CHAPTER 2
BACKGROUND

This chapter presents information on the background and history of the existing King County wastewater system. It also contains a brief description of the RWSP planning process leading to the selection of service strategies and service strategy options analyzed in this DEIS.

HISTORY

As early as 1911, Seattle had completed the Fort Lawton tunnel to take wastewater flows to West Point for discharge. Early systems, which were the beginning of the current combined sewerage system in the City of Seattle, were built to collect sanitary sewage from homes and businesses and runoff from streets, as well as carrying away horse manure and litter.

By the 1950s, more than 25 small sewage treatment plants had been built in the Seattle area. The treatment plants did not serve all communities, and untreated sewage entered Lake Washington and Lake Sammamish as well as Elliott Bay, the Duwamish River, the Lake Washington Ship Canal and Puget Sound off West Point. By the late 1950s, about 40 million gallons of raw sewage were being discharged daily off West Point alone.

The degradation of water quality in Lake Washington and concern over the future of other bodies of water led to the formation of a grassroots citizens' committee. The committee successfully sponsored state legislation to enable formation of a municipal corporation to manage the wastewater pollution problem for the Seattle metropolitan area. This led to the formation of the Municipality of Metropolitan Seattle (Metro) by a vote of citizens in 1958. In 1959, the Metro Council, comprised of elected representatives and appointees from local cities and sewer districts, assumed responsibility for cleaning up Lake Washington and establishing a regional sewerage system.

The *Comprehensive Sewerage Plan* was adopted by the newly created Metro Council in 1959. The plan was to become the core planning document for wastewater treatment services in the Lake Washington drainage basin, which includes most of the Seattle/King County region and a portion of Snohomish County, for the ensuing 35 years.

In 1961, Metro entered into a series of agreements with local sewer service providers to accept and treat wastewater collected in their systems. Metro would own and operate the regional pipelines, pump stations, and treatment plants serving Seattle and suburban King County. As noted earlier, the City of Seattle had a combined system; it carried sanitary sewage, as well as stormwater runoff. Relief points built into the system allow for overflows into area waterways when large storms inundate the system. These overflow points prevent sewer backups into streets and basements during heavy storms.

Studies showed that a system with large central facilities was more cost-effective to build and operate than a system with many small plants. With the construction of one regional

treatment plant in Renton (the East Treatment Plant) in 1965 and another at West Point in 1966, along with the major trunk lines and pump stations needed to take wastewater to these regional plants, Metro began closing 28 small treatment plants and eliminating 46 raw sewage discharge points into Lake Washington and Lake Sammamish. Metro continued to operate three small treatment plants at Alki, Carkeek Park, and Richmond Beach. The plants served small drainage basins discharging into Puget Sound. Overflows of untreated sewage during the dry season were eliminated, and the discharge of treated wastewater to lakes and rivers in the Lake Washington drainage basin was brought to a halt.

By the late 1960s, Lake Washington's water quality had dramatically improved, and the independent action of citizens in the King County area to invest in protecting their water resources was gaining national recognition. Across the country the King County area was held as a model of citizen action in cleaning up the environment.

The success of the 1960s did not end efforts to protect water resources. Much work has since been done to improve wastewater treatment and reduce combined sewer overflows. That work, along with the original construction of a regional system in the 1960s, amounted to a $3.3 billion investment (1995 dollars) in protecting public health and water resources in the Seattle/King County region. Highlights of those investments include the following:

- The East Treatment Plant, originally built as a secondary treatment plant because of its discharge into the Green/Duwamish River, has been expanded to handle increasing volumes of wastewater from a growing suburban population.

- A new effluent discharge pipeline and outfall for the East Treatment Plant (called the Effluent Transfer System, or ETS) was completed in 1986 to eliminate discharges to the Green/Duwamish River and carry treated wastewater 12 miles to a deep-water outfall in Puget Sound.

