



## CITY OF KIRKLAND

123 Fifth Avenue, Kirkland, WA 98033 425.587.3000  
www.ci.kirkland.wa.us

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### MEMORANDUM

**To:** Kurt Triplett, City Manager

**From:** David Snider, P.E., Interim Capital Projects Manager  
Ray Steiger, P.E., Interim Public Works Director

**Date:** October 7, 2010

**Subject:** PUBLIC HEARING - COMPREHENSIVE SEWER PLAN UPDATE

#### RECOMMENDATION:

It is recommended that City Council conduct a Public Hearing on the City's Sewer Comprehensive Plan (SCP) Update.

#### BACKGROUND AND DISCUSSION:

The City owns and operates a public sewer collection and disposal system within its corporate boundaries, and a comprehensive plan update has been finalized in accordance with Washington Administration Code (WAC 173-240-050). The current update to the SCP includes an analysis of the existing City sewer system network, its operations, financial viability, and recommended programs to maintain the system in good working order and to correct deficiencies needed to meet future service demands.

The City contracted with Roth Hill Engineering Partners, LLC, to prepare the SCP update. For the first phase of the update, Roth Hill Engineering Partners, LLC collected pertinent sewer system data and created a computerized wastewater flow model for use in analyzing the City's overall sewer system network. With the model created they then accomplished the following scope of services:

- Performed a review and update of sewer system policies and criteria to ensure future improvements are consistent with adjacent jurisdictions' comprehensive plans.
- Estimated the effects of future land uses on population and household trends within several service areas.
- Analyzed key system components such as lift stations and connecting pipes.
- Assessed the capability of the existing sewer system to meet existing and future demands.
- Identified existing sewer system deficiencies and developed the Capital Facilities Plan, including priorities for construction.
- Summarized financing methods for recommended facility improvements, and
- Documented the City's maintenance and operations program for existing sewer facilities.

In April 2009, Council was presented with a copy of an *Agency Draft* of the SCP for their review. At that time, staff also informed Council that the *Agency Draft* had been forwarded to the Washington State Department of Ecology (DOE) and to the Utilities Technical Review Committee (UTRC) of King County for their review and acceptance. As a courtesy, draft copies of the SCP were also sent to our neighboring cities and utility districts for their review. The final SCP is subject to approval by City Council once acceptance of the *Agency Draft* is obtained from the DOE and the UTRC; acceptance by both agencies occurred in August (DOE) and September (UTRC), 2010.

A complete copy of the SCP is available for review online at the Public Works Homepage ([http://www.ci.kirkland.wa.us/depart/Public\\_Works.htm](http://www.ci.kirkland.wa.us/depart/Public_Works.htm)) under "What's New". However, some of the highlights within the SCP are as follows:

- The City of Kirkland first constructed sanitary sewer facilities in the Downtown and West-of-Market areas in the early 1940s as part of a federal government war housing project.
- The City currently provides sewer service to approximately 57,000 persons within an 8.24 square mile service area, including a residential population of 33,600 and an employment population of 23,400.
- The City maintains 116 miles of sewer mainlines and six sewer lift stations.
- The City's sewer service area consists of nine large drainage basins.
- The City operates several joint-use facilities that provide service to areas of the City of Bellevue, the Northshore Utility District and the King County Wastewater Treatment Division (KCWTD).
- The City's wastewater is discharged at 32 locations into KCWTD's main sewer trunk line that primarily runs along the Eastside Rail Corridor (formerly the BNSF Railroad right-of-way).
- Approximately 25% of the City's sewer system is experiencing significant root intrusion and infiltration of storm or ground water. The Infiltration & Inflow Program (I & I) identified in the CIP, allows the City to work towards eliminating sources of I & I throughout the City. This can be accomplished by various maintenance improvements such as replacing manhole lids with weather-tight lids, and with CIP projects including replacing aging sewer mainline and side sewer connections.
- In 1998 the Emergency Sewer Program (ESP) was developed to extend sewer mainlines to areas of Kirkland without a public sewer system. Property owners within the City's sewer system that have a septic system that is failing or has failed may request to connect to the City sewer system through the ESP.

