this lift station was rated as “fair” and thus it is recommended that this lift station be replaced within the long-term timeframe with a submersible type lift station.

7.3.1.5 Replace Lift Station 6 (L-5)

Lift Station 6 has adequate capacity for the predicted year 2030 flows. However, based a design life of 20 years the pumps will reach the end of their useful life in year 2019. In addition, this station was built in 1975 with wet pit/dry pit configuration and the structure is anticipated to reach the end of its useful life by the year 2025. The overall condition of this lift station was rated as “fair” and thus it is recommended that this lift station be replaced within the long-term timeframe with a submersible type lift station.

7.3.1.6 Replacement of Pumps at Lift Station 8 (L-6)

Lift Station 8 is a submersible stations built in 2007 and it is anticipated that the pumps will reach the end of their useful life in the year 2027. Based on the capacity analysis, the station has sufficient capacity to meet year 2030 predicted flows. It is recommended a pump draw down test is performed to confirm the pumps actual capacity and replacing the pumps when the tests indicate that pump station firm capacity is less than is required. For this CIP, new pumps at Lift Station 8 were assumed for the long-term timeframe.

7.3.1.7 Abandon Lift Station 9 (L-7)

Lift Station 9 has pumps that have already reached the end of their useful life, based on an assumed 20-year design life. In addition, the station has a wet pit/dry pit configuration and the structure is anticipated to reach the end of its useful life in the year 2030.

The City wishes to eliminate this lift station and connect to the nearest King County sewer in Interurban Avenue South. For this CIP, costs for demolition of entire station and connecting to the King County trunk line are included in the long-term timeframe.

7.3.1.8 Replacement of Pumps at Lift Station 10 (L-8)

Lift Station 10 is a submersible station, built in 2007 and it is anticipated that the pumps will reach the end of their useful life in the year 2027. Based on the capacity analysis, the station has sufficient capacity to meet year 2030 predicted flows. It is recommended a pump draw down test is performed to confirm the pumps actual capacity and replacing the pumps when the tests indicate that pump station firm capacity is less than is required. For this CIP, new pumps at Lift Stations 10 were assumed for the long-term timeframe.

7.3.1.9 Replace Lift Station 12 (L-9)

Lift Station 12 conveys flows from Drainage Basins 4 and 8 to the King County trunk. Similar to Lift Stations 5, 6, and 9, Lift Station 12 also has sufficient capacity to convey the predicted year 2030 flows. The station was originally built in 1972 (wet pit/dry pit style) and pumps were replaced in 2003. It is anticipated that both the pumps and structure reach their useful life by year 2023.

The City is currently considering alternatives to serve Drainage Basin 4. Depending on the City's decision, flows to Lift Station 12 may be significantly different than predicted. Therefore, it is recommended that the City first monitor flows at the lift station and then replace it with submersible style station when either the flow to the station exceeds the firm capacity of the pumps or when the pumps and structure reach the end of their useful life. For this CIP, a new Lift Station 12 was assumed for the long-term timeframe. Due to the size of this project, it is anticipated that design will last one year and construction will last two years.

7.3.1.10 Replacement of Lift Station Generators (L-10)

As the generators at the lift stations age, they will need to be replaced. To fund this replacement, the City is planning on establishing a generator replacement fund with an annual contribution rate of $10,000.

7.3.2 Pipeline Projects

The City's sewer system will require several improvements to adequately provide service through the planning period. Several pipes were identified as having reached the end of their useful life or deficient due to sags. The following section presents a summary and estimated project costs to replace or repair the deficiencies in the system. Additionally, the City currently has a rigorous I/I reduction program and continued funding of this program is recommended through the planning period. Figure 7.2 presents the location of the pipelines CIP projects. A summary of pipeline project costs is presented in Table 7.3.

7.3.2.1 Annual Pipeline Repair Program (P-1)

The City has several sections of the conveyance system that are estimated to have reached the end of their useful life. It is estimated that the annual pipeline repair program for the City's sewers would cost approximately $1,490,000 per year. The City will evaluate which projects to include in this program on a yearly basis.

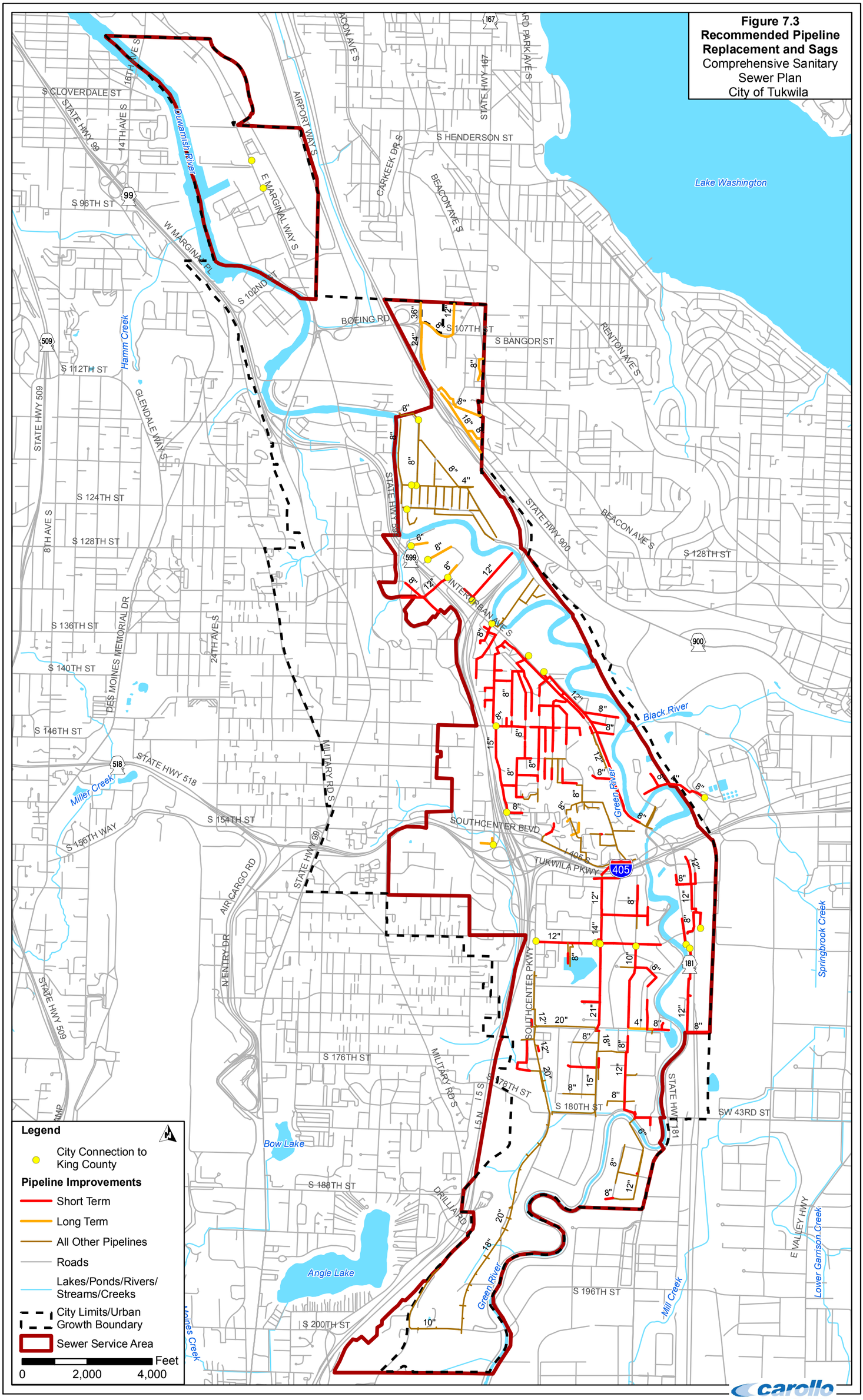


Figure 7.3
Recommended Pipeline Replacement and Sags
Comprehensive Sanitary Sewer Plan
City of Tukwila
Lake Washington
Duwamish River
Hamm Creek
Black River
Green River
Springbrook Creek
Miller Creek
Bow Lake
Angle Lake
Mill Creek
Lower Garrison Creek
Holmes Creek
S CLOVERDALE ST
S 96TH ST
S 102ND ST
BOEING RD
S 107TH ST
S BANGOR ST
S HENDERSON ST
S 112TH ST
S 124TH ST
S 128TH ST
S 136TH ST
S 140TH ST
S 146TH ST
S 154TH ST
S 156TH WAY
S 176TH ST
S 178TH ST
S 180TH ST
S 188TH ST
S 196TH ST
S 200TH ST
SW 43RD ST
SOUTHCENTER BLVD
TUKWILA PKWY
INTERURBAN AVE S
STATE HWY 99
STATE HWY 509
STATE HWY 518
STATE HWY 900
STATE HWY 181
MILITARY RD S
AIRPORT WAY S
E MARGINAL WAY S
W MARGINAL PL
BEACON AVE S
CARKEEK DR S
RENTON AVE S
GLENDALE WAY S
DES MOINES MEMORIAL DR
AIR CARGO RD
N ENTRY DR
SOUTHCENTER PKWY
DRILLIARD
E VALLEY HWY
14TH AVE S
16TH AVE S
8TH AVE S
24TH AVE S
I-5 N
I-5 S
405
Legend
City Connection to King County
Pipeline Improvements
Short Term
Long Term
All Other Pipelines
Roads
Lakes/Ponds/Rivers/ Streams/Creeks
City Limits/Urban Growth Boundary
Sewer Service Area
Feet
0
2,000
4,000
carollo

7.3.2.2 Correction of Sag Issues (P-2)

The City reported the three sag issues within its collection system:

1. Approximately 1500 feet of 8-inch sewer in Interurban Avenue from The Golden Nugget at 14025 Interurban Avenue South to the Foster Green Apartments at 13735 Interurban Avenue South (P2-a).
2. Approximately 865 feet of 12-inch sewer and 3 manholes between Andover Park East and Andover Park West have severe sags (P2-b).
3. Approximately 500 feet of 12-inch line under I-405 from North Hill and Andover Park West (P2-c).

The City plans to replace the sag between Andover Park East and Andover Park West in the near-term timeframe and the sag on Interurban Avenue South in the long-term timeframe.

The 12-inch line under I-405 currently conveys flow from Drainage Basin 4 across I-405 and drains to Drainage Basin 8. An analysis of several alternatives to serve Drainage Basin 4 that will eliminate this sag issue were evaluated and presented to the City. Based on the analysis, it is recommended a new below grade duplex submersible lift station and forcemain in Drainage Basin 4 is located to pump to the King County trunk at the intersection of Macadam Road and South 152nd Street. Due to the size of this project, the City is planning on the design and construction of this project to last four years. For this CIP, it is planned that the project will be completed within the near-term timeframe.

7.3.2.3 On-Going I/I Improvements (P-3)

The City has an aggressive I/I program as detailed in Chapter 3. Every four years, the City investigates the entire sanitary sewer system using cameras to search for leaks and piping problems. The City commits $75,000 in the annual capital improvements program to repair leaks found during the investigation. As part of this CIP, it is recommended that the City continue setting aside $75,000 every year to maintain the current aggressive I/I Reduction Program.

7.3.2.4 Metro Sewer Line Connection Repair (P-4)

The City has indicated that the connection from Lift Station 12 to the Metro Sewer Line at Andover Park West needs to be repaired within the long-term timeframe. The City estimates that this project will cost $150,000.

Table 7.3 Summary of Project Costs for Recommended Pipeline Projects

Project ID	Description	Project Timing	Short Term (2013-2019)	Long Term (2020-2030)
P-1	Annual Pipe Repair Program	Annual	$10,430,000	$16,390,000
P-2	Correction of Sag Issues			
P-2a	Interurban Avenue	Long-term		$940,000[1]
P-2b	Andover E and W	2013	$1,000,000[1]	
P-2c	Under I-405	2014 - 2016	3,971,000[1][2]	
P-3	On-going I/I	Annual	$525,000	$825,000
P-4	Metro Sewer Line Connection Repair	Long-term		$150,000
Total Cost			**$15,926,000**	**$18,305,000**

Notes:
1. Costs provided by City.
2. Costs include the new Lift Station and upgrades to the 3,200 feet of 8-inch pipe to a 12-inch pipe from Macadam Road to the I-405 undercrossing.

7.3.3 General Projects

The City has general system projects that are recommended, such as collection system hydraulic model and comprehensive sewer plans. A summary of the general projects costs are presented in Table 7.4.

Table 7.4 Summary of Costs for Recommended General Projects

Project ID	Description	Project Timing	Near-Term (2011-2019)	Long-Term (2020-2030)
G-1	Collection System Hydraulic Model	2017	$225,000	$ –
G-2	Comprehensive Sewer Plan Updates	2017, Long-term	$200,000	$400,000
G-3	GIS Inventory of Sewer System	Long-term		$605,000
Total Cost			**$425,000**	**$1,005,000**

7.3.3.1 Collection System Hydraulic Model (G-1)

As expressed in Chapter 5, a hydraulic modeling analysis was not performed for the collection system evaluation under this planning effort. Based on the modeling conducted for the previous plan, the capacity of the collection system is assumed to be sufficient in the near-term (year 2019) and flow monitoring and hydraulic model calibration and analysis is recommended within the next 5 years to identify any capacity issues in the long-term (between 2020 and 2030).

It is assumed that flow monitoring will be conducted using open channel flow meters at one location in each sewer basin for a three-month period capturing both dry and wet season conditions. It is also assumed that existing rainfall data will be used. The City's model would be expanded to include the major sewer lines for the entire system and calibrated to the measured rain gauge results. For the CIP it is assumed that this project would cost $425,000.

7.3.3.2 Comprehensive Sewer Plan Updates (G-2)

It is recommended that the City update the Comprehensive Sewer Plan every six years. In the CIP an amount of $200,000 is allocated in years 2017, 2023, and 2029.

7.3.3.3 GIS Inventory of Sewer System (G-3)

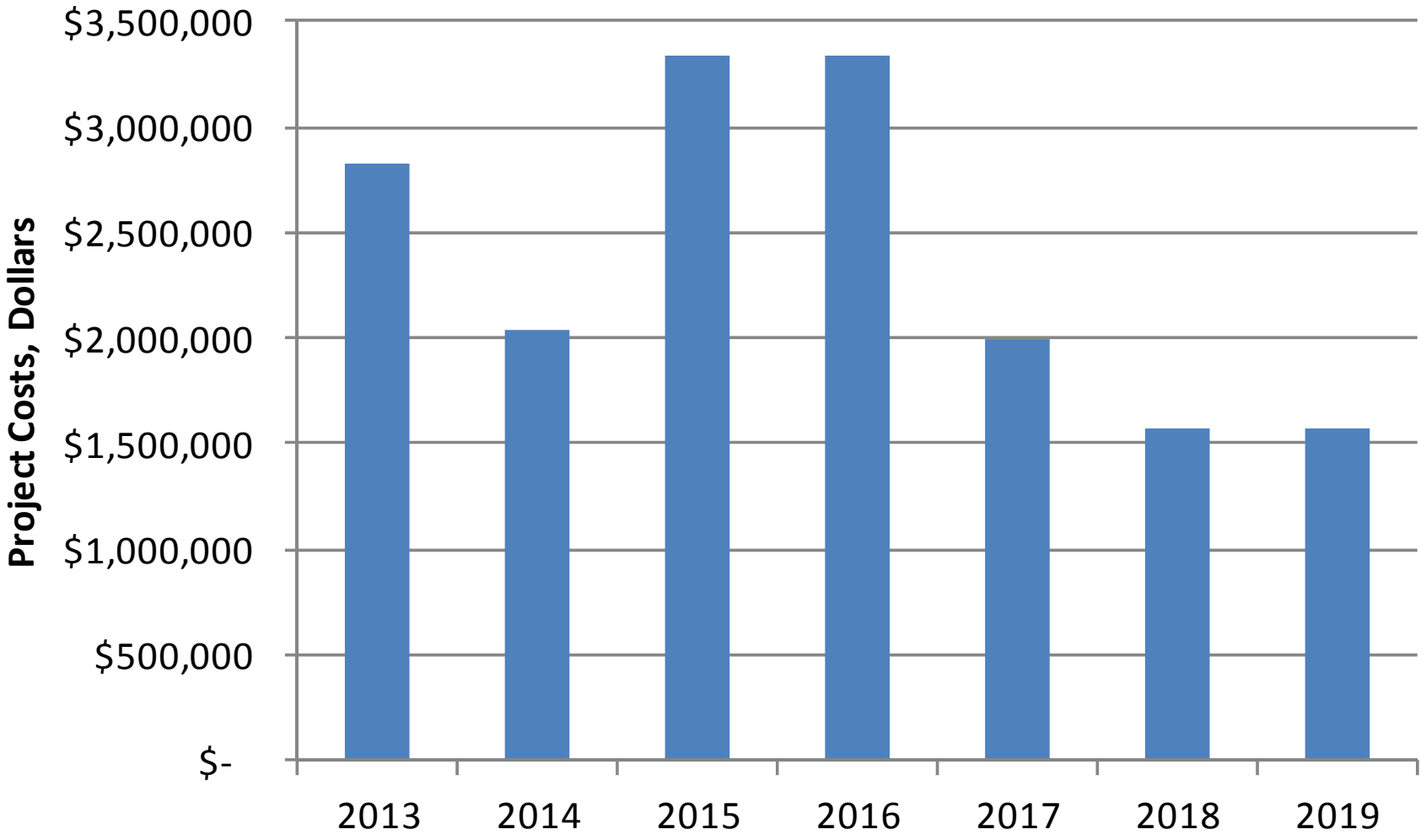
The City plans to perform a GIS Inventory of their sewer system to enable a more accurate tracking of their system. This effort will improve the City's understanding of their system and may yield for accurate results from subsequent hydraulic modeling efforts. The City has allocated an amount of $605,000 in the long-term for this project.

7.4 SUMMARY

In summary, the City's lift stations and collection system have been evaluated for general conditions and capacity, and appropriate projects have been recommended. Implementing the proposed projects will improve overall capacity, conditions, and reliability of the existing system. Table 7.5 presents the overall CIP for the City. Figures 7.3 and 7.4 present the total project costs for near-term and long-term, respectively.

Table 7.5 Capital Improvement Plan

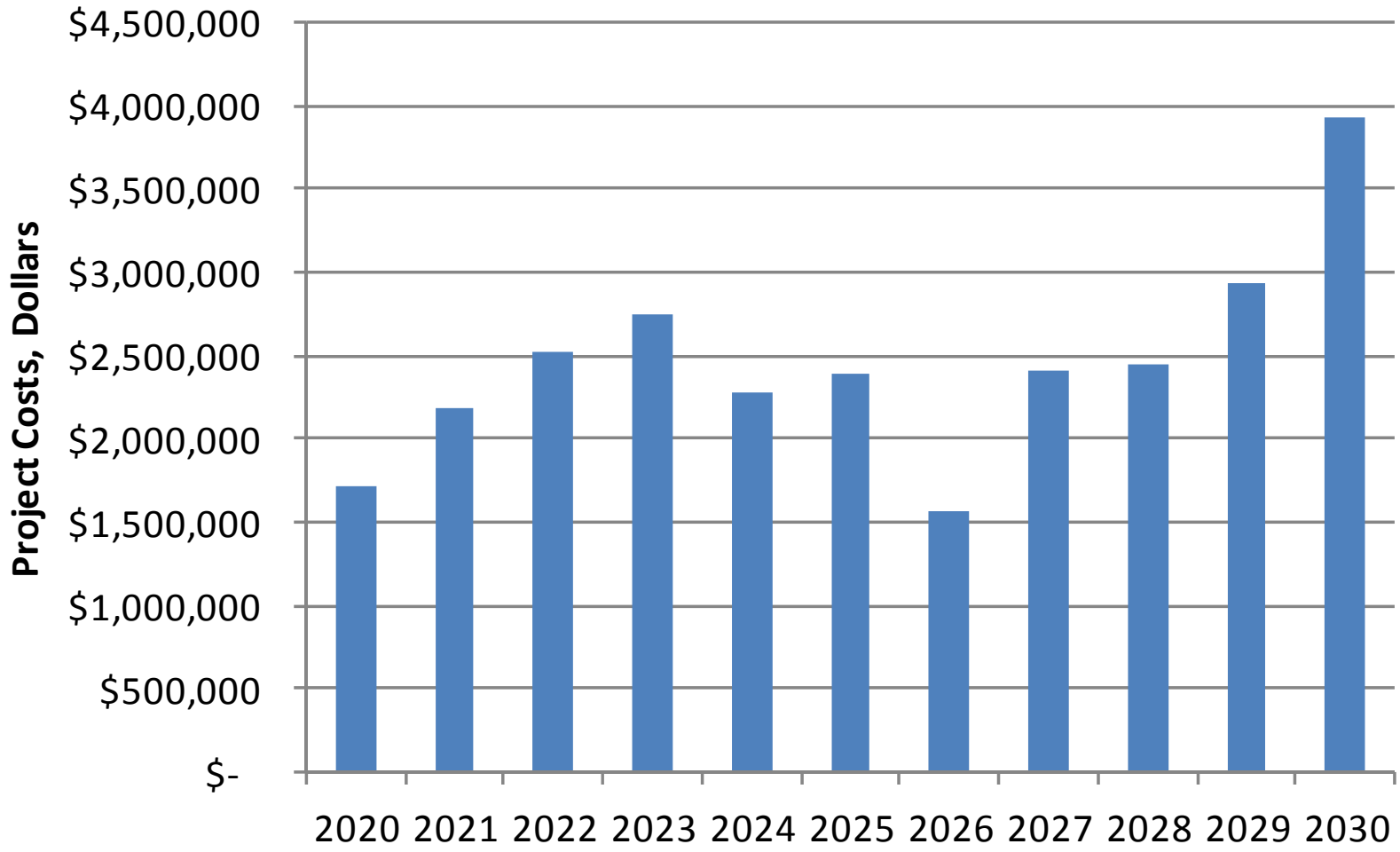
ID	2013	2014	2015	2016	2017	2018	2019	Near-Term	Long-Term
Lift Station Projects									
L-1	$ 250,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 250,000	$ 702,000
L-2	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 490,000
L-3	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 490,000
L-4	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 409,500
L-5	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 409,500
L-6	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 117,000
L-7	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 605,000
L-8	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 117,000
L-9	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400,000
L-10	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 70,000	$ 110,000
Pipeline Projects									
P-1	$ 1,490,000	$ 1,490,000	$ 1,490,000	$ 1,490,000	$ 1,490,000	$ 1,490,000	$ 1,490,000	$ 10,430,000	$ 16,390,000
P-2a	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 940,000
P-2b	$ 1,000,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,000,000	$ -
P-2c	$ -	$ 458,000	$ 1,756,000	$ 1,757,000	$ -	$ -	$ -	$ 3,971,000	$ -
P-3	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 525,000	$ 825,000
P-4								$ -	$ 150,000
General Projects									
G-1	$ -	$ -	$ -	$ -	$ 225,000	$ -	$ -	$ 225,000	$ -
G-2	$ -	$ -	$ -	$ -	$ 200,000	$ -	$ -	$ 200,000	$ 400,000
G-3	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 605,000
Total	$ 2,825,000	$ 2,033,000	$ 3,331,000	$ 3,332,000	$ 2,000,000	$ 1,575,000	$ 1,575,000	$ 16,671,000	$ 27,160,000



NEAR-TERM PROJECT COSTS

FIGURE 7.3

CITY OF TUKWILA
COMPREHENSIVE SANITARY SEWER PLAN



LONG-TERM PROJECT COSTS

FIGURE 7.4

CITY OF TUKWILA
COMPREHENSIVE SANITARY SEWER PLAN

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CHAPTER 8

FINANCIAL ANALYSIS

8.1 INTRODUCTION

This chapter presents the financial program, including financial history, outstanding debt, fees and charges, and capital improvement funding. A six-year plan is presented to fund the capital improvements recommended in Chapter 7. This chapter has been prepared by Katy Isaksen & Associates for inclusion in the Plan.

8.1.1 Financial History

The City owns and operates the sewer utility and contracts with King County for sewage treatment services. The City also owns and operates a water utility that allows for joint utility billing. The sewer utility is accounted for separately and operated in a self-sufficient manner. The Public Works Department manages the system, the Finance Department manages the billing, collection and accounting services, and the two departments jointly prepare and monitor the annual budget.

From a financial perspective, there are two portions of the sewer system: 1) the City owns and operates the sewer collection system, and; 2) contracts with King County for sewage treatment services. The City sets the monthly rates for the operations, maintenance and improvement of the City's sewer lines and pump stations. King County sets the monthly rates for the treatment services and they are included on the City's utility bills. As is typical in the region, the cost for sewage treatment is much higher than for the City's portion of the utility.

Table 8.1 shows the summary history of sewer operations in the recent years, 2009 through 2012.

Table 8.1 Summary Sewer Operating Fund History

Sewer Fund	2009	2010	2011	Estimated 2012
Sewer Revenue				
Monthly Sewer Charges	$4,652,000	$5,094,000	$5,513,000	$5,400,000
Miscellaneous Revenue	177,000	290,000	184,000	125,000
Grant/Bonds/PWTF	-	886,000	1,228,000	400,000
Sewer Connection Fees	234,000	107,000	115,000	52,000
Total Sewer Revenue	**$5,063,000**	**$6,377,000**	**$7,040,000**	**$5,977,000**

Table 8.1 Summary Sewer Operating Fund History

Sewer Fund	2009	2010	2011	Estimated 2012
Sewer Expenditures				
Operations & Maintenance	$4,382,000	$4,625,000	$4,298,000	$4,350,000
Debt Service	359,000	358,000	357,000	356,000
Interfund Utility Tax	754,000	550,000	562,000	500,000
Engineering Labor	69,000	75,000	137,000	100,000
Capital CIP Program	114,000	523,000	2,327,000	400,000
Total Sewer Expenditures	**$5,678,000**	**$6,131,000**	**$7,681,000**	**$5,706,000**
Annual Increase/(Use) of Reserves	(615,000)	246,000	(641,000)	271,000
Ending Sewer Fund Balance				**$1,125,000**

The estimated 2012 monthly sewer charges include King County Treatment ($3,400,000) and Regular City Sewer ($2,000,000).