- The West Treatment Plant has recently been upgraded to a secondary treatment plant, producing a higher quality effluent for discharge into Puget Sound.

- Major trunks and interceptors have been constructed, and old sewers and pipelines built in the early part of the century have been rehabilitated for continued use.

- The volume of CSOs has been greatly reduced since Metro built the regional wastewater treatment infrastructure in the 1960s. City of Seattle efforts to build storage facilities and separate storm sewers to collect street runoff, as well as Metro efforts to separate stormwater from sewage, reduced the volume of combined sewer overflows from an estimated 20 to 30 billion gallons each year in the 1960s to 1.6 billion gallons per year today. Several additional CSO control projects are underway.

A NEW GOVERNMENT

In 1993, the citizens of King County voted to combine the Metro and King County governments into a new regional government, Metropolitan King County. Metro's wastewater treatment, water quality, and transit responsibilities became part of an interim Department of Metropolitan Services for 2 years while the new government created its new structure. In 1996, the wastewater treatment and water quality functions of the Department of Metropolitan Services were transferred to the new King County Department of Natural Resources. The responsibilities of the former Metro Council, which provided oversight of wastewater treatment services for the first 35 years, now lie with the new Metropolitan King County Council and the King County Executive.

EXISTING REGIONAL KING COUNTY WASTEWATER SERVICE AREA

Major Facilities

King County provides wholesale wastewater services to 17 cities and 19 local sewer/water districts. The wastewater treatment plants and the major sewer interceptors and pumping stations that deliver the wastewater from local systems are owned, operated, and maintained by King County. The smaller pipelines and other conveyance facilities that carry wastewater to King County's interceptors are owned, operated, and maintained by the respective cities and districts (also known as local wastewater service agencies). King County has sewage disposal agreements which extend to July 1, 2036, with each of the 36 sewer agencies within the service areas.

Major elements of King County's wastewater system are shown in Figure 2-1. This figure also shows the locations of facilities which are under design or construction and are scheduled to be on-line by 1999. The King County system consists of over 255 miles of pipeline, 38 pump stations, 22 regulator stations, 2 secondary treatment plants, 2 CSO treatment plants, and 34 CSO control structures.

Wastewater Service Areas

When Metro was first established in 1958, its service area boundaries were legally defined as lying entirely within the boundaries of King County. To accommodate northern areas that naturally drain south into King County and Lake Washington, the service area was expanded to include part of southwestern Snohomish County. More recently, a small portion of northeastern Pierce County has been added to the service area. King County's wastewater service areas and the urban growth boundary are shown in Figure 2-2.

The current King County wastewater service area is divided into two subareas based upon where flows are conveyed for treatment. Approximately 1.2 million residents are served by the whole wastewater system. These service areas (including the North Service Area, which is currently part of the West Service Area) are shown in Figure 2-2.

West Service Area System

The West Service Area receives a mixture of separated flows (i.e., sewage not deliberately mixed with stormwater) from north of Lake Washington and combined sewage from the City of Seattle. The total service area consists of 66,800 acres; approximately 30,400 acres are served by combined sewers. The separated and the combined flows are joined before being routed through the treatment facilities.

The West Service Area wastewater treatment and conveyance facilities are primarily located in the City of Seattle. These facilities include the West Treatment Plant (located at West Point adjacent to Discovery Park in the Magnolia neighborhood in Seattle); the Kenmore Interceptor, Lake City Tunnel, and North Interceptor (these three interceptors carry flows from north King and south Snohomish counties and north Seattle to the West Treatment Plant); the Elliott Bay Interceptor (this carries flows to the West Treatment Plant from south Seattle); and CSO treatment plants located at Alki and Carkeek Park. (The Alki Plant will continue to operate as a primary treatment plant until 1999, when it will be converted to a CSO treatment facility; see below.)