An essential outcome of the SCP is the production of a Sewer Capital Facilities Plan list. For the updated SCP, a total of 14 new sewer mainline upgrades were identified together with three proposed sewer lift station improvements. Within the SCP, the 17 new improvements add up to a total of \$60M in short and long-term project needs, and all projects are accounted for in the 2011 - 2016 Preliminary Capital Improvement Program identified as either "Funded" or "Unfunded" projects.

Pending any modifications to the SCP, as a result of the Public Hearing, staff will return to Council at a future meeting with a recommendation to approve to Sewer Comprehensive Plan by Resolution.

Attachments: A Plan Table of contents  
B Plan Chapter 1

cc: Tracy Dunlap, Director of Finance and Administration  
Eric Shields, Director of Planning and Community Development  
Rob Jammerman, Development Engineering Manager  
Bobbi Wallace, Surface and Wastewater Manager

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- Appendix C Agency Comments/Responses
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## PURPOSE AND SCOPE



The City of Kirkland’s Sewer Comprehensive Plan Update has been prepared according to the Washington Administrative Code (WAC) 173-240. These regulations require that all formed sewer utilities prepare a Sewer Comprehensive Plan outlining the City’s present and reasonable foreseeable need in the future. The Plan is intended to supersede the 1993 Sewer Comprehensive Plan. This Plan was prepared in 2006 and 2007 and the date, 2008, reflects the issuance year.

This Plan establishes the sewer system policies and criteria in accordance with the City’s framework, analyzes the existing sewer system and its operations, and recommends improvements to correct deficiencies and meet future service needs. This Plan provides the City with a guide to evaluate the impacts of future proposed development and land use on the sewer system. The scope of the Plan is as follows:

- Review and update the sewer system policies and criteria to ensure future improvements are consistent with adjacent jurisdictions’ comprehensive plans.
- Estimate the effect of future land uses on population and household trends within the sewer service area.
- Document the existing sewer system.
- Analyze key system components such as lift stations and connecting piping.
- Assess the capability of the existing sewer system to meet existing and future demands.
- Identify existing sewer system deficiencies and develop the Capital Facilities Plan, including priorities for construction.
- Summarize financing methods for recommended facility improvements.
- Document the City’s maintenance and operations program for the sewer facilities.

## AUTHORIZATION

The City Council, recognizing the obligation to provide for the needs of its present and future customers, directed Roth Hill Engineering Partners, LLC to analyze and prepare an updated Sewer Comprehensive Plan. Authorization to proceed was given on August 9, 2006. This Plan has been prepared in compliance with the state law and county ordinances.

## PLAN ORGANIZATION

The subsequent sections of this Plan are organized as follows:

**Chapter 2** reviews planning considerations that are pertinent to the City’s sewer system. Included are descriptions of the City’s sewer service area, sewer system history, adjacent purveyors, related plans, and physical features.

**Chapter 3** includes sewer system policies and criteria for design and planning parameters of the City’s sewer system.

**Chapter 4** summarizes the existing and future land use, zoning, employment and population data.

**Chapter 5** summarizes existing sewer system facilities and major components, including the telemetry system, lift stations, and the conveyance system. Additionally, included are descriptions of sewage disposal facilities, Infiltration and Inflow (I/I) information and sewage quality.

**Chapter 6** summarizes the hydraulic analysis of the sewer system facilities. Additionally, included is an analysis of the system operations and capacity for current and future flows, identification of any system deficiencies, and the improvements required to resolve those deficiencies.

**Chapter 7** outlines the Capital Facilities Plan necessary to meet the City’s future sewer system needs.

**Chapter 8** describes the general financial framework that addresses the City’s overall financial status.

**Chapter 9** summarizes the City’s sewer operation program. Included therein is an overview of sewer system responsibility and authority, system operation and maintenance plan, equipment supplies and inventory and emergency response.

