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## Chapter 2

# Background

King County's regional wastewater system is a large, integrated wastewater conveyance and treatment system that serves 34 cities and sewer agencies. These cities and sewer agencies (collectively known as local agencies) provide direct sewer collection service to residences and businesses in incorporated and unincorporated areas of the County and parts of south Snohomish County and north Pierce County where natural drainage basins lead to a King County regional facility. King County owns and operates regional facilities necessary for *wastewater treatment* including treatment plants, major conveyance pipes, regulators, and pump stations. Local agencies own and operate the facilities necessary for *collecting wastewater* from residences and businesses. Their facilities include collector sewers, laterals, side sewers, and some pump stations. Private property owners typically own the side sewer pipes that connect their property to the local agency collection pipes.

This chapter summarizes the components that make up the regional wastewater treatment system.

## 2.1 Service Area

King County's regional wastewater system serves approximately 1.4 million residents within a 420-square-mile service area (Figure 2-1). The perimeter of the regional service area is defined by the service areas of the local agencies in King, Pierce, and Snohomish Counties that send their wastewater to the regional treatment system. These areas are located within the limits of the Urban Growth Areas (UGAs) as defined by the Growth Management Act (GMA). The portions of Pierce County in the regional service area are limited to portions of the Cities of Auburn and Pacific. Portions of south Snohomish County served by the Alderwood Sewer District, Cross Valley Water District, City of Brier, and Olympic View Water and Sewer District are also in the regional service area.

### System Components Defined

**Treatment plants** perform primary and secondary treatment of wastewater before discharging the clean effluent to Puget Sound.

**Conveyance pipes** carry all wastewater to the treatment plants.

**Pump stations** house pumps and other equipment that lift wastewater in pipes to higher elevations so that they can continue to flow by gravity.

**Regulator stations** control the flow of wastewater from two or more input pipes to a single output.

**CSO treatment plants** operate during periods of peak flow following large storm events. They provide primary treatment for wastewater diluted by stormwater prior to discharge to Puget Sound.