West Treatment Plant Facilities. The West Treatment Plant, located on a sand spit on Puget Sound, is bordered by Discovery Park and the U.S. Coast Guard's West Point lighthouse. The plant, currently the largest in the King County system, began providing primary treatment to wastewater in July 1966. (Primary treatment includes screening, settling, and disinfection of wastewater with less solids removal than secondary treatment.) It was constructed at this location because the existing collection system was already in place to deliver wastewater to the North Trunk outfall at the north beach of West Point. The plant was upgraded to provide secondary treatment in 1995 with an average wet-weather capacity of 133 mgd and a peak wet-weather capacity of 440 mgd. The plant's secondary treatment process involves influent pumping, screening, grit removal, primary sedimentation, air activated sludge, secondary sedimentation, disinfection (chlorination), and anaerobic digestion. After treatment is completed, secondary effluent is discharged through an outfall to Puget Sound.

Processing equipment has recently been added to treat a small portion of the West Treatment Plant's secondary effluent to a higher quality. This equipment carries out chemical coagulation, filtration and disinfection processes, storage and distribution pumping, and piping. The resulting highly treated effluent is available for use as process water within the plant. It can also be used for landscape irrigation. Chapter 9 of this DEIS provides more information on the effluent reuse program.

The treatment plant operates under an NPDES permit, which sets limits for biochemical oxygen demand and total suspended solids contained in the discharged effluent. Average monthly effluent biochemical oxygen demand (BOD) and total suspended solids (TSS) limits are each 30 milligrams per liter (mg/l).

Solid matter (called primary sludge) that settles in the primary clarifiers (settling tanks), requires additional treatment before it is suitable for reuse. Sludge processing consists of anaerobic digestion, thickening via gravity belt thickeners, and dewatering by centrifuges. The product resulting from this process is called "biosolids" and is suitable

for reuse as a fertilizer or soil amendment. Further information on biosolids processing, distribution, and use is presented in Chapter 10.

Both the West and the East Treatment Plants produce methane gas (a by-product of the wastewater treatment process). At the treatment plants, this gas is used to run equipment and help heat the plants. Excess methane gas at the West Treatment Plant is used to produce electricity which is sold to Seattle City Light at a higher rate than King County pays to purchase electricity.

Service Area and Collection/Conveyance System. The West Service Area includes most of the City of Seattle and neighboring cities and unincorporated areas to the north and northeast. Most of the service area within city limits and part of the unincorporated North Service Area (most of which is located in southern Snohomish County) currently have sewer service.

The North Service Area includes the Swamp Creek, North Creek, Bear Creek, and lower Sammamish River drainage basins. Only about one quarter of the North Service Area is currently served by sewers, all of which are tributary to the King County wastewater system. The 1990 population of the area served by sewers was about 98,000. By 2030, the population served by sewers is projected to be over 450,000. By that year the entire North Service Area is expected to be served by sewers, all of which will be tributary to the King County wastewater system.

Major interceptors that convey wastewater to the West Treatment Plant include the Kenmore Interceptor, Lake City Tunnel, the North Interceptor, and the Elliott Bay Interceptor.

The West Service Area System has two storm weather plants. The Carkeek Treatment Plant is a 20-mgd storm weather treatment plant located in Carkeek Park. From 1962 (when the plant first went into service) to 1994, the plant was a primary wastewater treatment plant. In 1994, sanitary stormwater flows up to 8.4 mgd were transferred to the West Treatment Plant, and the Carkeek Treatment Plant was converted to a storm weather plant. The plant provides primary treatment (screening, settling, and disinfection) of flows exceeding 8.4 mgd. Such flows occur during periods of heavy rain and are expected to take place about eight times per year and result in annual discharges of 14 million gallons.

The former Richmond Beach Treatment Plant was placed into service in 1963 as a primary wastewater treatment plant with a wet-weather design capacity of 3.2 mgd. The plant was dismantled in 1992 and replaced with a pump station that transfers its flows to the Edmonds Wastewater Treatment Plant.