The Appendices include: the State Environmental Policy Act Determination; Agency Comments/Responses; Sanitary Sewer Pre-Approved Notes, Design Criteria and Plans; Existing Service Agreements, TAZ Planning Data; and Rodding Schedules.

## APPROVAL PROCESS

This Plan is required to meet state, county, and local requirements. The Plan complies with the requirements of the Department of Ecology (DOE) as set forth in the Washington Administrative Code (WAC) 173-240-050,

the Department of Health (DOH) as set forth in WAC 271-040, and the Revised Code of Washington (RCW) as set forth in RCW 57.16.010. This Plan is also consistent with King County Code (KCC) Title 13.24 with respect to sewer system planning.

The City will submit this document to adjacent utilities and local governments having jurisdiction to assess consistency with their ongoing and adopted planning efforts. Additionally, King County, DOE, and DOH must review and approve the Plan. The King County approval is accomplished through the Utilities Technical Review Committee (UTRC) which reviews all proposed comprehensive plans prior to a recommended submission to the County Council.

The City Council will approve the final Sewer Comprehensive Plan Update after all other approvals have been obtained.

## ENVIRONMENTAL ASSESSMENT

The City has determined this Plan does not have a probable significant adverse impact on the environment and has issued a Determination of Non Significance under WAC 197-11-340(2). This decision was made after review of the completed State Environmental Policy Act checklist and other information on file with the lead agency. The environmental determination issued by the City for the Sewer Comprehensive Plan is provided in **Appendix A**.

It should be noted, however, that each Capital Facilities Plan project presented in this Plan will undergo subsequent project-specific environmental review as part of the preliminary and final design process.

## DEFINITIONS

The following terms are used in this Plan.

**Collector Sewer** - A sewer that discharges into a main or trunk sewer and has no other tributary sewers.

**Gravity Sewer Capacity** - The maximum capacity for a gravity sewer is the volume of flow that can be carried in a sewer at a depth to diameter ratio of 0.80.

**Hydraulic Analysis** - A computer simulation of a sewer system to determine its conveyance capacity and the demands on the system.

**Infiltration** - Infiltration is the entrance of groundwater into the sanitary sewer system through cracks, pores, breaks and defective joints in the sewer-piping network.

**Inflow** - Inflow refers to direct flow of stormwater into sanitary sewer systems through hookups from stormwater collection facilities and illegal connections.

**Interceptor Sewer** - A sewer that receives flows from a number of trunk sewers and conducts such wastewater to a point for treatment or disposal.

**Lift Station** - A sewage pumping facility which consists of a wet well for collecting wastewater; mechanical equipment such as pumps, valves and piping; electrical and control equipment, and a force main. In this Plan, synonymous with “Pump Station”.

**Lift Station Capacity** - The maximum capacity for a lift station is equal to the peak, wet weather flow that the largest pump within the lift station has been designed to convey.

**Main or Trunk Sewer** - The principle sewer to which collector sewers are tributary is called a main or trunk sewer. A main or trunk sewer receives many collectors' branches and serves a subbasin.

**Planning Area** - A geographic area as specifically defined on a map in a comprehensive plan that is a logical area for expansion of the system. Conversion of a planning area to a service area requires King County approval of an amendment to a comprehensive plan.

**Purveyor** - A purveyor is an agency, subdivision of the state, municipal corporation, firm, company, mutual or cooperative association, institution, partnership, person or other entity owning or operating a public sewer system. Purveyor also means the authorized agents of such entities.

**Sanitary Sewer** - A sewer that carries liquid and waterborne wastes from residences, commercial buildings, industrial plants and institutions, together with minor quantities of ground, storm and surface waters.

**Service Area** - A geographic area within which service to customers is available as specifically defined on a map in a comprehensive plan and approved by King County, as required.