**CSO control structures** store excess wastewater diluted by stormwater to prevent overflows into surface waters.

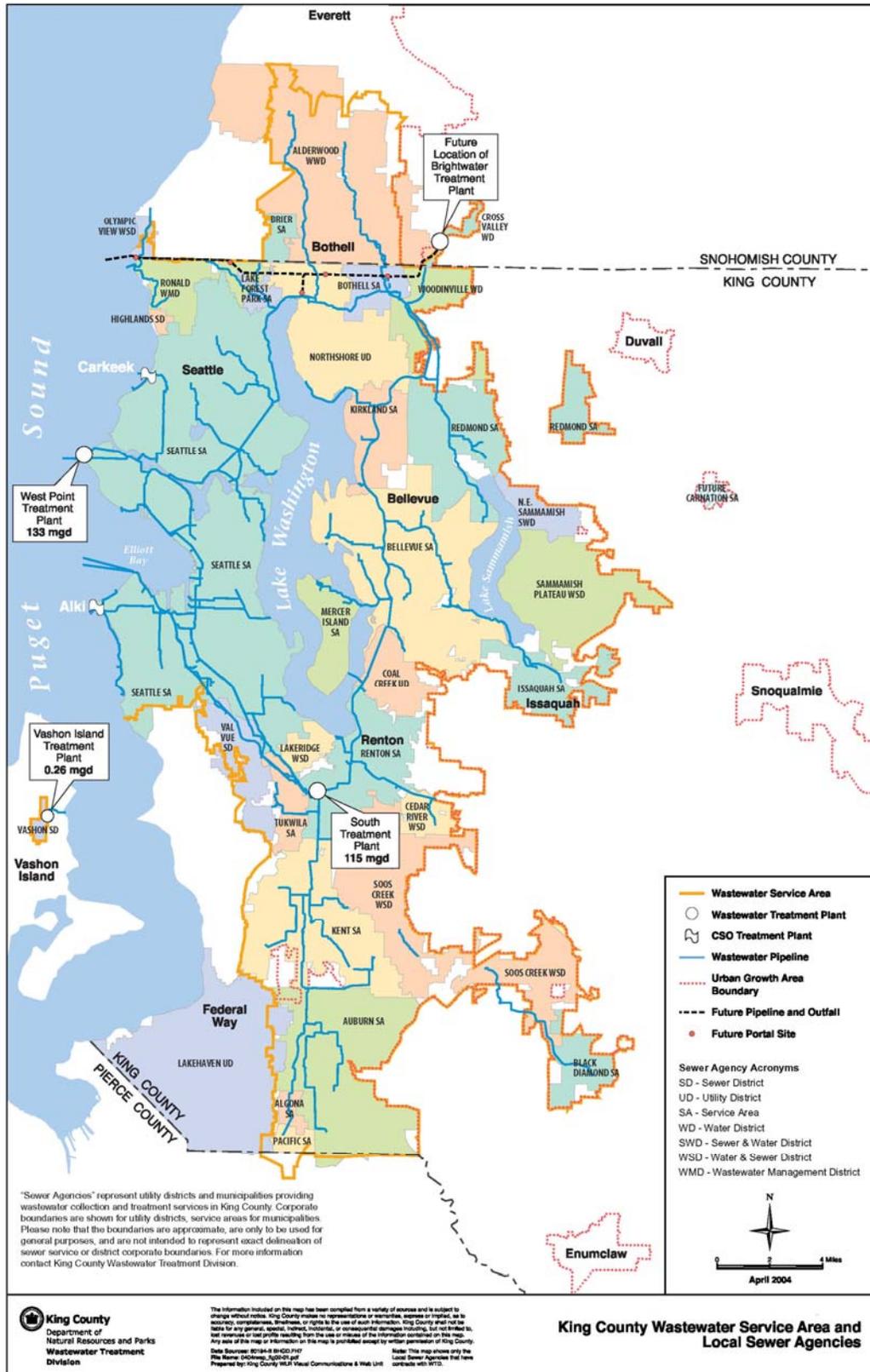


Figure 2-1. Local Sewer Agencies Within King County Wastewater Service Area

## 2.2 Regional Wastewater System

The regional wastewater system consists of the following components:

- 3 secondary treatment facilities (including the Vashon Treatment Plant)
- 335 miles of regional conveyance pipes
- 42 pump stations
- 19 regulator stations
- 2 combined sewer overflow (CSO) treatment plants
- 38 permitted CSO locations.
- 5,100 miles of collection pipes and numerous pump and regulator stations (owned by the local agencies)

Figure 2-2 shows conveyance pipes and treatment plants within the service area boundaries for the regional wastewater treatment system.

### 2.2.1 Conveyance and Treatment

With the exception of Vashon Island, the West Point Treatment Plant in Seattle or the South Treatment Plant in Renton currently treat all flows in the the regional wastewater service area. As such, the service area is divided into major sub-areas: the West Service Area and the East Service Area. The West Service Area includes areas north of Lake Washington and the City of Seattle. The East Service Area includes areas east of and south of Lake Washington. An exception to this service area delineation is the North Service Swap Area; flows from this area can currently be conveyed to either treatment plant. The swap area includes the eastern part of the regional wastewater service area in Snohomish County extending down to the northern half of the Lake Sammamish locality (Figure 2-2).

Figure 2-2 illustrates the service areas for the treatment plants. Note that the North Service Swap Area and part of the West Service Area in Snohomish County will be transferred to the new Brightwater Treatment Plant when it becomes operational.