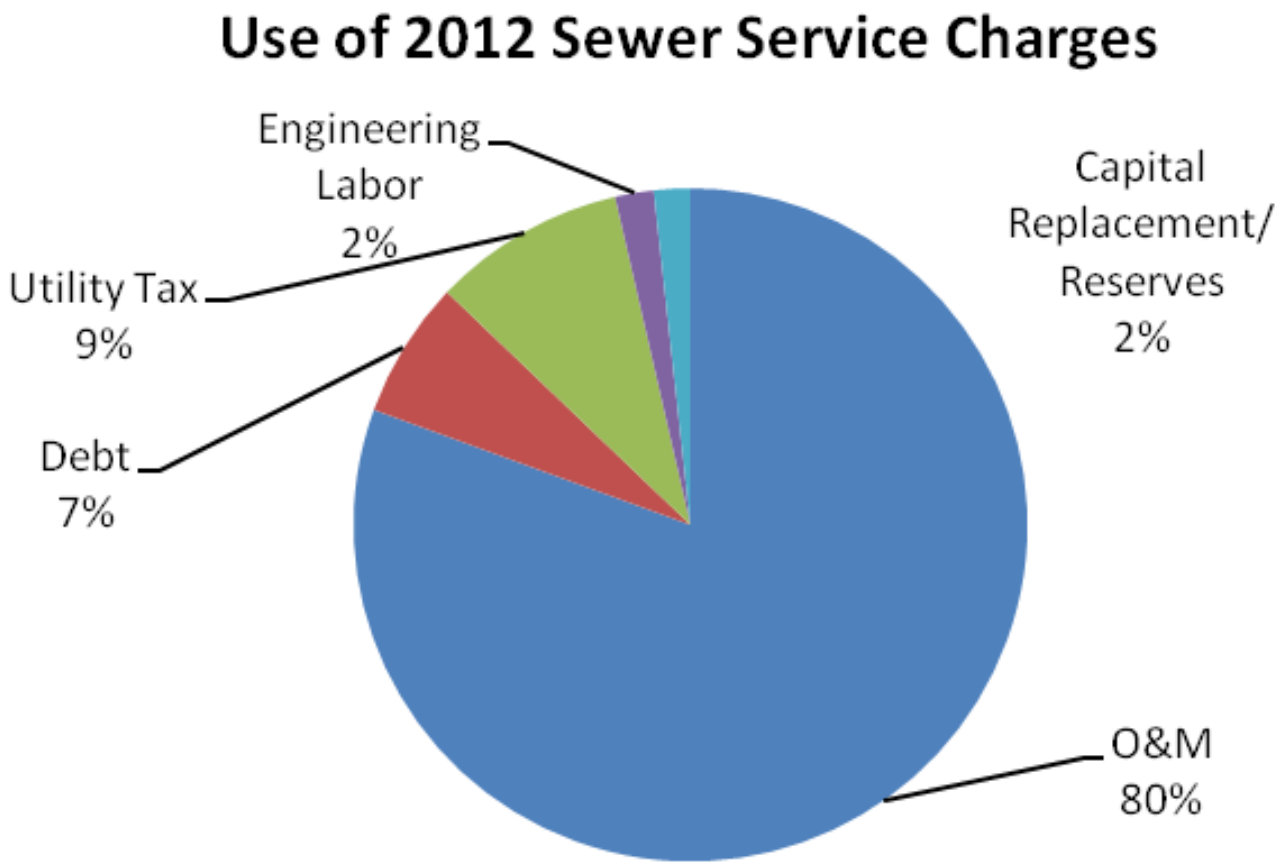
The sewer utility has been meeting the operations and maintenance expenses, debt repayment and capital replacement program in each year and has been maintaining a level of reserves for emergency and future replacement.

The bottom line of Table 8.1 for each year shows whether the utility reserves are increasing or being used. Table 8.1 shows that overall, the reserves for the sewer utility have been decreasing in recent years. In part this is due to the timing differences between the funding source and the project completion.

The reserve use shown in 2009 is related to an unanticipated new utility tax. A new utility tax was established in 2009 for a 15 percent tax on the City utility gross revenues for water, sewer and stormwater. In 2010, Ordinance 2298 reduced the tax to 10 percent through December 31, 2015.

The 2012 ending sewer fund balance was estimated to be $1,125,000. Of this, $1,115,000 is set aside for minimum target reserves (20 percent of the prior year's operating revenues) and $9,600 is available for future capital improvements. This reserve policy was updated in 2012 in Resolution No. 1774 Working Capital Reserve.

Monthly sewer service charges are the primary funding source for the sewer utility. The service charges are used to pay for the O&M, debt service, utility tax and the engineering labor for developing capital improvements. The remainder is available for current year capital improvements, future capital replacement or reserves. Figure 8.1 illustrates the use of the 2012 sewer service charges. The vast majority of service charge revenue went to funding on-going costs, leaving approximately $100,000 or 2 percent available for capital replacement or reserves.



USE OF 2012 SEWER SERVICE CHARGES

FIGURE 8.1

CITY OF TUKWILA
COMPREHENSIVE SANITARY SEWER PLAN

In addition, special connection fees are also collected from new connections in areas (e.g. Allentown, Foster Point) where the City has extended sewer with the understanding that the debt would be repaid with special connection charges from the connecting customers. This adds approximately $50,000 of revenue in the year 2012. Miscellaneous revenue of $125,000 would also be available for funding reserves or capital improvements. Thus for 2012, approximately $275,000 was available for capital improvements from current revenue. The City also received $400,000 in outside funding from grants, bonds or PWTF loans for capital improvements that were underway.

For several years, the sewer utility has identified the need for an additional Maintenance and Operations Specialist position but this has been delayed indefinitely in order to build up the Sewer fund's reserves.

8.1.2 Outstanding Debt

The City currently has two outstanding debt issues that sewer is paying a share of the debt service: a 2004 PWTF loan and a 2006 revenue bond. Both issues relate to extending water and sewer services to the Allentown and Foster Point neighborhoods. The sewer utility is paying 62 percent of the annual debt payments for each issue. Sewer will pay debt service (principal and interest) of $355,000 in 2013. The PWTF loan is a low-interest loan at 0.5 percent interest over 20 years, ending in 2024. The revenue bonds are at 4.0-4.5 percent interest over 20 years, ending in 2026.

Table 8.2 shows the outstanding sewer debt principal at the end of 2012, the interest rate, the year the debt will retire and the 2013 payment. In addition, the sewer utility has been approved for a new PWTF loan for the CBD Sewer Rehabilitation project for up to $750,000. It is anticipated that the debt repayment will begin in 2015 for approximately $45,000 annually and would be paid off in 2032. The loan agreement has been signed and funds have not yet been borrowed. The final debt payments will depend on when the funds are borrowed.

Table 8.2 Existing Sewer Debt

Debt Service Issue	Principal as of 12/31/2012	Interest Rate	Year Debt Ends	2013 P+I Payment
2004 PWTF: Allentown (62%)	$2,307,000	0.05%	2024	$204,000
2006 Rev Bond: AFP (62%)	$1,538,000	4-4.5%	2026	$151,000
Total Existing Debt Service	$3,845,000			$355,000
Approved but not yet borrowed (repayment beginning 2015)				
2012 PWTF: CBD Sewer Rehabilitation	*$750,000*	*0.05%*	*2032*	*$45,000*

Revenue bonds come with a promise that the utility will generate enough revenue each year to pay for operations and maintenance, revenue bond payments plus a little extra. The extra is known as coverage. The PWTF loan program, operated by the State of Washington, has been designed to provide loans that are subordinate to revenue bonds and does not have a coverage

requirement. Coverage is not only an issue for existing debt, it is also important to keep in mind as a strong coverage ratio results in better rates for future bond sales.

Figure 8.2 shows a map of the debt payments, including the approved 2012 PWTF loan. This debt map allows the sewer utility to plan ahead and seek opportunities to fund other improvements when existing debt issues end, such as after 2024, 2026 and 2032.

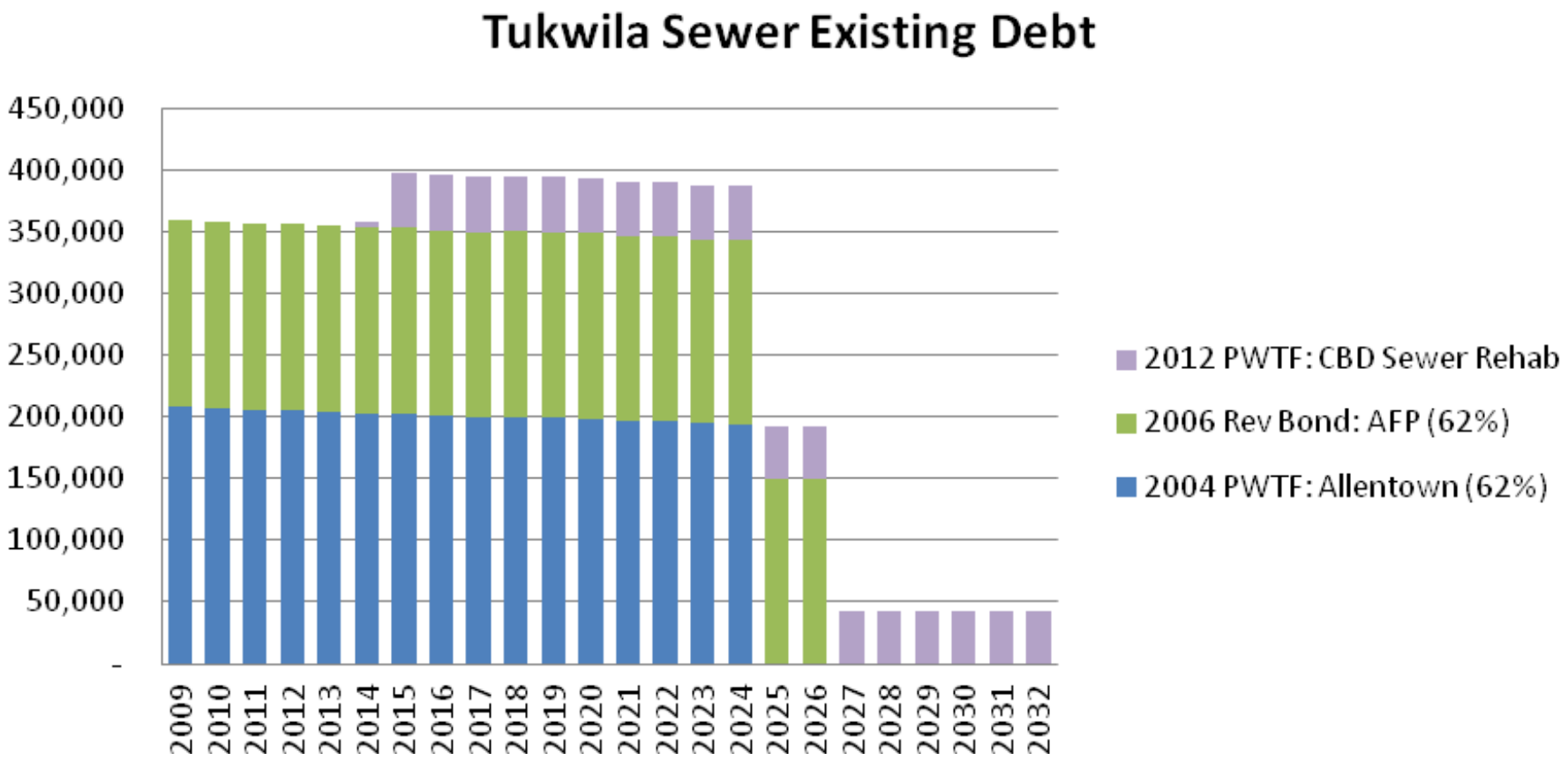
8.1.3 Current Rates and Charges

There are two components to the sewer rates – the City rate and the King County rate. Both components are included on the combined utility bill. The 2013 sewer rate schedule is shown in Table 8.3. A single family residence pays $62.89 per month for sewer service in 2013. A 50 percent discount is available for low-income senior and disabled customers. Multi-family customers are charged by the number of units (City) and water usage (King County). Commercial/Industrial customers are charged based on water usage for both components.

Table 8.3 Sewer Rate Schedule (Effective January 2013)

Monthly Sewer Rates	Base Charge	for City System	Sewer Treatment	by King County	Total Monthly
Single-family Residence	$23.10	Flat Rate per Dwelling	$39.79	Flat rate	$62.89
Senior & Disabled Low Income	$11.55	Flat Rate per Dwelling	$19.90	Flat rate	$31.45
Multi-family Residential Unit	$23.10	Flat Rate per Dwelling Unit	$39.79	Min. up to 750 cf	$62.89
	$0.00	Per each additional 750 cf or fraction thereof	$39.79	Per additional 750 cf	$39.79
Commercial/ Industrial	$40.48	Minimum Charge includes up to 750 cf of consumption	$39.79	Min. up to 750 cf	$80.27
	$40.48	Per each additional 750 cf or fraction thereof	$39.79	Per additional 750 cf	$80.27

For sewer customers outside the city limits, the rate depends on whether the community constructed and paid for the sewer mains or whether they connected to existing sewer mains. For the areas that constructed their own sewer mains, the monthly service charge is the same as in-city. For those that connected into existing sewer mains and did not pay for the construction, they are charged two times the in-city rate.



EXISTING DEBT

FIGURE 8.2

CITY OF TUKWILA
COMPREHENSIVE SANITARY SEWER PLAN

8.1.3.1 Connection Charges

The City does not currently charge all new connections for a general facilities charge, otherwise known as a system development fee or capital facilities charge. Instead, the City connection charges vary by area and are based on the sewer mains that a property will connect into. In essence, each customer is responsible for an equitable share of the sewer mains. If a property owner constructs the sewer mains and transfers ownership to the City, there will typically not be a special connection fee. However, if the property owner connects into an existing sewer main, a special connection fee will be required and will need to be calculated. Public Works maintains the records and maps that document the special connection fee areas.

In addition, all new connections are required to pay a King County Capacity Charge. This capacity charge is billed directly by King County and is typically paid monthly over 15 years. The rate for a property is set when the permit is issued and will remain the same for the 15 years. The property owners have the option to pre-pay at any time to reduce the interest charges included in the monthly fee. The current 2013 King County Capacity Charge is $53.50 per month, is billed directly by King County and is in addition to all sewer service charges billed by the City.

8.1.4 Affordability

The Environmental Protection Agency defines affordable sewer rates as two percent of median household income (MHI). Another way of looking at affordability is to ask about the definition of hardship for primary sewer grant and loan programs. The Clean Water State Revolving Fund loan program is managed by Ecology and uses the EPA definition of 2 percent of MHI. With sewer cost greater than 2 percent of MHI, a community may be eligible for higher grants or lower interest rates. These programs are typically targeted toward residential customers.

The Ecology application guidelines provide a table with MHI and the hardship rate for communities around the State. The current guidelines for use with Fiscal Year 2014 estimates the MHI for the City to be $44,271 from the American Community Survey with the current census. To qualify for hardship, 2 percent of the MHI would be $885, or $73.79 per month. By this measure, the current residential rates of $62.89 are affordable. However, for projects in areas with new connections paying the King County Capacity Charge, the total sewer cost of $116.39 ($62.89 + $53.50) would qualify.

Another measure of affordability is what residents in other jurisdictions are paying. Table 8.4 compares current 2013 single-family monthly rates for jurisdictions in the south King County area. The sewer providers at the higher end of the range are those that contract with King County for sewage treatment services. Those at the lower end of the range are those sewer districts that have their own treatment plants.

Table 8.4 Single-Family Monthly Sewer Rates

Sewer Provider	Local Sewer	King County Treatment	Total Sewer & Treatment
Renton	$27.49	$39.79	$67.28
Tukwila	$23.10	$39.79	$62.89
Auburn	$21.02	$39.79	$60.81
Kent	$17.27	$39.79	$57.06
Soos Creek WSD	$17.20	$39.79	$56.99
Valley View SD-KC area	$11.51	$39.79	$51.30
Lakehaven UD			$36.47
Valley View SD -Midway area			$35.50
Valley View SD -SWSSD area			$31.25
Southwest Suburban SD			$27.50

8.1.5 Capital Improvement Funding Sources

The City has been successful at using a variety of capital funding sources, including grants from various sources, combined water/sewer revenue bonds, PWTF loans, local improvement districts, sewer reserves and repaying debt with monthly sewer rates.

For the City, the recommended capital improvements relate to the sewer collection system, not the more costly sewage treatment system. The cost estimates for these projects typically range in the tens of thousands up to tens of millions. When seeking funding for the improvements, understanding that there is a certain cost to obtaining funding sources other than rates, the City may consider bundling projects for the most efficient effort.

Typical funding sources for capital improvements can be described in several categories:

1. Grant or low-interest loan programs are offered by state, federal and local agencies to assist in funding infrastructure projects. Each program will have its own requirements, eligibility, application cycle and method of doing business. In tough economic times, program changes are common and should be reviewed before seeking funding.

2. Bond sales are a common funding method where the City has the authority to sell bonds to fund the improvements and will be repaid over a number of years. This helps the utility lock in current interest rates to complete projects over a maximum three-year period. Revenue bonds are most common for sewer utilities, where the repayment is promised from the reliable stream of service charge revenue. General obligation bonds can also be used where the City pledges the overall revenue of the City.

3. Contributions from joint partners, developer extensions and local improvement districts are another category where specific owners, developers or partners pay for the improvements. This category also includes city projects that involve more than one utility or city function, such as street overlay, stormwater and water projects.

4. Other sources include state or federal appropriations, such as an earmark outside of funding assistance programs, one-time legislative programs or local regional programs.

5. Users include system development fees paid by new connections, monthly sewer rates to pay for projects or debt resulting from projects, and sewer reserves saved for future capital improvements.

The primary grant and loan programs for sewer collection projects are described below.

8.1.5.1 State Of Washington Department Of Commerce

State of Washington Department of Commerce manages several programs targeted toward infrastructure along with community, economic and job development. These include the Community Economic Revitalization Board (CERB) programs to assist in attracting and retaining private investment and resulting in jobs and increased tax revenue to the community. These may be a portion grant combined with a loan. A fairly new program has been added, Energy Efficiency Grants for Higher Education and Local Governments. The maximum grant under this program has been $500,000 for local governments and would be available for rehabilitating existing pump stations.

The Public Works Trust Fund (PWTF): The PWTF has had several programs, including construction, pre-construction, emergency and planning. Due to the State budget issues, the construction program and the emergency program are the two active programs. The construction program offers low-interest loans up to $10 million with an average loan over 20-years at 1.0 percent interest. There are incentives available to reduce the interest rate for less than 20-year repayment and completing the project on time. The City has successfully used this program in the past. The emergency program carries a higher interest rate but can be instrumental when unforeseen emergent needs arise that require substantial investment.

The PWTF construction program requires projects to be ready to proceed and thus the loans must be drawn within 36 months of approval. This is a competitive program with an annual application cycle in January to May of each year, and funds being available the following year. It is anticipated that the Public Works Board will open an application cycle in May or June 2013 depending on the outcome of the current legislative session.

It is possible that the pre-construction loan program may return. This loan program assisted jurisdictions with funding for engineering design, environmental, archeological, etc. requirements prior to construction.

Community Development Block Grant (CDBG) Program is also housed within the Department of Commerce. A city such as Tukwila would need to go through King County to apply for CDBG funds to assist in a low-income neighborhood.

8.1.5.2 State Of Washington Department Of Ecology

Ecology attempts to have one combined process for the Integrated Water Quality Programs (Centennial Clean Water Program, Clean Water State Revolving Fund, Section 319) for grants and loans for wastewater systems. The annual applications are due around October of each year. The key to a high rating for Ecology is to identify which water quality problems exist and are being addressed by the project. Low-interest loans are offered at 60 percent of the market rate, currently 2.3 percent interest, and limited grants are available for hardship communities. The standard loan is for 20 years and lower interest rates are available for five- and ten-year terms.

The draft offer list is published at the end of February and the final offer list comes in June. Agreements must be signed within a year of the offer. Actual work must begin within 16 months of the final offer list and be completed within five years. Ecology defines hardship where the sewer rate is greater than 2 percent of MHI. In hardship cases, limited grants are available to help make sewer more affordable for residential customers. Grants could include principal forgiveness or interest rate subsidy and would be matched with a companion loan. The maximum grant has been up to $5 million.

The program has also been offering principal forgiveness for eligible "green" projects. The current eligibility parameters should be considered to determine whether the project may qualify.

Another source of potential capital funding is through the economic development path. There are county, state and federal programs available to assist local governments in providing the necessary infrastructure to attract and retain private sector investment and jobs. These programs may or may not have funding available on a regular basis, so it is important to check websites and speak with program administrators before pursuing. With the current economy, there are new programs being established, either as a one-time offer or ongoing program.

8.1.5.3 US Economic Development Administration (USEDA)

The United States Department of Commerce Economic Development Administration has a Public Works and Economic Development Program to help support public infrastructure that is necessary to generate or retain private sector jobs and investments, attract private sector capital and promote regional competitiveness. The typical maximum is $1 million and all federal regulations would apply.

8.1.5.4 Other

Congressional or State Appropriations can be acquired by working with federal or state elected representatives to gain their support and request an appropriation specific to your project. In this budget climate, it is extremely difficult to obtain federal appropriations. State appropriations are also difficult, however each year the state capital budget seems to include a number of appropriations.

The State of Washington has had several pilot or ongoing Local Infrastructure Financing Tool Programs. The successful applicant is approved to retain a portion of the increased taxes from an area resulting from the targeted investment in infrastructure. Given the State budget issues, these programs may or may not be available and are typically subject to legislative approval.

There is an infrastructure funding program database that is provided by the Infrastructure Assistance Coordinating Council (IACC). This can be accessed on the web directly at www.infrafunding.wa.gov. This database is very helpful in determining which funding assistance programs may be available at the time the City is considering each project.

8.1.6 Sewer Capital Improvements

The recommended sewer capital improvements were presented in Chapter 7. The projects were identified as either near term, 2013-2019 or long term, 2020-2030. The cost estimates were prepared using the September 2011 Engineering News Record costs. It is reasonable to assume that the project costs will change based on the construction costs for the year scheduled. Table 8.5 summarizes the near-term project cost of $16,671,000 and shows that this may be $18,593,000 when escalated to the year of construction at 3 percent escalation per year.

Table 8.5 Sewer Capital Improvement Summary

	Estimated Cost (2011)	Escalated to Year of Construction
Near-term (2013-2019)	$16,671,000	$18,592,861
Long-term (2020-2030)	$27,160,000	$40,618,144
Totals	**$43,831,000**	**$59,211,005**

The long-term projects are estimated to cost $27,160,000, which is equivalent to $40,618,000 when escalated to the year of construction. The total estimated cost for near- and long-term projects is $43,831,000, and may reach over $59 million when escalated.

Completion of the recommended capital improvements will require a combination of rates, reserves, rate increases and borrowing. Grants would reduce the impact on ratepayers.

8.1.7 Six-Year Sewer Capital Improvements

Table 8.6 summarizes the recommended six-year capital improvements in three project categories: lift station, pipeline, and general projects. The total six-year costs are estimated to be $15,096,000, and would be $16,656,000 if escalated to the year of planned construction at 3 percent per year.

Table 8.6 Six-Year Sewer Capital Improvements (2013-2018)

Project Description	2013	2014	2015	2016	2017	2018
Lift Station Projects						
Replace & Expand Lift Stn 2	$250,000					
Replace Lift Stn Generators	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Pipeline Projects						
Annual Pipe Repair Program	$1,490,000	$1,490,000	$1,490,000	$1,490,000	$1,490,000	$1,490,000
Correction of Sag Issues			-	-	-	-
12-inch Andover E and W	$1,000,000					
12-inch under I-405	-	$458,000	$1,756,000	$1,757,000		
On-going I/I	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000

Table 8.6 Six-Year Sewer Capital Improvements (2013-2018)						
General Projects						
Coll Syst Hydr Model					$225,000	
Comp Sewer Plan Updates					$200,000	
Total Six-Year Costs	$**2,825,000**	$**2,033,000**	$**3,331,000**	**$3,332,000**	**$2,000,000**	**$1,575,000**
Total Escalated Costs	$**2,909,750**	$**2,156,810**	$**3,639,874**	**$3,750,195**	**$2,318,548**	**$1,880,632**

The recommended six-year CIP is similar to what the City has been planning with the exception of the annual pipe repair program. It is recommended that the City of Tukwila provide approximately $1.5 million per year for the annual pipeline repair program for pipes that are anticipated to have reached their remaining useful life during this planning period. This amount is much higher than the City's current level of investment. Table 8.7 presents the funding plan for the six-year improvements from Table 8.6.

Table 8.7 Funding Plan for Six-Year CIP						
	2013	**2014**	**2015**	**2016**	**2017**	**2018**
City-Planned Rates/Reserves	$335,000	$85,000	$85,000	$85,000	$85,000	$85,000
City-Planned Debt	$1,000,000	$458,000	$1,756,000	$1,757,000	-	-
Annual Pipe Repair Program	$1,490,000	$1,490,000	$1,490,000	$1,490,000	$1,490,000	$1,490,000
Annual Total	**$2,825,000**	**$2,033,000**	**$3,331,000**	**$3,332,000**	**$2,000,000**	**$1,575,000**

When comparing the 2013 revenue estimates for the Regular City Sewer portion, an annual investment of $1.5 million is the equivalent of 80 percent of the current City Portion of the sewer rate. It is unreasonable to assume that the City would consider such an increase. An alternate six-year funding plan was developed that reduces the annual pipe repair program with the understanding that the major projects planned in 2013 to 2016 would be replacing existing pipes as shown in Table 8.8. This reduces the six-year CIP from $15,096,000 to $9,521,000.

Table 8.8 Alternative Six-Year Funding Plan for CIP						
	2013	**2014**	**2015**	**2016**	**2017**	**2018**
City-Planned Rates/Reserves	$335,000	$85,000	$85,000	$85,000	$85,000	$85,000
City-Planned Debt	$1,000,000	$458,000	$1,756,000	$1,757,000	-	-
Annual Pipe Repair Program	$85,000	$100,000	$100,000	$100,000	$1,490,000	$1,490,000
Annual Total	**$1,420,000**	**$643,000**	**$1,941,000**	**$1,942,000**	**$2,000,000**	**$1,575,000**

The City's financial plan anticipates that the large pipe repair projects would be funded by borrowing, either from the PWTF program or by selling bonds. With the alternative six-year funding plan, the City has the opportunity to plan ahead to either step rates up to afford a higher level of annual funding for pipe repair or to seek additional debt each couple of years to complete large capital projects.

The City's current financial plan anticipates rate increases of 20 percent in 2013 and 2014, 10 percent and 15 percent increases in 2015 through 2018.

8.1.8 Six-Year Financial Plan

The City of Tukwila has a six-year financial planning model and capital improvement program that is updated annually. The six-year outlook allows the City to plan ahead to avoid drastic impacts on ratepayers and meets the State's requirement for a six-year financing plan. The most recent 2013 to 2018 plan was reviewed and is compared in developing this financial chapter.

The City has been planning to correct major maintenance issues with the large projects. In order to fund such projects, the City plans to borrow and has obtained the 2012 PWTF loan at 0.5 percent interest. A bond sale is also anticipated for the large projects in the six-year plan. Additional rate increases are anticipated in the City's financial plan to fund the debt payments.

The City's financial plan anticipates rate increases of 20 percent in 2013 and 2014, 10 percent and 15 percent increases in 2015 through 2018. The City will continue to monitor the debt repayment schedule and consider adjusting rates and managing additional debt as necessary.

The detailed six-year sewer financial plan is shown in Table 8.9. Additional rate increases, debt, or adjustment in annual pipe repair program will be necessary to balance 2017.