**ABBREVIATIONS**

AC	Asbestos-Cement (Pipe)
API	Annual Percentage Increase
APR	Annual Percentage Rate
APWA	American Public Works Association
ASTM	American Society for Testing and Materials
AWC	Association of Washington Cities
AWWA	American Water Works Association
BRB	Boundary Review Board
cf	Cubic Feet
CFP	Capital Facilities Plan
CI	Cast Iron (pipe)
CIP	Capital Improvement Program
Conn.	Service Connection
CPA	Certified Public Accountant
CPP	Countywide Planning Policies
d/D	Depth/Diameter
DI	Ductile Iron (pipe)
DNR	(King County) Department of Natural Resources and Parks
DOE	(Washington State) Department of Ecology
DOH	(Washington State) Department of Health
DOT	(Washington State) Department of Transportation
Du/ac	Dwelling Units Per Acre
ECY	(Washington State) Department of Ecology (a.k.a. DOE)
EPA	US Environmental Protection Agency
EPP	Environmental Protection Agency
ERU	Equivalent Residential Unit
ESA	Endangered Species Act
FAZ	Forecast Analysis Zones
FC	Fecal Coliform
FIU	Field Interface Unit
FM	Force Main
FPS	Feet Per Second
FT	Feet
FT2	Square Feet
FT3	Cubic Feet
FTE	Full Time Equivalent

GFC	General Facilities Charge
GIS	Geographic Information System
GMA	Growth Management Act
GP	Grinder Pump
gpad	Gallons Per Acre Per Day
gpcd	Gallons Per Capita Per Day
gpd	Gallons Per Day
gpm	Gallons Per Minute
HDPE	High-Density Polyethylene (pipe)
HP	Horsepower
I/I	Infiltration and Inflow
IE	Invert Elevation
IN	Inches
KC	King County
KCAS	King County Aerial Survey
KCCP	King County Comprehensive Plan
KCWTD	King County Department of Natural Resources and Parks Wastewater Treatment Division
KW	Kilowatt
LID	Local Improvement District
LF	Linear Feet
LS	Lift Station
M&O	Maintenance and Operations
Metro	King County Department of Natural Resources and Parks Wastewater Treatment Division (formerly the Municipality of Metropolitan Seattle)
MG	Million Gallons
MGD	Million Gallons Per Day
NE	Northeast
NW	Northwest
NUD	Northshore Utility District
NSF	Non-sufficient Funds
O&M	Operations and Maintenance (same as M&O)
OFM	Office of Financial Management (Washington)
PAA	Potential Annexation Area
PS	Pump Station
PSRC	Puget Sound Regional Council
PVC	Polyvinyl Chloride
PWTF	Public Works Trust Fund
R/W	Right-of-Way

RCP	Reinforced Concrete Pipe
RCW	Revised Code of Washington
RPM	Revolutions Per Minute
RTU	Remote Terminal Unit
RWSP	(King County) Regional Wastewater Services Plan
SDG	Small Diameter Gravity (pipe)
SDR	Standard Dimension Ratio
SE	Southeast
SEPA	State Environmental Policy Act
SF	Square Feet
SFR	Single-Family Residential
STEP	Septic Tank Effluent Pump
SW	Southwest
TAZ	Transportation Analysis Zone
TBD	To Be Determined
TDH	Total Dynamic Head
TV	Television
UGA	Urban Growth Area
UGB	Urban Growth Boundary
UL	Underwriters Laboratory
ULID	Utility Local Improvement District
UTRC	(King County) Utilities Technical Review Committee
V	Voltage
WASWD	Washington Association of Sewer and Water Districts
WAC	Washington Administrative Code

**CHAPTER 1**  
**INTRODUCTION**

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## **INTRODUCTION**

This chapter summarizes the City's history, service area topography, sewer service area (existing and projected), and service area agreements. It also includes a brief summary of the sewer system basins and facilities and the City's relationship with adjacent jurisdictions and other related plans.