The Alki Treatment Plant is located on a 2.8-acre site in West Seattle near the Alki Point lighthouse. The City of Seattle began operating the plant as a primary wastewater treatment plant in 1958 and it became part of the Metro system in 1962. In 1987, the plant has overhauled, including equipment upgrades, addition of odor control equipment, and architectural and landscaping improvements. A conveyance system is now under construction that, by 1999, will transfer a maximum wet-weather flow of 18.9 mgd from the Alki Treatment Plant to the West Treatment Plant. In conjunction with this transfer, the

Alki Treatment Plant will be converted to a 65-mgd storm weather plant. As a storm weather plant, the facility will provide primary treatment for a combination of sanitary sewage and stormwater for flows to the plant that exceed 18.9 mgd.

East Service Area System

The East Service Area receives wastewater flows from 97,300 acres east and south of Lake Washington. Most of the development within this area was originally constructed with separate conveyance systems for sanitary sewage and stormwater. The major East Service Area System treatment and conveyance facilities include the East Treatment Plant (located on Monster Road in the City of Renton), the South Interceptor (which collects and carries wastewater through the Green River valley from as far south as Pacific near the county line), the Eastside Interceptor (which conveys flows from the east side to the East Treatment Plant), and the effluent transfer system (ETS) (which conveys the treated wastewater from the East Treatment Plant to Puget Sound for discharge).

East Treatment Plant Facilities. The East Treatment Plant is located in the City of Renton near the Green/Duwamish River, 13 miles upstream of the river's mouth at Elliott Bay. The original treatment plant, constructed in 1965, had a secondary treatment capacity of 24-mgd, average dry-weather flow with effluent discharged into the Duwamish River. The plant's capacity was increased to 72 mgd in 1986 and is in the process of being increased to 115 mgd (average wet-weather flow) and a peak wet-weather capacity of 325 mgd. As part of the upgrade to 72 mgd, Metro transferred the plant's discharge from the Green River to Puget Sound through an effluent transfer system that parallels the Duwamish River and discharges to Puget Sound in deep water off Duwamish Head.

The plant's secondary treatment process is similar to the West Treatment Plant's process, as is its sludge processing. The sludge processing facilities consist of thickening using dissolved air flotation, anaerobic digestion, and dewatering by belt filter press. The resulting biosolids are taken from the treatment plant by truck to be land-applied at various locations (see Chapter 10).

Several alternative solids processing technologies are currently being tested as demonstration projects at the East Treatment Plant as part of the Applied Wastewater Technology Research Program (AWT). Currently, the Centridry (centrifuge/dryer) process is in the early phases of start up testing. Later in 1997, the Vertad, deep shaft aerobic reactor will be pilot tested. Tests completed last year include demonstrations of the Cyclus (anoxic gas floatation) and Vertech (wet oxidation) solids treatment systems. In addition, the AWT program hopes to stage a demonstration of molten carbonate fuel cell technology which can produce electricity from methane gas produced at the plant.

The East Treatment Plant also accepts septic tank solids from throughout the region and sludge from the Snoqualmie Valley cities. The treatment plant accepts septage collected by private companies and hauled to the plant for processing from other public agencies and private companies. Approximately 20 million gallons of septage per year is processed for a fee.

Methane gas produced by the solids treatment process is used to run equipment and heat the plant. Excess methane gas produced by the solids digestion process is sold to the Washington Energy Company.

A 0.7-mgd, Class A, reclaimed water treatment system was recently installed at the East Treatment Plant. The highly treated, reclaimed water produced by this system is currently used to meet plant process, operation, and landscaping irrigation needs. Two distribution lines make the reclaimed water available for use to meet heating/cooling and irrigation needs in the immediate vicinity. This system is similar to the facility installed at the West Treatment Plant (see previous subsection).