Table 8.9 Six-Year Sewer Financial Plan							
Sewer Financial Outlook	**Budget 2013**	**Projected 2014**	**Projected 2015**	**Projected 2016**	**Projected 2017[(1)]**	**Projected 2018**	**Total 2013-2018**
Sewer Operating Revenue							
Monthly Sewer Charge	$3,749,000	$3,749,000	$4,161,000	$4,161,000	$4,577,000	$4,577,000	$24,974,000
King County Metro Sewer	$1,886,000	$2,169,000	$2,342,000	$2,647,000	$2,859,000	$3,230,000	$15,133,000
Sewer Operating Revenue	$5,635,000	$5,918,000	$6,503,000	$6,808,000	$7,436,000	$7,807,000	$40,107,000
Capital improvement Revenue							
Miscellaneous Revenue	$150,000	$150,000	$160,000	$180,000	$200,000	$210,000	$1,050,000
Grants/Bonds/PWTF	$750,000	$458,000	$1,756,000	$1,757,000	$-	$750,000	$5,471,000
Sewer Connection Fees	$120,000	$120,000	$125,000	$125,000	$100,000	$100,000	$690,000
Total Capital Revenue	$1,020,000	$728,000	$2,041,000	$2,062,000	$300,000	$1,060,000	$7,211,000
Total Sewer Revenue	$6,655,000	$6,646,000	$8,544,000	$8,870,000	$7,736,000	$8,867,000	$47,318,000
Sewer O&M Expense							
King County Metro Sewer	$3,749,000	$3,749,000	$4,161,000	$4,161,000	$4,577,000	$4,577,000	$24,974,000
Regular City Sewer	$987,000	$1,012,000	$1,036,000	$1,067,000	$1,099,000	$1,132,000	$6,333,000
Sewer O&M Expenses	$4,736,000	$4,761,000	$5,197,000	$5,228,000	$5,676,000	$5,709,000	$31,307,000

Table 8.9 Six-Year Sewer Financial Plan

Sewer Financial Outlook	Budget 2013	Projected 2014	Projected 2015	Projected 2016	Projected 2017[(1)]	Projected 2018	Total 2013-2018
Debt Service							
Revenue Bond (2006) (P+I)	$151,000	$151,000	$151,000	$150,000	$149,000	$151,000	$903,000
Revenue Bond (2004) (P+I)	$204,000	$203,000	$202,000	$201,000	$200,000	$199,000	$1,209,000
Revenue Bond (2012) (P+I)		$4,000	$45,000	$45,000	$45,000	$45,000	$184,000
New Debt for CIP					$320,000	$320,000	$640,000
Subtotal Debt Services	$355,000	$358,000	$398,000	$396,000	$714,000	$715,000	$2,936,000
Interfund Utility Tax	$579,000	$609,000	$666,000	$699,000	$764,000	$802,000	$4,119,000
Engineering Labor	$74,000	$77,000	$78,000	$80,000	$83,000	$85,000	$477,000
Sewer Expense Before Capital	$5,744,000	$5,805,000	$6,339,000	$6,403,000	$7,237,000	$7,311,000	$38,839,000
Sewer Capital – CIP Program	$1,420,000	$643,000	$1,941,000	$1,942,000	$2,000,000	$1,575,000	$9,521,000
Total Sewer Expenditures	**$7,164,000**	**$6,448,000**	**$8,280,000**	**$8,345,000**	**$9,237,000**	**$8,886,000**	**$48,360,000**
Annual Increase/(Use) of Reserves	**$(509,000)**	**$198,000**	**$264,000**	**$525,000**	**$(1,501,000)**	**$(19,000)**	**$(1,042,000)**

Notes:

(1) Additional rate increases, deft or adjustment in annual pipe repair program will be necessary to balance 2017.

Appendix A

STATE ENVIRONMENTAL POLICY ACT CHECKLIST AND DETERMINATION OF NON-SIGNIFICANCE

City of Tukwila

Jim Haggerton, Mayor

Department of Community Development

Jack Pace, Director

DETERMINATION OF NON-SIGNIFICANCE (DNS)

File Number: **E13-008**
Applied: May 15, 2013
Issue Date: January 13, 2014
Status: **Issued Determination of Non-Significance**

Applicant: **Michael P. Cusick, Tukwila Public Works** Lead Agency: **City of Tukwila**

Description of Proposal: This proposal is a SEPA/Environmental Review in preparation for the City of Tukwila to update the Comprehensive Sanitary Sewer Plan. The Sewer Plan Update is a Non-Project action. The objective of this project is to evaluate the existing sewer system and its operation to identify present and future needs in those areas of the sewer system deemed to be critical by the City.

Location of Proposal: City-wide

The City has determined that the proposal does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21c.030(2) (c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

This DNS is issued under WAC 197-11-340(2). Comments must be submitted by January 27, 2014. The lead agency will not act on this proposal for 14 days from the date below.

Jack Pace, Responsible Official
City of Tukwila
6300 Southcenter Blvd
Tukwila, WA 98188
(206)431-3670

Date 1/10/2014

Any appeal shall be linked to a specific governmental action. The State Environmental Policy Act is not intended to create a cause of action unrelated to a specific governmental action. Appeals of environmental determinations shall be commenced within the time period to appeal the governmental action that is subject to environmental review. (RCW 43.21C.075)

FINAL STAFF EVALUATION
FOR ENVIRONMENTAL CHECKLIST

File No: E13-008

I. SUMMARY OF PROPOSED NON-ACTION

This proposal is a SEPA/Environmental Review in preparation for the City of Tukwila to update the Comprehensive Sanitary Sewer Plan. The Sewer Plan Update is a Non-Project action. The objective of this project is to evaluate the existing sewer system and its operation to identify present and future needs in those areas of the sewer system deemed to be critical by the City.

II. GENERAL INFORMATION

Project Name: City of Tukwila Comprehensive Sanitary Sewer Plan Update

Applicant: Michael P. Cusick, City of Tukwila, Public Works Department

Location: City of Tukwila, City-wide

Zoning and Comprehensive Plan Designation: N/A (City-wide)

The following information was considered as part of review of this application:

1. SEPA and ESA screening checklist (dated May 13, 2013).
2. Comprehensive Sanitary Sewer Plan (dated May 2013).
3. City of Tukwila Comprehensive Land Use Plan.
4. Emailed comments submitted by Karen Walter on behalf of the Muckleshoot Indian Tribe Fisheries Division.

NOTE: Technical reports and attachments referenced above may not be attached to all copies of this decision. Copies of exhibits, reports, attachments, or other documents may be reviewed and/or obtained by contacting Jaimie Reavis, Assistant Planner at (206) 431-3659, Jaimie.Reavis@TukwilaWA.gov, or 6300 Southcenter Boulevard, Tukwila, Washington, 98188.

III. REVIEW PROCESS

The proposed non-project action is subject to the State Environmental Policy Act (SEPA) review as the project does not meet the exemptions listed under WAC 197-11-800.

IV. BACKGROUND/PROPOSAL

Tukwila's current and future service area, city boundary, and other adjacent purveyor or service areas are shown in Figure ES.1 of the Final Draft – May 2013 SSP Update. In the future, the City expects to add four new areas to its service area. The precise timing of adding these new service areas is dependent on a variety of factors. The four new areas include: Ryan Area Septic, SE City Corner, South Septic, and South Annex areas.

V. REVIEW OF THE ENVIRONMENTAL CHECKLIST

The following lists the elements contained within the Environmental Checklist submitted for the proposed project. The numbers in the staff evaluation correspond to the numbers in the Environmental Checklist. If staff concurs with the applicant's response, this is so stated. If the response to a particular item in the checklist is found to be inadequate or clarification is needed, there is additional staff comment and evaluation.

A. BACKGROUND:

1-4 - Concur with checklist.

5 - The plan will be adopted following issuance of a SEPA determination.

6 - Concur with checklist.

7 - As sewer system projects identified within the plan are being planned for development, a project-level SEPA review will be required if applicable, including any associated environmental analyses required.

8 – Concur with checklist.

9-11 - Concur with checklist.

12 - Yes: Some of the sewer system projects include land that falls within 200 feet of the Green River or land located within other sensitive areas such as wetlands and wetland buffers, watercourse buffers, and steep slope areas. Specific impacts and mitigation measures will be reviewed under a separate environmental and regulatory review on a per-project basis as opportunities arise for planning and development of these serviced areas.

B. ENVIRONMENTAL ELEMENTS:

1. Earth:
   a - Concur with checklist.
   b-e - These characteristics (slope, soil types and conditions, filling/grading) will vary depending on the project, and will be reviewed on a per-project basis.

f-h - Generally, construction of new sewer systems, have the potential to result in erosion and addition of impervious surface. Impacts to the earth associated with construction of new sewer serviced areas, including erosion and increases in impervious surface area, will be reviewed at the project level. Measures to prevent or control such impacts will be included in this project-level review.

2. Air:

a-c - During individual project construction, minor impacts to the air (including dust and emissions from construction equipment) could occur. These impacts will occur at the project stage in the sewer system plan update. The applicant (whether it's the City of Tukwila, contractor, or other agency) shall obtain all relevant permits from Puget Sound Clean Air Agency and the Puget Sound Air Pollution Control Agency to address any emission to the air associated with project-level activities.

3. Water:

a(1-6) - Some of the projects in the Sewer System Plan Update, are proposed in areas where there are surface water bodies, including the Green/Duwamish River, streams, Tukwila Pond, and wetland areas, and associated buffer areas for rivers and streams. Work for various sewer system projects may involve work over, in, and/or adjacent to these waters. Each of the projects in these sensitive areas will be reviewed at the project level, to assess environmental impacts and required mitigation measures. All federal, state, and local regulations shall be complied with in the projects contained in the City of Tukwila Comprehensive Sanitary Sewer System Update Plan.

b(1-2) - Impacts including discharges to and withdrawals of ground water, and discharges of waste materials to the ground will be reviewed at the project level. All federal, state, and local laws shall be complied with related to these impacts.

c-d - Impacts related to surface, ground, and runoff water shall be reviewed at the project level. Any applicant for a project identified in the updated sewer system plan, shall comply with federal, state, and local policies and Best Management Practices related to surface, ground, and runoff water impacts.

4. Plants:

a-d - There is a variety of plant species within the City of Tukwila, including native and non-native plant species to the Puget Sound Region. In general, the update presents an opportunity to increase sewer serviced areas, and maintain those currently existing. In creation of new sewer system areas, most of the projects in this plan will involve some form of removal or alteration of vegetation, whether it is removal of invasive species on resource conservancy sites, or removal of vegetation in preparation for sanitary sewers.

Where practicable, the applicant shall retain significant trees regardless of their location within a sensitive area in addition to the requirements contained in the City of Tukwila Tree Regulations (TMC Chapter 18.54). Landscaping and vegetation removal for the projects contained in the plan will be reviewed at the project level, at which time mitigation measures will be determined for proposed impacts.

5. Animals:
a-d - A range of birds have been observed in Tukwila, including hawks, eagles, and songbirds. Mammals in Tukwila are generally small, including coyotes, squirrels, possums, etc. There are several species of fish in Tukwila, including salmon and trout. Threatened fish species observed in Tukwila include Chinook salmon, bull trout, and Puget Sound steelhead. The City of Tukwila is within the Pacific Flyway, a bird migration route. Impacts to wildlife and wildlife habitat will be reviewed at the project level.

6. Energy and Natural Resources:
a - Different types of sewer systems have differing needs in terms of energy. The requirements for each project in the plan will be different. Electricity for lighting will be the most common need for a given project, although some projects within the plan will not have any energy or natural resource needs.
b - Concur with checklist.
c - Energy needs and conservation features will be reviewed for each project as opportunities arise for existing and new sewer serviced areas.

7. Environmental Health:
a(1-2) - Concur with checklist.
b(1) - Noise from traffic on surrounding streets and highways, including I-5 and I-405 exist in the area. Noise from nearby airports, including SeaTac International Airport, the Boeing Airfield, and the Renton Municipal Airport also result in noise impacts in Tukwila. Noise from trains creates periodic noise impacts along the rail corridors within Tukwila. Noise associated with manufacturing and industrial activities is also typical in some areas of the city, including the Manufacturing and Industrial Center and the Tukwila Urban Center.
b(2)-b(3) - Short-term construction noise may be associated with the construction of projects contained in the Sanitary Sewer System update Plan. Future users of new sewer systems may result in additional noise impacts in some areas. Construction and future users of the systems must comply with City of Tukwila noise ordinance requirements. Additionally, compliance with applicable local, state and federal noise regulations will mitigate any potential adverse noise impacts associated with the project.

8. Land and Shoreline Use:
a-l - Land use impacts associated with the plan will be site-specific. Because of this, impacts to land use and environmentally sensitive areas (including land within the 200 foot buffer from the Green/Duwamish River) will be reviewed at the project stage. This plan has been created in accordance with the Growth Management Act, and is consistent with Tukwila's Comprehensive Land Use Plan. Projects contained in the plan shall be reviewed individually to ensure consistency with local, state, and federal regulations.

9. Housing:
a-c - Concur with checklist.

10. Aesthetics:
a-c - Generally, projects in the plan offer potential for view preservation and public access to view corridors, especially for those projects that involve preservation or creation of new sewer system service areas. Some of the sewer system projects which involve new structures have the potential to obstruct existing views. Since the plan provides a range of location options for

different types of sewer structures, aesthetic impacts and associated mitigation measures shall be reviewed at the project level, once specific sites have been proposed for particular projects.

11. Light and Glare:
a-d - Concur with checklist.

12. Recreation:
a-c - Concur with checklist.

13. Historic and Cultural Preservation:
a-c - Any required studies, including archaeological surveys, will be determined at the project level. The City of Tukwila and its contractors shall comply with all local, state, and federal laws in the case that archaeological or paleontological artifacts are encountered during construction of updating existing sewer systems and new sewer system projects.

14. Transportation:
a-g – Concur with checklist.

15. Public Services:
a-b - The Comprehensive Sanitary Sewer System Update Plan is programmatic, helping the city decide which types of existing sewer systems are feasible for construction within a time limitation of expected life. Implementation of the plan may increase the need for additional staff time to plan for and construct projects within the plan and to pursue grants and/or establish and administer user fees or impact fees.

16. Utilities:
a-b - The need for various types of utilities at new and existing sewer systems will vary. This will be part of the project-level review for each serviced sewer system.

C. SUPPLEMENTAL SHEET FOR NON-PROJECT PROPOSALS:

1. There may be temporary construction-related impacts; noise and emissions to the air due to the capital improvement projects identified in the plan. To avoid or reduce these increases the projects will comply with local noise ordinances and requirements related to dust control, vehicle emissions, work hours, erosion and sedimentation control.
2. Potential impacts to plants, animals, fish, and marine life will be evaluated on a project –specific basis and are dependent on project- and site-specific factors. To protect plants, animals, fish, and marine life, alternatives and associated protection measures will be identified and implemented on a project-specific basis.
3. Materials and equipment used during construction of new sewer system facilities may not be from renewable resources. Efficient planning and design of utilities will assist in the conservation of energy. Energy-efficient equipment for new and upgraded facilities will be utilized to the extent possible.
4. Some of the specific projects proposed are likely to be within sensitive areas. Each project will be reviewed to determine whether feasible alternatives exist in order to protect these sensitive areas. Projects will be compliant with all applicable Federal, State and local sensitive area regulations.
5. Some projects may affect the land and shoreline use because the City's Sewer System Plan is based on population projections and land use designations contained in the City's Comprehensive Land Use Plan, as required by State law. Land use and Shoreline impacts identified during project-specific

review will reviewed for consistency with existing plans, and will comply with requirements and conditions imposed by the relevant permitting approval agencies.

6. This plan will not increase the demand on transportation. The projects in the plan provide a framework for future development of the City's sewer system and the need for associated resources based on projected growth.
7. There are no known conflicts anticipated with Local, State, or Federal laws or requirements for the protection of the environment.

VI. COMMENTS:

Comments on the Comprehensive Sanitary Sewer Plan were submitted by email from Karen Walter on behalf of the Muckleshoot Indian Tribe Fisheries Division. The original comments, followed by the City's response (in red text) are included as Attachment B to this report. The comments from the Muckleshoot Indian Tribe generally covered two topics: (1) City consideration and planning for culvert repair projects that are within sewer line projects to help ensure sewer projects do not preclude the ability of the City to install fish-passable culverts; and (2) encouraging the City to implement planned projects using reclaimed sooner to help improve water quality standards for temperature in the Green River and to help augment groundwater resources.

The City's response to comments were provided by Michael Cusick, Tukwila Water and Sewer Utilities Engineer. Mr. Cusick forwarded the first comment related to fish-passable culverts to the Tukwila Surface Water Engineer, reported on a culvert replacement project that is planned to be fish-passable and is currently being designed by the City in cooperation with Valley View Sewer District and Water District #125, and agreed to include the comment letter in the Comprehensive Plan so that the Muckleshoot Indian Tribe's concerns with fish passable culverts will be referenced in it. For the second comment, Mr. Cusick clarified the location of Foster Golf Course in relation to the study area in the Green River Temperature Total Maximum Daily Load Publication," reported on existing City usage of reclaimed water and efforts to encourage local businesses to use reclaimed water, and he agreed to include the Muckleshoot Indian Tribe comment letter in the Comprehensive Plan so that the water quality report will be referenced in it.

VII. CONCLUSION

The proposal can be found to not have a probable significant adverse impact on the environment and pursuant to WAC 197-11-340 a Determination of Non-significance (DNS) is issued for this project. This DNS is based on impacts identified within the environmental checklist, attachments, and the above *Final Staff Evaluation for Environmental Checklist File No. E13-008*, and is supported by plans, policies, and regulations formally adopted by the City of Tukwila for the exercise of substantive authority under SEPA to approve, condition, or deny proposed actions.

Attachments:

A. SEPA and ESA screening checklist (dated May 13, 2013).
B. Comments submitted by Karen Walter on behalf of the Muckleshoot Indian Tribe Fisheries Division, and City responses to comments.

Prepared by: Courtney M. Johnson, Planning Intern and Jaimie Reavis, Assistant Planner
Date: January 10, 2014

City of Tukwila

Jim Haggerton, Mayor

Department of Community Development

Jack Pace, Director

NOTICE OF DECISION

To: **Mike Cusick, City of Tukwila Public Works Department**
State Department of Ecology, SEPA Division
King County Department of Development and Environmental Services, SEPA Information Center
Karen Walter, Muckleshoot Indian Tribe Fisheries Division

PROJECT :	City of Tukwila Comprehensive Sanitary Sewer Plan Update
FILE NUMBERS:	E13-008
ASSOCIATED FILE:	N/A
APPLICANT:	Mike Cusick, City of Tukwila, Public Works Department
REQUEST:	Non-project SEPA review of Comprehensive sewer plan update
LOCATION:	City of Tukwila, (City-wide)

This notice is to confirm the decision reached by Tukwila's SEPA Official to issue a Determination of Non-significance (DNS) for the above project based on the environmental checklist and the underlying permit application.

Project materials including the application, any staff reports, and other studies related to the permits are available for inspection at:

Tukwila Department of Community Development
6300 Southcenter BLVD., Suite 100
Tukwila, WA 98188
Monday through Friday 8:30 a.m. – 5:00 p.m.

The project planner is Jaimie Reavis, who may be contacted at (206) 431-3659 or Jaimie.Reavis@TukwilaWA.gov for further information.

The decision is appealable to the Superior Court pursuant to the Judicial review of Land Use Decision, Revised Code of Washington (RCW 36.70C).

Minnie Dhaliwal

From: Michael Cusick
Sent: Wednesday, October 30, 2013 12:37 PM
To: Karen Walter (KWalter@muckleshoot.nsn.us)
Cc: Pat Brodin; Bob Giberson; Robin Tischmak; Lara Kammereck (LKammereck@carollo.com); Ryan Larson; Minnie Dhaliwal
Subject: Comments to your Email to Courtney Johnson July 3, 2013

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Ms. Walters,
Below is the response to your email comments to the Tukwila Sewer Plan on July 3 2013:

1. As part of the City's Comprehensive Sewer Plan and subsequent individual project sewer line projects, the City needs to also consider and plan for any culvert repair projects that are within the sewer line projects. For example, at the end of the plan, there is a discussion about replacing the sewer line under I-405 near Gilliam Creek. There are culverts on Gilliam Creek that are currently fish passage barriers that need to be made fish passable. The sewer line projects need to ensure that they do not preclude future fish passage culvert repairs projects and will accommodate the largest sized crossing needed to provide the successful passage of fish, wood, water and sediment. It most cases these will be bridges or culverts designed using WDFW's Stream Simulation Method. This issue was not identified in the Comprehensive Sewer Plan or the checklist; therefore, we are identifying it now so that these issues can be planned and addressed accordingly.

The culverts in Gilliam Creek convey storm water and are not part of the Cities of Tukwila Sanitary Sewer Plan. Your comment was forwarded to the Surface Water Engineer for the City of Tukwila

2. We appreciate the City's commitment to using reclaimed water and identifying potential future project areas to use reclaimed water. We encourage the City to implement these projects sooner than not as the Green River currently exceeds State water quality standards for temperature and will benefit from reducing Green River water withdrawals at the Foster Golf Course (see page 3-14), as well as, augment groundwater resources. Using reclaimed water was identified as a implementation strategy (page 85) for the Green River Temperature Total Maximum Daily Load (TMDL) Water Quality Improvement Report issued June 2011 under Ecology's Publication No. 11-10-046. Again, this specific TMDL recommendation was not identified in the Comprehensive Sewer Plan or the environmental checklist so we are providing this information to the City

Thank you for your comments concerning the temperature and water quality for Green River. The City of Tukwila will include your comment letter in the Comprehensive Plan so that the Water Quality Report will be referenced in it.

Please note that the Foster Golf Course is below the area studied in the "Green River Temperature Total Maximum Daily Load Publication No. 11-10-046", the temperature study ended at river mile 11 where the Black River joins the Green River and that is upstream of the golf course and the lower reach of the Duwamish River.

The City of Tukwila is committed to protecting the river habitat for the benefit of the fish in the river. The City is currently using reclaimed water for landscape irrigation along Interurban Avenue South in the vicinity of 58th Avenue South. Reclaimed water is also being utilized to irrigate the soccer fields at the Starfire Sports Center at Fort Dent Park and for street sweeping with the City's broom fleet.

Please recognize that the Tukwila Public Works Department has teamed up with King County Department of Natural Resources along with other City departments and local businesses to find uses for reclaimed water. One consumer we are working with is an eductor truck company that intends to use the reclaimed water for cleaning sewer systems. Provisions are in place to bring the reuse system into the Foster Golf Links irrigation system.

Please contact me if you have any questions.
Thank you for your time.

Michael P. Cusick, P.E.
Sr. Utilities Engineer for Water and Sewer
Public Works Department
6300 Southcenter Boulevard Suite 100
Tukwila, Wa 98188
(206) 431-2441 (work)
(206) 571-6318 (cell)
Michael.Cusick@Tukwilawa.gov

Appendix B

AGENCY COMMENT LETTERS AND RESPONSES

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Northwest Regional Office • 3190 160th Ave SE • Bellevue, WA 98008-5452 • 425-649-7000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

September 27, 2013

Michael Cusick, P.E.
Sr. Utilities Engineer for Water and Sewer
Public Works Department
6300 Southcenter Blvd, Ste 100
Tukwila, WA 98188

Re: Ecology's Comments on *City of Tukwila Comprehensive Sanitary Sewer Plan*, Final Draft, May 2013, Corollo Engineers

Dear Mr. Cusick:

The Department of Ecology (Ecology) received the above-referenced *Draft Comprehensive Sanitary Sewer Plan* for review and comments on May 20, 2013.

This letter represents Ecology's review of the plan which is based significantly on the requirements of the Washington Administrative Code (WAC) Chapter 173-240-050. Overall the plan is comprehensive and well written, however the City needs to address the comments listed in the table below before Ecology can approve the plan.

Comprehensive Sanitary Sewer Plan Page	***Ecology's Comments***
Page 1-20, Table 1.7, WAC 173-240-050 Sewer Plan Requirements	The comprehensive sanitary sewer plan needs to include: (i) Any existing domestic or industrial wastewater treatment facilities within twenty miles of the general plan area and within the same topographical drainage basin containing the general plan area. (ii) A list of establishments producing industrial wastewater insofar as it may affect the sewer system or treatment plant.
Page 3-4, Section 3.3.1.1, Peak Flows, Paragraph 2	The wet weather months considered for peak flow calculations are January through May. However, Figure 3.2 on the next page shows the month of November has the highest average daily flow in 2009 for lift station 12. Also, the rest of the report considers November through May as wet weather months for estimating collection system flows and I/I.
Page 3-4, Section 3.3.1.1, Peak Flows, Paragraph 3, and Page 3-7, Figure 3.4	(i) The calculation for peak day average flow is based on January through May as wet weather months. However, the rest of the report considers November through May as wet weather months for estimating collection system flows and I/I. (ii) The best fit curve in Figure 3.4 is plotted using only three data points. Ecology encourages the City to use more representative data to estimate collection system flows.

Comprehensive Sanitary Sewer Plan Page	*Ecology's Comments*
Page 3-4, Section 3.3.1.1, Peak Flows, Paragraph 4, and Page 3-8, Figure 3.5	(i) Please clarify the explanation provided in this paragraph for calculating Peak Instantaneous Flow. (ii) The best fit curve in Figure 3.5 is plotted using only three data points. Ecology encourages the City to use more representative data to estimate collection system flows.
Page 5-13, Section 5.3.1.4, Sagging Pipe Issues	The report indicates that the Interurban Avenue South pipeline sag repair is included in the RUL short-term pipeline replacement program. However, Section 7.3.2.2 (Page 7-8), and Tables 7.3 (Page 7-9) and 7.5 (Page 7-11) put this project in the long-term timeframe. Please clarify.
Page 5-13, Section 5.3.2, Collection System capacity analysis, and Page 7-11, Table 7.5, Capital Improvement Plan	Ecology strongly recommends that the City update the collection system hydraulic model within the next five years to evaluate the collection system capacity.
Appendix A	Please provide documentation of DNS issuance by the City.
General	Per RCW 90.48.495, the plan needs to include a discussion of water conservation measures considered or underway that would reduce flows to the sewerage system and an analysis of their anticipated impact on public sewer service and treatment capacity.

Please be advised that when the revised Comprehensive Sanitary Sewer Plan meets Ecology's criteria, Ecology will approve the plan only after its approval by King County.

If you have any questions, please contact me at the above office address, at (425) 649-7027, or at mike.dawda@ecy.wa.gov.

Sincerely,

Mike Dawda

Mike Dawda
Water Quality Section

MD:bl
cc: Robin Tischmak, City of Tukwila
Lara Kammereck, P.E., Corollo Engineers
Mark Henley, P.E., Ecology
Alison Evans, P.E., Ecology
Steve Hirschey, King County

King County

Utilities Technical Review Committee
Department of Natural Resources and Parks
King Street Center
210 South Jackson Street, Suite 512
Seattle, WA 98104-3855
www.kingcounty.gov

August 7, 2013

KING COUNTY
SEWER

City of Tukwila
Attn. Mr. Michael Cusick, P.E.
6300 Southcenter Boulevard
Tukwila, WA 98188

Dear Mr. Cusick;

The City of Tukwila submitted a Comprehensive Sanitary Sewer Plan (Plan) on May 21, 2013 to King County. This letter is a review of the Plan by the Utilities Technical Review Committee (UTRC) pursuant to King County Code (K.C.C.) 28.84. The criteria for review are listed in K.C.C. 28.84.050(D)(3) and (E) and include the review of design and construction standards, and standard specifications; the review of ordinances and resolutions; and the requirement that comprehensive sewer plans are prepared and approved subject to K.C.C. chapter 13.24 and by reference chapter 173-240 Washington Administrative Code.