## **HISTORY**

The City of Kirkland first constructed sanitary sewer facilities in the downtown area in the early 1940s as part of the federal government war housing projects. Before then, the common practice was to dispose of wastewater on-site or to discharge it directly into Lake Washington. As part of the war housing projects, a primary treatment plant was constructed with an outfall to Lake Washington. By 1950, approximately 30% of the existing system was constructed.

In 1958, the Municipality of Metropolitan Seattle (METRO), now known as the King County Department of Natural Resources and Parks, Wastewater Treatment Division (KCWTD), was formed to solve the growing problem of pollution in Puget Sound, Lake Washington, and surrounding waters. METRO developed a regional plan for wastewater collection and treatment facilities in 1959 and assumed operating responsibilities for the regional interceptors and wastewater treatment systems in 1962, including Kirkland's primary treatment plant, which was located at the old City Hall site (near the intersection of 3rd Street and Central Way). The Kirkland treatment plant was eventually abandoned and a KCWTD-owned and operated lift station was constructed to convey flows to the new interceptor. Today, all of the City's wastewater discharges to these KCWTD facilities.

The City's facilities have gradually extended to meet growth demands. In 1989, the City of Kirkland assumed the operation and maintenance of the sewer system of the Rose Hill Water and Sewer District. After the assumption, the City constructed improvements in this area to integrate the Rose Hill system into the City's system.

Presently, the City serves approximately 56,986 persons within 8.24 square miles. Under the Growth Management Act (GMA), future sewer service, with few exceptions, will only be allowed in designated Urban Growth Areas (UGA).

## Previous Sewer Comprehensive System Plan

The City's most recent Sewer Comprehensive System Plan was adopted in 1993. No amendments have been prepared since then.

## SEWER SERVICE AREA

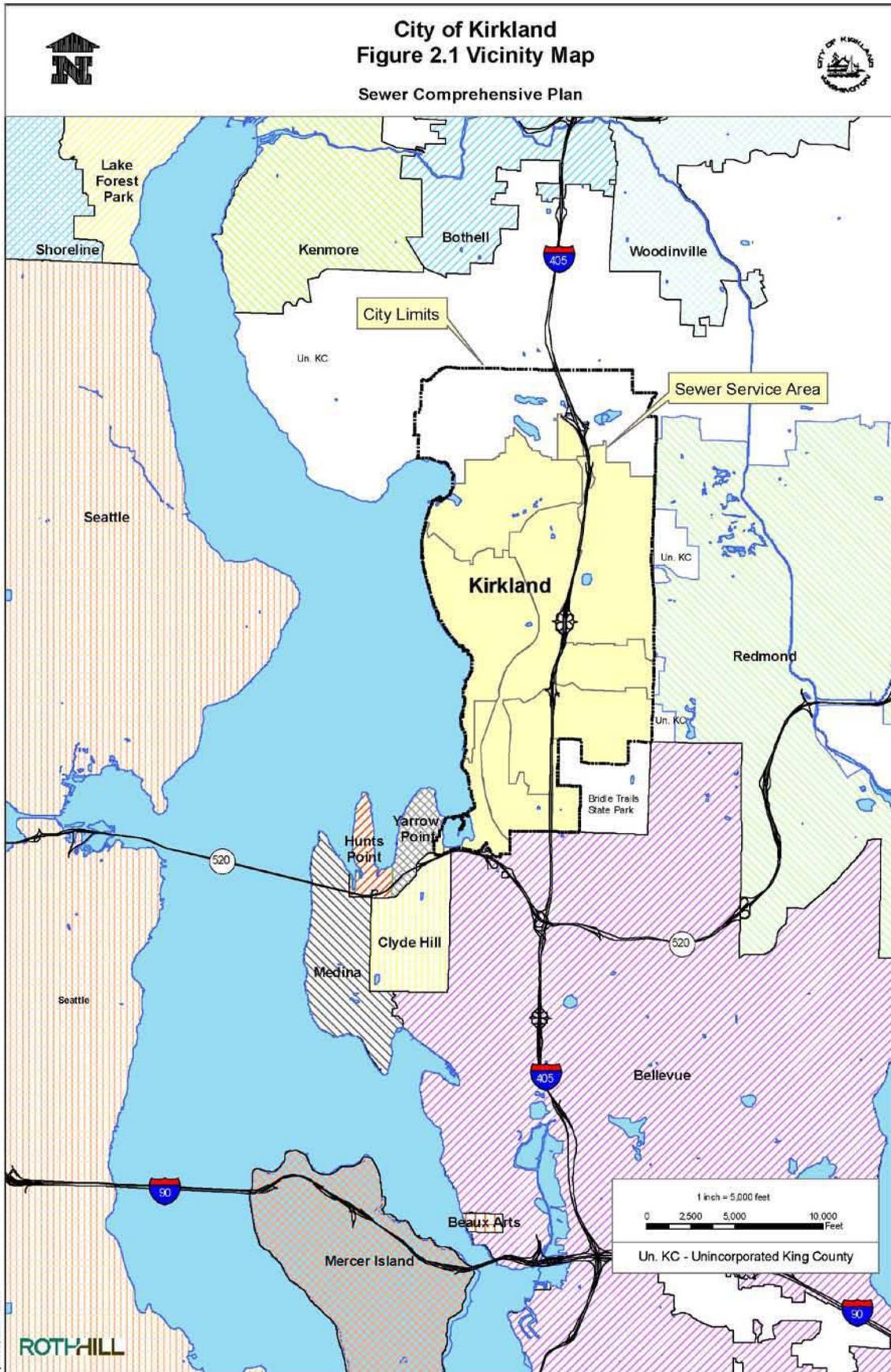
The City lies generally in King County directly east of and adjacent to Lake Washington and north of and adjacent to the City of Bellevue. It is bordered to the east by the City of Redmond and unincorporated King County, and to the north by unincorporated King County. The location of the City is shown on the Vicinity Map, **Figure 2.1**. Adjacent sewer purveyors include: the cities of Bellevue and Redmond, and Northshore Utility District.