Service Area and Collection/Conveyance System. The East Service Area lies primarily east and south of Lake Washington. It is approximately bounded by Juanita Bay on the north, the County's urban growth boundary on the east, the City of Auburn on the south, Mercer Island and Lake Washington on the northwest, and the western edge of the Green River watershed on the west. The largest conveyance pipelines are the Eastside Interceptor (located between Kirkland and the treatment plant in Renton) and the South Interceptor (located between Kent and the treatment plant).

The conveyance system for the East Service Area also includes the Sammamish, Redmond, Issaquah, Lake Hills and Auburn interceptors. All of these except the Auburn Interceptor connect to the Eastside Interceptor. The Auburn interceptor connects to the South Interceptor.

The East Treatment Plant's collection system is a separated system in which wastewater and stormwater are independently collected. Although the wastewater collection system is designed to convey only wastewater to the plant, a substantial amount of stormwater reaches the plant through unwanted infiltration and inflow into the system. Infiltration occurs where stormwater and groundwater enter the sewer system through cracked pipes and leaky joints. Stormwater also enters the system directly through manhole covers or roof connections (downspouts). When this occurs, it is called "inflow." Most of the infiltration and inflow reaching King County's system originates in local collection systems tributary to the King County system.

Infiltration and inflow comprise significant portions of the total wastewater flow in the East Service Area. A 1990 study showed that infiltration and inflow (I/I) comprise over 75 percent of peak flow at the East Treatment Plant (see Figure 2-3). Nearly all of the excess flow (95 percent) enters through the smaller collection systems owned by the local agencies, not the King County interceptors. The highest flows at the plant occur during, or shortly after, large storm events. They include a substantial quantity of rainfall-dependent infiltration and inflow. This flow proves very costly to King County as it must build additional conveyance lines to prevent overflows.

Combined Sewer Overflow Control

In the late 1800s, the City of Seattle built a combined sewerage system to collect untreated wastewater, stormwater and street litter and discharge it directly into local water bodies during periods of heavy rainfall. Construction of combined sewers was a standard practice until about 50 years ago.

In a combined sewer system, such as exists in the older parts of Seattle, sanitary sewage from businesses and households are combined with runoff from precipitation during storms. During long or intense storms, the additional stormwater exceeds the capacity of the sewers, causing overflows at designated relief points within the system.

Areas that have been developed since the 1940's have separate sanitary and storm sewer systems. In separated sewer systems only sanitary wastewater is conveyed to local sewage treatment plants while separate piping systems collect and convey stormwater to the closest body of water (see Figure 2-4).

In the early 1960s, Metro acquired facilities owned and operated by the City of Seattle and other sewer districts. Metro assumed responsibility for the CSOs associated with the trunks and interceptors it acquired and the City of Seattle retained responsibility for the rest of the combined system.

Before Metro was established, sewage treatment was provided for about half the sewage being generated in the greater Seattle metropolitan area. City of Seattle sewage was discharged into Puget Sound near West Point, along Elliott Bay and into the Duwamish River. Suburban areas had separate sanitary sewerage systems with small treatment plants discharging primarily into Lake Washington and local rivers. In subsequent years, Metro and the City of Seattle made improvements to reduce or eliminate CSOs. Current overflows occur from both the Seattle and King County system along the shorelines of Lake Washington, Lake Union, the Lake Washington Ship Canal, the Duwamish River, Elliott Bay and West Seattle (see Figure 2-5 for locations of King County CSOs). Metro and the City of Seattle, through partial sewer separation, treatment and storage projects, have eliminated virtually all problems of localized backups and flooding and reduced the incidence of overflows in the City and Metro systems.

Both King County and Seattle manage their own CSO control programs and, when possible, undertake joint projects to reduce CSO discharges. Since 1960, CSO discharge has been reduced from between 20 and 30 billion gallons per year (combined Metro and City discharges) to 2.4 billion gallons per year in 1982 (Metro discharges only) to a projected 1.6 billion gallons in 1998, when CSO projects currently underway will be complete and on-line. The City of Seattle has also substantially reduced volumes discharged from its CSOs.