In reviewing the Plan, the UTRC found that the Plan is largely consistent with the County's comprehensive plan and code. We have identified five points of clarification or additions that are necessary before we can make a recommendation to the Director of the Department of Natural Resources and Parks for approval of the City's Plan. In the Plan please provide:

- A list of all establishments producing industrial wastewater, the quantity of wastewater and periods of production, and the character of the industrial wastewater insofar as it may affect the sewer system or treatment plant. Consideration must be given to future industrial expansion, if any. Enclosed is a list of the known Industrial Waste Discharge permits for establishments within the City that King County has on record;
- A discussion that evaluates the impact of future water conservation efforts on wastewater flows;
- A clarification to the General Design Criteria 1.2.6 regarding City permitting and inspection of side sewer connections, including the very rare side sewer connections made directly to a King County transmission main. Note that King County approval of any connection is required. Because the intent is to minimize the number of connections to the regional wastewater system, direct side sewer connections are rarely approved;

- With respect to corrosion and odor control, and steps being taken to reduce their occurrence, we note the Plan does not identify any problems. Please document the odor and corrosion evaluation done; and
- A statement regarding compliance with the State Environmental Policy Act (SEPA), a final dated and signed SEPA checklist, and a copy of the final threshold decision document for this action.

The Plan discusses lift station recommendations in Table ES.6 and notes the City wishes to abandon Life Station 9. If the City pursues this action, please contact Todd Keithahn the local agency coordinator by telephone at (206.684-1369) or by mail at:

Todd Keithahn
LPA Coordinator
King County Wastewater Treatment Division
201 S. Jackson Street, MS KSC-NR-508
Seattle, WA 98104-3855

Sincerely,

Stephen Hirschey
Chair, Utilities Technical Review Committee

Enclosure

From: Karen Walter [mailto:KWalter@muckleshoot.nsn.us]
Sent: Wednesday, July 03, 2013 11:43 AM
To: Courtney Johnson
Cc: Fisher, Larry D (DFW); Dave Garland
Subject: RE: 2012 Comprehensive Plan Update Tukwila, E13-008, Notice of Application

Courtney,
Thank you again for getting us the City of Tukwila's 2012 Comprehensive Sewer Plan and environmental checklist for this project. We have reviewed this information, along with the Notice of Application and offer the following comments:

1. As part of the City's Comprehensive Sewer Plan and subsequent individual project sewer line projects, the City needs to also consider and plan for any culvert repair projects that are within the sewer line projects. For example, at the end of the plan, there is a discussion about replacing the sewer line under I-405 near Gilliam Creek. There are culverts on Gilliam Creek that are currently fish passage barriers that need to be made fish passable. The sewer line projects need to ensure that they do not preclude future fish passage culvert repairs projects and will accommodate the largest sized crossing needed to provide the successful passage of fish, wood, water and sediment. It most cases these will be bridges or culverts designed using WDFW's Stream Simulation Method. This issue was not identified in the Comprehensive Sewer Plan or the checklist; therefore, we are identifying it now so that these issues can be planned and addressed accordingly.

2. We appreciate the City's commitment to using reclaimed water and identifying potential future project areas to use reclaimed water. We encourage the City to implement these projects sooner than not as the Green River currently exceeds State water quality standards for temperature and will benefit from reducing Green River water withdrawals at the Foster Golf Course (see page 3-14), as well as, augment groundwater resources. Using reclaimed water was identified as a implementation strategy (page 85) for the Green River Temperature Total Maximum Daily Load (TMDL) Water Quality Improvement Report issued June 2011 under Ecology's Publication No. 11-10-046. Again, this specific TMDL recommendation was not identified in the Comprehensive Sewer Plan or the environmental checklist so we are providing this information to the City.

We appreciate the opportunity to review this proposal and look forward to the City's responses. Please let me know if you have any questions.

Best regards,
Karen Walter
Watersheds and Land Use Team Leader

Muckleshoot Indian Tribe Fisheries Division
Habitat Program
39015 172nd Ave SE
Auburn, WA 98092
253-876-3116

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RECORD OF COMMENT LOG

PROJECT : **Comprehensive Sanitary Sewer Plan**
City of Tukwila
Final
JOB # : 8472A.00

DATE ISSUED: 2/26/2014
DATE DUE:

COMMENTS BY : **Carollo**

#	COMMENT SOURCE	CHAPTER	SECTION/ PAGE	COMMENT	RESPONSE	PLAN CHANGE
1	DOE	1	1-20, Table 1.7	This comprehensive sanitary sewer plan needs to include: (i) Any existing domestic or industrial wastewater treatment facilities within twenty miles of the general plan area and within the same topographical drainage basin containing the general plan area. (ii) A list of establishments producing industrial wastewater insofar as it may affect the sewer system or treatment plant.	Existing domestic and industrial wastewater facilities, including those contributing to the City system have been documented in Section 4.6 and Table 4.4.	Section 4.6 and Table 4.4 added to Plan.
2	DOE	3	3-4, Section 3.3.1.1, Para 2	The wet weather months considered for peak flow calculations are January through May. However, Figure 3.2 on the next page shows the month of November has the highest average daily flow in 2009 for lift station 12. Also the rest of the reports considers November through May as wet weather months for estimating collection system flows and I/I.	Section 3.3.1.1 text has been updated to read November through May, " the January through May" was a text error.	Pg 3-4. Peak Flows. The first step was to determine the Maximum Month Wet Weather Flow (MMWWF) by plotting the monthly average flow (gpd) for ~~wet~~ each typical weather month~~s~~ in 2009 ~~(January through May)~~ against total rainfall accumulation for that month....[sic]... Next peak day average flow (PDAF) was determined by plotting storm events from November ~~January~~ through May against daily rainfall. Again, an equation correlating peak flows with high rain events is determined from a line of best fit.
3	DOE	3	3-4, Section 3.3.1.1, Para 3 and 3-7, Figure 3.4	(i) The calculation for peak day average flow is based on January through May as wet weather months. However, the rest of the report considers November through May as wet weather months for estimating collection system flows and I/I. (ii) The best fit curve in Figure 3.4 is plotted using only three data points. Ecology encourages the City to use more representative data to estimate collection system flow.	(i) Section 3.3.1.1 text has been updated to read November through May, " the January through May" was a text error. (ii) The curve of Figure 3.4 was developed with the available data.	(i) Please see above edits to Section 3.3.1.1. (ii) No change to Plan.

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4	DOE	3	3-4, Section 3.3.1.1, Para 4 and 3-8, Figure 3.5	(i) Please clarify the explanation provided in this paragraph for calculating Peak Instantaneous Flow. (ii) The best fit curve in Figure 3.5 is plotted using only three data points. Ecology encourages the City to use more representative data to estimate collection system flow.	(i) Section 3.3.1.1 text has been updated to clarify the PIF methodology, including Figure 3.5. (ii) The PIF methodology incorporated the three available probabilistic flow values (Average Annual Flow, MMWWF, and PDAF). Future additional data collection may allow additional data points to be calculated.	(i) Finally, the PIF is determined from a ~~probability graph, which plots~~ using a best fit line based on the Average Annual Flow, MMWWF, and PDAF. Figure 3.5 plots these flows against the probabilities of these each occurring on a log graph. For example, the average annual flow has a 50 percent probability of occurring, considering it is the annual average. Using a line of best fit, the PIF can be determined assuming it has a 0.011 percent (1 hour in 8760 hours/year) probability of occurring, resulting in a PIF of 1,176,270 gpd. The graph and regression equation for the PIF determination is shown in Figure 3.5. A summary of the Lift Station 12 analysis is presented in Table 3.3. Figure 3.5 has been updated with data point labels (i.e. average annual flow, MMWWF, and PDAF).
5	DOE	5	5-13, Section 5.3.1.4	The report indicates that the Interurban Avenue South pipeline sag repair is included in the RUL short-term pipeline replacement program. However, Section 7.3.2.2 (Page-8), and Tables 7.3 (Page 7-9) and 7.5 (Page-11) put this project in the long-term timeframe. Please clarify.	Section 7.3.2.2 correctly indicates the Interubran South pipeline sag repair as a long-term project. Section 5.3.1.4 has been modified indicate it as such.	These pipes will be included in the Capital Improvement Plan (Chapter 7) ~~for the near-term pipe repair program~~. Both the ~~Interurban Avenue South sag and~~ the 12-inch sewers between Andover Park East and Andover Park West are included in the RUL short-term pipeline replacement program and the Interurban Avenue South sag was included in the long-term timeframe.
6	DOE	5	5-13, Section 5.3.2 7-11, Table 7.5	Ecology strongly recommends that the City update the collection system hydraulic model within the next five years to evaluate the collection system capacity.	The City concurs with the need for an updated collection system hydraulic model, which has been included as the near-term CIP G-1. Data collection efforts for the hydraulic model update are anticipated to provide additional data for determining peak flow rates.	No Change to Plan
7	DOE	Appendix A		Please provide documentation of DNS issuance by the City.	DNS included in Appendix A.	Included DNS in Appendix A.

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8	DOE	General		Per RCW 90.48.495, the plan needs to include a discussion of water conservation measures considered or underway that would reduce flows to the sewage system and an analysis of their anticipated impact on public sewer service and treatment capacity.	The City developed a Comprehensive Water System Plan with this Plan to address integrated sytem issues. Section 3.5 and Table 3.8 have been added to the Plan.	The following text has been added as Section 3.5 of the Plan. In 2008, Cascade Water, which is the major supply source for the City, adopted a six-year conservation savings goal (2008-2013) of one million gallons per day. For the City, this water use efficiency (WUE) goal for conservation translated to achieve a savings of 52,000 gallons of water per day on an average annual basis compared to the current usage by December 31, 2013. Beyond year 2013, the City goal is to achieve an annual one percent reduction in water demand through the planning period. Reductions in water use will decrease the base sanitary sewer flows. However, WUE is not expected to affect I/I, which can contribute up to 7.8 times more flow than the base flow. Base sanitary flows were projected considering reduced water use in line with the WUE program goals using the methodology described in Section 3.2. The projected base sanitary flows are presented in Table 3.8.
9	King County			List all establishments producing industrial wastewater, the quantity of wastewater, and periods of production, and the character of the industrial wastewater insofar as it may affect the sewer system or treatment plant. Consideration must be given to future industrial expansion, if any. Enclosed is a list of known Industrial Waste Discharge permits for establishments within the City that King county has on record.	The City's policy is to periodically review industrial wastewater water dischargers to ensure they maintain the appropriate authorization in good standing. A list of dischargers are provided in Table 4.4. The City does not evaluate compliance with these authorizations or track the quantity of wastewater, periods of production, and the character of the industrial wastewater. Such activities are considered to be the purview of the authorizing agency, typically King County. The City is not currently planning for industrial expansion outside what is included in the demographic growth projections. The projected base sanitary flows for the planning period can be found in Section 3.2.	None

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10	King County			A discussion that evaluates the impact of future water conservation efforts on wastewater flows;	Please see the response to Item 8.	
11	King County			A clarification to the General Design Criteria 1.2.6 regarding City permitting and inspection of side sewer connections, including the very rare side sewer connections made directly to a King County transmission main. Note that King County approval of any connection is required. Because the intent is to minimize the number of connections to the regional wastewater system, direct side sewer connections are rarely approved;	The City has updated its policy to clarify the conditions required to connect to ah King County transmission main.	Side sewer connections to King County Wastewater Treatment Division (WTD) interceptor sewer lines are rarely allowed and only by written permission from King County. The City is the agency through which permits are obtained for such connections. The permittee is responsible for all coordination with King County WTD for necessary inspections and approvals.
12	King County			With respect to corrosion and odor control, and steps being taken to reduce their occurrence, we note the Plan does not identify any problems. Please document odor and corrosion evaluation done;	The City has begun a program to rehabilitate sewer pipes that are reaching their design life upper limits by the installation of a Cured in Place Pipe Line system which halts any corrosion within the pipe. This process can be used on concrete, ductile and asbestos pipe types. The pipes for this type of rehabilitation are identified by use of a video camera running through the pipe and evaluating the condition of the pipe, insertion of fiberglass liner which cures in place, and the cutting in of side sewers. The necessity of this program was brought to our attention by the complete failure and collapse of three separate sewer lines in the past five years, requiring expensive emergency repairs, and negatively impacting businesses and neighborhoods. The City of Tukwila promptly responds to odor complaints about the sanitary sewers. The actions may include the installation of deodorant blocks in manhole and lift station wet wells, sealing of manhole lids with silicon caulking to prevent sewer gases escaping the structures and the flushing of lines with the jet truck. We have not maintained a log of these complaints	None

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13	King County			A statement regarding compliance with the State Environmental Policy Act (SEPA), a final dated and signed SEPA checklist, and a copy of the final threshold decision document for this action.	Please see response to Item 7.	
14	Muckleshoot Indian Tribe	General		As part of the City's Comprehensive Sewer Plan and subsequent individual project sewer line projects, the City needs to also consider and plan for any culvert repair projects that are within the sewer line projects. For example, at the end of the plan, there is a discussion about replacing the sewer line under I-405 near Gilliam Creek. There are culverts on Gilliam Creek that are currently fish passage barriers that need to be made fish passable. The sewer line projects need to ensure that they do not preclude future fish passage culvert repairs projects and will accommodate the largest sized crossing needed to provide the successful passage of fish, wood, water and sediment. It most cases these will be bridges or culverts designed using WDFW's Stream Simulation Method. This issue was not identified in the Comprehensive Sewer Plan or the checklist; therefore, we are identifying it now so that these issues can be planned and addressed accordingly.	The culverts in Gilliam Creek convey storm water and are not part of the Citify of Tukwila Sanitary Sewer Plan. Your comment was forwarded to the Surface Water Engineer for the City of Tukwila	None

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15	Muckleshoot Indian Tribe	General		We appreciate the City's commitment to using reclaimed water and identifying potential future project areas to use reclaimed water. We encourage the City to implement these projects sooner than not as the Green River currently exceeds State water quality standards for temperature and will benefit from reducing Green River water withdrawals at the Foster Golf Course (see page 3-14), as well as, augment groundwater resources. Using reclaimed water was identified as a implementation strategy (page 85) for the Green River Temperature Total Maximum Daily Load (TMDL) Water Quality Improvement Report issued June 2011 under Ecology's Publication No. 11-10-046. Again, this specific TMDL recommendation was not identified in the Comprehensive Sewer Plan or the environmental checklist so we are providing this information to the City	Thank you for your comments concerning the temperature and water quality for Green River. The City of Tukwila will include your comment letter in the Comprehensive Plan so that the Water Quality Report will be referenced in it. Please note that the Foster Golf Course is below the area studied in the "Green River Temperature Total Maximum Daily Load Publication No. 11-10-046", the temperature study ended at river mile 11 where the Black River joins the Green River and that is upstream of the golf course and the lower reach of the Duwamish River. The City of Tukwila is committed to protecting the river habitat for the benefit of the fish in the river. The City is currently using reclaimed water for landscape irrigation along Interurban Avenue South in the vicinity of 58th Avenue South. Reclaimed water is also being utilized to irrigate the soccer fields at the Starfire Sports Center at Fort Dent Park and for street sweeping with the City's broom fleet. Please recognize that the Tukwila Public Works Department has teamed up with King County Department of Natural Resources along with other City departments and local businesses to find uses for reclaimed water. One consumer we are working with is an eductor truck company that intends to use the reclaimed water for cleaning sewer systems. Provisions are in place to bring the reuse system into the Foster Golf Links irrigation system.	Comment letter included in Appendix B.

Appendix C

ADOPTING RESOLUTION

Appendix D

TUKWILA'S WASTEWATER TREATMENT AGREEMENT WITH KING COUNTY

CITY OF TUKWILA

MUNICIPALITY OF METROPOLITAN SEATTLE

AMENDMENT TO AGREEMENT
FOR SEWAGE DISPOSAL

THIS AMENDMENT made as of the 2nd day of October, 1992 between the City of Tukwila, a municipal corporation of the State of Washington (hereinafter referred to as the "City") and the Municipality of Metropolitan Seattle, a metropolitan municipal corporation of the State of Washington (hereinafter referred to as "Metro");

WITNESSETH:

WHEREAS, the parties have entered into a long term Agreement for Sewage Disposal dated October 1, 1966 (hereinafter referred to as the "Basic Agreement"); and

WHEREAS, an advisory committee composed of elected and appointed officials in the metropolitan area was appointed by the Metropolitan Council to examine the structure of Metro's charges to its participants; and

WHEREAS, said advisory committee, following extensive research, study and deliberations, has recommended certain changes in the structure of Metro's charges to its participants and implementation of said changes requires amendment of the Basic Agreement; and

WHEREAS, the parties have determined that the recommendations are in the best public interest and therefore desire to amend said Basic Agreement to implement said recommendations;

NOW, THEREFORE, it is hereby agreed as follows:

Section 1. Amendment of Section 5 of the Basic Agreement. Section 5 of the Basic Agreement is hereby amended to read as follows:

"Section 5. Payment for Sewage Disposal. For the disposal of sewage hereafter collected by the City and delivered to Metro the City shall pay to Metro on or before the last day of each month during the term of this Agreement, a sewage disposal charge determined as provided in this Section 5.

1. For the quarterly periods ending March 31, June 30, September 30 and December 31 of each year every Participant shall submit a written report to Metro setting forth:

(a) the number of Residential Customers billed by such Participant for local sewerage charges as of the last day of the quarter,

(b) the total number of all customers billed for local sewerage charges by such Participant as of such day, and

(c) the total water consumption during such quarter for all customers billed for local sewerage charges by such Participant other than Residential Customers.

The quarterly water consumption report shall be taken from water meter records and may be adjusted to exclude water which does not enter the sanitary facilities of the customer. Where actual sewage flow from an individual customer is metered, the metered sewage flows shall be reported in lieu of adjusted water consumption. The total quarterly water consumption report in cubic feet shall be divided by 2,250 to determine the number of Residential Customer equivalents represented by each Participant's customers other than single family residences.

Metro shall maintain a permanent record of the quarterly customer reports from each Participant.

The City's first quarterly report shall cover the first quarterly period following the date when sewage is first delivered to Metro and shall be submitted within thirty days following the end of the quarter. Succeeding reports shall be made for each quarterly period thereafter and shall be submitted within thirty (30) days following the end of the quarter.

2. (a) To form a basis for determining the monthly sewage disposal charge to be paid by each Participant during any particular quarterly period, Metro shall ascertain the number of Residential Customers and Residential Customer equivalents of each Participant. This determination shall be made by taking the sum of the actual number of Residential customers reported as of the last day of the next to the last preceding quarter and the average number of Residential Customer Equivalents per quarter reported for the four quarters ending with said next to the last preceding quarter, adjusted for each Participant to eliminate any Residential Customers or Residential Customer equivalents whose sewage is delivered to a governmental agency other than Metro or other than a Participant for disposal outside of the Metropolitan Area.

(b) For the initial period until the City shall have submitted six consecutive quarterly reports, the reported number of Residential Customers and Residential Customer equivalents of the City shall be determined as provided in this subparagraph (b). On or before the tenth day of each month beginning with the month prior to the month in which sewage from the City is first delivered to Metro, the City shall submit a written statement of the number of Residential Customers and Residential Customer equivalents estimated to be billed by the City during the

next succeeding month. For the purpose of determining the basic reported number of Residential Customers and Residential Customer equivalents of the City for such next succeeding month, Metro may at its discretion adopt either such estimate or the actual number of Residential Customers and Residential Customer equivalents reported by the City as of the last day of the next to the last preceding reported quarter. After the City shall have furnished six consecutive quarterly reports the reported number of Residential Customers and Residential Customer equivalents of the City shall be determined as provided in the immediately preceding subparagraph (a).

(c) If the City shall fail to submit the required monthly and/or quarterly reports when due, Metro may make its own estimate of the number of Residential Customers and Residential Customer equivalents of the City and such estimate shall constitute the reported number for the purpose of determining sewage disposal charges.

3. The monthly sewage disposal charge payable to Metro shall be determined as follows:

(a) Prior to July 1st of each year Metro shall determine its total monetary requirements for the disposal of sewage during the next succeeding calendar year. Such requirements shall include the cost of administration, operation, maintenance, repair and replacement of the Metropolitan Sewerage System, establishment and maintenance of necessary working capital and reserves, the requirements of any resolution providing for the issuance of revenue bonds of Metro to finance the acquisition, construction or use of sewerage facilities, plus not to exceed 1% of the foregoing requirements for general administrative overhead costs.

(b) To determine the monthly rate per Residential Customer or Residential Customer equivalent to be used

during said next succeeding calendar year, the total monetary requirements for disposal of sewage as determined in subparagraph 3(a) of this section shall be divided by twelve and the resulting quotient shall be divided by the total number of Residential Customers and Residential Customer equivalents of all Participants for the October-December quarter preceding said July 1st; provided, however, that the monthly rate shall not be less than Two Dollars ($2.00) per month per Residential Customer or Residential Customer equivalent at any time during the period ending July 31, 1972.

(c) The monthly sewage disposal charge paid by each Participant to Metro shall be obtained by multiplying the monthly rate by the number of Residential Customers and Residential Customer equivalents of the Participant. An additional charge may be made for sewage or wastes of unusual quality or composition requiring special treatment, or Metro may require pretreatment of such sewage or wastes.

4. The parties acknowledge that, by resolution of the Metropolitan Council, Metro may impose a charge or charges directly on the future customers of a Participant for purposes of paying for capacity in Metropolitan Sewage Facilities and that such charges shall not constitute a breach of this agreement or any part thereof. The proceeds of said charge or charges, if imposed, shall be used only for capital expenditures or defeasance of outstanding revenue bonds prior to maturity.

In the event such a charge or charges are imposed, the City shall, at Metro's request, provide such information regarding new residential customers and residential customer equivalents as may be reasonable and appropriate for purposes of implementing such a charge or charges.

5. A statement of the amount of the monthly sewage disposal charge shall be submitted by Metro to each

Participant on or before the first day of each month and payment of such charge shall be due on the last day of such month. If any charge or portion thereof due to Metro shall remain unpaid for fifteen days following its due date, the Participant shall be charged with and pay to Metro interest on the amount unpaid from its due date until paid at the rate of 6% per annum, and Metro may, upon failure to pay such amount, enforce payment by any remedy available at law or equity.

6. The City irrevocably obligates and binds itself to pay its sewage disposal charge out of the gross revenues of the sewer system of the City. The City further binds itself to establish, maintain and collect charges for sewer service which will at all times be sufficient to pay all costs of maintenance and operation of the sewer system of the City, including the sewage disposal charge payable to Metro hereunder and sufficient to pay the principal of and interest on any revenue bonds of the City which shall constitute a charge upon such gross revenues. It is recognized by Metro and the City that the sewage disposal charge paid by the City to Metro shall constitute an expense of the maintenance and operation of the sewer system of the City. The City shall provide in the issuance of future sewer revenue bonds of the City that expenses of maintenance and operations of the sewer system of the City shall be paid before payment of principal and interest of such bonds. The City shall have the right to fix its own schedule of rates and charges for sewer service provided that same shall produce revenue sufficient to meet the covenants contained in this Agreement.

Section 2. Amendment of Section 6 of the Basic Agreement. Section 6 of the Basic Agreement is hereby amended to read as follows:

"Section 6. Responsibility of the City. The City shall be responsible for the delivery to the Metropolitan Sewerage System of sewage collected by the City, for construction, maintenance and operation of Local Sewerage Facilities, and for the payment of all costs incident to the collection of such sewage and its delivery to the Metropolitan Sewerage System.

In addition, the City will undertake continual rehabilitation and replacement of its local sewage facilities for purposes of preventing, reducing and eliminating the entry of extraneous water into such facilities and will expend annually, averaged over five (5) years, an amount equal to two (2) cents per inch of diameter per foot of its local sewage facilities, excluding combined sewers and force mains, for said rehabilitation and replacement. The amount of this expenditure requirement may be increased from time to time by the Metropolitan Council to reflect general inflation. Rehabilitation and replacement projects undertaken pursuant to this section shall be constructed in accordance with criteria adopted by the Metropolitan Council and included in Metro's Rules and Regulations. In the event the City fails to comply with the rehabilitation and replacement expenditure requirements described in this section, the City shall pay such charge as may be determined by Metro for quantities of storm or ground water entering its Local Sewage Facilities in excess of the minimum standard established by the general Rules and Regulations of Metro.

Section 3. Amendment of Basic Agreement to Add a New Section. A new Section 18 shall be added to the Basic Agreement to read as follows:

"Section 18. Future Amendments. The City agrees to amend and hereby concurs in any amendment to this agreement which incorporates any changes in the terms for

sewage disposal and/or payment therefore as may be proposed by Metro and agreed to by those Participants that shall represent, in total, not less than 90% of the Residential Customers and Residential Customer Equivalents then served by the Metropolitan Sewerage System."

Section 4. Effective Date of Amendment. This amendment shall take effect at the beginning of the first quarter following the date first written above with quarters beginning January 1, April 1, July 1, and October 1.

Section 5. Basic Agreement Unchanged. Except as otherwise provided in this amendment, all provisions of the basic agreement shall remain in full force and effect as written therein.

IN WITNESS WHEREOF, the parties have executed this Agreement as of the day and year first written above.

CITY OF TUKWILA

ATTEST:

City Clerk

MUNICIPALITY OF METROPOLITAN SEATTLE

~~Gary Zimmerman~~
Chair of the Council

ATTEST:

3

Executed in 6 counterparts of

5008 263

This is counterpart No. 1

MUNICIPALITY OF METROPOLITAN SEATTLE - CITY OF TUKWILA
SUPPLEMENTAL AGREEMENT FOR SEWAGE DISPOSAL

THIS AGREEMENT made as of this 23 day of MAY, 1968, between the City of Tukwila, a municipal corporation of the State of Washington, hereinafter referred to as the "CITY" and the Municipality of Metropolitan Seattle, a municipal corporation of the State of Washington, hereinafter referred to as "METRO",

W I T N E S S E T H:

WHEREAS, as of September 1, 1966 the parties entered into an Agreement for Sewage Disposal, hereinafter referred to as the "Basic Agreement", and thereafter embarked upon the performance of the Basic Agreement; and

WHEREAS, at the time of the execution of the Basic Agreement it was assumed by both parties as a material factor in the negotiation of the Basic Agreement that the City's Andover Park Sewage Pumping Station, hereinafter referred to as the "Station", located at the intersection of Andover Park Way West and Strander Blvd., Tukwila, Washington, would not be necessary to the operation of the local sewerage facilities contemplated by the Basic Agreement; and

WHEREAS, Metro's Tukwila Interceptor is now near completion and it has now been determined that contrary to the prior assumption, the operation of the Station will still be necessary to the operation of the facilities of the City after Metro's Tukwila Interceptor is placed into service, and that the Station will serve a natural drainage area of less than 1,000 acres; and

WHEREAS, the parties desire to settle certain disputes which have arisen relative to the responsibility for maintenance and operation of the Andover Park Sewage Pumping Station and alleged mistakes of fact on the part of the parties during the negotiation of the Basic Agreement as to the need to operate the

Andover Pumping Station after construction of the Metro facilities; and

WHEREAS, the City desires to use the interim force main constructed by Metro from the Tukwila Lagoon to Strander Blvd., and Metro is willing to convey such main and to relocate a portion thereof on the conditions set forth in this agreement; and

WHEREAS, the City desires to defer the final resurfacing of Strander Blvd. and is willing to assume responsibility for such resurfacing upon payment of an amount equal to the estimated cost thereof; and

WHEREAS, the parties desire that an extension of Metro's Val Vue Connection Trunk Sewer be made by Metro on the terms and conditions set forth herein;

NOW THEREFORE, in consideration of the mutual covenants contained herein, it is hereby agreed as follows:

1. At the time Metro's Tukwila Interceptor as specified in its Sewage Disposal Project Contract No. 67-6 is accepted by the Municipality and placed into operation, Metro will give the City written notice of such event. Prior to the giving of such notice, Metro shall prepare the Andover Park Sewage Pumping Station for the pumping of the decreased volume of sewage occasioned by the placement into service of the Tukwila Interceptor. Such preparation shall consist of changing the impellers on the pumps in said station.