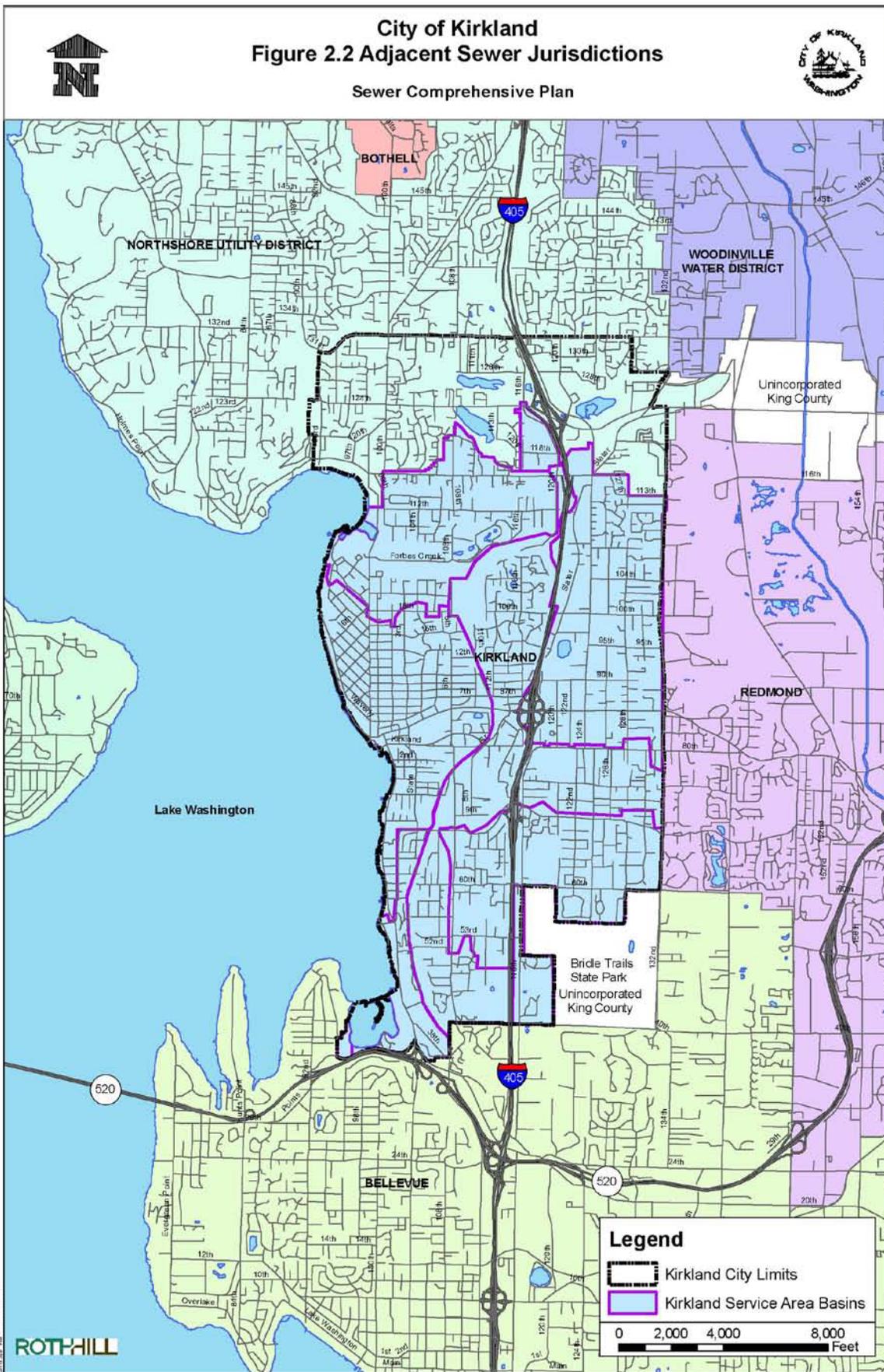
The corporate boundary is the legal boundary of the City as a municipal corporation. Those areas outside the corporate boundary and inside the planning area and Urban Growth Area have the option to annex to the City and receive sewer service.