In the mid-1980s, the Washington State Department of Ecology (Ecology) began requiring all municipalities with combined sewerage systems to develop plans to limit CSO frequency to no more than one event per year, on average, at each overflow location. As discussed above, Seattle and King County have made substantial progress towards the goal. The RWSP includes additional CSO facilities needed to reach the state goal.

RWSP PLANNING PROCESS

This section summarizes the processes used to develop the wastewater service strategies presented in Chapter 3 and the service strategy options discussed in Chapter 12. More

detailed descriptions of the processes leading to the service strategies and service strategy options are provided in Chapters 2 and 4 respectively of the RWSP.

The service strategy development process involved three components:

- develop a wide range of alternatives for wastewater management that were consistent with citizen input, existing policies, and core objectives;
- select the most practicable alternatives by applying a ranking process using criteria and input from stakeholders and an expert panel;
- develop options that could modify the components of each service strategy, including facilities, programs, or assumptions guiding wastewater management practices.

Three important elements contributed to the development of a wide range of possible service strategies. These include: 1) direction from citizens and stakeholders; 2) consistency with existing policies; and 3) concurrence with planning objectives.

An extensive interview process was conducted at the outset of the planning process with citizens, wastewater customers, community and environmental advocates and local elected officials. Over 120 people were interviewed, and all expressed a strong interest in wastewater and water quality issues.

Additional guidance came from King County Wastewater Treatment stakeholders. Stakeholders included: 1) elected officials and staff from King County, Seattle, Bellevue, Renton, Shoreline, and a number of the other suburban cities; 2) the Citizens' Water Quality Advisory Committee (CWQAC); 3) the Metropolitan Water Pollution Abatement Advisory Committee (MWPAAC); 4) representatives of the Puget Sound Water Quality Authority; and 5) staff from the Washington State Department of Ecology. Together, citizens and stakeholders played a major role in laying the foundation for the service strategies presented in the RWSP.

Additional perspectives on the proposal and associated potential environmental impacts were gained through the SEPA scoping process conducted in the fall of 1994.

In 1994, all of the policies that had been developed over the years to plan, operate and maintain the regional wastewater treatment system were reviewed for pertinence to this planning effort. They are referred to in the RWSP as "framework policies" because they provide a framework, or context for operating and making decisions about the wastewater system. The policies were established by the former Metro Council and many are reflected in subsequent amendments to the King County Code.

In 1995 the King County Council Regional Water Quality Committee reviewed the framework policies and provided suggestions for new policies which should be considered in the RWSP.

Building on the framework policies and the direction received from citizens, wastewater service customers and local elected officials, seven planning objectives were prepared to guide the development of future wastewater treatment and conveyance strategies. Over 60 preliminary wastewater system alternatives were developed using this guidance.

Subsequently, a process for narrowing the expansive list of possibilities to a limited number of sound choices was conducted using a set of criteria.

Four potential service strategies were the outcome of this extensive planning process. Each of the four could provide wastewater services to meet the needs of the region through the year 2030.

After the four service strategies were developed and reviewed, it became apparent that they represented an approach that would meet all existing regulations and policy directions but did not provide the range of choice desired by stakeholders, nor provide a basis for challenging the strategies' underlying assumptions. As a result King County staff and consultants developed service strategy options that could modify the four service strategies in some way. Fourteen options were selected for discussion in the RWSP and this EIS. The options are described in Chapter 4 of the RWSP and their environmental impacts are discussed in Chapter 12 of this EIS.

This EIS identifies adverse environmental impacts and mitigating measures associated with each of the four service strategies and the service strategy options. The discussion of environmental impacts that could result from implementing the service strategies and service strategy options is at a general, programmatic level. Additional, project-level environmental review would be required before specific projects could be implemented. For many of the options, additional feasibility studies would be warranted before proceeding to the next stage of environmental review.