2. Immediately upon the receipt of said notice the City shall resume complete responsibility for the maintenance and operation of the station. Metro shall have, thereafter, no obligation or responsibility whatsoever for the operation, maintenance, repair or replacement of the station and any sewerage facilities tributary thereto.

3. Metro shall, within twenty days of giving the aforesaid notice, pay to the City the total amount of $15,117.70.

4. Metro shall promptly relocate on the existing City of Tukwila easement the portion of 10 inch force main presently located on temporary right-of-way and Metro shall convey to the City the entire 10 inch force main as so relocated extending from the Lagoon to Strander Blvd. It is recognized by both parties that this force main is not a permanent sewerage facility and Metro makes no warranty as to its useful life or serviceability. Upon the relocation and conveyance of said force main to the City, the City shall have full responsibility for the maintenance, operation and eventual replacement of said force main. The City shall thereafter have sole and complete responsibility for the construction and operation of sewerage facilities adequate to deliver City sewage to Metro's Tukwila Interceptor as now constructed on Strander Blvd. Metro shall continue to operate the Tukwila Sewage Lagoon facilities through May 31, 1968.

5. Pacific Mechanical Constructors Inc., the contractor presently completing construction of the Tukwila Interceptor under contract No. 67-6 with Metro and under separate contract with Val Vue Sewer District, is required under said contracts to complete the restoration and final resurfacing of Strander Blvd. and is now prepared to accomplish such restoration. To accomodate the City's request that such final resurfacing be deferred to such time as the City may desire, Metro shall within forty-five days from the date of this agreement cause Pacific Mechanical Constructors Inc. to pay the sum of $9,640 to the City, representing the estimated cost of completing such paving under both contracts. The City does hereby, effective upon receipt of such funds, release Pacific Mechanical Constructors Inc., Metro and Val Vue Sewer District from their responsibility for the completion of such paving.

6. Metro shall promptly construct the portion of the Val Vue Connection Trunk Sewer described on Exhibit A attached

hereto and by this reference made a part hereof. Such portion shall be so constructed as to permit local service connections to be made thereto and in consideration thereof the City shall pay to Metro the cost of constructing an 8-inch local sewer on such alignment. Within 20 days following the first local connection, the City shall pay to Metro the sum of $23,075 representing the cost of an 8-inch sewer from Point A on Exhibit "A" to the connection with the 24-inch Freeway Crossing Sewer. Within 30 days following the first local connection made to the Val Vue Connection Trunk between Point A and Point B the City will pay to Metro the sum of $5,652. Metro will have and reserve the right to use the Val Vue Connection Sewer to transport sewage to the Metropolitan Sewerage System from tributary areas outside the present boundaries of the City. The City shall own, operate and maintain said sewer but in the event Metro shall use such sewer, Metro shall pay to the City a proportionate share of the cost of operation, maintenance or replacement of such sewer. Metro's share of such costs shall be in the same proportion which the area served by such sewer located outside the City bears to the total area served by such sewer. At such time as Metro notifies the City in writing that the use of the Val Vue Connection is no longer required by Metro to transport sewage collected from areas outside of the City, Metro shall thereby relinquish its rights of use and the City shall thereupon pay to Metro that portion of the total cost of construction of the Val Vue Connection sewer which shall have been borne by Metro. The City shall promptly issue a street use permit for such construction on the same terms and conditions as the street use permit issued to Metro by the City under date of August 21, 1967.

7. In consideration of the payments and the mutual covenants hereof the parties hereto do hereby mutually release one another from any and all claims at law or in equity arising out

of any mistakes of fact, alleged representations or understandings of the parties relative to the Andover Station and the effect of the Basic Agreement upon the operation of the Station.

8. Except as herein specifically provided, the Basic Agreement is in no way affected or modified by this Supplemental Agreement and shall be and remain in full force and effect in accordance with the terms thereof.

9. This Supplemental Agreement merges and supersedes all prior negotiations, representations and agreements between the parties hereto relating to the subject matter hereof and constitutes the entire agreement as to the said subject matter between the parties.

IN WITNESS WHEREOF the parties hereto have executed this agreement as of the day and year first above written.

CITY OF TUKWILA

Stan D. Michlen
Mayor

ATTEST:

Freda M Lealy
City Clerk

MUNICIPALITY OF METROPOLITAN SEATTLE

C. Carey Donworth
C. Carey Donworth
Chairman of the Council

ATTEST:

Marelyn Sullivan
Marelyn Sullivan
Clerk of the Council

3005 205

STATE OF WASHINGTON)
) ss.
COUNTY OF KING)

On this 10th day of MAY, 1968, before me personally appeared [illegible] and [illegible] LEARY, to me known to be the Mayor and City Clerk respectively, of the City of Renton, Washington, a municipal corporation, and acknowledged the within and foregoing instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that they were authorized to execute said instrument and that the seal affixed is the corporate seal of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

Notary Public in and for the State of Washington, residing at RENTON

STATE OF WASHINGTON)
) ss.
COUNTY OF KING)

On this 22nd day of May, 1968, before me personally appeared [illegible] and CATHRYN SULLIVAN, to me known to be the Chairman of the Council and Clerk of the Council, respectively, of the Municipality of Metropolitan Seattle, a municipal corporation, and acknowledged the within and foregoing instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that they were authorized to execute said instrument and that the seal affixed is the corporate seal of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

Jack A. Blakely
Notary Public in and for the State of Washington, residing at Seattle

Filed for Record June 6 1968 10:45 A.M.
Request of Metro
ROBERT A. MORRIS, County Auditor

4

SEWAGE DISPOSAL AGREEMENT

THIS AGREEMENT, made and entered into this 22nd day of July, 1977, by and between VAL VUE SEWER DISTRICT, a municipal corporation of the State of Washington, hereinafter referred to as "District" and the CITY OF TUKWILA, a municipal corporation of the State of Washington, hereinafter referred to as "Tukwila";

W I T N E S S E T H :

WHEREAS, the public health, welfare and safety of the residents of Tukwila and the residents of the District require the development of adequate systems of sewage collection and disposal; and

WHEREAS, the District is developing a sanitary sewage disposal system and anticipates establishing a sewer collection system within its boundaries immediately adjacent to the Tukwila areas hereinafter described; and

WHEREAS, Tukwila has constructed facilities of adequate capacity and anticipated connection to said facilities by the District under Tukwila Local Improvement District No. 24, hereinafter referred to as "LID 24", of those areas herein described on Exhibit A, attached hereto; and

WHEREAS, the District is desirous to connect to said Tukwila facilities from the areas hereinafter described; and

WHEREAS, the District and the residents of the hereinafter described areas desire that sewer collection service be provided for those areas, and the location of LID 24 and other topographic conditions make it difficult and expensive for the District to serve the requirements of the areas to be served; and

WHEREAS, said conditions make it feasible for the District to meet the sewage drainage requirements of said areas to LID 24; and

WHEREAS, the District is desirous of delivering to Tukwila the sewage collected in said areas for disposal through its system; and

WHEREAS, to provide for the disposal by the District of sewage collected in the District areas to be serviced and hereinafter described, it is necessary that a contract for these services be entered into now establishing certain rights and duties of the parties incident thereto,

NOW, THEREFORE, for and in consideration of the mutual premises and the covenants contained herein, it is agreed as follows:

1. The area of land described in Exhibit A, all of which is contained within the District, consists of approximately 1,808,800 square feet. Of this area, Utility Local Improvement District No. 9, within the District, contains 785,389 square feet of land and the land remaining exclusive of Utility Local Improvement District No. 9, hereinafter referred to as "ULID 10", contains 1,023,411 square feet.

2. At such time as any owner of real property within the area described in Exhibit A, or any portion thereof, elects to receive sewer service, the District shall pay to Tukwila the amount of $0.03550786 per square foot of land. The total to be paid by the District to Tukwila for land within the boundaries of ULID 9 shall be $27,887.48. The total moneys to be paid by the District to Tukwila for the balance of the land covered by this Agreement, exclusive of the area within ULID 9, shall be

$36,339.07.

3. The District contemplates construction of the Macadam Road Interceptor as more fully described and set forth in the document entitled "Sanitary Sewers Facilities Plan" which is dated November, 1976 and which has been partially funded under the State of Washington, Department of Ecology, Environmental Protection Agency, Grant No. C-530806-01-0. Portions of said plan are attached to this Agreement as Exhibits B and C.

4. As a part of its construction of the sanitary sewers facilities described in the above paragraph, the District agrees to:

A. Construct the Macadam Road Interceptor as near as practicable to the time schedule contained in Exhibit C, but no later than three years from the date of this Agreement; and

B. Construct the Macadam Road Interceptor at a proper elevation to accept flow from the Tukwila Pump Station from gravity thus allowing abandonment of said Pump Station; and

C. Not charge Tukwila any fees for the connection of the Tukwila Pump Station to the Macadam Road Interceptor as described on Exhibit B; and

D. Not charge Tukwila operation and maintenance costs for said Macadam Road Interceptor; and

E. Return to Tukwila all salvagable portions of the personal property contained within the limits of Tukwila LID 24 as the sole property of Tukwila; and

F. Pay Tukwila an additional fee to those as described in Paragraph 1 of this Agreement of $0.02649566 per square foot of land as described in Exhibit A if the items

contained in Paragraph 4(A), (B) and (C), or any one of them, are not fulfilled, completed or performed by District, in whole or in part.

5. If and only if the District performs all of its obligations as set forth in Paragraph 4(A), (B) and (C), the District will not be charged periodic operation and maintenance costs for use of Tukwila's LID 24 facilities. ~~In the event the District does not completely fulfill its obligations under the provisions of Paragraph 4(A), (B) and (C) of this Agreement, the District shall pay to Tukwila an additional fee to those as described in Paragraph 1 of this Agreement of $0.02649566 per square foot of land as described in Exhibit A.~~

6. The District shall have the right and authority to enter upon the streets, avenues, alleys, roads and public places of Tukwila, for the purpose of construction work, making extensions of mains and laterals, connecting same with service pipes from abutting property, repair equipment and maintain and operate said lines in Tukwila.

7. The District shall leave all Tukwila streets, avenues, alleys, roads or public places after laying and installing mains and doing construction work, making repairs to equipment, etc., in as good and safe a condition in all respects as they were in before the commencement of such work by the District, its agents or contractors and to the satisfaction of Tukwila.

In case of any damage to said Tukwila streets, avenues, alleys, roads or public places, paved roadways, turnouts, gutters, ditches, sidewalks, drain pipes, hand or embankment rails or bridges by the District, the District agrees to immediately repair said damage at its sole cost and expense.

8. The District hereby agrees for itself, its successors or assigns, to indemnify, protect, save and hold harmless Tukwila from all claims, actions or damages of every kind and description which may accrue to or be suffered by any person or persons, corporation or property by reason of any faulty construction, defective material or equipment or maintenance, or by the improper occupation of said Tukwila right-of-way, by the District or by reason of the neglect, improper or faulty manner of safeguarding any excavations, temporary turnouts, or inefficient operations by the District of sewer pipe over said streets, avenues, alleys, roads and public places as hereinbefore designated, and in case that suit or action is brought against Tukwila for damages arising out of or by reason of the above-mentioned cause, the District, its successors or assigns, will, upon notice to it or them of the commencment of said action, defend the same at its sole cost and expense and in case judgment shall be rendered against Tukwila in suit or actions, will fully satisfy said judgment within ninety (90) days after said suit or action shall have finally been determined, if determined adversely to Tukwila.

The District hereby agrees for itself, its successors and assigns, to repair any damage to the roads over which it holds a franchise in Tukwila and all other improvements caused by the failure of the District's work during the life of this Agreement.

Failure on the part of the District to promptly repair the damaged work in Tukwila upon notice to do so shall be warrant for Tukwila to make necessary repairs and charge the same to the District at the reasonable cost thereof.

Acceptance of the work by Tukwila at the time of completion shall be no defense for avoidance of this covenant. Provided that the District, its successors or assigns, shall have the right to employ its or their own counsel in any cause or action and by given the exclusive management of the defense thereof.

9. The District shall collect all of the sewage in said areas in the same manner as the sewage is collected for disposal in other areas of the District.

The additions, improvements, repairs and maintenance made to the sewage collection facilities provided for said areas shall be at the sole discretion and determination of the District as to the kind, type, manner and time except as specifically covered by this Agreement.

10. The laying, construction, maintenance and operation of the District's system of sewer pipe, laterals, service pipe, etc., granted under this Agreement shall not preclude Tukwila, its accredited agents or contractors, from blastings, grading or doing other necessary road work contiguous to the said District's pipe lines, provided that the District shall have twenty-four (24) hours' notice of said blasting or excavating in order that the District may protect its lines of pipe and property. Tukwila shall be liable to the District for any negligent acts damaging said system in the performance of the aforesaid road work, or any costs necessitated by the relocation of sewer lines due to said road work.

11. Property owners within the areas of Tukwila who have met the requirements of the District shall be entitled to connect to the lines of the District at such time as they are

completed and are approved to receive sewage within said area. Said connections shall be accomplished at the expense of the property owner and in accordance with the rules and regulations of the District and the ordinances of Tukwila, with points of connection being determined by the District.

12. Property owners connecting to said lines shall be required to obtain from the District and Tukwila such permits or licenses for connection as are generally required throughout the District and Tukwila.

13. Upon completion of the facilities for the areas of Tukwila to be serviced, the District shall have the sole duty and obligation to operate, maintain, repair and replace such facilities.

14. Neither party shall have the right to assign this Agreement or any of its rights and obligations hereunder either by operation of law or by voluntary agreement without the written consent of either party and neither party may terminate its obligations hereunder by dissolution or otherwise without first securing the written consent of the other party and this Agreement shall be binding upon and inure to the benefit of the respective successors and assigns of the parties hereto.

15. This Agreement shall be in full force and effect and binding upon the parties hereto, their successors and assigns, agents, employees, subcontractors, sublessors, independent contractors, and any and all other parties working for or under the direction of said parties, upon the execution of this Agreement and shall continue in full force and effect until such time as this Agreement is terminated by mutual assent.

16. Whenever, in this Agreement notice is required to be given, the same shall be given by certified mail addressed to the respective parties at an address hereafter designated in writing by either of the parties. The date of giving such notice shall be deemed to be the date of mailing thereof.

17. This Agreement may be executed in six counterparts, any of which shall be regarded for all purposes as one original.

DATED the day and year first above written.

CITY OF TUKWILA

By _____
Edgar D. Bauch, Mayor

ATTEST:

By _____
Maxine Anderson
City Clerk

APPROVED AS TO FORM:

By _____
Lawrence E. Hard
Deputy City Attorney

VAL VUE SEWER DISTRICT

By _____
Andy Simkus, Commissioner

By _____
Betty Lunz, Commissioner

By _____
B. W. Butters, Commissioner

ATTEST:

By _____

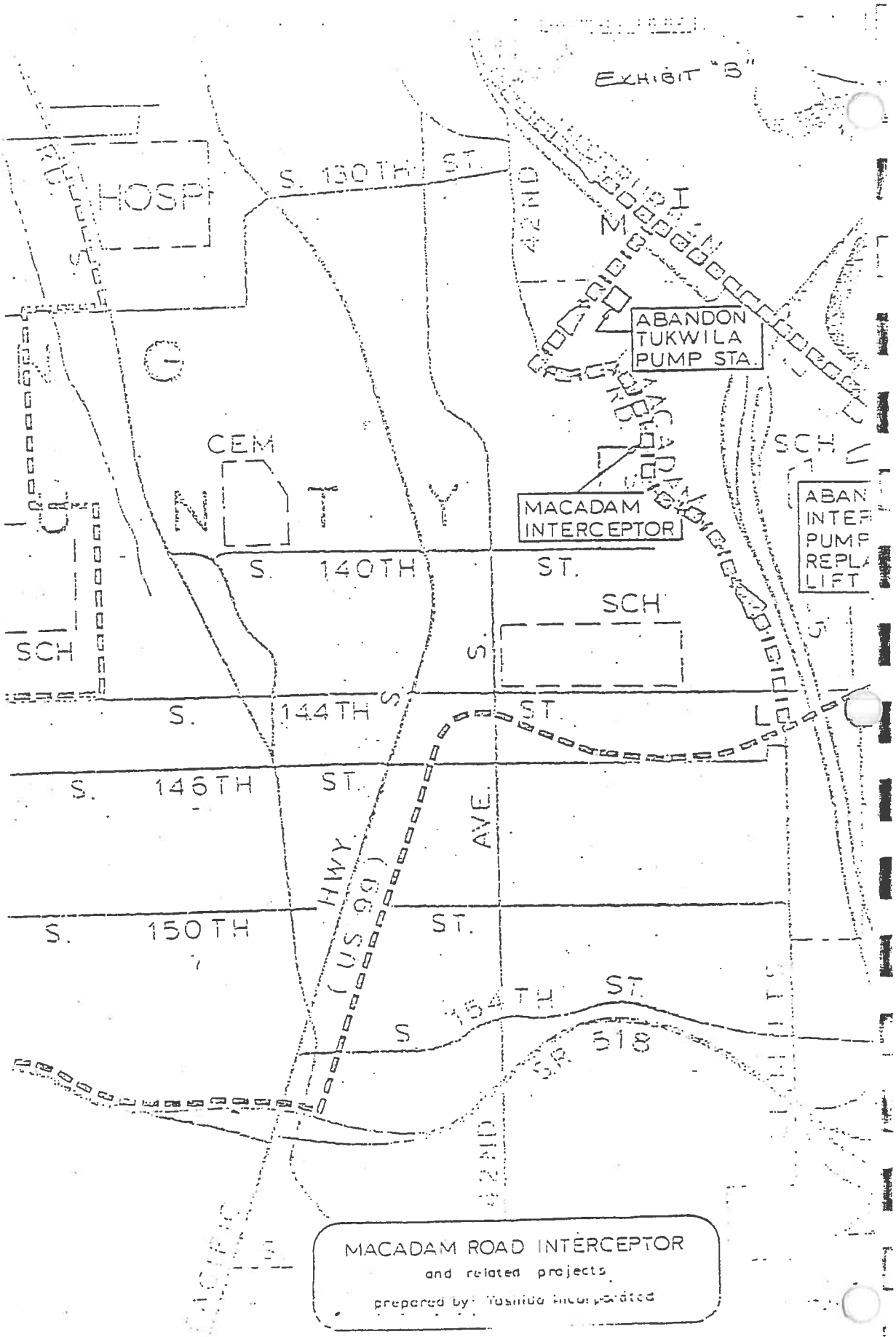


EXHIBIT "B"
HOSP
S. 150TH ST.
ABANDON TUKWILA PUMP STA.
MACADAM INTERCEPTOR
CEM
S. 140TH ST.
SCH
S. 144TH ST.
S. 146TH ST.
S. 150TH ST.
HWY (US 99)
AVE.
S. 154TH ST.
518
MACADAM ROAD INTERCEPTOR
and related projects
prepared by: Toshida Incorporated

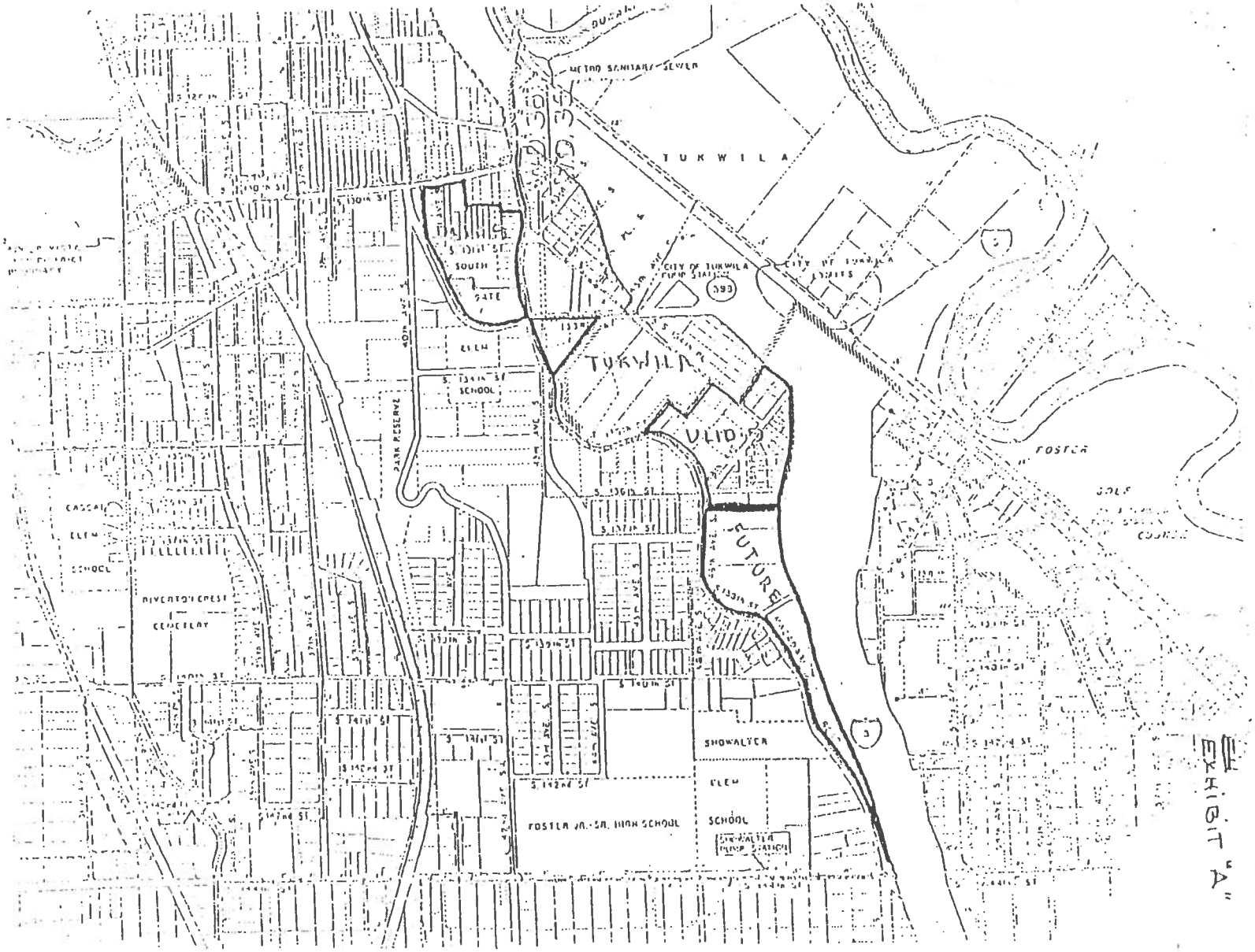

METRO SANITARY SEWER
TUKWILA
CITY OF TUKWILA PUMP STATION
393
SOUTH GATE
ELEM SCHOOL
PARK RESERVE
TUKWILA
ULID 2
FUTURE
FOSTER
CASCADE ELEM SCHOOL
RIVERTON CREST CEMETERY
SHOWALTER ELEM SCHOOL
FOSTER JR.-SR. HIGH SCHOOL
EXHIBIT "A"

EXHIBIT "C"
PAGE 1

PHASING

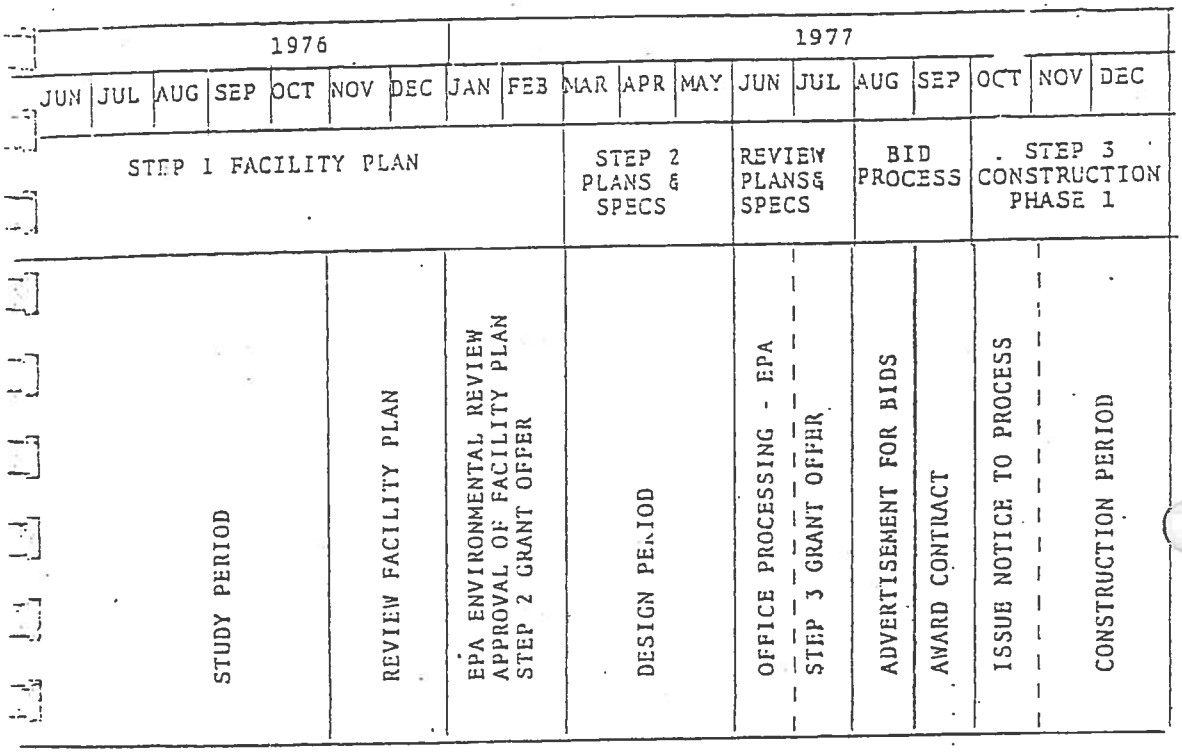
Although Step One of the Wastewater Treatment, Construction Grants Program for the entire scope of work contained in this document has been the responsibility of the Val Vue Sewer District, Steps Two and Three for the component projects will be divided between METRO and Val Vue. ~~METRO has assumed the responsibility for the Val Vue Connection as the service area for this project exceeds 1000 acres.~~ Val Vue will complete Steps Two and Three for the Macadam Road, Rainier Vista and Riverton Interceptor Projects.