The City's sewer service area is based on boundaries and criteria established by King County, existing agreements with neighboring municipalities and adjacent purveyors, topographical limitations, existing utility boundaries, and practical limitations of service. The location of the sewer planning area (service area) is shown on **Figure 2.2**. The existing sewer service area is within the City limits. The service area is not anticipated to increase as all adjacent areas already have sewer service provided through other purveyors. Properties currently served by on-site septic systems may connect to the City's sewer system if they are within the City's existing or future service area. The City does not allow on-site septic systems within its service area. However, some areas are served by on-site septic systems that were previously allowed under King County prior to annexation into the City's service area. These systems are regulated by the Public Health - Seattle & King County. The City will confirm that Public Health-Seattle & King County will notify the City of any septic system failures and new system proposals that occur within the City limits. The City may provide sewer service to residents who may not be able to repair their systems or would prefer to be on the City's system rather than a private system, through the bi-annual CIP Emergency Sewer Program. The conditions for sewer service provided by the City will be reviewed on a case by case basis."

## GEOLOGY, SOILS, AND TOPOGRAPHY

The geology of the City is largely the result of prehistoric glacial activity and subsequent ice retreats. The United States Department of Agriculture has mapped and analyzed the soils in the area in the Soil Survey of King County. The most common soil type in the area is known as the Alderwood series, which includes moderately well-drained gravelly sandy loams 24 to 40-inches deep over consolidated glacial till. The next most common type, but much less prevalent than the Alderwood series, is the Everett series. Everett soils are gravelly and are underlain by sand and gravel. In certain areas, principally basins and lowlands, organic materials such as peat and muck occur in depths up to 10 feet.





Soil properties and characteristics are important factors in determining the continued utilization of septic tanks in the Urban Growth Area. Some soil types are more suitable for septic tanks and drain fields than others. Soil suitability varies within the City. In recent years, concerns about soils that are too gravelly and percolate too rapidly have grown. The concern is the underlying groundwater aquifer may risk contamination, particularly with denser development, especially after years of septic tank use.