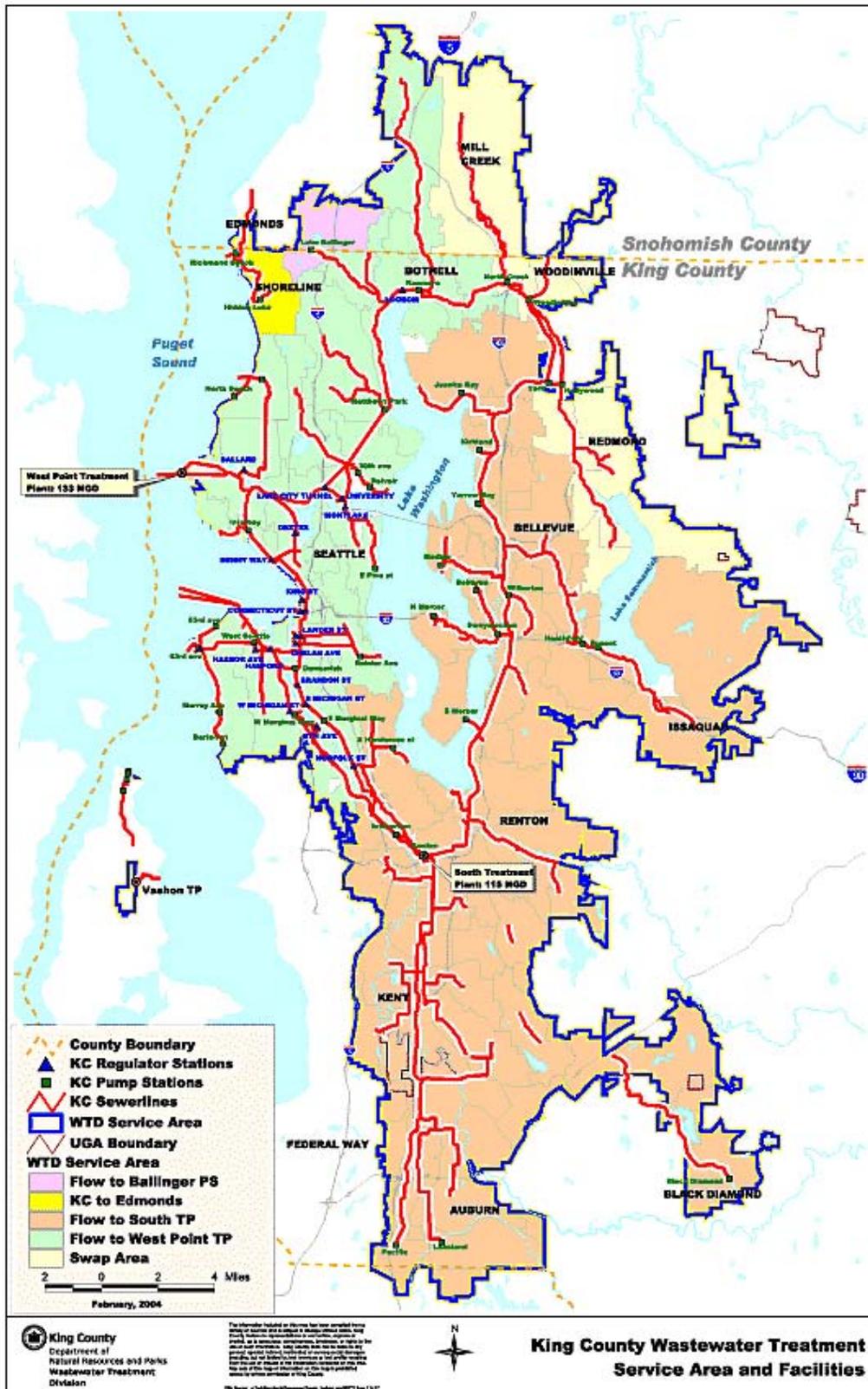


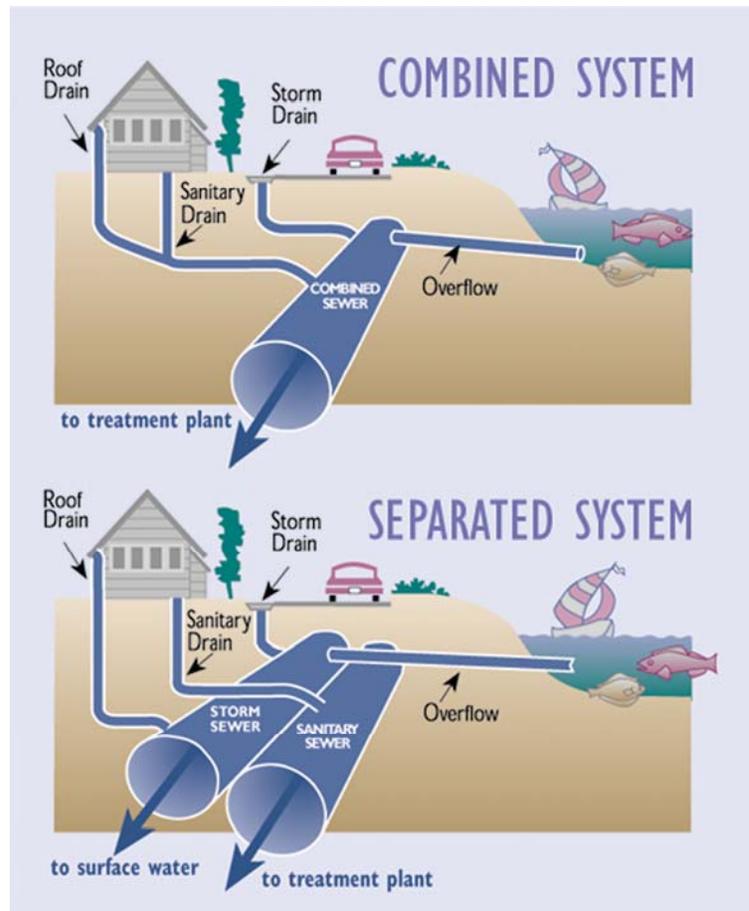
Figure 2-2. King County Wastewater Service Area

## 2.2.2 Combined Sewers and Separated Sewers

The systems of pipes that collect and convey wastewater were constructed over many decades. Older pipes, located in most parts of Seattle, are a combined sewer system that collects a combination of stormwater and sanitary sewage. During storms, the volume of stormwater entering combined sewer pipes can take up the capacity of pipes and of the West Point Treatment Plant, which treats wastewater from the combined sewer system.