The component projects will be committed to separate time schedules. All scheduling of Steps 2 & 3 is dependent upon the individual projects receiving sufficiently high ~~priority rating from the DOE for FY 1977~~ and upon funds being available for continuation of the Wastewater Treatment Works Grant Program. Grant applications for Steps 2 & 3 will be submitted separately for each of the four component projects. The following construction phasing is anticipated:

Phase 1 - Macadam Road Interceptor. Construction of the Macadam Road Interceptor should be possible during the 2nd half of 1977. This project has highest priority due to the severity of septic tank overflows within its service area. ~~$500,000 in HUD grant funding is presently being reserved to construct sewage collection systems within Sub-Basin 2.~~ The commitment of $300,000 of this funding is contingent upon construction of the Macadam Road Interceptor. Table 9-1 is the anticipated time schedule for the interceptor assuming Step 2 prioritization by December, 1976.

EXHIBIT "C"
PAGE 2

TABLE 9-1



Prior to the construction of the Val Vue Connection, the Macadam Road Interceptor will be connected to the Interurban Interceptor.

Phase II - ~~Contingent upon receiving sufficient priority rating, the Val Vue Connection, Rainier Vista Interceptor and Riverton Interceptor will be constructed during FY 1978.~~

Appendix E

SYSTEM MAPS

Wastewater System Map Index
Comprehensive Sanitary Sewer Plan
City of Tukwila

1
2
3
4
5
6
7
8
9
10
11

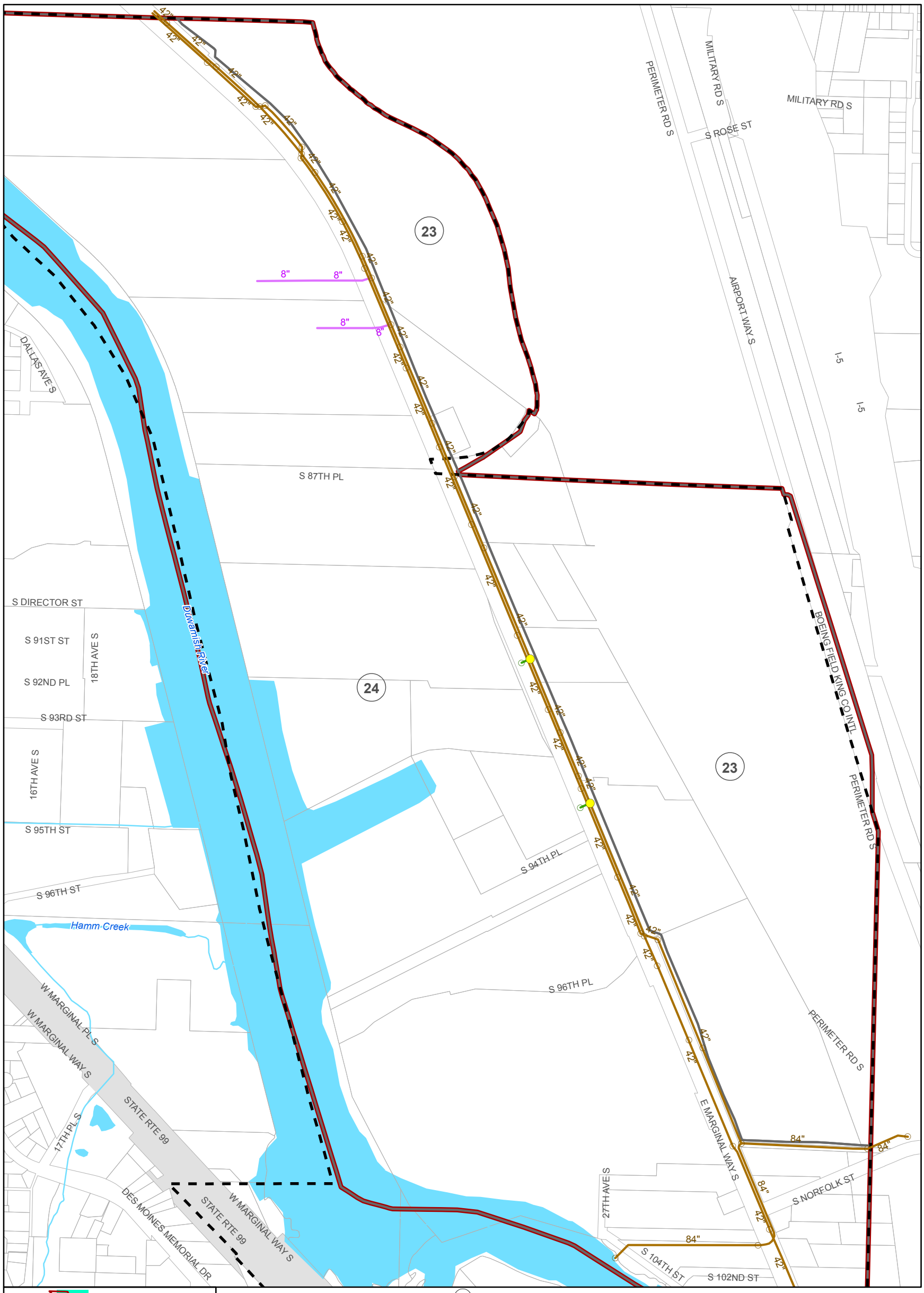
Lake Washington
Duwamish River
Hamm Creek
Miller Creek
Bow Lake
Angle Lake
Black River
Green River
Springbrook Creek
Lower Garrison Creek
Mill Creek
Des Moines Creek

S CLOVERDALE ST
STATE HWY 99
14TH AVE S
16TH AVE S
AIRPORT WAY S
E MARGINAL WAY S
W MARGINAL PL
S 96TH ST
S HENDERSON ST
CARKEEK DR S
BEACON AVE S
ARD PARK AVE S
STATE HWY 167
S 102ND ST
BOEING RD
S 107TH ST
S BANGOR ST
RENTON AVE S
S 112TH ST
GLENDALE WAY S
STATE HWY 509
S 124TH ST
8TH AVE S
S 128TH ST
STATE HWY 599
STATE HWY 900
INTERURBAN AVE S
S 136TH ST
S 140TH ST
DES MOINES MEMORIAL DR
24TH AVE S
S 146TH ST
STATE HWY 518
S 154TH ST
S 156TH WAY
MILITARY RD S
AIR CARGO RD
N ENTRY DR
SOUTHCENTER BLVD
TUKWILA PKWY
I-405 S
SOUTHCENTER PKWY
S 176TH ST
S 178TH ST
I-5 N
S 180TH ST
SW 43RD ST
RAMP
S 188TH ST
S 192ND ST
16TH AVE S
DRILLIA RD
S 200TH ST
S 204TH ST
S 196TH ST
E VALLEY HWY
S 212TH ST

Legend
- Roads
- Lakes/Ponds/Rivers/ Streams/Creeks
- Map Index
- Sewer Service Area

Feet
0 1,500 3,000

carollo



Legend

Tukwila Sanitary Sewer Facilities
- Manhole
- Lift Station
- Gravity Main
- Force Main

King County WTD Facilities
- Manhole
- Lift Station
- Gravity Main
- Force Main

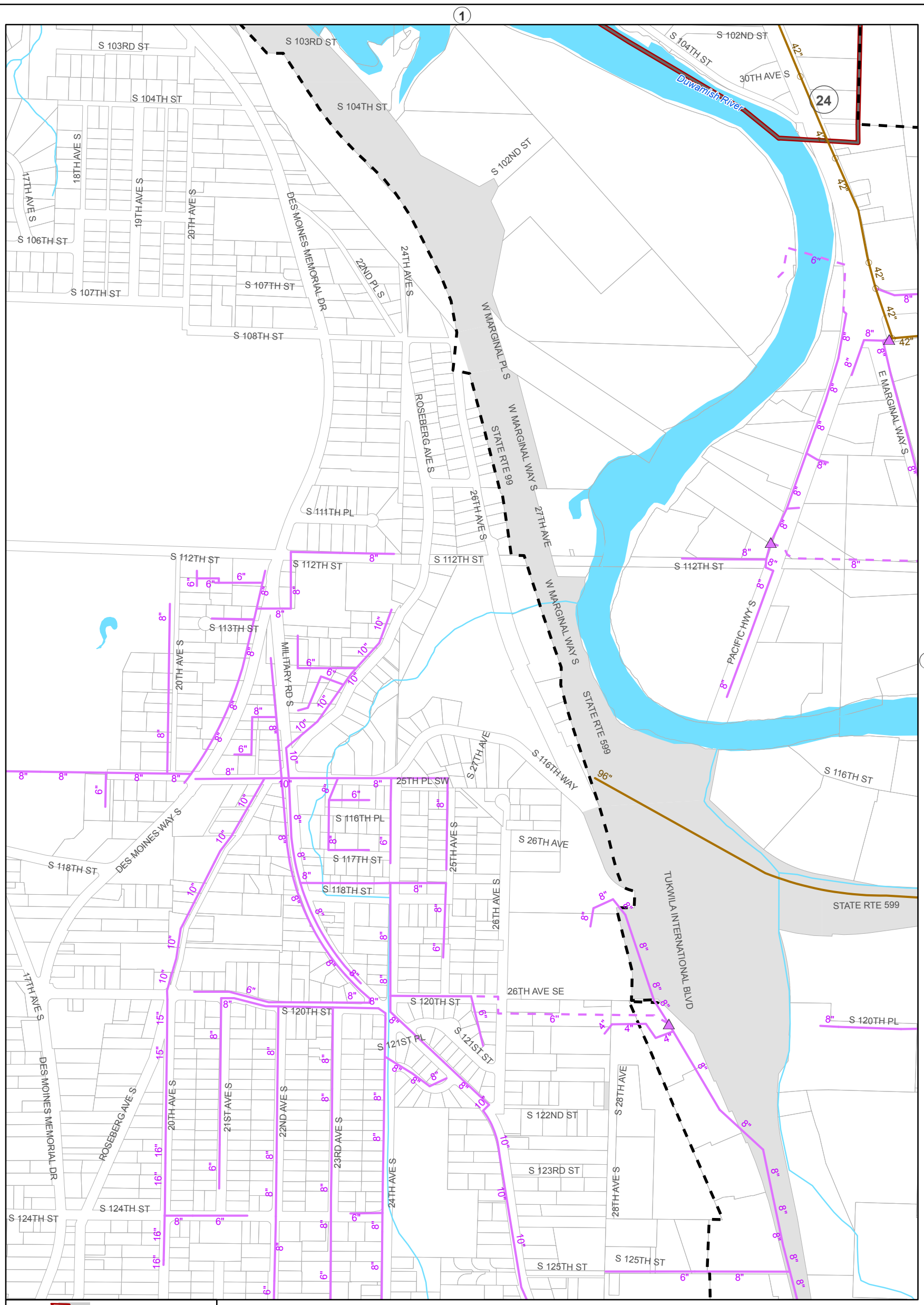
Other Sewer Facilities
- Lift Station
- Gravity Main
- Force Main

- City Connection to King County
- Rivers/Streams/Creeks
- Parcels
- (5) Drainage Basin Boundary
- Sewer Service Area
- City Limits

0 600 1,200 Feet

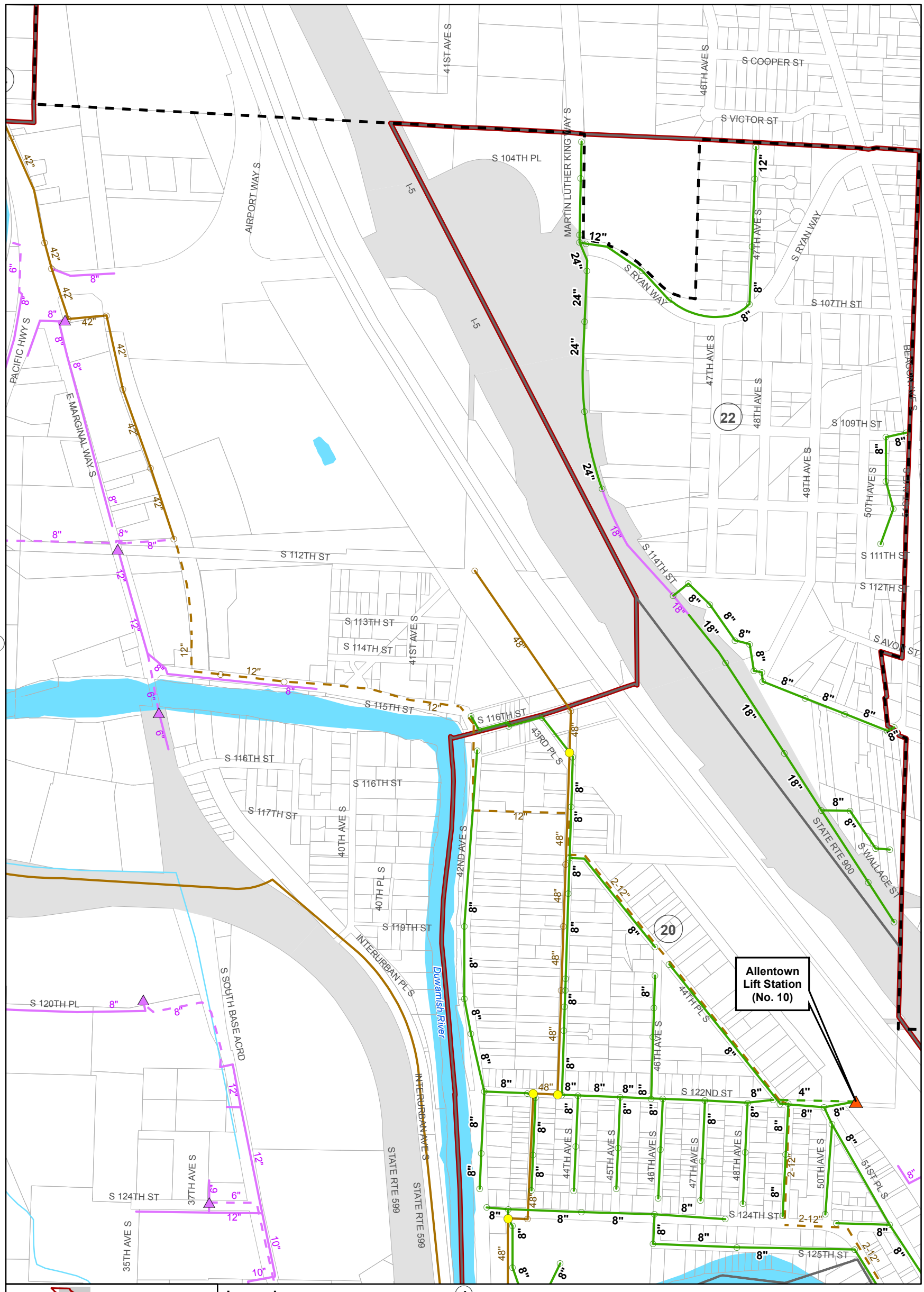
Wastewater System Map Sheet 1
Comprehensive Sanitary Sewer Plan
City of Tukwila
Effective Date: February 15, 2011

carollo



Wastewater System Map Sheet 2
Comprehensive Sanitary Sewer Plan
City of Tukwila
Effective Date: February 15, 2011

carollo



Legend

Tukwila Sanitary Sewer Facilities
- Manhole
- Lift Station
- Gravity Main
- Force Main

King County WTD Facilities
- Manhole
- Lift Station
- Gravity Main
- Force Main

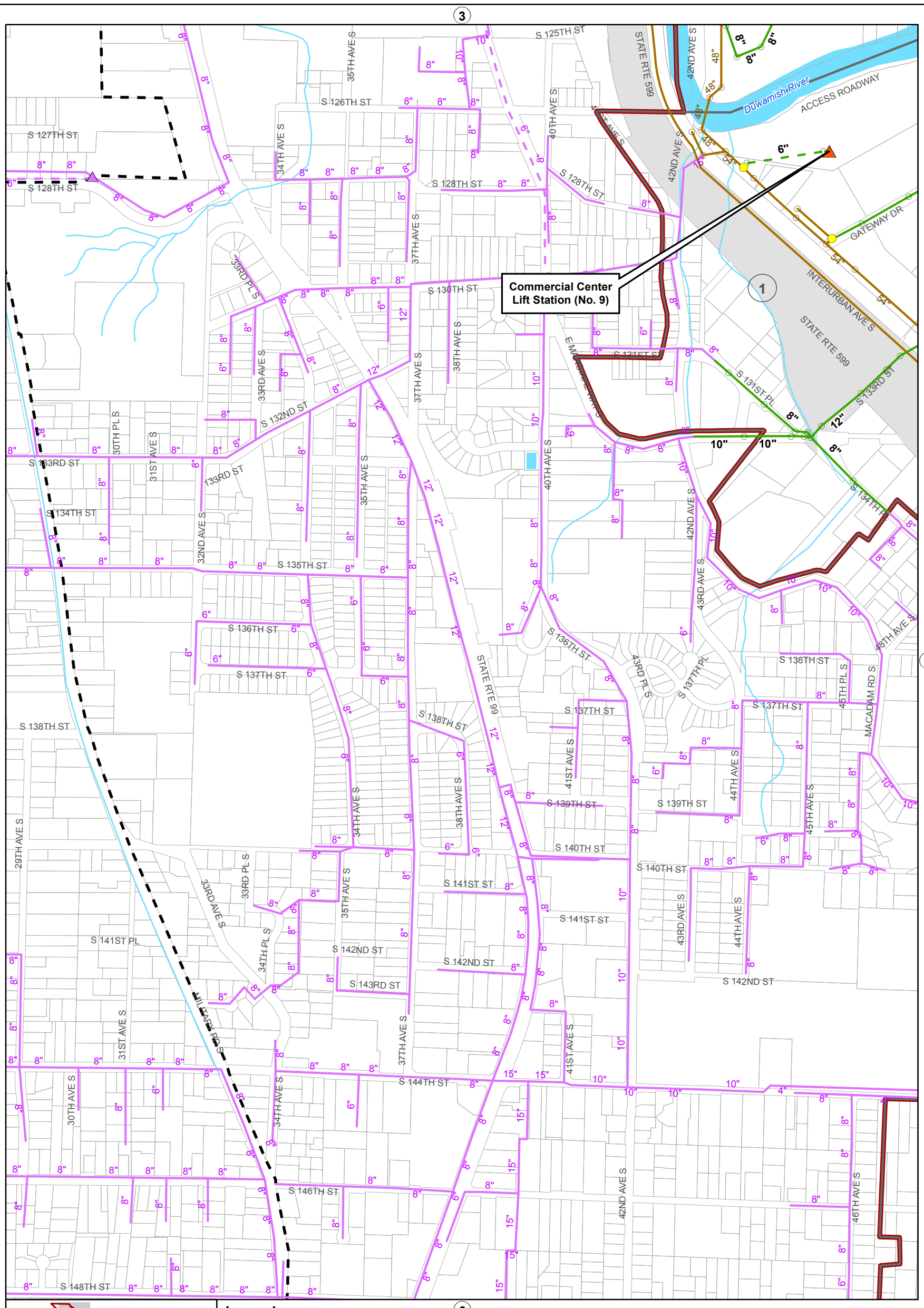
Other Sewer Facilities
- Lift Station
- Gravity Main
- Force Main

- City Connection to King County
- Rivers/Streams/Creeks
- Parcels
- 5 Drainage Basin Boundary
- Sewer Service Area
- City Limits

Feet
0 600 1,200

Wastewater System Map Sheet 3
Comprehensive Sanitary Sewer Plan
City of Tukwila
Effective Date: February 15, 2011

carollo


3
Commercial Center
Lift Station (No. 9)
1
5
6
Duwamish River
ACCESS ROADWAY
GATEWAY DR
INTERURBAN AVE S
STATE RTE 599
STATE RTE 99
S 125TH ST
S 126TH ST
S 127TH ST
S 128TH ST
S 130TH ST
S 131ST ST
S 131ST PL
S 132ND ST
S 133RD ST
S 134TH ST
S 135TH ST
S 136TH ST
S 137TH ST
S 138TH ST
S 139TH ST
S 140TH ST
S 141ST ST
S 141ST PL
S 142ND ST
S 143RD ST
S 144TH ST
S 146TH ST
S 148TH ST
30TH PL S
31ST AVE S
32ND AVE S
33RD AVE S
33RD PL S
34TH AVE S
34TH PL S
35TH AVE S
37TH AVE S
38TH AVE S
40TH AVE S
41ST AVE S
42ND AVE S
43RD AVE S
43RD PL S
44TH AVE S
45TH AVE S
45TH PL S
46TH AVE S
48TH AVE S
MACADAM RD S
MILITARY RD S
29TH AVE S
Legend
Tukwila Sanitary Sewer Facilities
Manhole
Lift Station
Gravity Main
Force Main
King County WTD Facilities
Manhole
Lift Station
Gravity Main
Force Main
Other Sewer Facilities
Lift Station
Gravity Main
Force Main
City Connection to King County
Rivers/Streams/Creeks
Parcels
Drainage Basin Boundary
Sewer Service Area
City Limits
Feet
0
600
1,200
Wastewater System Map Sheet 4
Comprehensive Sanitary Sewer Plan
City of Tukwila
Effective Date: February 15, 2011
carollo

Foster Point Lift Station (No. 8)

King County Interurban Lift Station

Duwamish River

MARTIN LUTHER KING WAY S

STATE RTE 900

STATE RTE 599

INTERURBAN AVE S

RAILROAD AVE

I-5

MACADAM RD S

BEACON COAL MINE RD S

MAULE AVE

S 125TH ST

S 126TH ST

S LANGSTON RD

S 129TH ST

S 133RD ST

S 134TH ST

S 136TH ST

S 137TH ST

S 138TH ST

S 139TH ST

S 140TH ST

S 141ST ST

S 141ST PL

S 142ND ST

S 144TH ST

S 145TH ST

S 146TH ST

GATEWAY DR

51ST PL S

56TH PL S

57TH AVE S

60TH AVE S

61ST PL S

59TH PL S

48TH AVE S

46TH AVE S

45TH PL S

47TH AVE S

51ST AVE S

52ND AVE S

53RD AVE S

54TH AVE S

55TH AVE S

56TH AVE S

58TH AVE S

59TH AVE S

Legend

Tukwila Sanitary Sewer Facilities

- Manhole
- Lift Station
- Gravity Main
- Force Main

King County WTD Facilities

- Manhole
- Lift Station
- Gravity Main
- Force Main

Other Sewer Facilities

- Lift Station
- Gravity Main
- Force Main

- City Connection to King County
- Rivers/Streams/Creeks
- Parcels
- Drainage Basin Boundary
- Sewer Service Area
- City Limits

0 600 1,200 Feet

Wastewater System Map Sheet 5
Comprehensive Sanitary Sewer Plan
City of Tukwila
Effective Date: February 15, 2011