Soil properties may also impact the design and location of sewer facilities. Detailed soil testing is often performed early in the design of proposed facilities to identify design parameters and to minimize construction costs. Soil evaluations of this type are beyond the scope of this Plan. Prior to the implementation of any elements of the Plan, appropriate soils testing may be required on a project-by-project basis.

Topography of an area is one of the principal factors in the design of sewage facilities. Every effort should be made to utilize the natural drainage basins in the design to take maximum advantage of gravity flow and minimize the need for constructing additional lift stations. The Drainage Basins Map, **Figure 2.3**, shows overall topography of the study area and the breakdown into drainage patterns. As part of the Plan preparation, detailed topographic maps were updated from aerial photographs. The topography of the area served by the City varies greatly in elevation. The east side of the service area is the highest with the land generally sloping downward from 132nd Avenue NE to Lake Washington. The ground elevations vary from approximately 500 feet above mean sea level in the Bridle Trails area to approximately 20 feet along Lake Washington. Valleys and lowlands have been carved into the terrain by several watercourses, including Juanita Creek, Forbes Creek, and Cochran Springs. Glacially created basins and depressions are occupied by lakes such as Lake Washington, Forbes Lake, and Totem Lake, as well as their associated wetlands. The varied terrain has required a combination of gravity sewers and pump stations to serve the area.

## WATER QUALITY

The City of Kirkland's sewer services lies within the Cedar River - Lake Washington Watershed (Water Resources Inventory Area 8 (WRIA 8)) is the land area in which rainwater drains to Lake Washington and out through the Hiram Chittenden Locks. WRIA 8 includes the Cedar River and its tributaries, May Creek, Coal Creek, Mercer Island, Mercer Slough, Kelsey Creek, Fairweather Creek, Yarrow Creek, Juanita Creek, Forbes Creek, Lyon Creek, McAleer Creek, Thornton Creek, and Ravenna Creek. The Sammamish River drainage is also part of the greater watershed.

Lake Washington is the largest of the three major lakes in King County, and the second largest natural lake in the State of Washington. Lake

Washington's two major influent streams are the Cedar River at the southern end. The majority of the immediate watershed is highly developed and urban in nature with 63% fully developed. The upper portion of the watershed is the headwaters of the Cedar River that lie in the closed watershed governed by Seattle Public Utilities. Lake Washington is perhaps the best example in the world of successful lake restoration by the diversion of sewage, and has been extensively studied and researched. Lake Washington remains on the Washington Department of Ecology's (Ecology) 303(d) list for various pollutants including ammonia, fecal coliform (FC), total polychlorinated biphenyl (PCB).

The main stem of Juanita Creek originates east of Interstate 405, and flows approximately five miles west and south entering Lake Washington on the west side of Juanita Beach Park. Juanita Creek drainage basin is roughly 4,000 acres with three main tributaries flowing into Juanita Creek, an upper West (Simonds Tributary), a lower West, and a lower East (Totem Lake Tributary). Juanita Creek is considered a Class AA water body. Juanita Creek is listed on Ecology's 303(d) list for violation of dissolved oxygen (DO), temperature, and fecal coliform (FC).

The Forbes Creek basin comprises approximately 1,000 acres. Forbes Creek originates at an elevation of 240 feet above sea level and flows roughly 1.8 miles through the City of Kirkland and a wetland area before entering the north east corner of Lake Washington. As a tributary to Lake Washington, Forbes Creek is considered a Class AA water body. It is also listed on Ecology's 303(d) list for violation of DO, temperature, and FC.

(Source: <http://dnr.metrokc.gov/wlr/watersheds/cedar-lkwa.htm>)

**Figure 2.4**, Streams and Lakes, shows the locations of streams, lakes and other water bodies within the City's sewer service area.

Figure 2.4  
Streams and Lakes