The rest of the region, including some portions of north Seattle, is served by a separated sewer system. Separated systems have separate collection and conveyance pipes for wastewater and stormwater. Separated wastewater systems dedicate their capacity to convey and treat wastewater. Figure 2-3 illustrates the structural and functional differences of combined and separated sewer systems.

Although the separated wastewater system is designed to handle wastewater only, other water does enter the system via inflow and infiltration (I/I). I/I is stormwater or groundwater that enters the separated system from sources such as leaky sewer pipes, roof drain connections, and manhole covers. Most inflow comes from stormwater; most infiltration comes from groundwater. I/I is a regional problem because it takes up needed capacity in collection and conveyance pipes and in treatment plants, which can lead to backups and overflows. About 75-percent of the region's peak flows in the separated conveyance system comes from I/I<sup>1</sup>.



**Figure 2-3. Combined and Separated Wastewater Conveyance Systems**

<sup>1</sup> Regional Wastewater Services Plan, Executive's Preferred Plan; April 1998, page 14.

## 2.3 Assessment of Needs

This Regional Needs Assessment (RNA) focuses on identifying needed improvements to the separated conveyance system that are necessary to accommodate projected regional growth and volumes of I/I through the year 2050. It identifies the current condition of the separated system, and identifies the conveyance system improvement (CSI) projects needed, including estimated costs, over the next several decades to meet capacity demands. This information provides a baseline for evaluating the cost-effectiveness of implementing I/I projects in lieu of constructing individual CSI projects.

## 2.4 Description of System Design Standards

King County has set a design standard for the wastewater conveyance system to ensure that an adequate level of service is provided across the region. The standard is based on policy contained in the adopted Regional Wastewater Services Plan (RWSP). The design standard is as follows: “The twenty-year design storm shall be used as the design standard for the County’s separated wastewater system” (KCC 28.86.060-CP-1:1).

Application of the standard considers both the sizing and timing of facilities:

- **Sizing.** What peak flow will a facility be designed to handle? What ultimate population will the facility serve (planning horizon)?
- **Timing.** What peak flow level should be used to decide when the facility would be replaced, upgraded, or added to? What is the expected life of a facility?

To determine an appropriate planning horizon for conveyance system improvements, population and economic growth projections developed by the Puget Sound Regional Council (PSRC) are used in combination with flow data from the regional system to calculate the ultimate population that conveyance facilities are expected to serve. This calculation is referred to as “saturation.” For the regional wastewater system, saturation is projected to occur by 2050. Thus, the design standard employed for regional conveyance system improvements is the 20-year design storm projected to occur in 2050<sup>2</sup>.

## 2.5 Other Related Programs

### 2.5.1 Combined Sewer Overflow (CSO) Planning

As mentioned in the discussion of combined sewer systems above, a portion of the regional wastewater system within the City of Seattle still manages stormwater and wastewater together

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<sup>2</sup> 2050 is the projected date when the regional wastewater service area will be fully built out and all portions of the service area will be connected into the wastewater treatment system.

in a combined sewer system. When flows entering the combined sewer system exceed pipe or treatment process capacity, overflows of wastewater diluted with stormwater are released into receiving waters.

The City of Seattle still owns and maintains a large portion of the combined sewer system. However, the County acquired some larger combined sewer facilities in the 1960s or developed new facilities over the years. Whenever possible, the County and the City of Seattle undertake joint projects to reduce CSO discharges. The combined efforts of the County to implement treatment and CSO control programs and the City has reduced the volume of overflows from about 30 billion gallons per year in the 1960s to approximately 1.5 billion gallons per year in 2000. The County's goal for controlling CSOs is to limit untreated discharges at each CSO location to one event per year (on average) by the year 2030. The CSO program will meet state and federal regulations and agreements, and King County will coordinate with state and federal agencies to develop cost-effective regulations that protect water quality.

This RNA identifies conveyance system improvements needed for the separated sewer system only. CSO planning is done separately on a 5-year cycle. In 2005, the County will submit a CSO program update to the Washington State Department of Ecology that coincides with the National Pollutant Discharge Elimination System (NPDES) permit renewal for the West Point Treatment Plant.

### 2.5.2 Brightwater Planning

Planning for the new Brightwater Treatment Plant is well under way. A plant site is selected in unincorporated Snohomish County. The routes for the conveyance and outfall pipes to send wastewater to the plant and treated water to Puget Sound are also identified. Predesign of both the treatment plant and conveyance and outfall pipes are under way. Design of the conveyance and outfall piping for the new treatment plant is expected to be substantially complete by late 2005.

This RNA identifies conveyance system improvements for the portions of the separated sewer system to be served by the existing West Point and South Treatment plants. While the planning and design of Brightwater treatment and conveyance facilities is a separate project, the conveyance improvements identified in this assessment account for projected capacity improvements and changes in flow that will result from operating the new Brightwater Treatment Plant.