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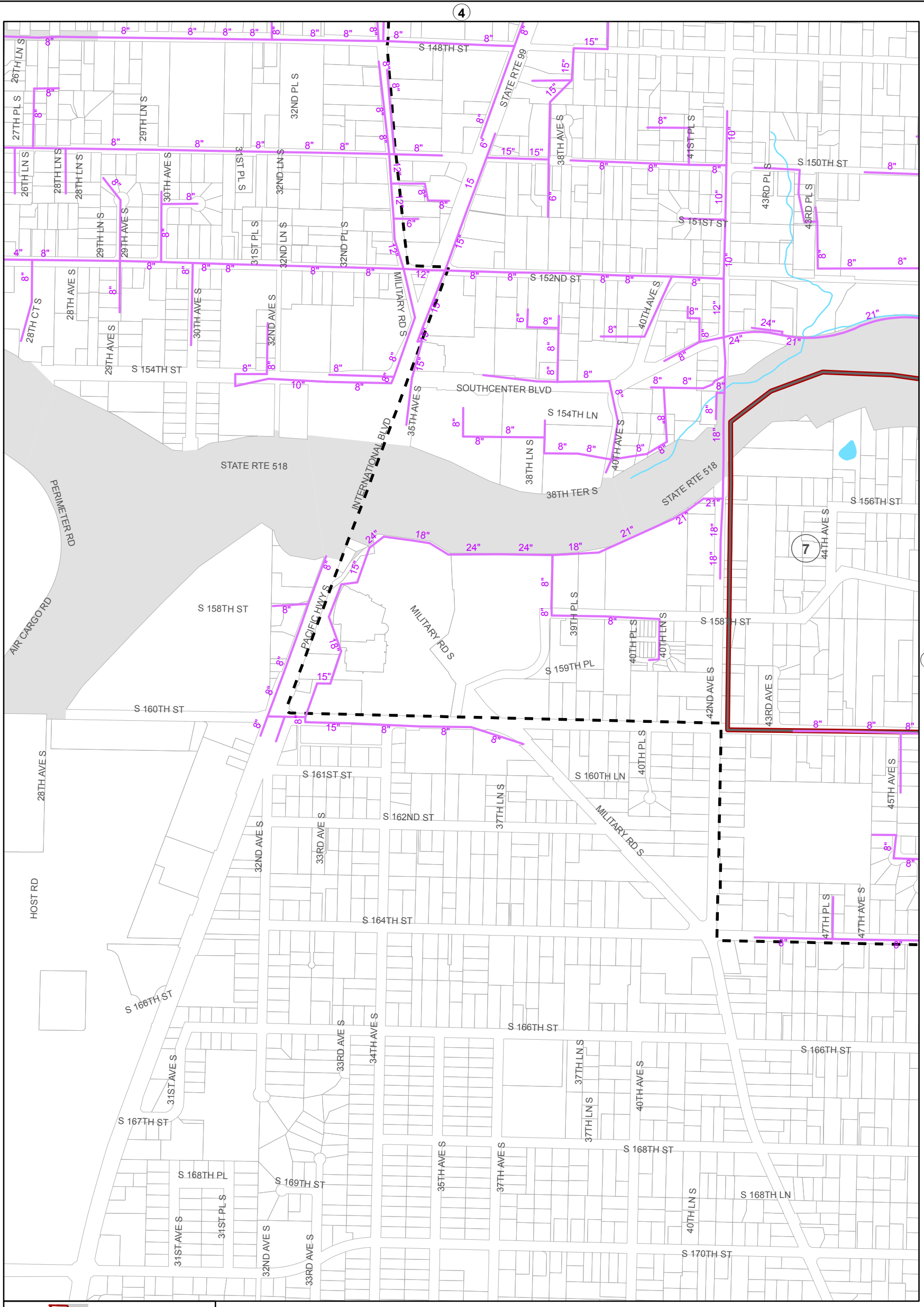
4
S 148TH ST
STATE RTE 99
26TH LN S
27TH PL S
29TH LN S
32ND PL S
26TH LN S
28TH LN S
28TH LN S
30TH AVE S
31ST PL S
32ND LN S
32ND PL S
29TH LN S
29TH AVE S
38TH AVE S
41ST PL S
S 150TH ST
43RD PL S
43RD PL S
S 151ST ST
S 152ND ST
28TH CT S
28TH AVE S
29TH AVE S
30TH AVE S
32ND AVE S
MILITARY RD S
40TH AVE S
S 154TH ST
SOUTHCENTER BLVD
35TH AVE S
S 154TH LN
38TH LN S
40TH AVE S
STATE RTE 518
INTERNATIONAL BLVD
38TH TER S
STATE RTE 518
S 156TH ST
44TH AVE S
7
PERIMETER RD
AIR CARGO RD
S 158TH ST
PACIFIC HWY S
MILITARY RD S
39TH PL S
40TH PL S
40TH LN S
S 158TH ST
S 159TH PL
42ND AVE S
43RD AVE S
7
S 160TH ST
28TH AVE S
S 161ST ST
S 160TH LN
40TH PL S
45TH AVE S
37TH LN S
S 162ND ST
33RD AVE S
32ND AVE S
MILITARY RD S
HOST RD
S 164TH ST
47TH PL S
47TH AVE S
S 166TH ST
S 166TH ST
S 166TH ST
31ST AVE S
33RD AVE S
34TH AVE S
37TH LN S
40TH AVE S
S 167TH ST
S 168TH PL
S 169TH ST
31ST AVE S
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33RD AVE S
35TH AVE S
37TH AVE S
S 168TH ST
40TH LN S
S 168TH LN
S 170TH ST
Legend
Tukwila Sanitary Sewer Facilities
Manhole
Lift Station
Gravity Main
Force Main
King County WTD Facilities
Manhole
Lift Station
Gravity Main
Force Main
Other Sewer Facilities
Lift Station
Gravity Main
Force Main
City Connection to King County
Rivers/Streams/Creeks
Parcels
5
Drainage Basin Boundary
Sewer Service Area
City Limits
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600
1,200
Feet
Wastewater System Map Sheet 6
Comprehensive Sanitary Sewer Plan
City of Tukwila
Effective Date: February 15, 2011
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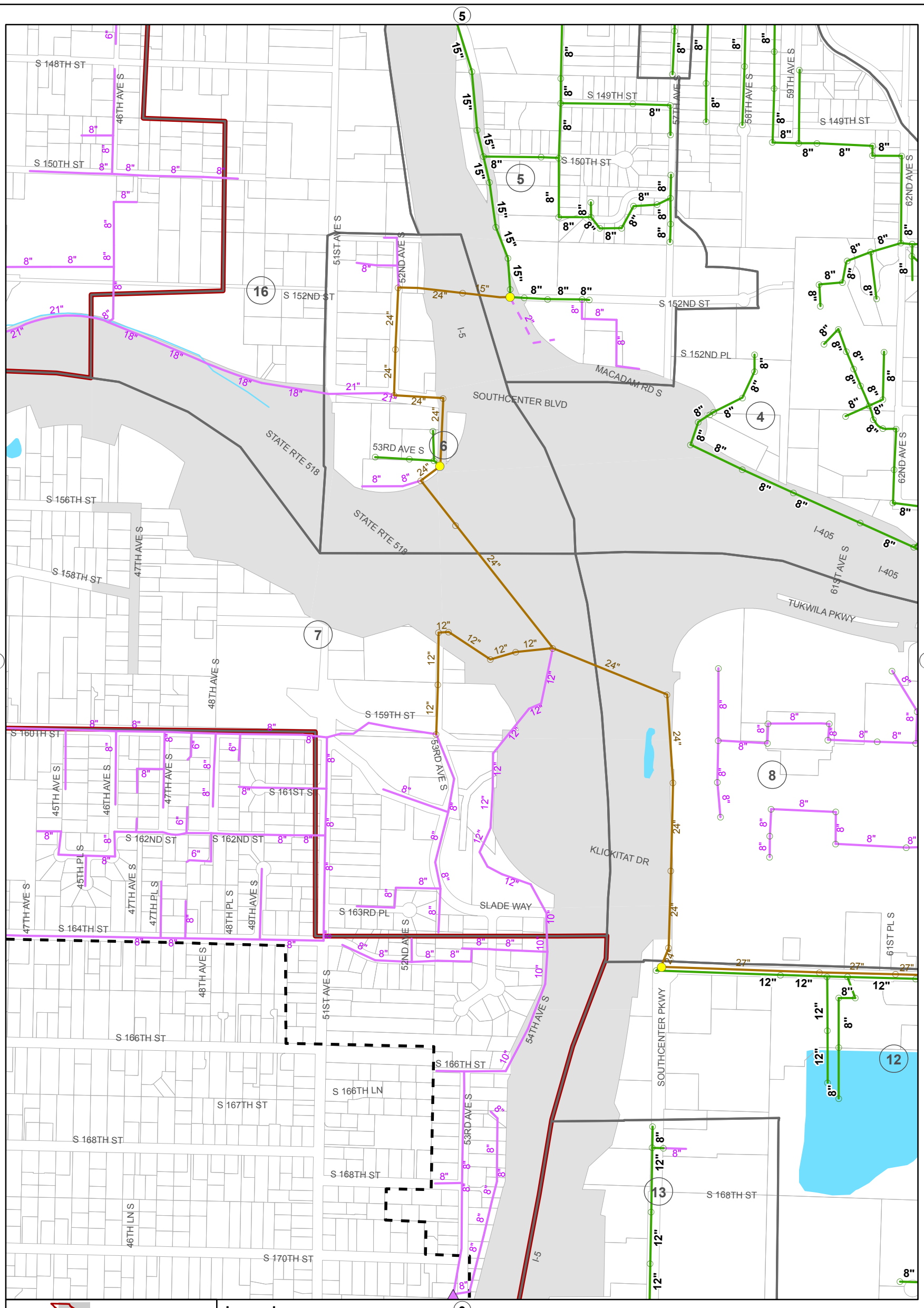

Legend

Tukwila Sanitary Sewer Facilities
- Manhole
- Lift Station
- Gravity Main
- Force Main

King County WTD Facilities
- Manhole
- Lift Station
- Gravity Main
- Force Main

Other Sewer Facilities
- Lift Station
- Gravity Main
- Force Main

- City Connection to King County
- Rivers/Streams/Creeks
- Parcels
- Drainage Basin Boundary
- Sewer Service Area
- City Limits

0 600 1,200 Feet

Wastewater System Map Sheet 7
Comprehensive Sanitary Sewer Plan
City of Tukwila
Effective Date: February 15, 2011

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Lift Station No. 6
Lift Station No. 5
King County South WWTP
Lift Station No. 12
S 149TH ST
62ND AVE S
INTERURBAN AVE S
S 151ST ST
S 151ST PL
PARK ACCESS RD
FORT DENT WAY
MONSTER RD SW
GRADY WAY
SW GRADY WAY
SW 16TH ST
SW 16TH ST
S 153RD ST
S 153RD ST
64TH AVE S
65TH AVE S
62ND AVE S
I-405
S GRADY WAY
I-405
SOUTHCENTER BLVD
CHRISTENSEN RD
S 156TH ST
NELSON PL
LONGACRES DR SW
TUKWILA PKWY
CHRISTENSEN RD
SW 21ST ST
LONGACRES WAY
ANDOVER PARK E
68TH AVE S
BAKER BLVD
S 164TH ST
INTERURBAN TRL
STRANDER BLVD
SW 27TH ST
61ST PL S
ANDOVER PARK W
TRECK DR
INDUSTRY DR
CHRISTENSEN RD
Green River
78TH AVE S
W VALLEY RD
STATE RTE 181
LONGACRES DR SW
3
4
7
9
10
11
12

Legend

Tukwila Sanitary Sewer Facilities
- Manhole
- Lift Station
- Gravity Main
- Force Main

King County WTD Facilities
- Manhole
- Lift Station
- Gravity Main
- Force Main

Other Sewer Facilities
- Lift Station
- Gravity Main
- Force Main

- City Connection to King County
- Rivers/Streams/Creeks
- Parcels
- 5 Drainage Basin Boundary
- Sewer Service Area
- City Limits

0 600 1,200 Feet

Wastewater System Map Sheet 8
Comprehensive Sanitary Sewer Plan
City of Tukwila
Effective Date: February 15, 2011

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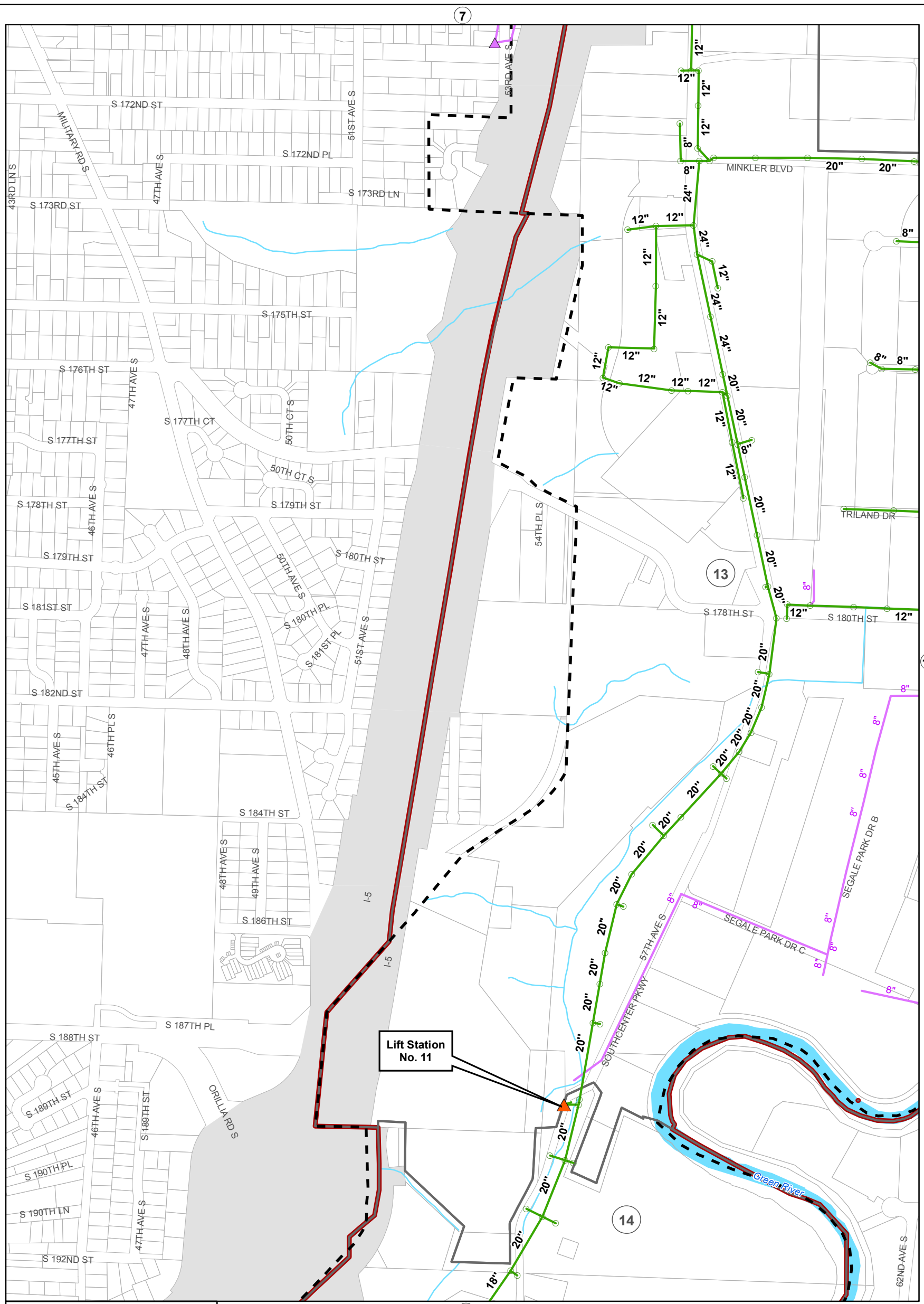
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51ST AVE S
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MINKLER BLVD
S 175TH ST
S 176TH ST
47TH AVE S
S 177TH CT
50TH CT S
S 177TH ST
S 178TH ST
46TH AVE S
S 179TH ST
50TH CT S
S 180TH ST
54TH PL S
TRILAND DR
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S 181ST ST
47TH AVE S
48TH AVE S
50TH AVE S
S 180TH PL
S 181ST PL
51ST AVE S
S 178TH ST
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S 182ND ST
45TH AVE S
46TH PL S
S 184TH ST
S 184TH ST
48TH AVE S
49TH AVE S
I-5
S 186TH ST
SEGALE PARK DR B
SEGALE PARK DR C
57TH AVE S
SOUTHCENTER PKWY
S 187TH PL
S 188TH ST
Lift Station
No. 11
S 189TH ST
46TH AVE S
S 189TH ST
ORILLIA RD S
S 190TH PL
S 190TH LN
47TH AVE S
Green River
14
S 192ND ST
62ND AVE S
11
Legend
Tukwila Sanitary Sewer Facilities
Manhole
Lift Station
Gravity Main
Force Main
King County WTD Facilities
Manhole
Lift Station
Gravity Main
Force Main
Other Sewer Facilities
Lift Station
Gravity Main
Force Main
City Connection to King County
Rivers/Streams/Creeks
Parcels
5
Drainage Basin Boundary
Sewer Service Area
City Limits
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Wastewater System Map Sheet 9
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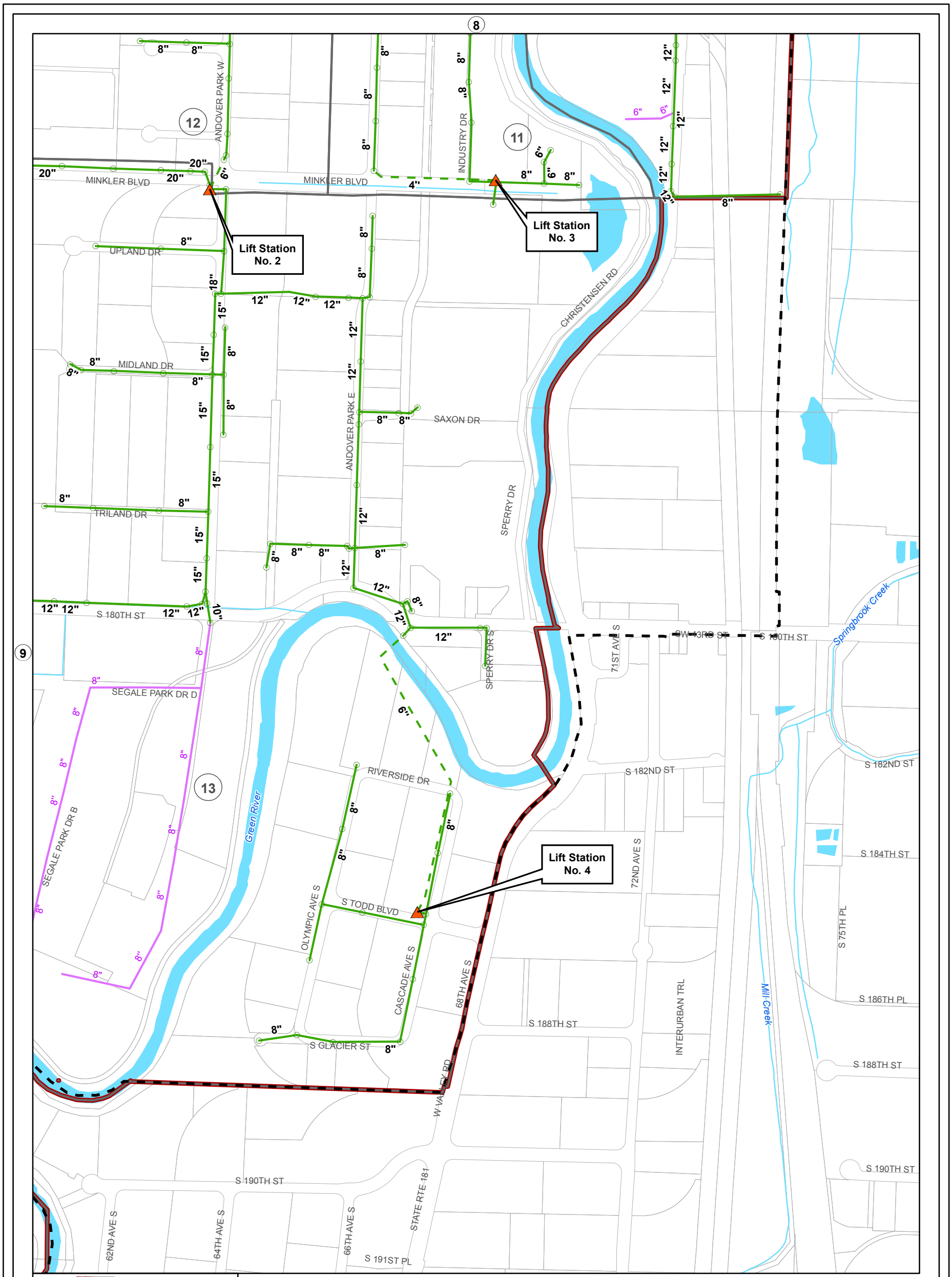
8
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ANDOVER PARK W
INDUSTRY DR
MINKLER BLVD
Lift Station No. 2
Lift Station No. 3
UPLAND DR
CHRISTENSEN RD
MIDLAND DR
TRILAND DR
ANDOVER PARK E
SAXON DR
SPERRY DR
S 180TH ST
SW 43RD ST
S 180TH ST
71ST AVE S
Springbrook Creek
SEGALE PARK DR D
SEGALE PARK DR B
Green River
RIVERSIDE DR
S 182ND ST
Lift Station No. 4
OLYMPIC AVE S
S TODD BLVD
CASCADE AVE S
72ND AVE S
S 184TH ST
S 75TH PL
68TH AVE S
S 188TH ST
INTERURBAN TRL
S GLACIER ST
Mill Creek
S 186TH PL
W VALLEY RD
S 190TH ST
62ND AVE S
64TH AVE S
66TH AVE S
STATE RTE 181
S 191ST PL
Legend
Tukwila Sanitary Sewer Facilities
Manhole
Lift Station
Gravity Main
Force Main
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Gravity Main
Force Main
Other Sewer Facilities
Lift Station
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Force Main
City Connection to King County
Rivers/Streams/Creeks
Parcels
Drainage Basin Boundary
Sewer Service Area
City Limits
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Wastewater System Map Sheet 10
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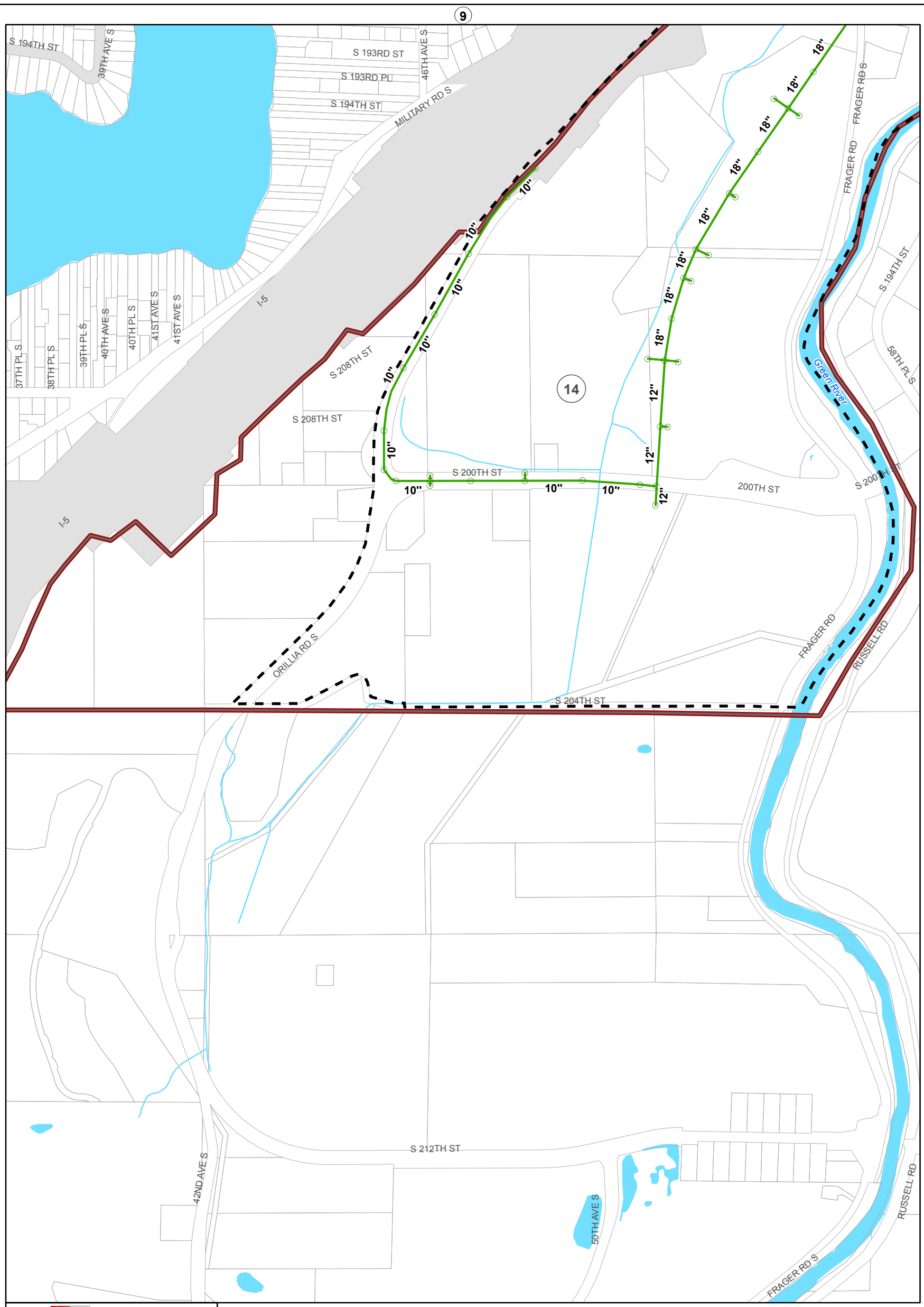
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MILITARY RD S
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37TH PL S
38TH PL S
39TH PL S
40TH AVE S
40TH PL S
41ST AVE S
41ST AVE S
S 208TH ST
S 208TH ST
S 200TH ST
200TH ST
S 200TH ST
FRAGER RD S
FRAGER RD
S 194TH ST
58TH PL S
Green River
ORILLIA RD S
S 204TH ST
FRAGER RD
RUSSELL RD
S 212TH ST
42ND AVE S
50TH AVE S
FRAGER RD S
RUSSELL RD
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12"
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Legend
Tukwila Sanitary Sewer Facilities
Manhole
Lift Station
Gravity Main
Force Main
King County WTD Facilities
Manhole
Lift Station
Gravity Main
Force Main
Other Sewer Facilities
Lift Station
Gravity Main
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City Connection to King County
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Drainage Basin Boundary
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Feet
Wastewater System Map Sheet 11
Comprehensive Sanitary Sewer Plan
City of Tukwila
Effective Date: February 15, 2011
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Appendix F

PROJECT MEMORANDUM
DRAINAGE BASIN 4

Engineers...Working Wonders With Water®

PROJECT MEMORANDUM

Project Name:	City of Tukwila, Comprehensive Sanitary Sewer Plan	**Date:**	September 20, 2011
Client:	Mike Cusick, City of Tukwila	**Project Number:**	8472A00
Prepared By:	Tyler Whitehouse		
Reviewed By:	Lara Kammereck, Anne Conklin, Tim Taylor		
Subject:	Sewer Service in Drainage Basin 4		
Distribution:	Client, Reviewers		

1.0 INTRODUCTION

As part of the City of Tukwila (City) Comprehensive Sanitary Sewer Plan (Plan), Carollo developed several conveyance alternatives to serve Drainage Basin 4 (DB4) customers. This evaluation was requested by the City due to an existing 12-inch diameter sewer pipeline structural failure beneath Interstate 405 (I-405). The following memorandum presents the evaluation of possible alternatives to serve DB4.

2.0 BACKGROUND

Currently, the flow from DB4 crosses I-405 and drains to Drainage Basin 8 (DB8). Television inspection of the existing 12-inch diameter sewer pipeline between DB4 and DB8 indicates that the existing pipeline is partially constricted due to structural failure. Replacement of the sewer pipeline is complicated by an existing Washington State Department of Transportation (WSDOT) 108-inch diameter storm drain pipe within the I-405 right of way (ROW) and a Seattle Public Utilities (SPU) 60-inch diameter water transmission main adjacent to I-405 ROW. Both pipelines run parallel to the I-405 corridor and their horizontal and vertical alignment interferes with the most desirable vertical alignment for a new sanitary sewer crossing.

WSDOT approved the I-405, Interstate 5 (I-5), and State Route (SR) 169 Stage 1 – widening project in 2009. The widening project provided an additional lane in each direction on I-405 between SR 167 and I-5. The existing 12-inch diameter sewer pipeline between DB4 and DB8 was anticipated to be replaced during this project. In 2006, the City tasked Blazier Engineers with developing and analyzing a number of alternatives for crossing the I-405 corridor with a new 12-inch diameter gravity sanitary sewer pipeline or by pumping to the King County trunk at the intersection of Macadam Road and South 152nd Street. The evaluation recommended crossing I-405 with an inverted siphon below WSDOT's 108-inch diameter storm drain and SPU's 60-inch diameter water main. Two methods to install the siphon below I-405 were recommended; horizontal directional drilling (HDD) and standard jack and bore.

3.0 DESIGN CRITERIA

The current and future flow projections for DB4 discussed in the City's Plan (currently being developed by Carollo) are presented in Table 3.1 below.

Table 3.1 Drainage Basin 4 Projected Flows

Year	AA, Average Annual (gpm)	PDF, Peak Day Flow (gpm)	PIF, Peak Instantaneous Flow (gpm)
2011	54	278	452
2030	218	476	773

Based on the 2030 Peak Instantaneous Flow (PIF) projections of 773 gallons per minute (gpm), the pipelines and pump stations presented in this alternatives analysis are designed for a capacity of 800 gpm.

4.0 ALTERNATIVES ANALYSIS

The following is a list of feasible alternatives to provide service to DB4 customers.

- Alternative 1: Inverted Siphon Under I-405
  - Cross I-405 with an inverted siphon under SPU's 60-inch diameter water main and WSDOT's 108-inch diameter storm drain that parallels the existing pipeline alignment.
- Alternative 2: Gravity Sewer Under I-405 and Tukwila Parkway Lift Station and Force Main
  - Cross I-405 by gravity under SPU's 60-inch diameter water main and WSDOT's 108-inch diameter storm drain, and install lift station and force main adjacent to Tukwila Parkway.
- Alternative 3: Southcenter Boulevard Lift Station and Force Main to King County Trunk
  - Install lift station adjacent to Southcenter Boulevard and pump to the King County Trunk at the intersection of Macadam Road and South 152nd Street.
- Alternative 4: Southcenter Boulevard Lift Station and Force Main/Gravity Sewer to Drainage Basin 3
  - Install lift station adjacent to Southcenter Boulevard and pump to a new sewer manhole near the Green River Trail entrance, then flow by gravity to an existing manhole in Drainage Basin 3 (DB3) located near the intersection of Fort Dent Way and Interurban Avenue South.
- Alternative 5: Southcenter Boulevard Lift Station and Force Main to Drainage Basin 8
  - Install lift station adjacent to Southcenter Boulevard and pump to an existing sewer manhole located at the intersection of Tukwila Parkway and Andover Park West in DB8.

A detailed discussion of each alternative is presented below. Refer to Figure 1 for a graphical representation of each alternative.

4.1 Alternative 1: Inverted Siphon Under I-405

Alternative 1 includes an inverted siphon installed below I-405 from Southcenter Boulevard to Tukwila Parkway. An inverted siphon or depressed sewer can be used to convey gravity sewer flow under an obstruction such as a stream or highway. A siphon incorporates two structures, an inlet and outlet structure. Siphons generally incorporate two or more pipes or barrels between the two structures to accommodate varying demand flows. Each barrel is sized to maintain a self-cleaning velocity of 3 feet per second or greater at least once per day. When multiple barrels are required, weirs or other flow control devices are used to direct higher flows into the barrels.

Positive pressure develops in the atmosphere upstream of a siphon due to the downstream movement of air induced by the sewage flow. The air tends to vent from the inlet structure and upstream manholes. This venting of air is a potential cause for odor release, especially during lower flows when the formation of hydrogen sulfide is more prevalent. Likewise, there is a tendency for air to be pulled into the outlet structure. To control the release of air and odors in the structures, an air jumper can be installed. An air jumper directs the air from the inlet structure to the outlet structure, and can be located above or below ground. Condensate may collect in the lower elevations of the air jumper and provisions shall be included to remove the accumulated condensate. The size of the air jumper is determined on a case-by-case analysis; however, it is generally one-half the diameter of the largest barrel of the siphon. Provisions for the addition of future odor control should be provided on both structures.

The inverted siphon from Southcenter Boulevard to Tukwila Parkway will be approximately 380 linear feet and include a concrete inlet and outlet structure. The inlet structure approximately 8 feet wide by 14 feet long by 18 feet deep can be located in the driveway entrance to Xerox Corporation (Xerox) north of Southcenter Boulevard. The inlet structure is located within City ROW. The outlet structure will be a standard 6 to 7 foot diameter manhole located in Tukwila Parkway. The inverted siphon will include two 6-inch diameter high density polyethylene (HDPE) barrels. The siphon barrels can be carried by one larger diameter casing pipe. Casing material will be either HDPE, steel or other suitable material depending on the method of pipeline installation. A small diameter air jumper to vent between the inlet and outlet structure will also be installed along side the two siphon barrels.

A 15-inch diameter PVC gravity sewer and manhole will also be installed in Tukwila Parkway as part of this alternative. The sewer will be extended approximately 250 linear feet to connect the siphon outlet structure to the DB8 sewer system.

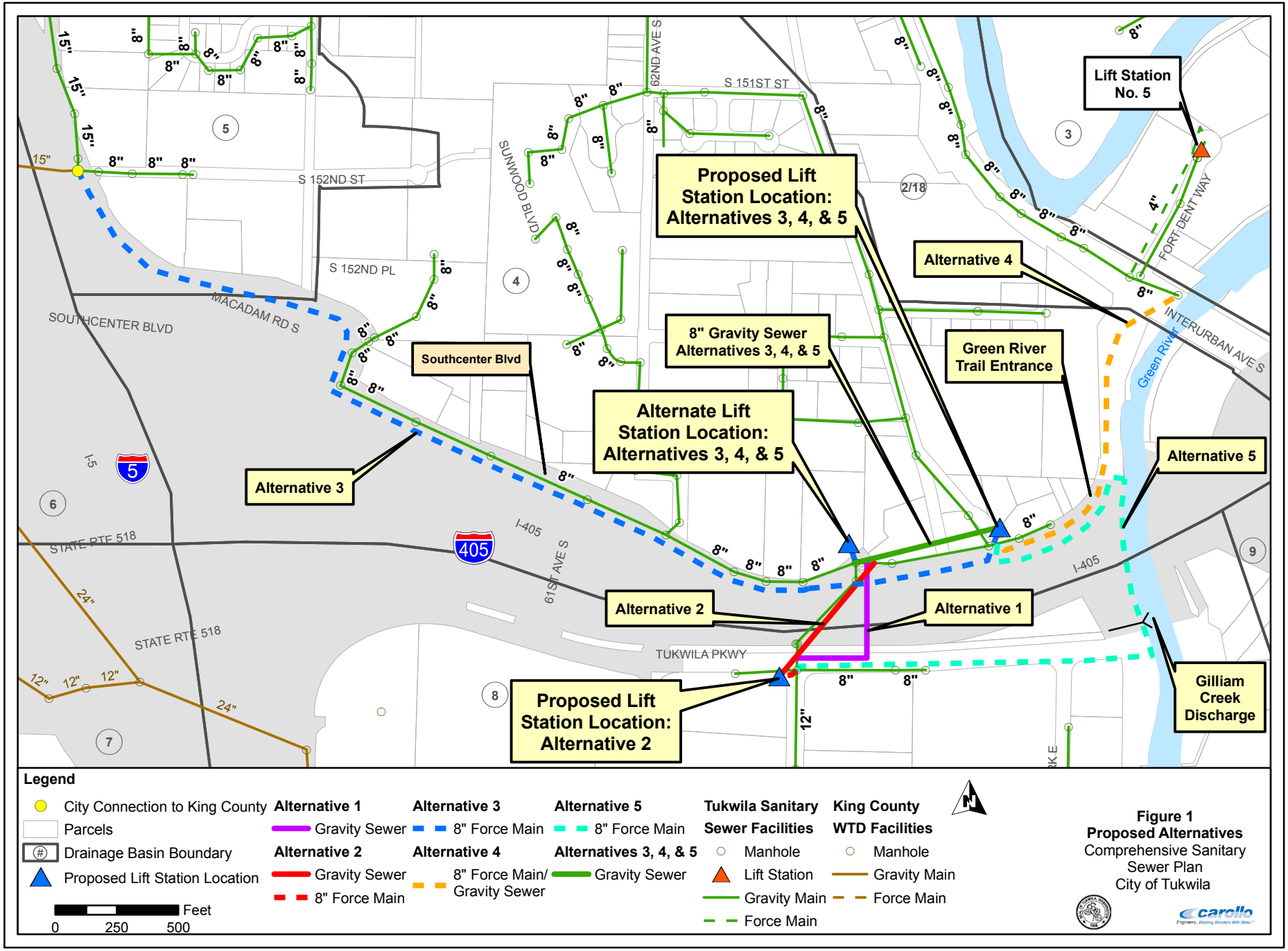

Figure 1
Proposed Alternatives
Comprehensive Sanitary Sewer Plan
City of Tukwila

Three methods of trenchless installation for the inverted siphon below I-405 include HDD, jack and bore, and pilot tube microtunneling (PTMT). The gravity sewer in Tukwila Parkway will be installed by open trench construction. See section 5.0 Pipeline Construction Methods later in this memorandum for a discussion of the advantages and disadvantages of each.

4.2 Alternative 2: Gravity Sewer Under I-405 and Tukwila Parkway Lift Station and Force Main

Alternative 2 includes a gravity sewer pipeline installed below I-405 and a submersible pump lift station and force main to pump to an existing sewer manhole (SMH 593) in DB8. The gravity pipeline will be 12-inch diameter and approximately 580 linear feet. The sewer line will be installed in a larger diameter steel or other suitable material casing pipe by jack and bore or PTMT methods. The 12-inch diameter sewer will begin at a new manhole located in the driveway entrance to Xerox north of Southcenter Boulevard and terminate at the new lift station located in the northeast corner of the Bank of America (the Bank) parking lot, adjacent to the intersection of Tukwila Parkway and Andover Park West. The pipeline will be installed below the existing 108-inch diameter WSDOT storm drain and maintain a constant slope. The manhole north of Southcenter Boulevard will be located in City ROW. The lift station will be located in Southcenter Mall property.

A new duplex submersible pump lift station is assumed to be located in a developed area in the northeast corner of the Bank parking lot, adjacent to the intersection of Tukwila Parkway and Andover Park West. The station's wet well will be constructed of concrete, approximately 8-foot diameter and 40 feet deep. Shoring and dewatering will be required for installation of the wet well. The wet well will include two 10 horsepower (hp) submersible sewage pumps, each rated for 800 gallons per minute (gpm) at a Total Dynamic Head (TDH) of 30 feet. Pump removal will be facilitated at grade using guide rails. The pumps will operate in a duty/standby mode to provide full pump redundancy. A separate below grade concrete valve vault will house the pump's check and isolation valves. The station control panel and all electrical apparatus will be located in a 10 foot by 10 foot concrete masonry unit (CMU) block control building adjacent to the wet well. A standby generator to provide back-up power will also be located at grade. Lift station access will be facilitated through the Bank parking lot. Site improvements could include a 6-foot masonry wall or slatted fence around the perimeter of the facility to shield above grade equipment and maintenance operations from Bank customers and Tukwila Parkway motorists and to provide site security. The submersible pump lift station will be constructed to City lift station design standards.

The lift station will pump approximately 90 linear feet through a new 8-inch diameter force main and discharge to an existing sewer manhole (SMH 593) located in the intersection of Tukwila Parkway and Andover Park West in DB8. The force main will be installed by open cut trenching methods in the developed areas at a depth of 4 feet to top of pipe.

4.3 Alternative 3: Southcenter Boulevard Lift Station and Force Main to King County Trunk

Alternative 3 includes a new submersible pump lift station and force main located in DB4 to pump to the King County Trunk at the intersection of Macadam Road and South 152nd Street. A new duplex submersible pump lift station is anticipated to be located in a grassy area immediately north of Southcenter Boulevard in old 65th Avenue South. The proposed location of the lift station is within City ROW. The station's wet well will be constructed of concrete, approximately 8-foot diameter and 40 feet deep. Shoring and dewatering will be required for installation of the wet well. The wet well will include two 70 hp submersible sewage pumps, each rated for 800 gpm at a TDH of 160 feet. Lift station operation and ancillary facilities will be similar to the lift station discussed in Alternative 2. The lift station will be accessed from Southcenter Boulevard. Similar to Alternative 2, site improvements could include a 6-foot tall masonry wall or slatted fence around the perimeter of the facility to shield above grade equipment and maintenance operations from Southcenter Boulevard motorists and to provide site security.

The lift station will pump approximately 4,400 linear feet through a new 8-inch diameter force main and discharge to an existing sewer manhole at the intersection of Macadam Road South and South 152nd Street. The force main will be installed by open cut trenching methods in developed (roadway) areas for the entire alignment at a depth of 4 feet to top of pipe.

The proposed location of the lift station will require a new 8-inch diameter PVC gravity sewer be installed adjacent to Southcenter Boulevard. The sewer will be approximately 570 linear feet and serve to connect the western portion of DB4 to a new sewer manhole and eventually the lift station. A new sewer manhole and short run of 12-inch diameter PVC gravity sewer will be required to combine the flows of DB4 and divert flow to the lift station. The gravity pipelines will be installed by open cut trenching methods. Open trench excavations near the new lift station are anticipated to be as high as 35 feet deep.

Figure 1 also shows an alternative lift station location directly north of Southcenter Boulevard and adjacent to the driveway to Xerox. In follow on discussions with the City, this is a less desirable lift station location due to the close proximity to surrounding businesses and existing terrain features. This lift station location will not require an additional 570 linear feet of gravity sewer as discussed above and the wet well can be constructed at a shallower depth. The force main length for this alternative would also reduce by approximately 600 linear feet.

4.4 Alternative 4: Southcenter Boulevard Lift Station and Force Main/Gravity Sewer to Drainage Basin 3

Alternative 4 includes a new submersible pump lift station and force main to pump to a new sewer manhole located near the entrance to the Green River Trail (the Trail). The sewage from DB4 will flow by gravity from the new manhole to an existing sewer manhole in DB3. The lift station facility and features are similar to Alternative 3, except the lift station will only require 15 hp pumps due to the reduced force main length and TDH of 40 feet.

The lift station will pump approximately 600 linear feet through a new 8-inch diameter force main to a new sewer manhole located near the Trail entrance. A 12-inch diameter PVC gravity sewer approximately 800 linear feet will convey the DB4 flow from the new manhole to an existing sewer manhole located near the intersection of Fort Dent Way and Interurban Avenue South. The gravity sewer will parallel the Trail adjacent to the Green River. A series of shallow manholes may be required along the Trail where changes in direction require. The force main and gravity sewer will be installed by open cut trenching methods in developed (roadway) and undeveloped areas at a depth of 4 feet to top of pipe. Deeper trench depths for the gravity sewer are anticipated near the connection to the existing sewer manhole. This alternative may also provide conveyance with the 8-inch diameter force main the entire length and eliminate the 12-inch diameter gravity sewer.

Alternative 4 includes discharging all flow from DB4 to DB3. Follow on discussions with the City indicate there is not adequate capacity in the DB3 sewer system at this location to accommodate DB4 flow. Modifications to the DB3 sewer system will be required for this alternative. This may include piping improvements that are undefined and are not included within the scope of this alternative.

An alternative lift station location is presented in Figure 1 for Alternative 4. See Alternative 3 discussions for alternative lift station location. Note the force main for a lift station in this alternate location would increase by approximately 600 linear feet.

4.5 Alternative 5: Southcenter Boulevard Lift Station and Force Main to Drainage Basin 8

Alternative 5 includes a new submersible pump lift station and force main to pump to an existing sewer manhole in DB8. The lift station facility and features are similar to Alternative 4, with the lift station requiring 15 hp pumps and a TDH of 40 feet. Although this alternative includes nearly five times longer force main than Alternative 4, the static pumping head is much less.

The lift station will pump approximately 2,800 linear feet through a new 8-inch diameter force main to an existing sewer manhole (SMH 593) in DB8 located in the intersection of Tukwila Parkway and Andover Park West. The force main will be routed along Southcenter Boulevard to the Green River Trail (the Trail) where it will parallel an existing water pipeline along the Trail adjacent to the Green River for approximately 700 linear feet. The new force main will cross below both the Southcenter Boulevard and I-405 bridges and cross over Gilliam Creek, which is contained in a 9-foot diameter culvert pipe along the Trail. The last approximate 1,400 linear feet of force main will be routed along Tukwila Parkway to the existing sewer manhole in DB8. The force main will be installed by open cut trenching methods in developed (roadway) and undeveloped areas at a depth of 4 feet to top of pipe.

An alternative lift station location is presented in Figure 1 for Alternative 5. See Alternative 3 discussions for alternative lift station location. Note the force main for a lift station in this alternate location would increase by approximately 600 linear feet.

The force main for this alternative discharges into an existing manhole with 12-inch diameter sewer outlet capacity. Other force main routing alternatives exist for Alternative 5 to discharge into manholes with 8-inch diameter sewer outlet capacity in DB8. However, piping improvements may be required to handle the additional capacity from DB4.

5.0 PIPELINE CONSTRUCTION METHODS

A brief discussion of the advantages and disadvantages for each method of pipeline construction discussed in the previous alternatives is presented herein. Where multiple methods are feasible for pipeline installation, it is recommended that the Contractor determine the lowest cost alternative.

5.1 Horizontal Directional Drilling (HDD)

HDD or directional drilling is a minimally invasive technique to install underground pipes in an arced alignment beneath pipelines, waterways, roadways, and/or any other interfering structures. The pipeline installation method is largely dependent on the site soil and groundwater conditions. Geotechnical investigations conducted in 2007 along I-405 conclude the conditions along the alignment do not appear unfavorable to directional drilling operations.

Directional drilling does not require deep entrance and exit pits, however, there will be shallow disturbance at both the entrance and exits points in developed (roadway) areas to accommodate the pipe and drilling fluid. The drilling machine is located at the entrance pit and requires approximately a 20-foot wide by 40-foot long area for operations. This dimensioning is based on a 60,000 pound pulling drill machine, which will be required for installation of a 24-inch diameter HDPE pipe for Alternative 1. Prior to pulling the sewer pipe into place, the pipe must be assembled to the length of the pull and laid out at the exit pit. Thus, a lay down area equal to the length of pull is required at the exit pit. For Alternative 1, the driveway to Xerox will serve as the pipeline lay down area.

5.2 Jack and Bore

Jack and bore or auger boring pipeline installation advances a steel casing by hydraulic thrusting or jacking methods utilizing a rotating cutter head and auger to remove the displaced soil. Jack and bore requires an entry pit (or drive shaft) large enough to house the boring machine and steel casing spools, and an exit pit (or receiving shaft) to make the pipeline connection. Assuming 20-foot steel casing lengths, the entry pit will be approximately 30 to 35 feet in length and 15 feet wide. Additional area at grade outside the entry pit will be required for equipment and operations. In the case of Alternatives 1 and 2, the receiving shaft could serve as the excavation for the new manhole north of Southcenter Boulevard. The entry pit will be located in Tukwila Parkway for Alternative 1 and in the location of the new lift station for Alternative 2. The entry and receiving pit for Alternative 1 will be approximately 35 feet deep and 20 feet deep, respectively. The entry and receiving pit for Alternative 2 will be approximately 40 feet deep and 35 feet deep, respectively. The steel casing will range from 36 to 48 inches in diameter to allow manned entry for removal of obstructions. It is recommended the diameter of

the casing be selected by the Contractor. Typical jack and bore operations proceed uphill to facilitate groundwater draining and muck removal; however, the direction of jacking could be reversed provided the Contractor conducts operations within the allotted space requirements north of Southcenter Boulevard for Alternatives 1 and 2. Contractor work area restrictions will be determined during detailed design of the project.

5.3 Pilot Tube Microtunneling (PTMT)

PTMT utilizes methods of directional drilling and auger boring. This method is used for installation of smaller diameter pipes requiring high accuracy in line and grade. The operation includes a steerable pilot bore, followed by a reamer and auger to enlarge the pilot bore and installation of the casing by thrusting or jacking. Similar to jack and bore, an entry and receiving shaft are required. As this method utilizes a guided steering head, the casing diameter can be smaller compared to a jack and bore casing. Vitrified clay pipe (VCP) is typically used as the jacking pipe due to its high compressive strength, no-leakage joint, and affordability in short lengths. A 24-inch diameter VCP will serve as the casing pipe for Alternatives 1 and 2. An approximate 10-foot diameter entry shaft will be required to house the machine. As the equipment and pipe casing lengths are smaller than for jack and bore, less area at grade will be required for Contractor operations. The reduced area of the drive shaft may permit installation of the shaft in the undeveloped area north of Tukwila Parkway between SPUs 60-inch diameter water main and I-405. Similar to jack and bore, the receiving shaft could serve as the excavation for the new manhole north of Southcenter Boulevard. The drive and receiving shafts will be similar depth to jack and bore methods.

5.4 Open Trench

Open trench construction will likely be used for all pipeline installations where features at grade can be disturbed and below grade features permit. This method requires shoring and dewatering, and sections of closed off Contractor work area at different periods along the full length of the alignment. Open trench construction is the most common and typically least expensive option for installing pipe.

6.0 EVALUATION CRITERIA

The alternatives presented in this memorandum are evaluated with respect to six criteria: cost, constructability, property acquisition, permitting, public impacts, and maintenance and operations. The criteria are evenly weighted because there can be cost implications associated with each one that is difficult to quantify at this stage of the project. Each alternative is assigned a negative (-1), neutral (0) or positive (+1) number score for each criteria. The criteria scores are then added together to determine the highest score and recommended alternative. The scores are comparative between the alternatives presented. For example, a positive permitting score for an alternative does not necessarily mean that there is no permitting involved; it may just mean that this alternative is better than the other alternatives presented in this category.

- **Cost**: Alternatives with higher cost receive lower scores for this criterion. The total project cost for each alternative is a planning level cost (2011 dollars) developed from historical bid tabulations, cost curves, information obtained from previous studies, and Carollo's experience on similar projects. The expected accuracy range is -30 percent to +50 percent, meaning the actual cost should fall in the range of 30 percent below the estimate to 50 percent above the estimate. Construction costs apply the following mark-ups to the direct costs: 30 percent for contingency, 10 percent for general conditions, 15 percent for contractor overhead and profit (OH&P), and 9.5 percent for sales tax. Project costs include an additional 30 percent for engineering, legal, and administration (ELA) costs. Costs do not include maintenance and operational costs. Maintenance and operations is addressed in a separate category.
- **Constructability**: Alternatives with limited construction and staging area, elements of difficulty or requiring specialty construction, requiring a longer duration project schedule, construction in high traffic areas, limited construction access routes, and construction near environmentally sensitive areas, receive lower scores for this criterion.
- **Property Acquisition**: Alternatives outside of City ROW that require purchasing property and/or acquiring temporary or permanent easements for construction and maintenance, receive lower scores for this criterion.
- **Permitting**: Alternatives that require additional permitting above the standard city/county building permits, receive lower scores for this criterion.
- **Public Impacts**: Alternatives that affect local residences and the general public during construction and/or normal operations of the facility including noise, dust, traffic detours, modifications or restrictions to existing pedestrian walkways and roadways, and other inconveniences, receive lower scores for this criterion.
- **Maintenance and Operations**: Alternatives that require additional maintenance and operation after construction such as facility operational costs including power and maintenance personnel, and equipment upkeep costs, receive lower scores for this criterion.

7.0 EVALUATION OF ALTERNATIVES AND RECOMMENDATION

The total project cost for each alternative is presented in Table 7.1. Alternative 1 is the lowest cost alternative estimated at $1.55 Million. Alternative 3 is the highest cost alternative estimated at $2.88 Million, largely due to the long length of force main required to pump to the King County Trunk. Alternatives 2, 4 and 5 are estimated to be $2.39, $1.99, and $2.27 Million, respectively.

Table 7.2 provides a brief explanation and criteria score for each alternative. Alternative 3 scored the highest among the five alternatives, followed by Alternative 4, Alternatives 1 and 5 and lastly, Alternative 2. Although Alternative 3 is the highest cost alternative, it ranks the highest for constructability and is anticipated to have the least permitting requirements of the five alternatives. The final construction will include a new below grade submersible lift station and sewer manhole that will be located in City ROW. Temporary construction easements from

adjacent businesses will likely be required. Permitting requirements are anticipated to be minimal and not cause delays in the project schedule.

Should issues associated with constructability and permitting be determined less of an impact for the other alternatives, a lower cost alternative may be more feasible.

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Table 7.1 Cost Comparison of Alternatives (2011 Dollars)

Alternative	Lift Station Direct Cost[1]	Pipelines & Structures Direct Cost	Direct Construction Cost	Contingency (30%)	General Conditions (10%)	Contractor OH&P (15%)	Sales Tax (9.5%)	Total Construction Cost	Design/ELA (30%)	Total Project Cost[4]
1	NA	$660,000[2]	$660,000	$198,000	$86,000	$142,000	$103,000	$1,189,000	$357,000	**$1,546,000**
2	$370,000	$650,000[3]	$1,020,000	$306,000	$133,000	$219,000	$159,000	$1,837,000	$551,000	**$2,388,000**
3	$440,000	$790,000	$1,230,000	$369,000	$160,000	$264,000	$192,000	$2,215,000	$665,000	**$2,880,000**
4	$370,000	$480,000[5]	$850,000	$255,000	$111,000	$182,000	$133,000	$1,531,000	$459,000	**$1,990,000**
5	$370,000	$600,000	$970,000	$291,000	$126,000	$208,000	$152,000	$1,747,000	$524,000	**$2,271,000**

Notes:

1. Complete lift station facility as described for each alternative. Costs for power service to lift station are not included.
2. Assumes 24-inch diameter HDPE casing pipe installed by HDD methods under I-405.
3. Assumes 48-inch diameter steel casing pipe installed by jack and bore methods under I-405.
4. Property acquisition, permitting, and operation and maintenance costs not included.
5. Does not include improvements to pipelines in DB3.

Table 7.2 Criterion Scoring of Alternatives

Description	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Cost	**1** • $ 1.55 Million	**0** • $ 2.39 Million	**-1** • $ 2.88 Million	**0** • $ 1.99 Million	**0** $ 2.27 Million
Constructability	**-1** • Trenchless construction methods, assumed HDD • Construction in high traffic areas • Close proximity to WSDOT's 108-inch diameter storm drain and SPU's 60-inch diameter water main	**-1** • Trenchless construction methods, assumed jack and bore • Construction in high traffic areas • Close proximity to WSDOT's 108-inch diameter storm drain and SPU's 60-inch diameter water main • Pit/shaft construction • Longer duration project schedule	**0** • Open trench construction • Construction in high traffic areas • Below grade lift station construction • Longer duration project schedule	**-1** • Open trench construction • Construction in high traffic areas • Below grade lift station construction • Difficult construction access along Green River • Construction adjacent to Green River (steep slopes) • Longer duration project schedule	**-1** • Open trench construction • Construction in high traffic areas • Below grade lift station construction • Difficult construction access along Green River • Construction adjacent to Green River (steep slopes) • Longer duration project schedule
Property Acquisition	**1** • Temporary construction easements • Permanent easement for sewer under I-405 • Manhole structures are located in City ROW	**0** • Temporary construction easements • Permanent easement for sewer under I-405 • Manhole structures are located in City ROW • Property acquisition for lift station and force main in Southcenter Mall property	**1** • Temporary construction easements • Lift station, gravity sewers, and force main are located in City ROW	**1** • Temporary construction easements • Lift station, gravity sewers, and force main are located in City ROW	**1** • Temporary construction easements • Lift station, gravity sewers, and majority of force main are located in City ROW • Permanent easement may be required for force main below I-405 bridge
Permitting	**-1** • City building permit may be required • Type C and E City Public Works Permits will be required • WSDOT permitting to construct below I-405 will be required • WSDOT/SPU permitting to construct below existing pipelines may be required	**-1** • City building, mechanical, and electrical permits will be required • Type C and E City Public Works Permits will be required • WSDOT permitting to construct below I-405 will be required • WSDOT/SPU permitting to construct below existing pipelines may be required	**1** • City building, mechanical, and electrical permits will be required • Type C and E City Public Works Permits will be required	**0** • City building, mechanical, and electrical permits will be required • Type C and E City Public Works Permits will be required • Sensitive areas and flood zone control permits to construct near Green River may be required.	**-1** • City building, mechanical, and electrical permits will be required • Type C and E City Public Works Permits will be required • Sensitive areas and flood zone control permits to construct near Green River may be required. • WSDOT permitting to construct below I-405 will be required
Public Impacts	**0** • Lane closures may be required during construction • Construction noise • Pedestrian walkways may be altered during construction • Access routes to businesses during construction may be altered	**0** • Lane closures will be required during construction • Construction noise • Pedestrian walkways may be altered during construction • Access routes to businesses during construction may be altered • Permanent lift station will be installed near high traffic roadway	**0** • Lane closures will be required during construction • Construction noise • Pedestrian walkways may be altered during construction • Access routes to businesses during construction may be altered • Permanent lift station will be installed near high traffic roadway	**0** • Lane closures will be required during construction • Construction noise • Pedestrian walkways may be altered during construction • Green River Trail may require closure during construction • Access routes to businesses during construction may be altered • Permanent lift station will be installed near high traffic roadway	**0** • Lane closures will be required during construction • Construction noise • Pedestrian walkways may be altered during construction • Green River Trail may require closure during construction • Access routes to businesses during construction may be altered • Permanent lift station will be installed near high traffic roadway
Operations and Maintenance	**-1** • Routine cleaning of siphons will be required	**0** • Standard lift station, gravity sewer, and force main maintenance, and operational costs will be required	**0** • Standard lift station, gravity sewer, and force main maintenance, and operational costs will be required	**0** • Standard lift station, gravity sewer, and force main maintenance, and operational costs will be required	**0** • Standard lift station, gravity sewer, and force main maintenance, and operational costs will be required
Total Score	**-1**	**-2**	**1**	**0**	**-1**